The Drive & Control Company

Product catalog
Industrial hydraulics

Part 1: Pumps












Product catalog Industrial hydraulics

Part 1: Pumps

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General

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Installation, commissioning and maintenance of hydraulic systems

RE 07900/10.06
Replaces: 08.06

1. General

1.1 Long service life and functional reliability of hydraulic systems and their components depend on correct handling.

Ensure trouble-free operation by observing the following points:

– The specific installation and operating instructions for the relevant components

– Special instructions in individual cases

– Technical data in the data sheet.

In addition, we would like to draw your attention to the following regulations:

– German standard “Hydraulic systems“ DIN 24346

– ISO standard ISO 4413

2. Installation

2.1 Preparatory work for the installation

– Sauberkeit der Anlage gewährleisten!

• For the surroundings:

Keep power units, line connections and components clean or clean them (e.g. pickling after, for example, processes have been carried out that involve heat, i.e. welding, hot bending, etc.)!

• For hydraulics fluids:

Take care of contamination and humidity; contamination from the environment must not enter the tanks! Fill oil tanks only through filters, preferably system filters or portable filter stations with fine filters.
Internal protective coatings, if any, must be resistant to the hydraulic fluid used!

• For parts taken from stock:

The storage of parts that were not filled or treated with anti-corrosion fluid can lead to the formation of resin. Solve the resin using a grease solvent and renew the lubricating film.

– Check to see that all of the parts required for the installation are available!

– Take note of any transport damage!

2.2 Carrying out the montage

– Use lifting lugs and transport facilities!

– Do not apply force to prevent transverse forces and tension on pipes and components. The valve mounting surfaces must be perfectly even. The fixing screws must be tightened evenly at the specified torque.

Take care that pipes are adequately fixed!

– When selecting pipes, hoses and fittings/flanges, observe the correct pressure stage (wall thickness, material). Use only seamless precision steel pipes.

– Do not use hemp or putty as sealing materials! This may cause contamination and thus malfunction.
– To prevent external leakage, observe the installation instructions of the pipe fittings' manufacturer. We recommend the use of fittings with elastic seals.
– Make sure that hoses are properly laid! Rubbing and abutting of the lines must be prevented.
– Provide the correct hydraulic fluids
  • Mineral oils:
    HLP hydraulic oils according to DIN 51524 part 2 are generally suitable for standard systems and components.
  • Fast bio-degradable hydraulic fluids:
    VDMA 24568.
    For these fluids, the system and components must be matched.
  • Hardly inflammable hydraulic fluids:
    VDMA 24317. For these fluids, the system and components must be matched. (Before filling in the special media, check, whether the system is compatible with the intended fluid.)

The following points must be observed in accordance with the relevant requirements:
– Viscosity of the hydraulic fluid
– Operating temperature range
– Type of seals used on the components fitted

3. Commissioning

When the installation has been carried out correctly, proceed with commissioning and functional testing.

3.1 Preparations for trial run
– Tank cleaned?
– Lines cleaned and properly installed?
– Fittings, flanges tightened?
– Lines and components correctly connected in line with installation drawings and circuit diagram?

Is the accumulator filled with nitrogen? Fill in nitrogen until the pre-charge pressure p0 as specified in the cicuit diagram is reached. (On the fluid side the system must be pressureless!). It is recommended that the gas pre-charge pressure is marked on the accumulator itself (e.g. self-adhesive label) and in the hydraulic circuit so that a comparative check is possible, if required.

⚠ **Caution!** Use only nitrogen as pre-charge gas!

Accumulators must comply with the safety regulations valid at the place of installation.
– Are the drive motor and pump properly installed and aligned?
– Is the drive motor correctly connected?
– Are filters with the prescribed filter rating used?
– Are filters fitted in the correct direction of flow?
– Has the specified hydraulic fluid filled up to the upper marking?

As the hydraulic fluids often do not comply with the required cleanliness, the fluids must be filled through a filter. The absolute filter rating of the filling filter should be at least that of the filters installed in the system.

3.2 Trial run
– For safety reasons, only personnel of the machine manufacturer and, if required, maintenance and operating personnel should be present.
– All pressure relief valves, pressure reducing valves, pressure controllers of pumps must be unloaded. An exemption to this are TÜV-set valves.
– Open isolator valves completely!
– Switch the system on briefly and check whether the direction of rotation of the drive motor matches the prescribed direction of rotation of the pump.
– Check the position of the directional valves and, if necessary, move the spool to the required position.
– Set the control spool to by-pass.
– Open suction valves of the pump. If required for design reasons, fill pump housing with hydraulic fluids to prevent bearings and parts of the rotary group from running dry.
– If a pilot oil pump is provided, commission it[1)].
– Start up the pump, swivel it from its zero position and listen for any noises.
– Swivel the pump slightly out (ca. 5°)[1)].
– Bleed the system
  Carefully loosen fittings or bleed screws at high points in the system. When the escaping fluid is free from bubbles, then the filling process is completed. Re-tighten fittings.
– Flush the system; if possible, short-circuit actuators. Flush the system until the filters remain clean; check the filters!
  With servo-systems, the servo-valves must be removed and replaced by flushing plates or direction valves of the same size. Short-circuit the actuators.
  During flushing, the hydraulic fluid in the complete hydraulic system should reach temperatures that are at least as high as later during operation. Change the filter elements as required.
  Flushing continues until the required minimum cleanliness is reached. This can only be achieved by continuous monitoring using a particle counter.
– Check the system functions under no-load conditions, if possible, by hand; cold-test the electrohydraulic control.
– When the operating temperature has been reached, test the system under load; slowly increase the pressure.
– Monitor control and instrumentation equipment!
– Check the housing temperature of hydraulic pumps and hydraulic motors.
– Listen for noises!
– Check the hydraulic fluid level; if required, top up!

[1)] As far as possible with the control elements fitted; otherwise, start up at full displacement. In conjunction with combustion engines, start up at idle speed.

- Check the setting of pressure relief valves by loading or braking the system.
- Inspect the system for leaks.
- Switch off the drive.
- Retighten all fittings, even if there is no evidence of leakage.

  ⚠ **Caution!** Only tighten fittings when the system is depressurised!
- Is the pipe fixing adequate, even under changing pressure loads?
- Are the fixing points at the correct positions?
- Are the hoses laid so that they do not chamfer, even under pressure load?
- Check the fluid level.
- Test the system for all functions. Compare measured values with the permissible or specified data (pressure, velocity. Adjust further control components).
- Jerky movements indicate, amongst other things, the presence of air in the system. By briefly swivelling the pump in one or both directions with the actuator being loaded or braked, it is possible to eliminate certain air pockets. The system is completely bled when all functions are performed jerk-free and smoothly and the sur face of the hydraulic fluid level is free from foam. Experience has shown that foaming should have ceased one hour after start-up at the latest.
- Check the temperature.
- Switch off the drive.
- Remove filter elements (off-line and full-flow filters) and inspect them for residues. Clean filter elements or replace them, if required. Paper or glass fibre elements **cannot** be cleaned.
- If further contamination is found, additional flushing is required to prevent premature failure of the system components.
- All the adjustments made are to be recorded in an acceptance report.

3.3 Commissioning of fast running systems

Such system can often not be commissioning using the normal measuring instruments (such as pressure gauges, thermometers, electrical multimeters, etc.) and standard tools. Optimization is also not possible.
These systems include, for example, forging presses, plastics injection moulding machines, special machine tools, rolling tools, crane controls, machines with electrohydraulic closed-loop control systems.
Commissioning and optimization of these systems often require more comprehensive measuring equipment to allow several measurements to be taken at a time (e.g. several pressures, electrical signals, travel, velocities, flows, etc.).

3.4 The most common faults occurring during commissioning

Apart from servicing, commissioning is very decisive for the service life and functional reliability of a hydraulic system.

For this reason, faults during commissioning must be avoided as far as possible.

The most common faults are:

- The fluid tank is not inspected.
- The hydraulic fluid is not filtered before being filled in.
- The installation is not checked before commissioning (subsequent conversion with loss of fluid!).
- System components are not bled.
- Pressure relief valves are set only slightly higher than the operating pressure (closing pressure differential is not observed).
- Pressure controllers of hydraulic pumps are set higher or to the same pressure as the pressure relief valve.
- The flushing time of servo systems is not adhered to.
- Abnormal pump noise is ignored (cavitation, leaking suction lines, too much air in the hydraulic fluid).
- Transversal loads on cylinder piston rods are not observed (installation error!).
- Hydraulic cylinders are not bled (damage to seals!)
- Limit switches are set too low.
- The switching hysteresis of pressure switches is not taken into account when settings are made.
- Hydraulic pump and hydraulic motor housings are not filled with hydraulic fluid prior to commissioning.
- Settings are not documented.
- Adjustment spindles are not secured or sealed.
- Unnecessary personnel present during commissioning of the system.

4. Maintenance

According to DIN 31 051 the term “maintenance” includes the following fields of activity:

- **Inspection**

  Measures to recognise and assess the actual situation, i.e. recognise how and why the so-called wear reserve continues to decrease.
- **Maintenance**

  Measures to preserve the nominal conditions, i.e. to take precautions in order that the reduction in the wear reserve during the useful life is kept as low as possible.
- **Repair**

  Measures to restore the nominal condition, i.e. compensate for reduction in performance and restore the wear reserve.

Maintenance measures must be planned and taken in accordance with the operating time, the consequences of a failure and the required availability.

4.1 Inspection

The individual points to be inspected should be summarised for a specific system in so-called inspection lists in order that the inspections can be carried out adequately by employees with different qualification levels.

Important points of inspection are:

- Checking the hydraulic fluid level in the tank.
- Checking the heat exchanger (air, water) for effectiveness.

1

– Checking the system for external leakage (visual inspection).
– Checking the hydraulic fluid temperature during operation.
– Checking pressures
– Amount of leakage
– Checking the cleanliness of the hydraulic fluid

⚠ **Caution!**

Visual inspections can only give an approximation (clouding of the hydraulic fluid, darker appearance than at the time of filling, sediments in the fluid tank).

If conventional particle counting is impossible, the following three methods can be used for establishing the fluid cleanliness:

- Particle counts using electronic counting and sorting equipment.
- Microscopic examination.
- Gravimetric establishment of solids by means of finest filtration of a certain fluid volume (e.g. 100 ml) and weighing of the filter paper before and after the filtration process. This allows the establishment of the amount of solid particles in mg/l.

– Check the contamination of filters. A visual inspection of deep filters, which are widely used today, is **no** longer possible.
– Analyse the chemical properties of the hydraulic fluid.
– Check the temperature at points where bearings are located.
– Check the generation of noise.
– Test performance and velocity.
– Inspect pipes and hoses.

⚠ **Caution!**

Damaged pipes and hoses must be immediately replaced.

– Inspect accumulator stations.

4.2 Maintenance

In practice, inspection, maintenance and repair work is not as strictly separated as the definitions may suggest. Servicing is often done in conjunction with inspections.

For safety reason, pipe fittings, connections and components **must not** be loosened or removed as long as the system is pressurised.

Important service work is:

– Create a maintenance book

We recommend that a maintenance book is created to lay down the parts to be inspected.

– Check the hydraulic fluid level
  - continuously during commissioning
  - shortly after commissioning
  - later, at weekly intervals
– Inspect filters
  - during commissioning every two to three hours and, if necessary, replace them.
  - daily during the first week and replace them as required.
  - After one week, the filters should be cleaned as required.
  - Maintenance of suction filters:

    Suction filters require particularly thorough servicing. After the running-in period, they must be inspected at least once a week and cleaned, if necessary.
– Service the system fluid
  - Maintenance intervals depend on the following operating factors:

    - Hydraulic fluid condition (e.g. water in oil, strongly aged oil)
    - Operating temperature and oil fill

    We recommend that the fluid be changed in dependence upon an oil analysis. With systems whose oil is not analysed at regular intervals the fluid should be replaced every 2000 to 4000 operating hours at the latest.
  - Drain the system fluid at operating temperature and change it.
  - Severely aged or contaminated system fluid **cannot** be improved by adding new fluid!
  - Only fill in oil via filters that have at least the same separation capacity as the filters installed in the system, or use a system filter.
  - Take samples of the system fluid to have the type, size and amount of particles analysed in the lab. Record the results.
– Check the accumulator for its pre-charge pressure; for this, the accumulator must be depressurised on the fluid side.

⚠ **Caution!**

Work on systems that include accumulators may only be carried out after the fluid pressure was unloaded.

Welding or soldering work or any mechanical work on accumulators is not permitted.

Improper repairs can lead to severe accidents. Repairs on hydraulic accumulator may therefore only be carried out by Rexroth Service service personnel.

– The operating temperature must be measured. An increase in the operating temperature indicates increasing friction and leakage.
– Leakage in the pipework

Leakage, especially with underfloor piping, represents, apart from loss of fluid, a risk for equipment and concrete floors.

For safety reasons, sealing work on the pipes may only be carried out when the system is depressurised. Leakage at points that are sealed with soft seals (O-rings, form seal rings, etc.) **cannot** be eliminated by tightening as these sealing elements are either destroyed or hardened. Sealing can only be achieved by replacing the sealing elements.

– Check main and pilot pressure
  • Check interval: One week
  • Document pressure corrections in the maintenance book.
  • Frequent pressure adjustments indicate, among other things, wear of the pressure relief valve.

4.3 Repair

Locate and eliminate malfunction and damage.

– Fault localisation

A precondition for system repairs is successful, i.e. systematic fault search.

This requires in any case detailed knowledge of the structure and the operating principle of the individual components as well as of the entire system. The required documentation should be available and easily accessible.

The most important measuring instruments (thermometer, electrical multimeter, industrial stethoscope, stop watch, rpm counter, etc.) should also be available in the vicinity of the system, especially in the case of large systems.

– Fault correction

When carrying out any work, observe strictest cleanliness. Before loosening fittings, clean the surrounding area.

Generally, defective components should not be repaired on site, since for the proper repair, the required tooling and the required cleanliness are usually not given on site. On site, only complete components should be changed whenever possible, in order

• to keep the time for which the opened system is exposed to ambient influences to a minimum,
• to keep the fluid loss as low as possible,
• to ensure the shortest possible downtime through the use of overhauled and tested components.

After failed components are located, it is essential to check whether the entire system or parts of the system have been contaminated by broken parts or larger amounts of abraded metal.

4.4 Repair and major overhaul of hydraulic components

Generally, it can be said that only the component manufacturer can carry out major overhauls in the most efficiently and reliably (same quality standard, trained personnel, test facilities, warranty, etc.).

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Installation, commissioning and servicing of hydraulic pumps and motors

(vane pumps, internal gear pumps, radial piston motors, internal gear pumps)

RE 07080/07.05
Replaces: 02.03

1. General

1.1 To ensure proper operation of pumps and motors, please observe the following information:

– Technical data in the data sheet

– General notes on commissioning of hydraulic systems

– The following notes on installation and operation

2. Installation

2.1 Flushing

– On pumps taken from stock, resin may have formed. This must be removed by means of solvents. Then, the lubricating film must be renewed. In the case of hardly inflammable fluids, no special measures have to be taken.

2.2 Installation

– Observe drawings and/or instructions

– Ensure stress-free installation

– In the case of prime movers, ensure that foundations are level

2.3 Lines and connections

2.3.1 Suction lines

– Design and assemble lines according to the manufacturer's instructions.

– Suction vacuum pressure or feed pressure must be within the limits specified by the manufacturer; filters and valves possibly installed must be taken into account.

– Take care that the suction lines are leak-free.

– The flow velocity in suction lines should not exceed 0.5 m/s.

– Cut the pipe ends at an angle of less than 45° and install them at a distance of at least 2.5 x the pipe diameter from the tank floor in order to prevent the aspiration of deposits from the tank floor.

2.3.2 Leakage drain lines

– Use sufficiently large nominal widths in order to keep the backpressure in the housing within the permissible limits.

– When installing the lines, make sure that the housing is completely filled with fluid, while taking care that a siphoning effect is avoided.

– Pressureless return flow to the tank

– Sufficient cooling and settling of the hydraulic fluid is achieved by directing the fluid to the tank wall.

– Ensure a sufficient distance to temperature switches.

2.3.3 Installation instructions

- All lines have to be submerged at least 2.5 x the pipe diameter below the lowest permissible fluid level, but at least 100 mm in order to prevent foaming.
- Install the leakage drain line higher than the suction line and take precautions that the returning oil cannot be directly re-aspired.
- The ends of the suction, return and leakage drain lines must therefore be installed with a distance of at least 200 mm from each other.
- We recommend seamless precision steel pipes to DIN 2391 and pipe connections that can be loosened.

2.4 Filters

- Whenever possible, use return line or pressure filters.
- Use suction filters only in conjunction with underpressure switches/clogging indicators.
- Depending on the pump type, the required filter rating is 25 µm to 40 µm.
  Recommendation: 10- µm filters prolong the service life under high load conditions.

2.5 Hydraulic media

2.5.1 Mineral oils

- When HL oils without wear-reducing additives are used, vane pumps (V3, V4, PV7, PVV, PVQ) may only be operated at reduced pressure.
- Oils containing polar additives (slide way oils) must not be used for pumps with plain bearings, as the additives precipitate at 70 °C and thus impair cooling and lubrication of the bearings.

2.5.2 HFC fluid (water glycol)

- Internal gear pumps of types PGF and PGH are suitable for operation with HFC fluids.

  Please note the information in the data sheets!

  When using hydraulic media, which are not listed in the technical data, please consult us.

3. Commissioning

3.1 Electrical open and closed-loop control elements

- Observe voltages and current intensity

3.2 Direction of rotation of drive/output shafts

- Observe the arrow of direction of rotation
- Testing of a unit filled with hydraulic fluid:
  Switching the unit briefly on and off prevents damage in the case of the wrong direction of rotation.

3.3 Filling

- Pump types V3, V4, PV7, PVV, PVQ are self-priming, the housings need not to be filled. Internal gear pumps must be filled prior to commissioning! For all other pumps, verify, whether the housing must be filled.

3.4 Start-up

- Observe specific component instructions.
- Set all valves, especially on the suction and supply side, to the free-flow position.
- Switch the motor briefly on and off several times in order to facilitate bleeding. Only operate the pump under full load when it runs properly and smoothly.
- During initial start-up, bleed the pressure line to allow complete filling of the pump.
  Exceptions to this are pump with automatic bleed valve.
- When the system starts up, the fluid level in the tank must not fall below the minimum suction level.

3.5 Pressure limitation / pressure control

- Always select the lowest settings for commissioning.
- Carefully increase the pressure to the required values, but do not set to unnecessarily high values.
- If required, secure settings against unwanted adjustment.

3.6 Temperature

- Check the fluid temperature under normal operating conditions.

4. Routine maintenance

4.1 Frequency

- Loads and operating conditions determine regular maintenance intervals.

4.2 Mounting

- Check the correct orientation of the pumps, motors, cylinders, further energy converters and lines at normal operating pressure and operating temperature.

4.3 Filters

- Observe clogging indicators and check suction filters for operability according to the operating instructions.

4.4 Servicing

- We recommend regular servicing of the complete system by Bosch Rexroth!

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Rexroth
Bosch Group

Hydraulic fluids based on mineral oils and related hydrocarbons

RE 90220/05.12 1/16
Replaces: 05.10

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	**Hydraulic fluids based on mineral oils and related hydrocarbons**	Environmentally acceptable hydraulic fluids	Fire-resistant, water-free hydraulic fluids	Fire-resistant, water-containing hydraulic fluids
Standard	**DIN 51524**	ISO 15380	ISO 12922	ISO 12922
Data sheets	**RE 90220**	RE 90221	RE 90222	RE 90223 (in preparation)
Classification	**HL** **HLP** **HLPD** **HVLP** **HLPD** **and more**	HEPG HEES partially saturated HEES saturated HEPR HETG	HFDR HFDU (ester base) HFDU (glycol base) and more	HFC HFB HFAE HFAS

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1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of hydraulic fluids based on mineral oils and related hydrocarbons in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant fluid standard during the whole of the period of use.

Other regulations and legal provisions may also apply. The operator is responsible for their observance, e.g. EU directive 2004/35/EG and their national implementations. In Germany the Water Resources Act (WHG) is also to be observed.

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

1.2 Scope

This data sheet must be observed when using hydraulic fluids based on mineral oils and related hydrocarbons in Bosch Rexroth hydraulic components.

Please note that the specifications of this data sheet may be restricted further by the specifications given in the product data sheets for the individual components.

The use of the individual hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with hydraulic fluids based on mineral oils and related hydrocarbons according to DIN 51524 if specified in the respective component data sheet or if Rexroth approval for use is furnished.

Notes:
In the market overview RE 90220-01, hydraulic fluid based on mineral oil are described which, according to the information of the lubricant manufacturer, feature the respective parameters of the current requirements standard DIN 51524 and other parameters which are of relevance for suitability in connection with Rexroth components.

These specifications are not checked or monitored by Bosch Rexroth. The list in the market overview does not therefore represent a recommendation on the part of Rexroth or approval of the respective hydraulic fluid for use with Rexroth components and does not release the operator from his responsibility regarding selection of the hydraulic fluid.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.3 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For hydraulic fluids, the cleanliness level is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	Up to and including	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6

20 / 18 / 15
$>$ 4 µm $>$ 6 µm $>$ 14 µm

3 Selection of the hydraulic fluid

The use of hydraulic fluids based on mineral oils for Rexroth hydraulic components is based on compliance with the minimum requirements of DIN 51524.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter component life cycle will result.

3.1.2 Viscosity-temperature behavior

For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops; see Fig. 1 "Viscosity temperature chart for HL, HLP, HLPD (VI 100)". The interrelation between viscosity and temperature is described by the viscosity index (VI).

The viscosity temperature diagram in Fig. 1 is extrapolated in the < 40 °C range. This idealized diagram is for reference purposes only. Measured values can be obtained from your lubricant manufacturer and are to be preferred for design purposes.

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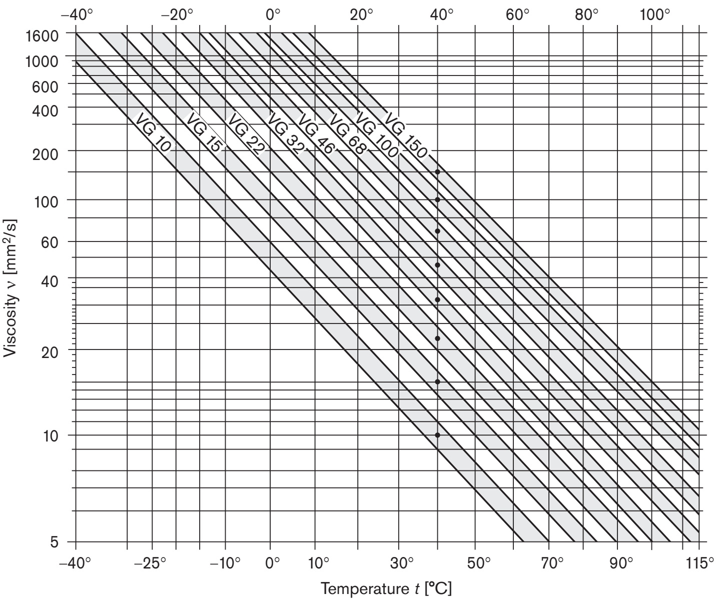
Fig. 1: Viscosity-temperature chart for HL, HLP, HLPD (VI 100, double logarithmic representation)



3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in DIN 51524-2,-3 via test procedures "FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). From ISO VG 32 DIN 51524-2,-3 prescribes a rating of at least 10 (FZG test). At present, the FZG test cannot be applied to viscosity classes < ISO VG 32.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HLxx classifications	with EPDM seals
Zinc- and ash/free hydraulic fluids	with bronze-filled PTFE seals

3.1.5 Aging resistance

The way a hydraulic fluid ages depends on the thermal, chemical and mechanical stress to which it is subjected. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids.

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

Hydraulic fluids based on mineral oils and related hydrocarbons are tested with 20% water additive during testing of aging resistance according to ISO 4263-1.

The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content < 0.1%, cf. chapter 4.10. "Water".

3.1.6 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids contain approx. 7 to 13 percent by volume of dissolved air (with atmospheric pressure and 50 °C). Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging.
It cannot be improved by additives.

According to DIN 51524 for instance, an ASA value ≤ 10 minutes is required for viscosity class ISO VG 46, 6 minutes are typical, lower values are preferable.

3.1.7 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

For larger systems with permanent monitoring, a demulsifying fluid with good water separation capability (WSC) is recommended. The water can be drained from the bottom of the reservoir. In smaller systems (e.g. in mobile machines), whose fluid is less closely monitored and where water contamination into the hydraulic fluid, for instance through air condensation, cannot be ruled out completely, an HLPD fluid is recommended.

The demulsifying ability up to ISO-VG 100 is given at 54 °C, and at 82 °C for fluids with higher viscosity.

Water emulsifying HLPD hydraulic fluids have no, or a very poor, demulsifying ability.

3.1.8 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. Depending on the basic fluid used and the additives (VI enhancers) there are great differences here.

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.9 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in DIN 51524. Hydraulic fluids that are not compatible with the materials listed above must not be used, even if they are compliant with ISO 51524.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

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3.1.10 Additivation

The properties described above can be modified with the help of suitable additives. A general distinction is made for fluids between heavy metal-free and heavy metal-containing (generally zinc) additive systems. Both additive systems are most often incompatible with each other. The mixing of these fluids must be avoided even if the mixing ratio is very low. See chapter 4, "Hydraulic fluids in operation".

Increasing additivation generally leads to deteriorated air separation ability (ASA) and water separation capability (WSC) of the hydraulic fluid. According to the present state of knowledge, all hydraulic fluids described in this document, independently of the actual additivation, can be filtered using all filter materials with all known filtration ratings ≥ 1 μm without filtering out effective additives at the same time.

Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HL fluids according to DIN 51524-1 VI = 100	Hydraulic fluids predominantly only with additives for oxidation and corrosion protection, but no specific additives for wear protection in case of mixed friction	HL fluids can be used in hydraulic systems that do not pose any requirements as to wear protection.	HL fluids may be used only for components whose product data sheet specifically allows HL fluids. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. Hydraulic fluids that only comply with the requirements of classes HL and HR in accordance with ISO 11158 without proving that DIN 51524-1 is also met may be used only with written approval of Bosch Rexroth AG. Observe restrictions as to pressure, rotation speed etc.
HLP fluids according to DIN 51524-2 VI = 100	Hydraulic fluid with corrosion, oxidation and verified wear protection additives	HLP fluids are suitable for most fields of application and components provided the temperature and viscosity provisions are observed.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. For the viscosity classes VG10, VG15 and VG22, DIN 51524 defines no requirements as to wear protection (DIN 51354 part 2 and DIN 51389 part 2). Beyond the requirements of DIN 51524 part 2, we require the same base oil type, identical refining procedure, identical additivation and identical additivation level across all viscosity classes.

Continued on page 8

Table 4: Classification and fields of application (continued from page 7)

Classification	Features	Typical field of application	Notes
HVLP fluids according to DIN 51524-3 VI > 140	HLP hydraulic fluid with additional improved viscosity temperature behavior	HVLP fluids are used in systems operated over a wide tempera-ture range.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. The same notes and restrictions as defined for HLP fluids apply accordingly. The effect on Rexroth components (e.g. compatibility with material seals, wear resistance capacity) may differ when using related hydrocarbons instead of mineral oils, cf. Table 6, line 8. When using HVLP fluids, the viscosity may change on account of the shear of the long-chain VI enhancers. The viscosity index, high at the start, decreases during operation. This needs to be taken into account when selecting the hydraulic fluid. The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part 6. Please note that there are practical applications that create a much higher shear load on such fluids than can be achieved by this test. Up to VI < 160, we recommend a maximum permitted viscosity drop of 15 %, viscosity at 100 °C. The viscosity limits given by Bosch Rexroth for its components are to be observed for all operating conditions, even after the hydraulic fluids have sheared. HVLP fluids should be used only if required by the temperature ranges of the application.
HLPD fluids according to DIN 51524-2, HVLPD fluids in accordance with DIN 51524-3	HLP and HVLP hydraulic fluid with additional detergent and or dispersant additives	HLPD and HVLPD fluids are used in systems where deposits as well as solid or liquid contamination need to be kept temporarily suspended	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. Some of these fluids are able to absorb significant quantities of water (> 0.1 %). This may have negative implications for the wear protection and the aging properties of the fluid. The wetting ability of these fluids varies largely depending on the product. Therefore it is not correct to say that they are generally all very well able to prevent stick-slip. In individual cases where higher water contamination is to be expected (such as in steelworks or under humid conditions), the use of HLPD/HVLPD fluids cannot be recommended as the emulsified water does not settle in the reservoir but is evaporated in heavily loaded positions. For such cases, we recommend using HLP hydraulic fluids with particularly good demulsifying ability. The water collected at the reservoir bottom is to be drained regularly. If HLPD/HVLPD fluids are used, contamination does not settle. It rather remains suspended and needs to be filtered out or removed by appropriate draining systems. For this reason, the filter area must be increased. HLPD/HVLPD fluids may contain additives that in the long run are incompatible with plastics, elastomers and non-ferrous metals. Furthermore, these additives may lead to the premature clogging of hydraulic filters. Therefore, test the filterability and the selection of the filter material in consultation with the filter manufacturer.

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard DIN 51524 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing the fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

Changeovers, in particular between hydraulic fluids with heavy metal-free and heavy metal-containing (generally zinc) additives, frequently lead to malfunctions, see chapter 3.1.10 "Additivation".

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remainder of the previous hydraulic fluid. We recommend obtaining a written performance guarantee from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

For information on changing over hydraulic fluids with different classifications please refer to VDMA 24314, VDMA 24569 and ISO 15380 appendix A.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

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4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This also includes hydraulic fluids with the same classification and from the market overview RE 90220-01. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with DIN 51524 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

During storage and operation, hydraulic fluid based on mineral oils with anti-corrosion additives protect components against water and "acidic" oil degradation products.

4.9 Air

Under atmospheric conditions, the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)".

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

Water in the hydraulic fluid may result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation.

Undissolved water can be drained from the bottom of the reservoir. Dissolved water can be removed only by using appropriate measures. If the hydraulic system is used in humid conditions, preventive measures need to be taken, such as an air dehumidifier at the reservoir vent. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

To ensure a long service life for the hydraulic fluids and the components, we recommend that values below 0.05 % (500 ppm) are permanently maintained. Detergent and or dispersant hydraulic fluids (HLPD / HVLPD) are able to absorb (and keep suspended) more water. Prior to using these hydraulic fluids, please contact the lubricant manufacturer.

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness level".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced in regular intervals and tested by the lubricant manufacturer or recognized, accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum

Compared to the pure unused hydraulic fluid, the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid. This value must be kept as low as possible. As soon as the trend analysis notes a significant increase in the acid number, the lubricant manufacturer should be contacted.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

Hydraulic fluids based on mineral oil and related hydrocarbons are hazardous for the environment. They are subject to a special disposal obligation.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Other hydraulic fluids based on mineral oil and related hydrocarbons

Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
1	Hydraulic fluids with classification HL, HM, HV according to ISO 11158	– Can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see Table 4: "Hydraulic fluid classification". – Fluids **only** classified in accordance with ISO 11158 may be used only with prior written approval of Bosch Rexroth AG.
2	Hydraulic fluids with classification HH, HR, HS, HG according to ISO 11158	– May not be used.
3	Hydraulic fluids with classification HL, HLP, HLPD, HVLP, HVLPD to DIN 51502	– DIN 51502 merely describes how fluids are classified / designated on a national level. – It contains no information on minimum requirements for hydraulic fluids. – Hydraulic fluids standardized according to DIN 51502 can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see Table 4: "Hydraulic fluid classification".
4	Hydraulic fluids with classification HH, HL, HM, HR, HV, HS, HG according to ISO 6743-4	– ISO 6743-4 merely describes how fluids are classified / designated on an international level. It contains no information on minimum requirements for hydraulic fluids. – Hydraulic fluids standardized according to ISO 6743 -4 can be used without confirmation provided they are listed in the respective product data sheet and are compliant with DIN 51524. Conformity with DIN 51524 must be verified in the technical data sheet of the fluid concerned. For classification see table 4: "Classification and fields of application".
5	Lubricants and regulator fluids for turbines to DIN 51515-1 and -2	– Turbine oils can be used after confirmation and with limited performance data. – They usually offer lower wear protection than mineral oil HLP. Classification of turbine oils to DIN 51515-1 comparable to HL, turbine oils to DIN 51515-2 comparable to HLP. – Particular attention must be paid to material compatibility!
6	Lube oils C, CL, CLP in accordance with DIN 51517	– Lube oils in acc. with DIN 51517 can be used after confirmation and with limited performance data. They are mostly higher-viscosity fluids with low wear protection. Classification: CL similar to HL fluids and CLP similar to HLP fluids. – Particular attention must be paid to material compatibility, specifically with non-ferrous metals!
7	Fluids to be used in pharmaceutical and foodstuff industries, in acc. with FDA / USDA / NSF H1	– There are medical white oils and synthetic hydrocarbons (PAO). – Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – May be used only with FKM seals. – Other fluids used in pharmaceutical and foodstuff industries may be used only after confirmation. – Attention is to be paid to material compatibility in accordance with the applicable food law. **Caution!** Fluids used in pharmaceutical and foodstuff industries should not be confused with environmentally acceptable fluids!

Continued on page 13

Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons
(continued from page 12)

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
8	Hydraulic fluids of classes HVLP and HVLPD based on related hydrocarbons	– Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – Lower pour point than HLP – Other wetting (polarity)
9	Automatic Transmission Fluids (ATF)	– ATF are operating fluids for automatic gearboxes in vehicles and machines. In special cases, ATFs are also used for certain synchronous gearboxes and hydraulic systems comprising gearboxes. – To be used only after confirmation! – Some of these fluids have poor air separation abilities and modified wear properties. – Check material compatibility and filterability!
10	Multi-purpose oil (MFO) – Industry	– Multi-purpose oils (industry) combine at least two requirements for a fluid, for instance metal machining and hydraulics. – To be used only after confirmation! – Please pay particular attention to air separation ability, modified wear properties and the reduced material life cycle. – Check material compatibility and filterability!
11	Multi-purpose oils (MFO) – Mobil UTTO, STOU	– Multi-purpose oils combine requirements for wet brakes, gearboxes, motor oil (STOU only) and hydraulics. – Fluids of the types: – UTTO (= universal tractor transmission oil) and – STOU (= Super Tractor super tractor universal oil) – To be used only after confirmation! – Please pay particular attention to shear stability, air separation ability and modified wear properties. – Check material compatibility and filterability!
12	Single-grade engine oils 10W, 20W, 30W	– To be used only after confirmation! – Please pay particular attention to the air separation ability and filtering ability.
13	Multi-grade engine oils 0Wx-30Wx	– To be used only after confirmation! – Please pay particular attention to air separation ability, changes in wear protection capability, viscosity changes during operation, material compatibility, dispersant and detergent properties and filterability. **Caution!** Multi-grade engine oils have been adapted to specific requirements in combustion engines and are suitable for use in hydraulic systems only to a limited extent.
14	Hydraulic fluids for military applications to MIL 13919 or H 540, MIL 46170 or H 544, MIL 5606 or H 515, MIL 83282 or H 537, MIL 87257	– To be used only after confirmation! – Please pay particular attention to air separation ability, changes in wear protection capability, viscosity changes during operation, material compatibility, water separation capability and filterability. **Caution!** Hydraulic fluids for military applications do not meet the current requirements for high-quality hydraulic fluids and are suitable for use only to a limited degree.
15	Motor vehicle transmission oils	– Motor vehicle transmission oil can be used after confirmation and with limited performance data. – Pay particular attention to wear protection, material compatibility, specifically with non-ferrous metals, as well as viscosity!

Continued on page 14

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Table 6: Other hydraulic fluids based on mineral oils and related hydrocarbons
(continued from page 13)

Serial number	Hydraulic fluids	Features / Typical field of application / Notes
16	Diesel, test diesel in acc. with DIN 4113	– Diesel / test diesel has poorer wear protection capabilities and a very low viscosity (< 3 mm²/s). – May be used only with FKM seals – Please note their low flash point! – To be used only after confirmation and with limited performance data!
17	Hydraulic fluids for roller processes	– Hydraulic fluids for roller processes have lower wear protection capabilities than mineral oil HLP and a lower viscosity – Please note their low flash point! – Hydraulic fluids for roller processes with limited performance data can be used only after confirmation.
18	Fluids for power steering, hydro-pneumatic suspension, active chassis etc.	– Can only be used after consultation and approval for use in the specific application, even if they are compliant with DIN 51524. – Please note the low viscosity! – In most cases they have poor water separation capability – Check the material compatibility!

7 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration.

API classification
Classification of basic fluids by the **A**merican **P**etroleum **I**nstitute (API) – the largest association representing the US oil and gas industry.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance".

Related hydrocarbons
Related hydrocarbons are hydrocarbon compounds that are not classified as API class 1, 2 or 5.

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Demulsifying
Ability of a fluid to separate water contamination quickly; achieved with careful selection of base oil and additives.

Detergent
Ability of certain additives to emulsify part of the water contamination in the oil or to hold it in suspension until it has evaporated with increasing temperature. Larger water quantities, in contrast (above approx. 2 %), are separated immediately.

Dispersant
Ability of certain additives to keep insoluble liquid and solid contamination in suspension in the fluid.

Diesel effect
If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Hydraulic fluids based on mineral oils
Hydraulic fluids based on mineral oils are made from petroleum (crude oil).

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Stick-slip effect (sliding)
Interaction between a resilient mass system involving friction (such as cylinder + oil column + load) and the pressure increase at very low sliding speeds. The static friction of the system is a decisive value here. The lower it is, the lower the speed that can still be maintained without sticking. Depending on the tribologic system, the stick-slip effect may lead to vibrations generated and sometimes also to significant noise emission. In many cases, the effect can be attenuated by replacing the lubricant.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm^2/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid.
The lower the change of viscosity in relation the temperature, the higher the VI.

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No statements concerning the suitability of a hydraulic fluid for a specific purpose can be derived from our information. The information given does not release the user from the obligation of own judgment and verification.

It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Rexroth
Bosch Group

Environmentally acceptable hydraulic fluids

RE 90221/05.12 1/14
Replaces: 05.10

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	Hydraulic fluids based on mineral oils and related hydrocarbons	**Environmentally acceptable hydraulic fluids**	Fire-resistant, water-free hydraulic fluids	Fire-resistant, water-containing hydraulic fluids
Standard	DIN 51524	**ISO 15380**	ISO 12922	ISO 12922
Data sheets	RE 90220	**RE 90221**	RE 90222	RE 90223 (in preparation)
Classification	HL HLP HLPD HVLP HLPD and more	**HEPG** **HEES partially saturated** **HEES saturated** **HEPR** **HETG**	HFDR HFDU (ester base) HFDU (glycol base) and more	HFC HFB HFAE HFAS

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1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of environmentally compatible hydraulic fluids in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant fluid standard during the whole of the period of use.

Other regulations and legal provisions may also apply. The operator is responsible for their observance, e.g. EU directive 2004/35/EG, 2005/360/EG and their national implementation. In Germany the Water Resources Act (WHG) is also to be observed.

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

Environmentally acceptable hydraulic fluids have been used successfully for many years. In some countries, the use of environmentally acceptable hydraulic fluids is already prescribed in ecologically sensitive areas (e.g. forestry, locks, weirs).

Environmentally acceptable hydraulic fluids may only be used in the pharmaceutical and food industry subject to required certification to FDA/USDA/NSF **H1**.

1.2 Environmental compatibility

There is no unambiguous legal definition for environmentally acceptable hydraulic fluids as different testing procedures can be applied for biological degradation and toxicity.

According to ISO 15380 the definition of "environmentally acceptable" is as follows: Humans, animals, plants, air and soil must not be endangered. With regard to hydraulic fluids in an unused condition in the bin this mainly means:

– biological degradation at least 60 % (according to ISO 14593 or ISO 9439)
– acute fish toxicity at least 100 mg/l (according to ISO 7346-2)
– acute daphnia toxicity at least 100 mg/l (according to ISO 5341)
– acute bacteria toxicity at least 100 mg/l (according to ISO 8192)

The same amount of care should be taken when handling environmentally acceptable hydraulic fluids as for mineral oils, leakage from the hydraulic system should be avoided. Environmentally acceptable hydraulic fluids are designed so that in the event of accidents and leakage,less permanent environmental damage is caused than by mineral oils, see also chapter 5 "Disposal and environmental protection".

In comparison to mineral oil HLP/HVLP , the biological degradation of environmentally acceptable hydraulic fluids may change fluid aging, see chapter 3.1.5 "Aging resistance", 3.1.6. "Biological degradation" and 4 "Hydraulic fluids in operation".

1.3 Scope

This data sheet must be applied when using environmentally acceptable hydraulic fluids with Rexroth hydraulic components. The specifications of this data sheet may be further restricted by the specification given in the data sheets for the individual components.

The use of the individual environmentally acceptable hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with environmentally acceptable hydraulic fluids according to ISO 15380 if specified in the respective component data sheet or if a Rexroth approval for use is furnished.

The manufacturers of hydraulic systems must adjust their systems and operating instructions to the environmentally acceptable hydraulic fluids.

Notes:
In the market overview RE 90221-01, environmentally acceptable hydraulic fluids based on mineral oil are described which, according to the information of the lubricant manufacturer, feature the respective parameters of the current requirements standard ISO 15380 and other parameters which are of relevance for suitability in connection with Rexroth components.

These specifications are not checked or monitored by Bosch Rexroth. The list in the market overview does not therefore represent a recommendation on the part of Rexroth or approval of the respective hydraulic fluid for use with Rexroth components and does not release the operator from his responsibility regarding selection of the hydraulic fluid.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.4 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For mineral oils, the cleanliness level of environmentally acceptable hydraulic fluids is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	**Up to and including**	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6

20 / 18 / 15
$>$ 4 µm $>$ 6 µm $>$ 14 µm

3 Selection of the hydraulic fluid

Environmentally acceptable hydraulic fluids for Bosch Rexroth hydraulic components are assessed on the basis of their fulfillment of the minimum requirements of ISO 15380.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter life cycle will result.

Please ensure that the permissible temperature and viscosity limits are observed for the respective components. This usually requires either cooling or heating, or both.

1

3.1.2 Viscosity-temperature behavior

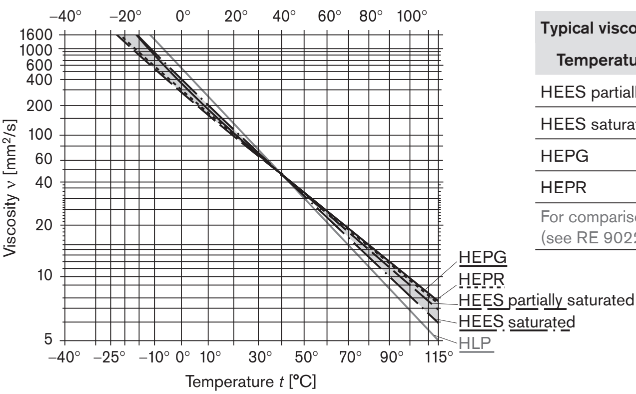
For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops. The interrelation between viscosity and temperature is described by the viscosity index (VI).

If exposed to the cold for several days, viscosity may rise significantly (HETG and HEES). After heating, the characteristic values as specified on the data sheet are restored. Please ask your lubricant manufacturer for the " Flow capacity after 7 days at low temperature" (ASTM D 2532) of fluid classifications HETG and partially saturated HEES.

All known environmentally acceptable hydraulic fluids have better viscosity temperature behavior than mineral oil HLP and generally feature greater shear stability than HVLP mineral oils. This should be taken into consideration when selecting hydraulic fluid for the required temperature range. A lower viscosity level can frequently be used to save any drive power during a cold start and avoid viscosity being too low at higher temperatures. The required viscosity and temperature limits in the product data sheets are to be observed in all operating conditions.

Depending on the basic fluid types/classes, VI indices can be achieved of 140–220, see Fig. 1: "Examples: V-T diagrams in comparison to HLP (reference values)" and Table 4: "Classification and fields of application of environmentally acceptable hydraulic fluids".

Fig. 1: Examples V-T diagrams in comparison to HLP (reference values, double-logarithmic representation)



Typical viscosity data [mm²/s]			
Temperature	–20 °C	40 °C	100 °C
HEES partially saturated	1250	46	9
HEES saturated	2500	46	8
HEPG	2500	46	10
HEPR	1400	46	10
For comparison HLP (see RE 90220)	4500	46	7

Detailed V-T diagrams may be obtained from your lubricant manufacturer for their specific products.

3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in ISO 15380 via test procedures"FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). From ISO VG 32, ISO 15380 prescribes a rating of at least 10 (FZG test). At present, the FZG test cannot be applied to viscosity classes < ISO VG 32. The wear protection capability of environmentally acceptable hydraulic fluids in relation to the two test procedures is comparable to that of mineral oil HLP/HVLP.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HE... general	One-component color coatings, lead, galvanized zinc coatings, some non-ferrous metals, seals made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. NBR is only permitted by prior consent, please observe the customary seal and tube replacement intervals. Do not use any hydrolysis/susceptible polyurethane qualities. **Note** Please check seals and coatings of control cabinets, outer coatings of hydraulic components and accessories (connectors, cables, control cabinets) for resistance to vapors issuing from hydraulic fluids.
HETG/HEES	Zinc, some non-ferrous alloys with zinc
HEPG	Steel/aluminum tribocontacts, paper filters, polymethylmethacrylate (PMMA), NBR **Note** Check plastics for resistance

The material incompatibilities mentioned here do not automatically result in function problems. However the elements of the materials are found in the hydraulic fluids after use. The biological degradation of hydraulic fluids is negatively influenced.

3.1.5 Aging resistance

The way an environmentally acceptable hydraulic fluids ages depends on the thermal, chemical and mechanical stress to which it is subjected. The influence of water, air, temperature and contamination may be significantly greater than for mineral oils HLP/HVLP. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids .

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

A modified aging test (without adding water) is prescribed for fluid classifications HETG and HEES. Hydraulic fluids with HEPG and HEPR classification are subjected to the identical test procedure as mineral oils (with 20 % water added). The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content < 0.1%, cf. chapter 4.10. "Water".

3.1.6 Biological degradation

Environmentally acceptable hydraulic fluids are ones which degrade biologically much faster than mineral oils. Biological degradation is a biochemical transformation effected by micro-organisms resulting in mineralization. For environmentally acceptable hydraulic fluids that make reference to ISO 15380, biological degradation according to ISO 14593 or ISO 9439 must be verified. 60% minimum degradation is defined as limit value. Proof of biological degradation is furnished for the new, unmixed, ready-formulated hydraulic fluids. Aged or mixed hydraulic fluids are less able to degrade biologically. Biological degradation outside the defined test procedure is subject to a variety of natural influences. The key factors are temperature, humidity, contamination, fluid concentration, type and quantity of micro-organisms. Environmentally acceptable hydraulic fluids require no extended maintenance in comparison to mineral oils, please observe chapter 4 "Hydraulic fluids in operation".

3.1.7 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging. It cannot be improved by additives.

According to ISO 15380, for instance, an ASA value ≤ 10 minutes is required for viscosity class ISO VG 46, 6 minutes are typical, lower values are preferable.

3.1.8 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

Fluids classified HETG, HEES and HEPR separate from water. HETG and HEES hydraulic fluids have a different water separation ability to mineral oil HLP/HVLP. At 20 °C, in comparison to mineral oil HLP/HVLP, a multiple (> factor 3) of water can separate in the hydraulic fluid. Water solubility is also more temperature-dependent than for mineral oils. With regard to water solubility, HEPR hydraulic fluids behave like HVLP hydraulic fluids (see RE 90220). In the majority of cases, HEPG-classified fluids HEPG dissolve water completely , see chapter "4.10 Water".

3.1.9 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. Depending on the different basic fluids (glycols, saturated and partially saturated ester oils, hydrocrack oils, polyalpha olefins, triglycerides) and additives (VI enhancers), there are great differences here.

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Rexroth therefore requires the same degree of filterability of environmentally acceptable hydraulic fluids as for mineral oils HLP/HVLP to DIN 51524. As ISO 15380 does not comment on the filterability of hydraulic fluids, filterability comparable to that of mineral oils HLP/HVLP must be requested of lubricant manufacturers.

Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.10 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in ISO 15380. Hydraulic fluids that are not compatible with the materials listed above must not be used, even if they are compliant with ISO 15380.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

3.1.11 Additivation

The properties described above can be modified with the help of suitable additives. Environmentally acceptable hydraulic fluids should never contain heavy metals. According to the present state of knowledge, all hydraulic fluids, regardless of additivation, can be filtered with all customary filter materials in all known filtration ratings (≥ 0.8 μm), without filtering out effective additives at the same time.

Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HEPG according to ISO 15380 Density at 15 °C: typically > 0.97 kg/dm³ VI: typical > 170	Basic fluid, glycols	Systems on exposed water courses (locks, weirs, dredgers)	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Very good viscosity/temperature characteristics, shear stability – Resistant to aging – Incompatible with mineral oil (exceptions must be confirmed by the lubricant manufacturer) – Can be water-soluble – Can be mixed with water – Very good wear protection properties – A higher implementation temperature with the same viscosity in comparison to mineral oil is to be expected – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – Classified as insignificantly water-endangering (water hazard class WGK 1) – Prior to commissioning, contact the lubricant manufacturer, as the components are tested with mineral oil HLP/corrosion protection oil.
HEES partially saturated according to ISO 15380 Density at 15 °C: typically 0.90–0.93 kg/dm³ VI: typical > 160 Iodine count < 90	Basic fluid: Ester based on renewable raw materials, synthetic esters, mixtures of various esters, mixtures with polyalphaolefines (< 30%)	Suitable for most fields of application and components.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Limit lower (depending on viscosity class) and upper implementation temperatures (maximum 80 °C due to aging) – Good viscosity/temperature characteristics, shear stability. – Good corrosion protection, if correspondingly additivized – Mostly classed as insignificantly water-endangering (water hazard class WGK 1), in some cases as not water-endangering – High dirt dissolving capacity on fluid changeovers – In unfavorable operating conditions (high water content, high temperature), HEES on ester basis have a tendency to hydrolysis. The acidic organic decomposition products can chemically attack materials and components.

Continued on page 9

Table 4: Classification and fields of application (continued from page 8)

Classification	Features	Typical field of application	Notes
HEES saturated according to ISO 15380 Density at 15 °C: typically 0.90–0.93 kg/dm³ VI: typical 140–160 Iodine count <15	Basic fluid: Ester based on renewable raw materials, synthetic esters, mixtures of various esters, mixtures with polyalphaolefines (< 30%)	Suitable for most fields of application and components. Saturated HEES should be preferred over partially saturated HEES and HETG for components and systems exposed to high stress levels.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Good viscosity/temperature characteristics, shear stability – Good corrosion protection, if correspondingly additivized – Mostly classed as insignificantly water-endangering (water hazard class WGK 1), in the case of low viscosity classes (up to ISO VG 32) also classed as not water-endangering – High dirt dissolving capacity on fluid changeovers
HEPR according to ISO 15380 Density at 15 °C: typically 0.87 kg/dm³ VI : typical 140–160	Basic fluid: synthetically manufactured hydrocarbons (polyalpha olefins PAO) partly mixed with esters (< 30 %)	Suitable for most fields of application and components. HEPR should be preferred over partially saturated HEES and HETG for components and systems exposed to high stress levels.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Behaves similarly to HVLP- hydraulic fluids, individual products comply with ISO 15380 HEPR and DIN 51524-3 HVLP – Preferred use of FKM seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – Good viscosity-temperature behavior – Classified as insignificantly water-endangering (water hazard class WGK 1) **Note:** Note shear stability (see chapter 4.11 "Fluid servicing, fluid analysis and filtration" and chapter 6 "Glossary")
HETG according to ISO 15380 Density at 15 °C: typically 0.90-0.93 kg/dm³ VI: typical > 200 Iodine count > 90	Basic fluid: vegetable oils and triglycerides	Not recommended for Rexroth components!	Practical requirements are frequently not fulfilled by hydraulic fluids in this classification. Use only permissible after consultation. – Viscosity is not stable over time – Very fast fluid aging, very hydrolysis-susceptible (please observe neutralization number) – Tendency to gumming, gelling and setting. – Limit the lower (depending on viscosity class) and upper implementation temperatures (see chapter 3.1.5) – Only limited material compatibility – Filterability problems at water ingress – High dirt dissolving capacity on fluid changeovers – Mostly classed as not water-endangering

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard ISO 15380 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Bosch Rexroth will accept no liability for damage to its components within the framework of the applicable liability legislation insofar as the latter is due to non-observance of the following instructions.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

In particular with the changeover from mineral oils to environmentally acceptable hydraulic fluids, but also from one environmentally acceptable hydraulic fluids to another, there may be interference (e.g. incompatibility in the form of gelling, silting, stable foam or reduced filterability or filter blockage).

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remains of the previous hydraulic fluid. Bosch Rexroth recommends obtaining verification of compatibility from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

For information on changing over hydraulic fluids with different classifications, please refer to VDMA 24314, VDMA 24569 and ISO 15380 appendix A.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This also includes hydraulic fluids with the same classification and from the market overview RE 90221-01. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with ISO 15380 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

Environmentally acceptable hydraulic fluids are tested for corrosion protection in the same way as mineral oil HLP/HVLP. When used in practice other corrosion mechanisms are revealed in detail and in individual cases, for the most part in contact with non-ferrous and white alloys.

4.9 Air

Under atmospheric conditions the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)".

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

HEPG dissolves water completely. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

In the case of hydraulic fluids classed HETG, HEES and HEPR undissolved water can be drained off from the reservoir sump, the remaining water content is however too high to ensure that the maximum permissible water limit values are observed in the long term.

Water in the hydraulic fluid can result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all environmentally acceptable hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

Due to the higher water solubility (except for HEPR) in comparison to mineral oil HLP/HVLP it is urgently advised that precautions be taken when using environmentally acceptable hydraulic fluids, such as a dehumidifier on the reservoir ventilation.

Water content has an affect particularly in the case of HETG and partially saturated HEES in that it accelerates aging (hydrolysis) of the hydraulic fluid and biological degradation, see chapter 4.11 "Fluid servicing, fluid analysis and filtration".

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness levels".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced at regular intervals and tested by the lubricant manufacturer or recognized accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum"

Differences in the maintenance and upkeep of environmentally acceptable hydraulic fluids with the corresponding suitability characteristics (as required in market overview RE 90221-01) in comparison to mineral oil HLP/HVLP are not necessary. Attention is however drawn to the note in chapter 1.3.

After changing over hydraulic fluids it is recommended that the filters be replaced again after 50 operating hours as fluid aging products may have detached themselves ("self-cleaning effect").

Compared to the pure unused hydraulic fluid the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid. This difference must be kept as low as possible. As soon as the trend analysis notes a significant increase in the values, the lubricant manufacturer should be contacted.

A higher viscosity than that of new materials indicates that the hydraulic fluid has aged. Evaluation by the test lab or lubricant manufacturers is however authoritative, whose recommendation should be urgently observed.

On systems where the possibility of water contamination cannot be completely ruled out (also condensation), it should be ensured via the hydraulic system circuit that fluid aging products are not accumulating in individual areas of the hydraulic system, but are being removed from the system in a controlled manner via the filtration system. This should be ensured via suitable hydraulic circuits (e.g. flushing circuit) or system manufacturer's operating instructions/specifications.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

All environmentally acceptable hydraulic fluids, are like mineral oil-based hydraulic fluids, subject to special disposal obligations.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration. Please refer to Hydrolysis.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance”.

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Diesel effect
If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Saturated esters
Esters differ by the number of C atoms (chain length) and position of the bonds between the C atoms. Saturated esters do not have double/multiple bonds between C atoms and are therefore more resistant to aging than partially saturated esters.

Partially saturated esters
In contrast to saturated esters, partially saturated esters have double/multiple bonds between C atoms. Rexroth defines partially saturated esters as unsaturated bonds and mixtures of esters with unsaturated and saturated bonds. Esters with unsaturated bonds are produced on the basis of renewable raw materials.

Depending on their number and position, these unsaturated bonds between the C atoms are instable. These bonds can detach themselves and form new bonds, thus changing the properties of those liquids (an aging mechanism). One of the underlying requirements for inclusion in the market overview RE 90221-01 is an aging stability characteristic. Attention is however drawn to the note in chapter 1.3.

Hydrolysis
Hydrolysis is the splitting of a chemical bond through the reaction with water under the influence of temperature.

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method..

Iodine count
The iodine count is a yardstick for the quantity of single and multiple unsaturated bonds between C atoms in the basic fluid. A low iodine count indicates that the hydraulic fluid contains few unsaturated bonds and is thus considerably more resistant to aging than a hydraulic fluid with a high iodine count. A statement about the position at which these multiple bonds are located and about how "stable" they are against influencing factors cannot be derived simply by stating the iodine count.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values. For hydraulic fluids based on glycol, DIN EN ISO 12937 is to be applied in conjunction with DIN 51777-1.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Stick-slip
Interaction between a resilient mass system involving friction (such as cylinder + oil column + load) and the pressure increase at very low sliding speeds. The static friction of the system is a decisive value here. The lower it is, the lower the speed that can still be maintained without sticking. Depending on the tribologic system, the stick-slip effect may lead to vibrations generated and sometimes also to significant noise emission. In many cases, the effect can be attenuated by replacing the lubricant.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm²/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid. The lower the change of viscosity in relation the temperature, the higher the VI.

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No statements concerning the suitability of a hydraulic fluid for a specific purpose can be derived from our information. The information given does not release the user from the obligation of own judgment and verification.

It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Rexroth
Bosch Group

Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)

Application notes and requirements for Rexroth hydraulic components

Hydraulic fluids

Title	Hydraulic fluids based on mineral oils and related hydrocarbons	Environmentally acceptable hydraulic fluids	**Fire-resistant, water-free hydraulic fluids**	Fire-resistant, water-containing hydraulic fluids
Standard	DIN 51524	ISO 15380	**ISO 12922**	ISO 12922
Data sheets	RE 90220	RE 90221	**RE 90222**	RE 90223 (in preparation)
Classification	HL HLP HLPD HVLP HLPD and more	HEPG HEES partially saturated HEES saturated HEPR HETG	**HFDR** **HFDU (ester base)** **HFDU (glycol base)** **and more**	HFC HFB HFAE HFAS

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1 Basic information

1.1 General instructions

The hydraulic fluid is the common element in any hydraulic component and must be selected very carefully. Quality and cleanliness of the hydraulic fluid are decisive factors for the operational reliability, efficiency and service life of a system.

Hydraulic fluids must conform, be selected and used in accordance with the generally acknowledged rules of technology and safety provisions. Reference is made to the country-specific standards and directives (in Germany the directive of the Employer's Liability Insurance Association BGR 137).

This data sheet includes recommendations and regulations concerning the selection, operation and disposal of fire-resistant, water-free hydraulic fluids in the application of Rexroth hydraulic components.

The individual selection of hydraulic fluid or the choice of classification are the responsibility of the operator.

It is the responsibility of the user to ensure that appropriate measures are taken for safety and health protection and to ensure compliance with statutory regulations. The recommendations of the lubricant manufacturer and the specifications given in the safety data sheet are to be observed when using hydraulic fluid.

This data sheet does not absolve the operator from verifying the conformity and suitability of the respective hydraulic fluid for his system. He is to ensure that the selected fluid meets the minimum requirements of the relevant hydraulic fluid standard during the whole of the period of use.

The currently valid standard for fire-resistant hydraulic fluids is the ISO 12922. In addition, other, more detailed documents, guidelines, specifications and legislation may also be valid. The operator is responsible for ensuring that such regulations are observed, for example:

– 7th Luxembourg Report: Luxembourg, April 1994, Doc. No. 4746/10/91 EN "Requirements and tests applicable to fire-resistant hydraulic fluids for hydrostatic and hydrokinetic power transmission and control"

– VDMA 24314 (1981-11): "Changing hydraulic fluids – guidelines"

– VDMA 24317 (2005-11): "Fire-resistant hydraulic fluids – minimum technical requirements"

– FM Approval Standard 6930 (2009-04): "Flammability Classification of Industrial Fluids" (only available in English)

– DIN Technical Report CEN/TR 14489 (2006-01): "Selection guidelines for protecting safety, health and the environment"

We recommend that you maintain constant, close contact with lubricant manufacturers to support you in the selection, maintenance, care and analyses.

When disposing of used hydraulic fluids, apply the same care as during use.

1.2 Fire resistance

There is no clear legal definition of fire-resistant hydraulic fluids. There are great differences regarding fire resistance. The selection is the sole responsibility of the system operator with respect to requirements (application, construction and design of the system, hottest source in the system, necessary fire protection).

Different test procedures are applied for evaluating fire resistance.

Fire resistance test procedure according to ISO 12922:

– Ignition properties of spray according to ISO 15029-1 (Spray flame persistence – hollow-cone nozzle method)

– Ignition properties of spray according to ISO 15029-2 (Stabilized flame heat release)

– Wick flame persistence of fluids according to ISO 14935 (average flame persistence)

– Determination of the flammability characteristics of fluids in contact with hot surfaces, ignition process according to ISO 20823 (ignition temperature, flame spread)

In general, fire-resistant hydraulic fluids are distinguished between **water-containing** fire-resistant and **water-free** fire-resistant hydraulic fluids. Water-containing fire-resistant hydraulic fluids are described in RE 90223.

Water-free, fire-resistant hydraulic fluid means hydraulic fluids with a water-proportion of 0.1% by volume ("Karl Fischer method", see chapter 6 "Glossary"), measured at the time of filling in the transport container.

In Europe water-free, fire-resistant hydraulic fluids are not approved for use in underground coal mining. The classification HFDU is no longer included in the VDMA 24317: 2005.

Note
In contrast to water-containing fluids, all water-free, fire-resistant hydraulic fluids have a flash point and a fire point. Specific parameters for flash point and fire point can be found in the technical and/or safety data sheet for the hydraulic fluid concerned.

Just as much care should be taken when working with fire-resistant hydraulic fluids are with other hydraulic fluids, e.g. mineral oils. A leak from the hydraulic system must be avoided. The best and most cost-effective protection against fire and explosion is to prevent leakage with meticulous service, maintenance and care of the hydraulic system.

1.3 Scope

This data sheet must be applied when using water-free, fire-resistant hydraulic fluids with Rexroth hydraulic components. The specifications of this data sheet may be further restricted by the specifications given in data sheets for the individual components concerned.

The use of the individual water-free, fire-resistant hydraulic fluids in accordance with the intended purpose can be found in the safety data sheets or other product description documents of the lubricant manufacturers. In addition, each use is to be individually considered.

Rexroth hydraulic components may only be operated with water-free, fire-resistant hydraulic fluids according to ISO 12922 if specified in the respective component data sheet or if a Rexroth approval for use is furnished.

The manufacturers of hydraulic systems must adjust their systems and operating instructions to the water-free, fire-resistant hydraulic fluids.

Bosch Rexroth will accept no liability for its components for any damage resulting from failure to comply with the notes below.

1.4 Safety instructions

Hydraulic fluids can constitute a risk for persons and the environment. These risks are described in the hydraulic fluid safety data sheets. The operator is to ensure that a current safety data sheet for the hydraulic fluid used is available and that the measures stipulated therein are complied with.

2 Solid particle contamination and cleanliness levels

Solid particle contamination is the major reason for faults occurring in hydraulic systems. It may lead to a number of effects in the hydraulic system. Firstly, single large solid particles may lead directly to a system malfunction, and secondly small particles cause continuous elevated wear.

For mineral oils, the cleanliness level of water-free, fire-resistant hydraulic fluids is given as a three-digit numerical code in accordance with ISO 4406. This numerical code denotes the number of particles present in a hydraulic fluid for a defined quantity. Moreover, foreign solid matter is not to exceed a mass of 50 mg/kg (gravimetric examination according to ISO 4405).

In general, compliance with a minimum cleanliness level of 20/18/15 in accordance with ISO 4406 or better is to be maintained in operation. Special servo valves demand improved cleanliness levels of at least 18/16/13. A reduction in cleanliness level by one level means half of the quantity of particles and thus greater cleanliness. Lower numbers in cleanliness levels should always be striven for and extend the service life of hydraulic components. The component with the highest cleanliness requirements determines the required cleanliness of the overall system. Please also observe the specifications in table 1: "Cleanliness levels according to ISO 4406" and in the respective data sheets of the various hydraulic components.

Hydraulic fluids frequently fail to meet these cleanliness requirements on delivery. Careful filtering is therefore required during operation and in particular, during filling in order to ensure the required cleanliness levels. Your lubricant manufacturer can tell you the cleanliness level of hydraulic fluids as delivered. To maintain the required cleanliness level over the operating period, you must use a reservoir breather filter. If the environment is humid, take appropriate measures, such as a breather filter with air drying or permanent off-line water separation.

Note: the specifications of the lubricant manufacturer relating to cleanliness levels are based on the time at which the container concerned is filled and not on the conditions during transport and storage.

Further information about contamination with solid matter and cleanliness levels can be found in brochure RE 08016.

Table 1: Cleanliness levels according to ISO 4406

Particles per 100 ml		Scale number
More than	Up to and including	
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64000	130,000	17
32000	64000	16
16000	32000	15
8000	16000	14
4000	8000	13
2000	4000	12
1000	2000	11
500	1000	10
250	500	9
130	250	8
64	130	7
32	64	6

20 / 18 / 15
> 4 µm > 6 µm > 14 µm

3 Selection of the hydraulic fluid

Water-free, fire-resistant hydraulic fluids for Bosch Rexroth hydraulic components are assessed on the basis of their fulfillment of the minimum requirements of ISO 12922.

3.1 Selection criteria for the hydraulic fluid

The specified limit values for all components employed in the hydraulic system, for example viscosity and cleanliness level, must be observed with the hydraulic fluid used, taking into account the specified operating conditions.

Hydraulic fluid suitability depends, amongst others, on the following factors:

3.1.1 Viscosity

Viscosity is a basic property of hydraulic fluids. The permissible viscosity range of complete systems needs to be determined taking account of the permissible viscosity of all components and it is to be observed for each individual component.

The viscosity at operating temperature determines the response characteristics of closed control loops, stability and damping of systems, the efficiency factor and the degree of wear.

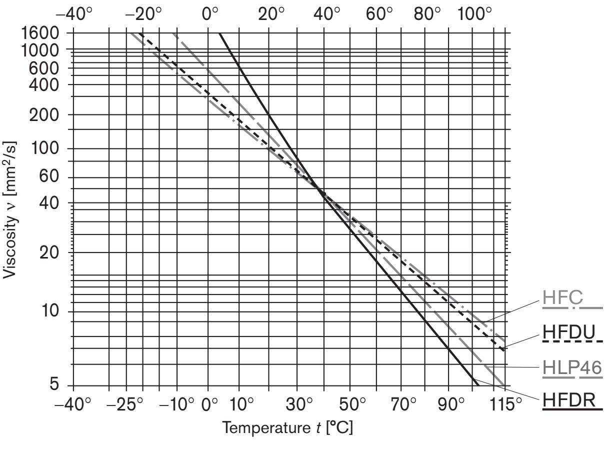
We recommend that the optimum operating viscosity range of each component be kept within the permissible temperature range. This usually requires either cooling or heating, or both. The permissible viscosity range and the necessary cleanliness level can be found in the product data sheet for the component concerned.

If the viscosity of a hydraulic fluid used is above the permitted operating viscosity, this will result in increased hydraulic-mechanical losses. In return, there will be lower internal leakage losses. If the pressure level is lower, lubrication gaps may not be filled up, which can lead to increased wear. For hydraulic pumps, the permitted suction pressure may not be reached, which may lead to cavitation damage.

If the viscosity of a hydraulic fluid is below the permitted operating viscosity, increased leakage, wear, susceptibility to contamination and a shorter component life cycle will result.

Please ensure that the permissible temperature and viscosity limits are observed for the respective components. This usually requires either cooling or heating, or both.

Fig. 1: Examples V-T diagrams for water-free, fire-resistant hydraulic fluids in comparison to HLP and HFC (reference values, double-logarithmic representation)



Typical viscosity data [mm²/s] at temperature	0 °C	40 °C	100 °C
HFDR	2500	43	5,3
HFDU (ester base)	330	46	9,2
HFDU (glycol base)	350	46	8,7
For comparison HLP (see RE 90220)	610	46	7
For comparison HFC (see RE 90223)	280	46	

Detailed V-T diagrams may be obtained from your lubricant manufacturer for their specific products. Descriptions of the individual classifications can be found in chapter 3.2 and in Table 4.

3.1.2 Viscosity-temperature behavior

For hydraulic fluids, the viscosity temperature behavior (V-T behavior) is of particular importance. Viscosity is characterized in that it drops when the temperature increases and rises when the temperature drops. The interrelation between viscosity and temperature is described by the viscosity index (VI).

For cold testing over a period of several days, the viscosity of ester-based HFDU can increase greatly. After heating, the characteristic values as specified on the data sheet are restored. Please ask your lubricant manufacturer for the "Flow capacity after seven days at low temperature" (ASTM D 2532) for the fluid classification ester-based HFDU .

HFDU fluid based on ester and glycol have better viscosity/temperature characteristics than mineral oil HLP (see Fig. 1). This should be taken into consideration when selecting hydraulic fluid for the required temperature range. The viscosity and temperature limits required in the product data sheets are to be observed in all operating conditions.

Note
For ambient temperatures below 0 °C, fire-resistant, **water-containing** hydraulic fluids of classification HFC are to be preferred because they observe the component-related viscosity ranges and because the have better pour points (see RE 90223).

3.1.3 Wear protection capability

Wear protection capability describes the property of hydraulic fluids to prevent or minimize wear within the components. The wear protection capability is described in ISO 12922 via test procedures"FZG gear test rig" (ISO 14635-1) and "Mechanical test in the vane pump" (ISO 20763). The wear protection capability of water-free, fire-resistant hydraulic fluids in relation to the two test procedures is comparable to that of mineral oil HLP/HVLP.

3.1.4 Material compatibility

The hydraulic fluid must not negatively affect the materials used in the components. Compatibility with coatings, seals, hoses, metals and plastics is to be observed in particular. The fluid classifications specified in the respective component data sheets are tested by the manufacturer with regard to material compatibility. Parts and components not supplied by us are to be checked by the user.

Table 2: Known material incompatibilities

Classification	Incompatible with:
HFD in general	Seals, plastics and coatings of control cabinets, outer coatings of hydraulic components and accessory components (connectors, wiring harnesses, control cabinets) are to be tested for stability. **Note:** hydraulic fluid vapors can also lead to incompatibility!
HFDR	Individual component color coating, lead, galvanic zinc-plating, in part non-ferrous metals with zinc, tin and aluminum in a tribological system. Sealing elements made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. Do not use any hydrolysis/susceptible polyurethane qualities.
HFDU based on ester	Single-component color coatings, lead, galvanized zinc coatings, in part non-ferrous metals with zinc, tin, seals made of NBR. In some cases, the latter show major increases in volume when impermissibly aged hydraulic fluids come into contact with the material. Do not use any hydrolysis/susceptible polyurethane qualities.
HFDU based on glycol	Single-component color coatings, steel/aluminum tribocontacts, paper filters, polymethylmethacrylate (PMMA). The compatibility of NBR is to be examined for individual case.

The material incompatibilities mentioned here do not automatically result in function problems. However the elements of the materials are found in the hydraulic fluids after use. The material incompatibilities described here may lead to accelerated aging of the hydraulic fluid and to reduced fire resistance.

3.1.5 Aging resistance

The way a water-free, fire-resistant hydraulic fluid ages depends on the thermal, chemical and mechanical stress to which it is subjected. The influence of water, air, temperature and contamination may be significantly greater than for mineral oils HLP/HVLP. Aging resistance can be greatly influenced by the chemical composition of the hydraulic fluids.

High fluid temperatures (e.g. over 80 °C) result in a approximate halving of the fluid service life for every 10 °C temperature increase and should therefore by avoided. The halving of the fluid service life results from the application of the Arrhenius equation (see Glossary).

Table 3: Reference values for temperature-dependent aging of the hydraulic fluid

Reservoir temperature	Fluid life cycle
80 °C	100 %
90 °C	50 %
100 °C	25 %

1

A modified aging test (ISO 4263-3 or ASTM D943 – without the addition of water) is specified for fluid classification HFDU. Fluid classification HFDR is described with a special procedure with respect to oxidation stability (EN 14832) and oxidation service life (ISO 4263-3). The calculated fluid service life is derived from the results of tests in which the long-term characteristics are simulated in a short period of time by applying more arduous conditions (condensed testing). This calculated fluid service life is not to be equated to the fluid service life in real-life applications.

Table 3 is a practical indicator for hydraulic fluids with water content $< 0.1\%$, cf. chapter 4.10. "Water".

3.1.6 Environmentally acceptable

HFDU fluids based on ester and glycol are hydraulic fluids which may also be classified as environmentally acceptable. The main criteria for fire-resistant, water-free hydraulic fluids are the leak-free, technically problem-free use and the necessary fire resistance. Environmentally acceptable is merely a supplementary criterion. Notes on environmentally compatible hydraulic fluids can be found in RE 90221.

3.1.7 Air separation ability (ASA)

The air separation ability (ASA) describes the property of a hydraulic fluid to separate undissolved air. Hydraulic fluids always contain dissolved air. During operation, dissolved air may be transformed into undissolved air, leading to cavitation damages. Fluid classification, fluid product, reservoir size and design must be coordinated to take into account the dwell time and ASA value of the hydraulic fluid. The air separation capacity depends on the viscosity, temperature, basic fluid and aging. It cannot be improved by additives.

According to ISO 12922 for instance, an ASA value $\leq$ 15 minutes is required for viscosity class ISO VG 46, practical values on delivery are $<$ 10 minutes, lower values are preferable.

3.1.8 Demulsifying ability and water solubility

The capacity of a hydraulic fluid to separate water at a defined temperature is known as the demulsifying ability. ISO 6614 defines the demulsifying properties of hydraulic fluids.

The fluid classifications HFDU based on ester and HFDR separate water, but HFD hydraulic fluids have a different water separation ability to mineral oil HLP/HVLP. At 20 °C, in comparison to mineral oil HLP/HVLP, a multiple ($>$ factor 3) of water can separate in the hydraulic fluid. Water solubility is also more temperature-dependent than for mineral oils. The fluid classification HFDU based on glycol usually dissolves water completely, see chapter "4.10 Water".

3.1.9 Filterability

Filterability describes the ability of a hydraulic fluid to pass through a filter, removing solid contaminants. The hydraulic fluids used require a good filterability, not just when new, but also during the whole of their service life. This can differ greatly depending on the different basic fluids (glycols, esters) and additives (VI enhancers, anti-fogging additives).

The filterability is a basic prerequisite for cleanliness, servicing and filtration of hydraulic fluids. Rexroth therefore requires the same degree of filterability of water-free, fire-resistant hydraulic fluids as for mineral oils HLP/HVLP to DIN 51524.
As ISO 12922 does not comment on the filterability of hydraulic fluids, filterability comparable to that of mineral oils HLP/HVLP must be requested of lubricant manufacturers.

Filterability is tested with the new hydraulic fluid and after the addition of 0.2 % water. The underlying standard (ISO 13357-1/-2) stipulates that filterability must have no negative effects on the filters or the hydraulic fluid, see chapter 4 "Hydraulic fluids in operation".

3.1.10 Corrosion protection

Hydraulic fluids should not just prevent corrosion formation on steel components, they must also be compatible with non-ferrous metals and alloys. Corrosion protection tests on different metals and metal alloys are described in ISO 12922.

Rexroth components are usually tested with HLP hydraulic fluids or corrosion protection oils based on mineral oils before they are delivered.

3.1.11 Additivation

The properties described above can be modified with the help of suitable additives.
Bosch Rexroth does not prescribe any specific additive system.

3.2 Classification and fields of application

Table 4: Classification and fields of application

Classification	Features	Typical field of application	Notes
HFDU (glycol-based) according to ISO 12922 Density at 15 °C: typically > 0.97 kg/dm³ VI: typical > 170 The classification "HFDU" is no longer listed in the current standard sheet VDMA 24317.	Base fluid: Glycols	Mobile systems with high thermal loading	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Very good viscosity/temperature characteristics, shear stability – Resistant to aging – Can be water-soluble – Can be mixed with water – Very good wear protection properties – A higher implementation temperature with the same viscosity in comparison to mineral oil is to be expected – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – Prior to commissioning, contact the lubricant manufacturer, as the components are tested with mineral oil HLP/corrosion protection oil. – Incompatible with mineral oil (exceptions must be confirmed by the lubricant manufacturer).
HFDU (ester-based) according to ISO 12922 Density at 15 °C: typically 0.90-0.93 kg/dm³ VI: typical > 160 Iodine count < 90 The classification "HFDU" is no longer listed in the current standard sheet VDMA 24317.	Base fluid: Ester based on regenerative raw materials, synthetic ester and mixtures of different esters Because of the fire resistance, HFDU hydraulic fluids based on ester are usually partially saturated esters	Suitable for most fields of application and components.	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Preferred use of FKM seals. Please enquire about shaft seal rings and implementation temperatures under –15 °C. – Note shear stability (see chapter 4.11 "Fluid servicing, fluid analysis and filtration" and chapter 6 "Glossary") – Fire resistance is not stable over time – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity. Please check ATEX approvals for hydraulic components. – Limit the lower (see chapter 3.1.2) and upper implementation temperatures (see chapter 3.1.5) – Good viscosity-temperature behavior – Usually classified as insignificantly water-endangering (water hazard class WGK 1) – High dirt dissolving capacity on fluid changeovers – In unfavorable operating conditions (high water content, high temperature), HFDU on ester basis have a tendency to hydrolysis. The acidic organic decomposition products can chemically attack materials and components.

Classification	Features	Typical field of application	Notes
HFDR according to ISO 12922 Density at 15 °C: typically 1.1 kg/dm³ VI : typical 140–160	Base fluid: phosphoric acid ester	Turbine control systems	For information on approved components, please refer to the respective product data sheet. For components which have not been approved according to the product data sheet, please consult your Bosch Rexroth sales partner. – Classified as hazardous materials (for transportation and storage) – Hazardous working material – Water-endangering (Water hazard class 2 – WGK2) – Develops toxic vapors in case of fire – Preferred use of FKM, and possibly PTFE seals. Please enquire for shaft seal rings and implementation temperatures under –15 °C. – In operation, a higher temperature in comparison to mineral oil HLP/HVLP is to be expected given identical design and viscosity – Phosphoric acid esters display a tendency to hydrolysis when they come into contact with moisture. Under the influence of water/moisture, they become unstable or form highly aggressive, acidic components which could damage the hydraulic fluid and component beyond repair. – Poor viscosity/temperature characteristics – Due to the higher density in comparison to HLP, lower suction pressures are to be anticipated for pumps. Reduce the maximum speed as required and optimize suction conditions. – In unfavorable operating conditions (high water content, high temperature), HFDR have a tendency to hydrolysis. The acidic inorganic decomposition products chemically attack materials and components.
HFDU (continued)	Based on triglycerides, mineral oils or related hydrocarbons	Not recommended for Rexroth components!	Hydraulic fluids based on polyalphaolefines are not recommended on account of their poor fire resistance. This classification can usually be identified from: density $<$ 0.89; VI $<$ 140 to 160 Hydraulic fluids based on triglycerides are not recommended on account of their aging resistance. This classification can usually be identified from: density $>$ 0.92; VI $>$ 190; iodine count $>$ 90 Consult your lubricant manufacturer or your Bosch Rexroth sales partner if the classification of a hydraulic fluid is not clear.
HFDS HFDT	Based on halogenated hydrocarbons or mixtures with halogenated hydrocarbons	Not approved for Rexroth components!	HFDS and HFDT have not been permitted to be manufactured or used since 1989 for environmental reasons.

4 Hydraulic fluids in operation

4.1 General

The properties of hydraulic fluids can change continually during storage and operation.

Please note that the fluid standard ISO 12922 merely describes minimum requirements for hydraulic fluids in new condition at the time of filling into the bins. The operator of a hydraulic system must ensure that the hydraulic fluid remains in a utilizable condition throughout its entire period of use.

Deviations from the characteristic values are to be clarified with the lubricant manufacturer, the test labs or Bosch Rexroth.

Bosch Rexroth will accept no liability for damage to its components within the framework of the applicable liability legislation insofar as the latter is due to non-observance of the following instructions.

Please note the following aspects in operation.

4.2 Storage and handling

Hydraulic fluids must be stored correctly in accordance with the instructions of the lubricant manufacturer. Avoid exposing the containers to lengthy periods of direct heat. Containers are to be stored in such a way that the risk of any foreign liquid or solid matter (e.g. water, foreign fluids or dust) ingression into the inside of the container can be ruled out. After taking hydraulic fluids from the containers, these are immediately to be properly resealed.

Recommendation:

– Store containers in a dry, roofed place

– Store barrels on their sides

– Clean reservoir systems and machine reservoirs regularly

4.3 Filling of new systems

Usually, the cleanliness levels of the hydraulic fluids as delivered do not meet the requirements of our components. Hydraulic fluids must be filtered using an appropriate filter system to minimize solid particle contamination and water in the system.

As early as possible during test operation, new systems should be filled with the selected hydraulic fluid so as to reduce the risk of accidentally mixing fluids (see chapter 4.5 "Mixing and compatibility of different hydraulic fluids"). Changing the hydraulic medium at a later point represents significant additional costs (see following chapter).

4.4 Hydraulic fluid changeover

Problems may be encountered in particular when changing over from water-containing, fire-resistant hydraulic fluid or mineral oils to water-free, fire-resistant hydraulic fluids (e.g. incompatibilities in the form of gelling, silting, stable foam, reduced filterability or filter blockage). This may also happen when changing products within the same classification.

In the case of changeovers of the fluid in hydraulic systems, it is important to ensure compatibility of the new hydraulic fluid with the remains of the previous hydraulic fluid. Bosch Rexroth recommends obtaining verification of compatibility from the manufacturer or supplier of the new hydraulic fluid. The quantity of old fluid remaining should be minimized. Mixing hydraulic fluids should be avoided, see following chapter.

Information about changing to a hydraulic fluid of a different classification can be found, for example, in VDMA 24314 and in ISO 7745. In addition, the information given in chapter 3.1.4 "Material compatibility" is also to be observed.

Bosch Rexroth will not accept liability for any damage to its components resulting from inadequate hydraulic fluid changeovers!

4.5 Mixing and compatibility of different hydraulic fluids

If hydraulic fluids from different manufacturers or different types from the same manufacturer are mixed, gelling, silting and deposits may occur. These, in turn, may cause foaming, impaired air separation ability, malfunctions and damage to the hydraulic system.

If the fluid contains more than 2 % of another fluid then it is considered to be a mixture. Exceptions apply for water, see chapter 4.10 "Water".

Mixing with other hydraulic fluids is not generally permitted. This includes hydraulic fluids with the same classification. If individual lubricant manufacturers advertise miscibility and/or compatibility, this is entirely the responsibility of the lubricant manufacturer.

Bosch Rexroth customarily tests all components with mineral oil HLP before they are delivered.

Note: With connectible accessory units and mobile filtering systems, there is a considerable risk of non-permitted mixing of the hydraulic fluids!

Rexroth will not accept liability for any damage to its components resulting from mixing hydraulic fluids!

4.6 Re-additivation

Additives added at a later point in time such as colors, wear reducers, VI enhancers or anti-foam additives, may negatively affect the performance properties of the hydraulic fluid and the compatibility with our components and therefore are not permissible.

Rexroth will not accept liability for any damage to its components resulting from re-additivation!

4.7 Foaming behavior

Foam is created by rising air bubbles at the surface of hydraulic fluids in the reservoir. Foam that develops should collapse as quickly as possible.

Common hydraulic fluids in accordance with ISO 12922 are sufficiently inhibited against foam formation in new condition. On account of aging and adsorption onto surfaces, the defoamer concentration may decrease over time, leading to a stable foam.

Defoamers may be re-dosed only after consultation with the lubricant manufacturer and with his written approval.

Defoamers may affect the air separation ability.

4.8 Corrosion

The hydraulic fluid is to guarantee sufficient corrosion protection of components under all operating conditions, even in the event of impermissible water contamination.

Water-free, fire-resistant hydraulic fluids are tested for corrosion protection in the same way as mineral oil HLP/HVLP. When used in practice other corrosion mechanisms are revealed in detail and in individual cases, for the most part in contact with non-ferrous and white alloys.

4.9 Air

Under atmospheric conditions the hydraulic fluid contains dissolved air. In the negative pressure range, for instance in the suction pipe of the pump or downstream of control edges, this dissolved air may transform into undissolved air. The undissolved air content represents a risk of cavitation and of the diesel effect. This results in material erosion of components and increased hydraulic fluid aging.

With the correct measures, such as suction pipe and reservoir design, and an appropriate hydraulic fluid, air intake and separation can be positively influenced.

See also chapter 3.1.7 "Air separation ability (ASA)”.

4.10 Water

Water contamination in hydraulic fluids can result from direct ingress or indirectly through condensation of water from the air due to temperature variations.

HFDU hydraulic fluids on glycol basis are water-soluble or can be mixed with water. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

In the case of HDFU hydraulic fluids on ester basis, undissolved water can be drained off from the reservoir sump, the remaining water content is however too high to ensure that the maximum permissible water limit values are observed in the long term.

With the fluid classification HFDR, the greater density of the ester means that the any water that has ingressed will be on the surface of the hydraulic fluid. This means that any water that has ingressed into the system cannot be drained off in the sump of the reservoir.

Water in the hydraulic fluid can result in wear or direct failure of hydraulic components. Furthermore, a high water content in the hydraulic fluid negatively affects aging and filterability and increases susceptibility to cavitation. During operation, the water content in all hydraulic fluids, determined according to the "Karl Fischer method" (see chapter 6 "Glossary") for all water-free, fire-resistant hydraulic fluids must constantly be kept below 0.1% (1000 ppm). To ensure a long service life of both hydraulic fluids and components, Bosch Rexroth recommends that values below 0.05% (500 ppm) are permanently maintained.

Due to the higher water solubility in comparison to mineral oil HLP/HVLP it is urgently advised that precautions be taken when using water-free, fire-resistant hydraulic fluids, such as a dehumidifier on the reservoir ventilation.

Water content has an affect particularly in the case of HEDU hydraulic fluid on ester basis and HFDR in that it accelerates aging (hydrolysis) of the hydraulic fluid and biological degradation, see chapter 4.11 "Fluid servicing, fluid analysis and filtration".

4.11 Fluid servicing, fluid analysis and filtration

Air, water, operating temperature influences and solid matter contamination will change the performance characteristics of hydraulic fluids and cause them to age.

To preserve the usage properties and ensure a long service life for hydraulic fluid and components, the monitoring of the fluid condition and a filtration adapted to the application requirements (draining and degassing if required) are indispensable.

The effort is higher in the case of unfavorable usage conditions, increased stress for the hydraulic system or high expectations as to availability and service life, see chapter 2 "Solid particle contamination and cleanliness levels".

When commissioning a system, please note that the required minimum cleanliness level can frequently be attained only by flushing the system. Due to severe start-up contamination, it may be possible that a fluid and/or filter replacement becomes necessary after a short operating period (< 50 operating hours).

The hydraulic fluid must be replaced at regular intervals and tested by the lubricant manufacturer or recognized accredited test labs. **We recommend a reference analysis after commissioning.**

The minimum data to be tested for analyses are:

- Viscosity at 40 °C and 100 °C
- Neutralization number NN (acid number AN)
- Water content (Karl-Fischer method)
- Particle measurement with evaluation according to ISO 4406 or mass of solid foreign substances with evaluation to EN 12662
- Element analysis (RFA (EDX) / ICP, specify test method)
- Comparison with new product or available trend analyses
- Assessment / evaluation for further use
- Also recommended: IR spectrum

No differences are needed in the maintenance and care of water-free, fire-resistant hydraulic fluids with the appropriate suitability parameters compared to HLP/HVLP mineral oils. Attention is however drawn to the note in chapter 1.3.

After changing over hydraulic fluids it is recommended that the filters be replaced again after 50 operating hours as fluid aging products may have detached themselves ("self-cleaning effect").

Compared to the pure unused hydraulic fluid the changed neutralization number NN (acid number AN) indicates how many aging products are contained in the hydraulic fluid. This difference must be kept as small as possible. The lubricant manufacturer should be contacted as soon as the trend analysis notes a significant increase in values.

A higher viscosity than that of new materials indicates that the hydraulic fluid has aged. Evaluation by the test lab or lubricant manufacturers is however authoritative, whose recommendation should be urgently observed.

On systems where the possibility of water contamination cannot be completely ruled out (also condensation), it should be ensured via the hydraulic system circuit that fluid aging products are not accumulating in individual areas of the hydraulic system, but are being removed from the system in a controlled manner via the filtration system. This should be ensured via suitable hydraulic circuits (e.g. flushing circuit) or system manufacturer's operating instructions/specifications.

In case of warranty, liability or guarantee claims to Bosch Rexroth, service verification and/or the results of fluid analyses are to be provided.

5 Disposal and environmental protection

All water-free, fire-resistant hydraulic fluids, are, like mineral oil-based hydraulic fluids, subject to special disposal obligations.

The respective lubricant manufacturers provide specifications on environmentally acceptable handling and storage. Please ensure that spilt or splashed fluids are absorbed with appropriate adsorbents or by a technique that prevents it contaminating water courses, the ground or sewerage systems.

It is also not permitted to mix fluids when disposing of hydraulic fluids. Regulations governing the handing of used oils stipulate that used oils are not to mixed with other products, e.g. substances containing halogen. Non-compliance will increase disposal costs. Comply with the national legal provisions concerning the disposal of the corresponding hydraulic fluid. Comply with the local safety data sheet of the lubricant manufacturer for the country concerned.

6 Glossary

Additivation
Additives are chemical substances added to the basic fluids to achieve or improve specific properties.

Aging
Hydraulic fluids age due to oxidation (see chapter 3.1.5 "Aging resistance"). Liquid and solid contamination acts as a catalyzer for aging, meaning that it needs to be minimized as far as possible by careful filtration. Please refer to Hydrolysis.

Arrhenius equation
The quantitative relation between reaction rate and temperature is described by an exponential function, the Arrhenius equation. This function is usually visualized within the typical temperature range of the hydraulic system. For a practical example, see chapter 3.1.5 "Aging resistance".

Basic fluids
In general, a hydraulic fluid is made up of a basic fluid, or base oil, and chemical substances, the so-called additives. The proportion of basic fluid is generally greater than 90%.

Diesel effect

If hydraulic fluid that contains air bubbles is compressed quickly, the bubbles are heated to such a degree that a self-ignition of the air-gas mix may occur. The resultant temperature increase may lead to seal damage and increased aging of the hydraulic fluid.

Partially saturated esters
In contrast to saturated esters, partially saturated esters have double/multiple bonds between C atoms. Rexroth defines partially saturated esters as unsaturated bonds and mixtures of esters with unsaturated and saturated bonds. Esters with unsaturated bonds are produced on the basis of renewable raw materials.

Depending on their number and position, these unsaturated bonds between the C atoms are instable. These bonds can detach themselves and form new bonds, thus changing the properties of those liquids (an aging mechanism). Attention is however drawn to the note in chapter 1.3.

Hydrolysis
Hydrolysis is the splitting of a chemical bond through the reaction with water under the influence of temperature.

ICP (atomic emission spectroscopy)
The ICP procedure can be used to determine various wear metals, contamination types and additives. Practically all elements in the periodic system can be detected with this method.

Iodine count
The iodine count is a yardstick for the quantity of single and multiple unsaturated bonds between C atoms in the basic fluid. A low iodine count indicates that the hydraulic fluid contains few unsaturated bonds and is thus considerably more resistant to aging than a hydraulic fluid with a high iodine count. A statement about the position at which these multiple bonds are located and about how "stable" they are against influencing factors cannot be derived simply by stating the iodine count.

Karl Fischer method
Method to determine the water content in fluids. Indirect coulometric determination procedure in accordance with DIN EN ISO 12937 in connection with DIN 51777-2. Only the combination of both standards will assure adequately accurate measured values. For hydraulic fluids based on glycol, DIN EN ISO 12937 is to be applied in conjunction with DIN 51777-1.

Cavitation
Cavitation is the creation of cavities in fluids due to pressure reduction below the saturated vapour pressure and subsequent implosion when the pressure increases. When the cavities implode, extremely high acceleration, temperatures and pressure may occur temporarily, which may damage the component surfaces.

Neutralization number (NN)
The neutralization number (NN) or acid number (AN) specifies the amount of caustic potash required to neutralize the acid contained in one gram of fluid.

Pour point
The lowest temperature at which the fluid still just flows when cooled down under set conditions. The pour point is specified in the lubricant manufacturers' technical data sheets as a reference value for achieving this flow limit.

RFA (wavelength dispersive x-ray fluorescence analysis)
Is a procedure to determine nearly all elements in liquid and solid samples with nearly any composition. This analysis method is suitable for examining additives and contamination, delivering fast results.

Shearing/shear loss
Shearing of molecule chains during operation can change the viscosity of hydraulic fluids with long chain VI enhancers and anti-fogging additives. The initially high viscosity index drops. This needs to be taken into account when selecting the hydraulic fluid.

The only value at present that can be used to assess viscosity changes in operation is the result of the test in accordance with DIN 51350 part -6. Please note that there are practical applications that create a much higher shear load on such hydraulic fluids than can be achieved by this test.

Viscosity
Viscosity is the measure of the internal friction of a fluid to flow. It is defined as the property of a substance to flow under tension. Viscosity is the most important characteristic for describing the load-bearing capacity of a hydraulic fluid.

Kinematic viscosity is the ratio of the dynamic viscosity and the density of the fluid; the unit is mm^2/s. Hydraulic fluids are classified by their kinematic viscosity into ISO viscosity classes. The reference temperature for this is 40 °C.

Viscosity index (VI)
Refers to the viscosity temperature behavior of a fluid. The lower the change of viscosity in relation the temperature, the higher the VI.

1

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Rating of hydraulic fluids for Rexroth hydraulic components (pumps and motors)

RE 90235
Edition: 01.2013

Bosch Rexroth offers the rating of hydraulic fluids as service – inclusive assistance and consulting of experienced engineers.

Hydraulic fluids

Title	Hydraulic fluids based on mineral oils and related hydrocarbons	Environmentally acceptable hydraulic fluids	Fire-resistant, water-free hydraulic fluids	Fire-resistant, water-containing hydraulic fluids
Standard	DIN 51524	ISO 15380	ISO 12922	ISO 12922
Data sheets	90220	90221	90222	90223 (in preparation)
Classification	HL HLP HLP(D) HVLP HVLP(D) and more	HEPG HEES partially saturated HEES saturated HEPR HETG	HFDR HFDU (ester base) HFDU (glycol base) and more	HFC HFB HFAE HFAS

The safe and reliable operation of industrial and mobile equipment is only possible if the hydraulic fluid used is selected with respect to the application. The main tasks of the hydraulic fluid are e.g. transmission of power, lubrication of the components, reduction of friction, corrosion prevention and heat dissipation. Unfortunately the common element "hydraulic fluid" is often disregarded during conceptual design.
Increased requirements on machines and equipment constantly raise the quality requirements on the hydraulic fluid used. For using a suitable hydraulic fluid, adequate knowledge and experience of this are necessary.
Therefore Bosch Rexroth offers the rating of hydraulic fluids for Rexroth hydraulic components as service.
Bosch Rexroth defines hydraulic fluids on the basis of the illustration on page 1. Application notes and requirements for Rexroth hydraulic components can be taken out of the data sheets mentioned in this illlustration on page 1.

1 Description

Minimum requirements
At present the DIN/ISO conformity for the minimum requirement on fluids is defined in our Bosch Rexroth component data sheets. The fluid manufacturers' technical data sheets have to include that the specific standard is met. The plausibility and correctness of the fluid data is not reviewed by Bosch Rexroth.

Basic Level
Fluid data of the manufacturer has to be according to DIN / ISO and Bosch Rexroth requirements (tightened data of standards, further Bosch Rexroth requirements). Bosch Rexroth demands the data to be confirmed in writing. The plausibility and correctness of the fluid data is reviewed by Bosch Rexroth.
Furthermore retained samples (finished fluid, base oils) are stored.
No special Rexroth fluid test with Rexroth hydraulic components will be done.

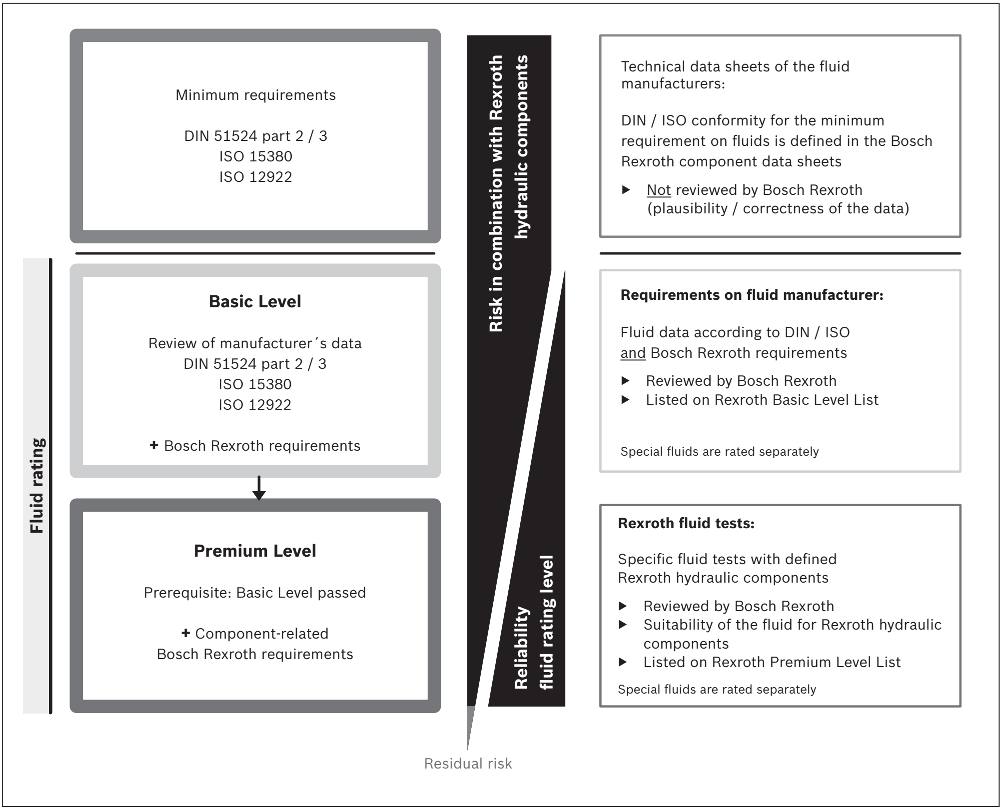
When the requirements are fulfilled the corresponding hydraulic fluids will be listed on the following Bosch Rexroth documents:
- 90240: Rexroth Basic Level List (HLP/HLP(D)/HVLP/HVLP(D))

in preparation:
- 90241: Rexroth Basic Level List (HExx)
- 90242: Rexroth Basic Level List (HFDx)
- 90243: Rexroth Basic Level List (HFxx)

Premium Level
It is a precondition for the Premium Level to meet the Basic Level.
The Premium Level contains specific fluid tests which show the suitability of the hydraulic fluid with defined Rexroth components. According to the Rexroth components used the corresponding test has to be passed with respect to the oil category.

When the requirements are fulfilled the corresponding hydraulic fluids will be listed on the following Bosch Rexroth document:
- 90245: Rexroth Premium Level List

Note
The fluid tests carried out in the Premium Level can not cover all machine and system-dependent conditions (see residual risk on rating scheme on page 3). Only single Rexroth components (type of pumps/motors used for the fluid test) can be examined.
Premium Level testing does not cover all systems and applications. Releases for special applications are excluded from the fluid rating.
The responsibility for selection of the hydraulic fluid remains with the equipment/machinery operator and the lubricant manufacturer.
By means of the fluid test contained in the Premium Level the risk in combination with Rexroth hydraulic components can be considerably reduced and the reliability significantly increased.


Minimum requirements
DIN 51524 part 2 / 3
ISO 15380
ISO 12922
Basic Level
Review of manufacturer´s data
DIN 51524 part 2 / 3
ISO 15380
ISO 12922
+ Bosch Rexroth requirements
Premium Level
Prerequisite: Basic Level passed
+ Component-related
Bosch Rexroth requirements
Fluid rating
Risk in combination with Rexroth hydraulic components
Reliability fluid rating level
Residual risk
Technical data sheets of the fluid manufacturers:
DIN / ISO conformity for the minimum requirement on fluids is defined in the Bosch Rexroth component data sheets
▶ Not reviewed by Bosch Rexroth (plausibility / correctness of the data)
Requirements on fluid manufacturer:
Fluid data according to DIN / ISO and Bosch Rexroth requirements
▶ Reviewed by Bosch Rexroth
▶ Listed on Rexroth Basic Level List
Special fluids are rated separately
Rexroth fluid tests:
Specific fluid tests with defined Rexroth hydraulic components
▶ Reviewed by Bosch Rexroth
▶ Suitability of the fluid for Rexroth hydraulic components
▶ Listed on Rexroth Premium Level List
Special fluids are rated separately

2 Process

The process of a fluid rating includes the following steps:

Process fluid rating

Basic Level

(BR*	Contacting fluid manufacturer)			
FM**	Registration for “fluid rating” on website of Bosch Rexroth (www.boschrexroth.com/fluidrating)			
BR	Reviewing registration data of the fluid manufacturer for plausibility			
BR	Assignation of registration number to fluid manufacturer Activating of fluid manufacturer´s access to download area of “fluid rating” on the website of Bosch Rexroth			
BR	Information to fluid manufacturer: 1) Registration number (=user name for login download area “fluid rating“) 2) Activating for download area is done			
FM	Download of all documents (conditions, applications) necessary for “fluid rating” (Basic Level)			
FM	Submitting of all documents and retained samples necessary for “fluid rating” (Basic Level) to Bosch Rexroth			
BR	Reviewing of the manufacturer´s data, testing of specific fluid data, storing of retained samples			
BR	when the requirements are fulfilled - hydraulic fluid will be listed on the Rexroth Basic Level List (HLP/HLP(D)/HVLP/HVLP(D): 90240, lists for other fluid categories in preparation) → **rated@Rexroth4Basic.HLP** → **rated@Rexroth4Basic.HLP(D)**	→ **rated@Rexroth4Basic.HVLP** → **rated@Rexroth4Basic.HVLP(D)**	validity period: 3 years		

Premium Level

FM	Request for quotation for fluid test by Bosch Rexroth			
FM	Commissioning of fluid test, supply of fluid for fluid test			
BR	Implementation of specific fluid test using defined Rexroth components	**RFT-APU-CL** Rexroth Fluid Test - Axial Piston Unit - Closed Loop	**RFT-APU-OL-HFC** Rexroth Fluid Test - Axial Piston Unit - Open Loop-HFC	further fluid tests in preparation
BR	when the requirements are fulfilled - hydraulic fluid will be listed on the Rexroth Premium Level List 90245 → **rated@Rexroth4Premium.RFT-APU-CL** → **rated@Rexroth4Premium.RFT-APU-OL-HFC**			

*BR: Bosch Rexroth **FM: fluid manufacturer

3 Fluid tests

3.1 Rexroth fluid test RFT-APU-CL
(**R**exroth **F**luid **T**est **A**xial **P**iston **U**nit **C**losed **L**oop)

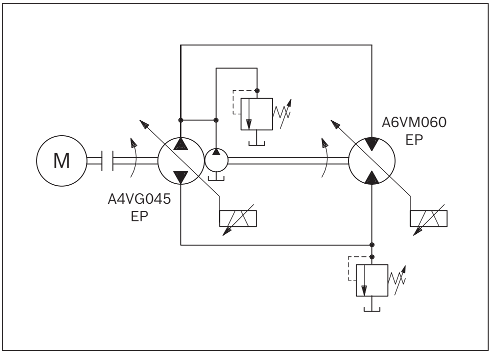
Fluid test for closed loops using a combination unit existing of a hydraulic pump A4VG045EP and a hydraulic motor A6VM060EP. This fluid test represents the requirements on a hydrostatic transmission.

Features of the fluid test
The suitability of the hydraulic fluid is tested at high stress under laboratory conditions. The fluid test consists of a break-in test, swivel cycle test and a corner power test.

Rating criteria
- Examination of the interaction fluid to component
  - Measurement of the component weight change respectively dimensional change
  - Material compatibility
  - Visual inspection of components/component surfaces
  - Oil analysis (SOT, during test, EOT)
- Evidence of endurance performance
- Determination of efficiency (SOT, EOT)

Test bench

▼ **Schematical hydraulic circuit diagram of the RFT-APU-CL**



Technical data of the test components

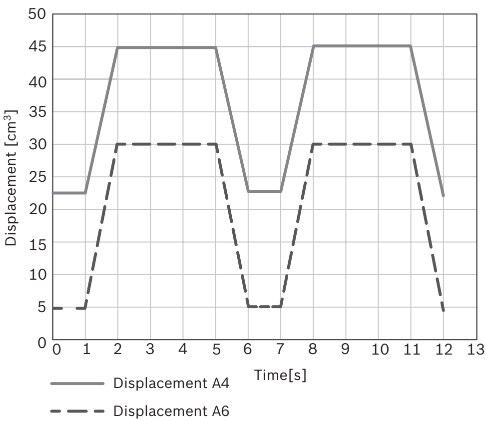
Type	A4VG045EP	A6VM060EP
Data sheet	92004	91610
Operation mode	pump	motor
Nominal volume	45 cm^3	62 cm^3
Maximum speed (at $V_{g\,max}$)	4300 min^{-1}	4450 min^{-1}
Maximum pressure	500 bar	500 bar
Control	electric (EP)	electric (EP)

Operating data

1. Break-in test	
Speed	2000 min^{-1}
Operating pressure	250 bar
Viscosity	10 to 15 mm^2/s
Operating time	10 h

2. Swivel cycle test	
Speed	4000 min^{-1}
Operating pressure	450 bar
Viscosity	5 to 7 mm^2/s
Operating time	300 h

▼ **Swivel cycle (schematic diagram)**



3. Corner power test	
Speed	4000 min^{-1}
Operating pressure	500 bar
Viscosity	5 to 7 mm^2/s
Operating time	200 h

3.2 Rexroth fluid test RFT-APU-OL-HFC
(**R**exroth **F**luid **T**est **A**xial **P**iston **U**nit **O**pen **L**oop-**HFC**)

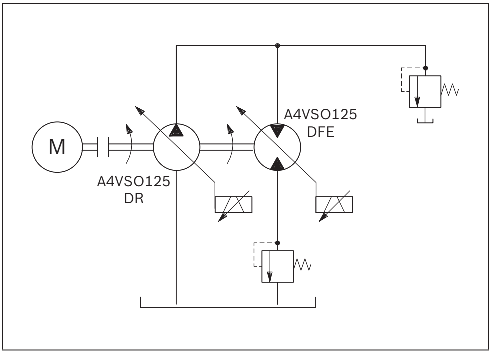
Fluid test for open loops using a A4VSO swashplate axial piston combination unit (hydraulic pump and hydraulic motor). This fluid test represents the requirements on applications demanding water-containing, fire-resistant hydraulic fluids of the classification HFC.

Features of the fluid test
The suitability of the hydraulic fluid is tested at high stress under laboratory conditions. The fluid test consists of a constant and swivel cycle test.

Rating criteria
- ▶ Examination of the interaction fluid to component
  - Wear and cavitation behaviour
  - Material compatibility
  - Visual inspection of components/component surfaces
  - Measuring records of functional relevant component surfaces
  - Oil analysis (SOT, during test, EOT)
- ▶ Evidence of endurance performance

Test bench

▼ **Schematical hydraulic circuit diagram of the RFT-APU-OL-HFC**



Technical data of the test components

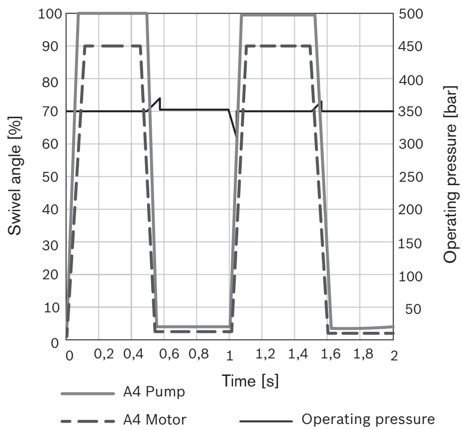
Type	A4VSO125DR	A4VSO125DFE
Data sheet	92053	92053
Operation mode	pump, self-priming	motor
Nominal volume	125 cm^3	125 cm^3
Maximum speed	2200 min^{-1}	2200 min^{-1}
Maximum pressure	400 bar	400 bar

Operating data

1. Constant test	
Speed	1800 min^{-1}
Operating pressure	350 bar
Displacement	$V_{g\ max}$, $V_{g\ min}$
Temperature	40°C
Operating time	200 h

2. Swivel cycle test	
Speed	1800 min^{-1}
Operating pressure	350 bar
Displacement	0,5 sec $V_{g\ min}$ / 0,5 sec $V_{g\ max}$
Temperature	40/50 °C
Operating time	800 h

▼ **Swivel cycle (schematic diagram)**



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Pumps

Axial piston pumps
Axial piston pumps are available in swash plate or bent axis design for medium and high pressure applications. Variable pumps facilitate tailored flows for the realization of energy-efficient drives. Different versions, performance ranges and control options ensure optimum solutions for stationary applications.

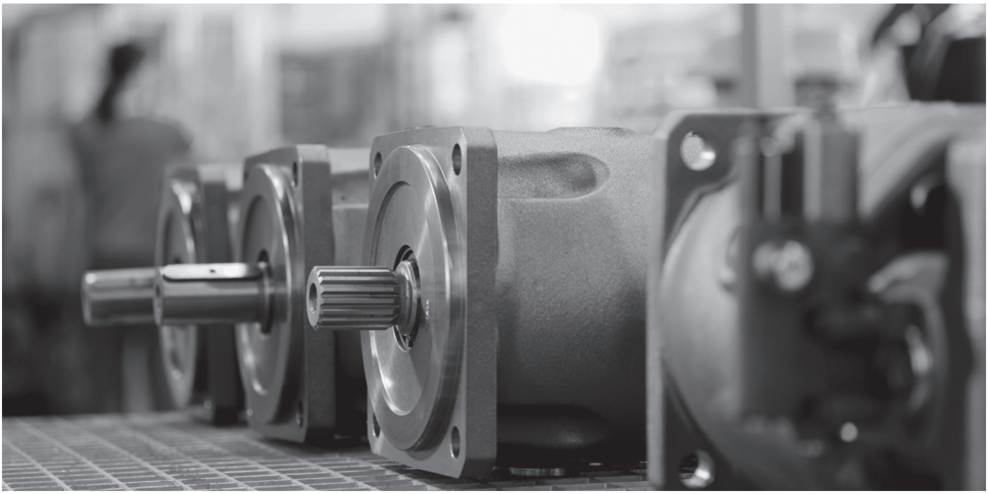
External gear pumps
External gear pumps are cost-effective displacement pumps. They are available in many different versions.
A selected range of single and multiple pumps is available on short notice. For special noise requirements, the SILENCE version with low pulsation as well as the SILENCE PLUS versions with very low background noise and low pulsation are available.

Internal gear pumps
Internal gear pumps can be used for continuous pressures of up to 315 bar (depending on the frame size). This pump principle features a compact design with particularly high energy density.

Vane pumps
Vane pumps are available in a wider range of sizes. They are used in applications requiring medium operating pressures and low noise emissions.

Radial piston pumps
Radial piston pumps provide high power density and round off the product range for high-pressure applications with operating pressures of up to 700 bar.

Gerotor pumps
Gerotor pumps are designed for low-pressure applications of up to 15 bar as economic oil pumps for cooling, filtering or lubrication circuits.



Axial piston pumps

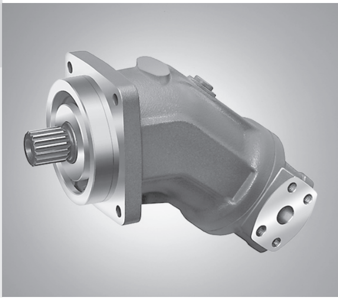
Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Displacement pumps						
Open circuit, series 6	A2FO	5 ... 1000		450	91401	71
Open circuit, series 1 and 3	A4FO	16 ... 500		450	91455	105
Variable-Speed drive with Fixed displacement unit or Variable displacement unit	A10FZO, A10FZG, A10VZO, A10VZG	6 ... 180			91485	121
Variable displacement pumps						
Variable-Speed drive with Fixed displacement unit or Variable displacement unit	A10FZO, A10FZG, A10VZO, A10VZG	6 ... 180			91485	121
Open circuit	A4VSO	40 ... 1000		400	92050	181
Open circuit, for HFC Fluids	A4VSO	125 ... 250		400	92053	249
Open circuit	A4VBO	71 ... 450		500	92122	257
Open circuit	A15VSO	175 ... 280		420	92800	285
Open circuit	A10VO	10 ... 100		315	92703	325
Open circuit	A10VSO	28 ... 140		350	92711	381
Open circuit	A10VSO	45 ... 180		350	92714	429
Open circuit	A10VSNO	63		250	92740	473
Open circuit	A7VO	28 ... 160		400	92202	489
Open circuit	A7VO	250 ... 500		400	92203	525
Open circuit	A1VO	35		280	92650	577
Open and closed circuit, Metering pump for polyurethane components	A7VK	12 ... 107		315	94010	597
Closed circuit	A4VSG	40 ... 1000		400	92100	621
Closed circuit, Compact unit	A4CSG	250 ... 750		400	92105	689
Controller / adjustment devices for type A4VS...						
Closed-loop speed control, secondary controlled	DS2	40 ... 1000	1X/3X	400	92057	721
Hydraulic adjustment device, pilot pressure dependent	HD	40 ... 1000		400	92080	751
Control devices	DR, DP, FR, DFR	40 ... 1000		400	92060	803
Power controllers with hyperbolic characteristic	LR, LR.N	40 ... 1000		400	92064	835
Control and adjustment device	HM, HS, HS4, EO	40 ... 1000		400	92076	903
Control and adjustment device	EPA, EPGA, EPB, EPGB, EPD, EPG	40 ... 1000		400	92084	955
Control and adjustment device	DFE1	125 ... 355		400	92088	971
Controller / adjustment devices for type A10V..						
Control and adjustment device	EF, LA	18 ... 140		350	92709	983
Accessories						
Scavenging and Pressure relief valve blocks	SDVB	16 ... 50			95533	991
Power limiting valves	LV06	6			95546	1003
Universal through drive					95581	1011

Rexroth
Bosch Group

Axial Piston Fixed Pump A2FO

RE 91401/06.2012 1/34
Replaces: 03.08

Data sheet



Series 6

Size	Nominal pressure/Maximum pressure
5	315/350 bar
10 to 200	400/450 bar
250 to 1000	350/400 bar

Open circuit

Contents

Ordering code for standard program	2
Technical data	4
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Dimensions sizes 80, 90	20
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Features

- Fixed pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in an open circuit
- For use in mobile and stationary applications
- The flow is proportional to the drive speed and displacement
- The drive shaft bearings are designed for the bearing service life requirements usually encountered in these areas
- High power density
- Small dimensions
- High total efficiency
- Economical design
- One-piece tapered piston with piston rings for sealing

Ordering code for standard program

	A2F		O		/	6			–	V				
01	02	03	04	05		06	07	08		09	10	11	12	13

Hydraulic fluid

01	Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearings "L" (without code)		
	HFB, HFC hydraulic fluid	Sizes 5 to 200 (without code)	
		Sizes 250 to 1000 (only in combination with long-life bearings "L")	E-

Axial piston unit

02	Bent-axis design, fixed	A2F

	Drive shaft bearing	5 to 200	250 to 500	710 to 1000	
03	Standard bearing (without code)	●	●	–	
	Long-life bearing	–	●	●	L

Operating mode

04	Pump, open circuit	O

Sizes (NG)

05	Geometric displacement, see table of values on page 7																					
		5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250	355	500	710	1000

Series

06		6

Index

07		NG10 to 180	1
		NG200	3
		NG5 and 250 to 1000	0

Directions of rotation

08	Viewed on drive shaft	clockwise	R
		counter-clockwise	L

Seals

09	FKM (fluor-caoutchouc)	V

	Drive shafts	5	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	200	250 to 1000	
10	Splined shaft DIN 5480	–	●	●	●	●	●	●	–	●	●	●	●	●	●	●	●	●	–	A
		–	●	●	–	●	●	–	●	●	–	●	–	●	–	●	–	–	●	Z
	Parallel keyed shaft DIN 6885	●	●	●	●	●	●	●	–	●	●	●	●	●	●	●	●	●	–	B
		–	●	●	–	●	●	–	●	●	–	●	–	●	–	●	–	–	●	P
	Conical shaft[1]	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C

	Mounting flanges		5 to 250	355 to 1000	
11	ISO 3019-2	4-hole	●	–	B
		8-hole	–	●	H

● = Available ❍ = On request – = Not available ▭ = Preferred program

1) Conical shaft with threaded pin and woodruff key (DIN 6888). The torque must be transmitted via the tapered press fit.

Ordering code for standard program

	A2F		O		/	6			–	V				
01	02	03	04	05		06	07	08		09	10	11	12	13

Port plates for service lines[2)]

		5	10 to 16	23 to 250	355 to 1000	
12	SAE flange port A/B at side and SAE flange port S at rear	–	–	●	–	**05**
	Threaded port A/B at side and threaded port S at rear	–	●	–	–	**06**
	SAE flange ports A/B and S at rear	–	–	–	●	**11**
	Threaded ports A/B and S at side	●	–	–	–	**07**

Standard / special version

13	Standard version (without code)	
	Standard version with installation variants, e. g. T ports against standard open or closed	**–Y**
	Special version	**-S**

● = Available ❍ = On request – = Not available ▭ = Preferred program

2) Fastening thread or threaded ports, metric

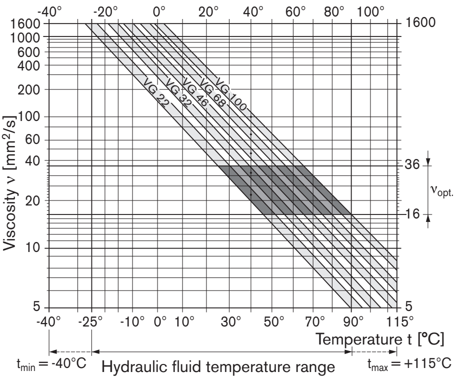
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The fixed pump A2FO is not suitable for operation with HFA hydraulic fluid. If HFB, HFC or HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit, the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range ($\nu_{opt.}$, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U (sizes 250 to 1000).

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq$ -50 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up[1]	ν_{max} = 1600	$T_{St} \geq$ -40 °C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm (for sizes 5 to 200), n ≤ 0.25 • n_{nom} (for sizes 250 to 1000)
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	ν < 1600 to 400	T = -40 °C to -25 °C	at p ≤ 0.7 • p_{nom}, n ≤ 0.5 • n_{nom} and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 12 K	between hydraulic fluid in the bearing and at port T.
Maximum temperature		115 °C	in the bearing
		103 °C	measured at port T
Continuous operation	ν = 400 to 10 ν_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port T, no restriction within the permissible data
Short-term operation[2]	$\nu_{min} \geq 7$	T_{max} = +103 °C	measured at port T, t < 3 min, p < 0.3 • p_{nom}
FKM shaft seal[1]		T ≤ +115 °C	see page 5

1) At temperatures below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).
2) Sizes 250 to 1000, please contact us.

Technical data

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

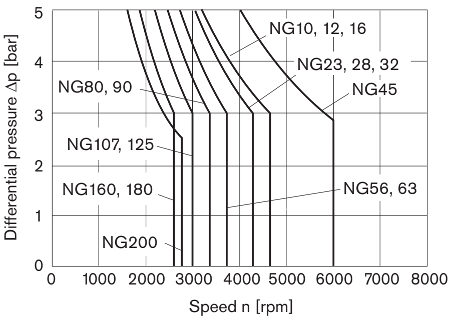
Shaft seal

Permissible pressure loading

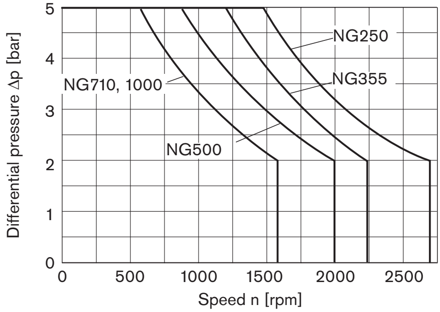
The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.

Sizes 10 to 200



Sizes 250 to 1000



The values are valid for an ambient pressure $p_{abs} = 1$ bar.

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering.
Please contact us.

Direction of flow

Direction of rotation, viewed on drive shaft	
clockwise	**counter-clockwise**
S to **B**	**S** to **A**

Long-life bearing

Sizes 250 to 1000
For long service life and use with HF hydraulic fluids. Identical external dimensions as motor with standard bearings. Subsequent conversion to long-life bearings is possible. Bearing and case flushing via port U is recommended.

Flushing flow (recommended)

NG	250	355	500	710	1000
$q_{v\ flush}$ (L/min)	10	16	16	16	16

2

Technical data

Operating pressure range
(operating with mineral oil)

Pressure at service line port A or B

Size 5

Nominal pressure p_{nom} ______ 315 bar absolute

Maximum pressure p_{max} ______ 350 bar absolute
Single operating period ______ 10 s
Total operating period ______ 300 h

Sizes 10 to 200

Nominal pressure p_{nom} ______ 400 bar absolute

Maximum pressure p_{max} ______ 450 bar absolute
Single operating period ______ 10 s
Total operating period ______ 300 h

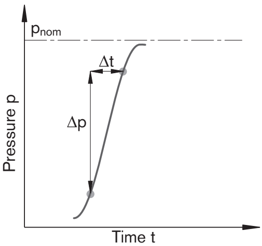
Sizes 250 to 1000

Nominal pressure p_{nom} ______ 350 bar absolute

Maximum pressure p_{max} ______ 400 bar absolute
Single operating period ______ 10 s
Total operating period ______ 300 h

Minimum pressure (high-pressure side) ___ 25 bar absolute

Rate of pressure change $R_{A\ max}$
Without pressure-relief valve ______ 16000 bar/s



Pressure at suction port S (inlet)

Minimum pressure $p_{S\ min}$ ______ 0.8 bar absolute

Maximum pressure $p_{S\ max}$ ______ 30 bar absolute

Note
Values for other hydraulic fluids, please contact us.

Definition

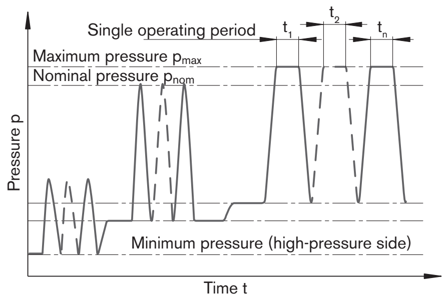
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Minimum pressure (inlet)
Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed of the axial piston unit (see diagram on page 7).

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period $= t_1 + t_2 + ... + t_n$

Technical data

Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size		NG		5	10	12	16	23	28	32	45	56	63	80
Displacement geometric, per revolution		V_g	cm^3	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4
Speed maximum[1)]		n_{nom}	rpm	5600	3150	3150	3150	2500	2500	2500	2240	2000	2000	1800
		n_{max}[2)]	rpm	8000	6000	6000	6000	4750	4750	4750	4250	3750	3750	3350
Flow at n_{nom}		q_V	L/min	27.6	32	38	50	57	70	80	102	112	126	145
Power at	$\Delta p = 350$ bar	P	kW	14.5[4)]	19	22	29	33	41	47	60	65	74	84
	$\Delta p = 400$ bar	P	kW	–	22	25	34	38	47	53	68	75	84	96
Torque[3)]														
at V_g and	$\Delta p = 350$ bar	T	Nm	24.7[4)]	57	67	89	128	157	178	254	313	351	448
	$\Delta p = 400$ bar	T	Nm	–	66	76	102	146	179	204	290	357	401	512
Rotary stiffness		c	kNm/rad	0.63	0.92	1.25	1.59	2.56	2.93	3.12	4.18	5.94	6.25	8.73
Moment of inertia for rotary group		J_{GR}	kgm^2	0.00006	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072
Maximum angular acceleration		α	rad/s^2	5000	5000	5000	5000	6500	6500	6500	14600	7500	7500	6000
Case volume		V	L		0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
Mass (approx.)		m	kg	2.5	6	6	6	9.5	9.5	9.5	13.5	18	18	23

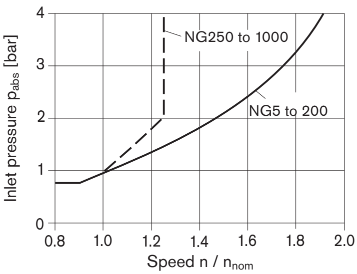
Size		NG		90	107	125	160	180	200	250	355	500	710	1000
Displacement geometric, per revolution		V_g	cm^3	90	106.7	125	160.4	180	200	250	355	500	710	1000
Speed maximum[1)]		n_{nom}	rpm	1800	1600	1600	1450	1450	1550	1500	1320	1200	1200	950
		n_{max}[2)]	rpm	3350	3000	3000	2650	2650	2750	1800	1600	1500	1500	1200
Flow at n_{nom}		q_V	L/min	162	171	200	233	261	310	375	469	600	852	950
Power at	$\Delta p = 350$ bar	P	kW	95	100	117	136	152	181	219	273	350	497	554
	$\Delta p = 400$ bar	P	kW	108	114	133	155	174	207	–	–	–	–	–
Torque[3)]														
at V_g and	$\Delta p = 350$ bar	T	Nm	501	594	696	893	1003	1114	1393	1978	2785	3955	5570
	$\Delta p = 400$ bar	T	Nm	573	679	796	1021	1146	1273	–	–	–	–	–
Rotary stiffness		c	kNm/rad	9.14	11.2	11.9	17.4	18.2	57.3	73.1	96.1	144	270	324
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0072	0.0116	0.0116	0.0220	0.0220	0.0353	0.061	0.102	0,178	0.55	0.55
Maximum angular acceleration		α	rad/s^2	6000	4500	4500	3500	3500	11000	10000	8300	5500	4300	4500
Case volume		V	L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2	8	8
Mass (approx.)		m	kg	23	32	32	45	45	66	73	110	155	325	336

1) The values are valid:
- at an absolute pressure $p_{abs} = 1$ bar at suction port S
- for the optimum viscosity range from $\nu_{opt} = 16$ to $36\ mm^2/s$
- with hydraulic fluid based on mineral oils

2) Maximum speed (limiting speed) with increased inlet pressure p_{abs} at suction port S, see adjacent diagram.

3) Torque without radial force, with radial force see page 8

4) Torque at $\Delta p = 315$ bar



Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

2

Technical data

Permissible radial and axial forces of the drive shafts

(splined shaft and parallel keyed shaft)

Size	NG		5	5[3]	10	10	12	12	16	23	23
Drive shaft	ø	mm	12	12	20	25	20	25	25	25	30
Maximum radial force[1]	$F_{q\,max}$	kN	1.6	1.6	3.0	3.2	3.0	3.2	3.2	5.7	5.4
at distance a (from shaft collar)	a	mm	12	12	16	16	16	16	16	16	16
with permissible torque	T_{max}	Nm	24.7	24.7	66	66	76	76	102	146	146
≙ permissible pressure Δp	Δp_{perm}	bar	315	315	400	400	400	400	400	400	400
Maximum axial force[2]	$+F_{ax\,max}$	N	180	180	320	320	320	320	320	500	500
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$\pm F_{ax\,perm/bar}$	N/bar	1.5	1.5	3.0	3.0	3.0	3.0	3.0	5.2	5.2

Size	NG		28	28	32	45	56	56[4]	56	63	80
Drive shaft	ø	mm	25	30	30	30	30	30	35	35	35
Maximum radial force[1]	$F_{q\,max}$	kN	5.7	5.4	5.4	7.6	9.5	7.8	9.1	9.1	11.6
at distance a (from shaft collar)	a	mm	16	16	16	18	18	18	18	18	20
with permissible torque	T_{max}	Nm	179	179	204	290	357	294	357	401	512
≙ permissible pressure Δp	Δp_{perm}	bar	400	400	400	400	400	330	400	400	400
Maximum axial force[2]	$+F_{ax\,max}$	N	500	500	500	630	800	800	800	800	1000
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$\pm F_{ax\,perm/bar}$	N/bar	5.2	5.2	5.2	7.0	8.7	8.7	8.7	8.7	10.6

Size	NG		80[4]	80	90	107	107	125	160	160	180
Drive shaft	ø	mm	35	40	40	40	45	45	45	50	50
Maximum radial force[1]	$F_{q\,max}$	kN	11.1	11.4	11.4	13.6	14.1	14.1	18.1	18.3	18.3
at distance a (from shaft collar)	a	mm	20	20	20	20	20	20	25	25	25
with permissible torque	T_{max}	Nm	488	512	573	679	679	796	1021	1021	1146
≙ permissible pressure Δp	Δp_{perm}	bar	380	400	400	400	400	400	400	400	400
Maximum axial force[2]	$+F_{ax\,max}$	N	1000	1000	1000	1250	1250	1250	1600	1600	1600
	$-F_{ax\,max}$	N	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$\pm F_{ax\,perm/bar}$	N/bar	10.6	10.6	10.6	12.9	12.9	12.9	16.7	16.7	16.7

Size	NG		200	250	355	500	710	1000
Drive shaft	ø	mm	50	50	60	70	90	90
Maximum radial force[1]	$F_{q\,max}$	kN	20.3	1.2[6]	1.5[6]	1.9[6]	3.0[6]	2.6[6]
at distance a (from shaft collar)	a	mm	25	41	52.5	52.5	67.5	67.5
with permissible torque	T_{max}	Nm	1273	[5]	[5]	[5]	[5]	[5]
≙ permissible pressure Δp	Δp_{perm}	bar	400	[5]	[5]	[5]	[5]	[5]
Maximum axial force[2]	$+F_{ax\,max}$	N	1600	2000	2500	3000	4400	4400
	$-F_{ax\,max}$	N	0	0	0	0	0	0
Permissible axial force per bar operating pressure	$\pm F_{ax\,perm/bar}$	N/bar	16.7	[5]	[5]	[5]	[5]	[5]

1) With intermittent operation
2) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.
3) Conical shaft with threaded pin and woodruff key (DIN 6888)
4) Restricted technical data only for splined shaft
5) Please contact us.
6) When at a standstill or when axial piston unit operating in non-pressurized conditions. Higher forces are permissible when under pressure, please contact us.

Note

Influence of the direction of the permissible axial force:

$+F_{ax\,max}$ = Increase in service life of bearings

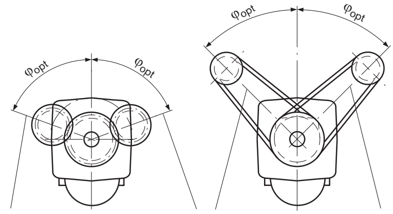
$-F_{ax\,max}$ = Reduction in service life of bearings (avoid)

Technical data

Effect of radial force F_q on the service life of bearings

By selecting a suitable direction of radial force F_q, the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

	Toothed gear drive	V-belt output
NG	$\varphi_{opt.}$	$\varphi_{opt.}$
5 to 180	± 70°	± 45°
200 to 1000	± 45°	± 70°



Determining the operating characteristics

Flow $$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$$ [L/min]

Torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$$ [Nm]

Power $$P = \frac{2\,\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$$ [kW]

V_g = Displacement per revolution in cm^3

Δp = Differential pressure in bar

n = Speed in rpm

η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

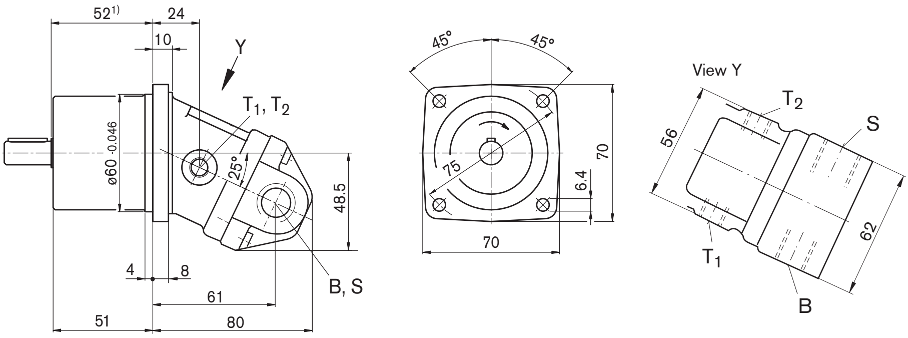
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Dimensions size 5

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

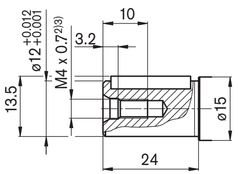
Port plate 07 – Threaded ports A/B and S at side

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

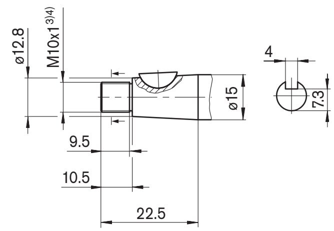


Drive shafts

B Parallel keyed shaft DIN 6885, A4x4x20



C Conical shaft with threaded pin and woodruff key, 3x5 (DIN 6888), (tapering 1:10)



Ports

Designation	Port for	Standard[6)]	Size[3)]	Maximum pressure [bar][5)]	State[7)]
B (A)	Service line	DIN 3852	M18 x 1.5; 12 deep	350	O
S	Suction line	DIN 3852	M22 x 1.5; 14 deep	30	O
T_1	Drain line	DIN 3852	M10 x 1; 8 deep	3	O
T_2	Drain line	DIN 3852	M10 x 1; 8 deep	3	O

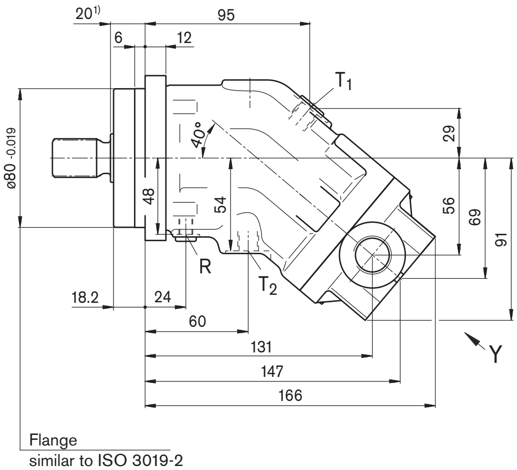
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Thread according to DIN 3852, maximum tightening torque: 30 Nm
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)

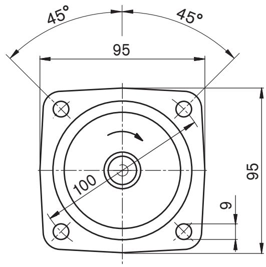
Dimensions sizes 10, 12, 16

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

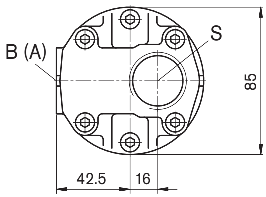
Port plate 06 – Threaded port A/B at side and threaded port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



1) To shaft collar

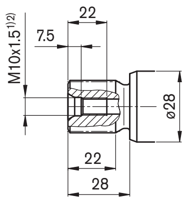
Dimensions sizes 10, 12, 16

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

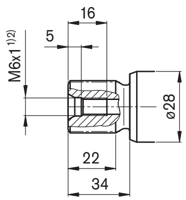
Sizes 10, 12, 16

A Splined shaft DIN 5480
W25x1.25x18x9g



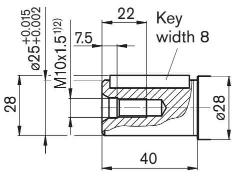
NG10, 12

Z Splined shaft DIN 5480
W20x1.25x14x9g



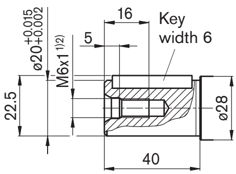
Sizes 10, 12, 16

B Parallel keyed shaft
DIN 6885, AS8x7x32



NG10, 12

P Parallel keyed shaft
DIN 6885, AS6x6x32



Ports

Designation	Port for	Standard[5)]	Size[2)]	Maximum pressure [bar][3)]	State[6)]
B (A)	Service line	DIN 3852	M22 x 1.5; 14 deep	450	O
S	Suction line	DIN 3852	M33 x 2; 18 deep	30	O
T_1	Drain line	DIN 3852	M12 x 1.5; 12 deep	3	X[4)]
T_2	Drain line	DIN 3852	M12 x 1.5; 12 deep	3	O[4)]
R	Air bleed	DIN 3852	M8 x 1; 8 deep	3	X

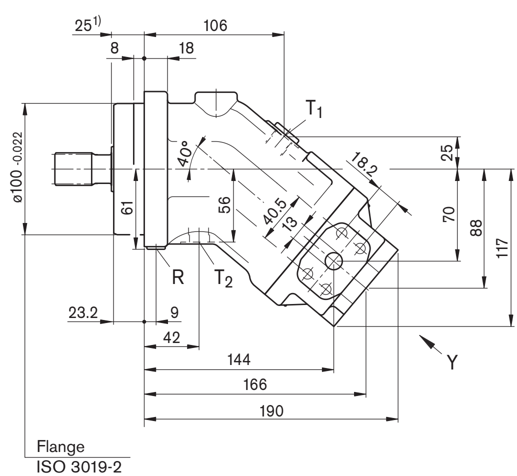
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

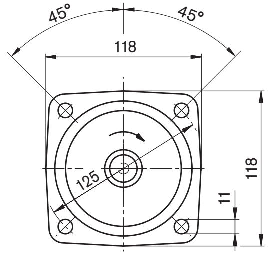
Dimensions sizes 23, 28, 32

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

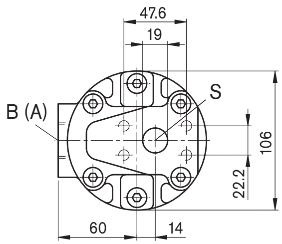
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



1) To shaft collar

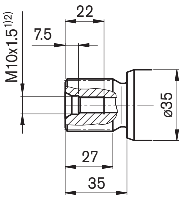
Dimensions sizes 23, 28, 32

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

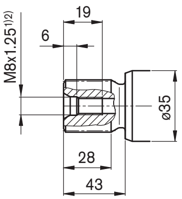
Sizes 23, 28, 32

A Splined shaft DIN 5480 W30x2x14x9g



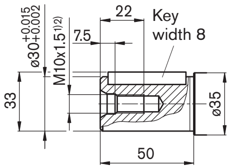
NG23, 28

Z Splined shaft DIN 5480 W25x1.25x18x9g



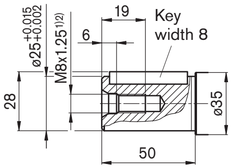
Sizes 23, 28, 32

B Parallel keyed shaft DIN 6885, AS8x7x40



NG23, 28

P Parallel keyed shaft DIN 6885, AS8x7x40



2

Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State[7)]
B (A)	Service line Fastening thread B/A	SAE J518[5)] DIN 13	1/2 in M8 x 1.25; 15 deep	450	O
S	Suction line Fastening thread	SAE J518[5)] DIN 13	3/4 in M10 x 1.5; 17 deep	30	O
T_1	Drain line	DIN 3852[6)]	M16 x 1.5; 12 deep	3	X[4)]
T_2	Drain line	DIN 3852[6)]	M16 x 1.5; 12 deep	3	O[4)]
R	Air bleed	DIN 3852[6)]	M10 x 1; 12 deep	3	X

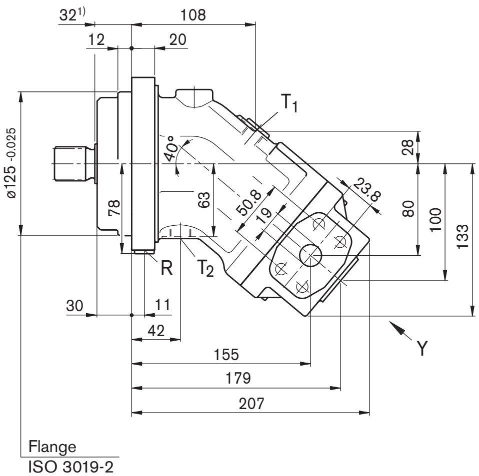
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

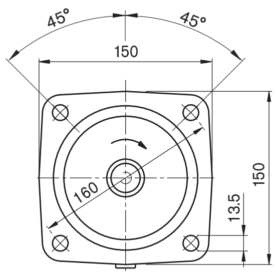
Dimensions size 45

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

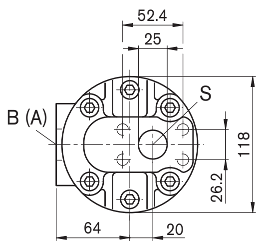
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



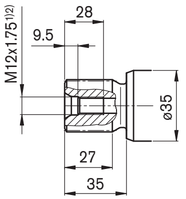
1) To shaft collar

Dimensions size 45

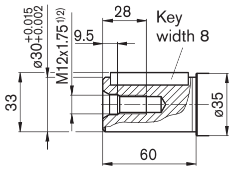
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft DIN 5480
W30x2x14x9g



P Parallel keyed shaft
DIN 6885, AS8x7x50



2

Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[7]
B (A)	Service line Fastening thread B/A	SAE J518[5] DIN 13	3/4 in M10 x 1.5; 17 deep	450	O
S	Suction line Fastening thread	SAE J518[5] DIN 13	1 in M10 x 1.5; 17 deep	30	O
T_1	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	X[4]
T_2	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	O[4]
R	Air bleed	DIN 3852[6]	M12 x 1.5; 12 deep	3	X

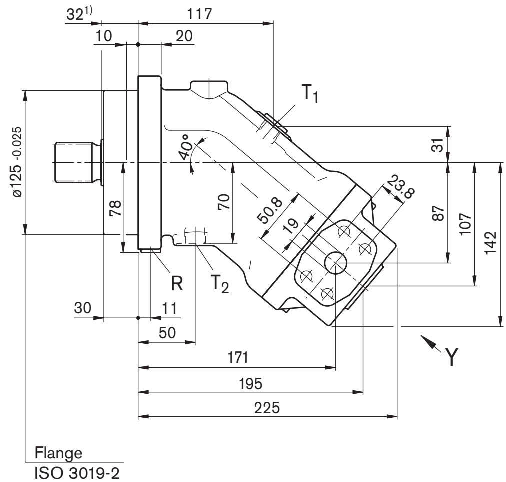
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

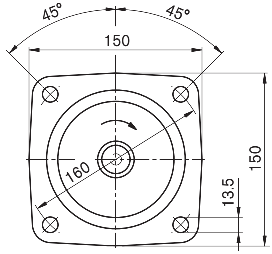
Dimensions sizes 56, 63

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

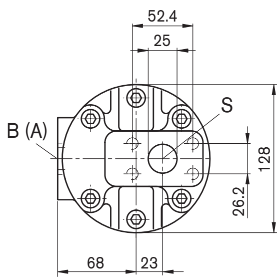
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



1) To shaft collar

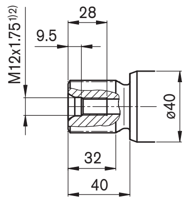
Dimensions sizes 56, 63

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

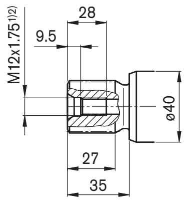
NG56, 63

A Splined shaft DIN 5480
W35x2x16x9g



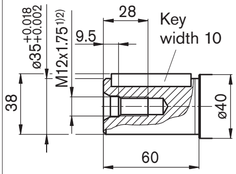
NG56

Z Splined shaft DIN 5480
W30x2x14x9g



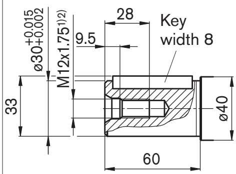
NG56, 63

B Parallel keyed shaft
DIN 6885, AS10x8x50



NG56

P Parallel keyed shaft
DIN 6885, AS8x7x50



2

Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State[7)]
B (A)	Service line Fastening thread B/A	SAE J518[5)] DIN 13	3/4 in M10 x 1.5; 17 deep	450	O
S	Suction line Fastening thread	SAE J518[5)] DIN 13	1 in M10 x 1.5; 17 deep	30	O
T_1	Drain line	DIN 3852[6)]	M18 x 1.5; 12 deep	3	X[4)]
T_2	Drain line	DIN 3852[6)]	M18 x 1.5; 12 deep	3	O[4)]
R	Air bleed	DIN 3852[6)]	M12 x 1.5; 12 deep	3	X

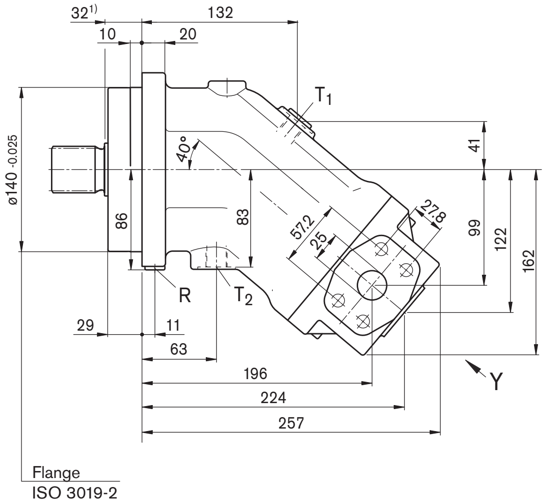
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

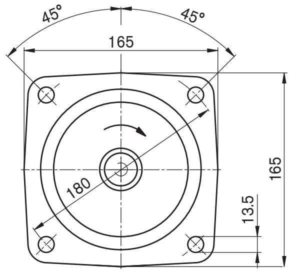
Dimensions sizes 80, 90

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

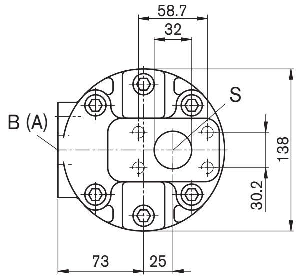
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



1) To shaft collar

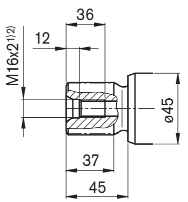
Dimensions sizes 80, 90

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

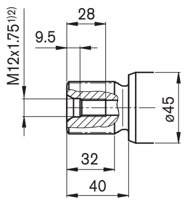
NG80, 90

A Splined shaft DIN 5480 W40x2x18x9g



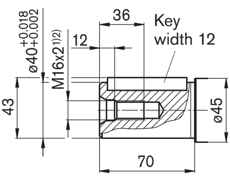
NG80

Z Splined shaft DIN 5480 W35x2x16x9g



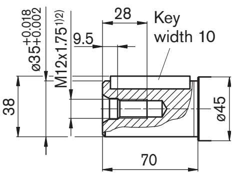
NG80, 90

B Parallel keyed shaft DIN 6885, AS12x8x56



NG80

P Parallel keyed shaft DIN 6885, AS10x8x56



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[7]
B (A)	Service line Fastening thread B/A	SAE J518[5] DIN 13	1 in M12 x 1.5; 17 deep	450	O
S	Suction line Fastening thread	SAE J518[5] DIN 13	1 1/4 in M10 x 1.5; 17 deep	30	O
T_1	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	X[4]
T_2	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	O[4]
R	Air bleed	DIN 3852[6]	M12 x 1.5; 12 deep	3	X

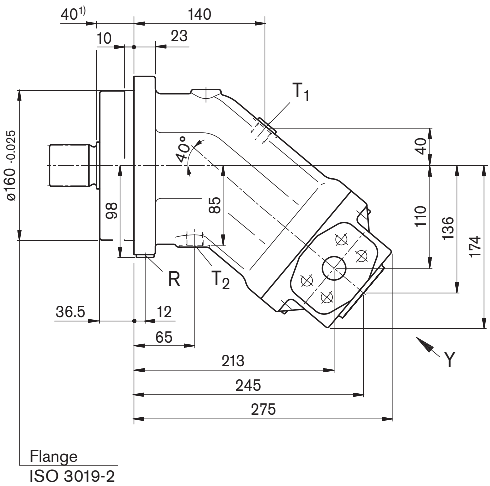
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

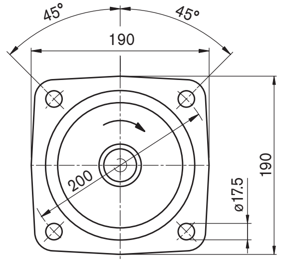
Dimensions sizes 107, 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

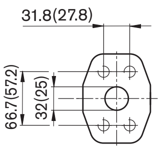
Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

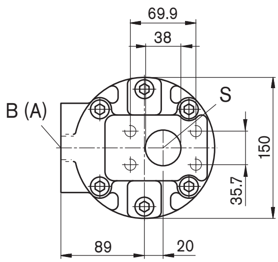




View Y

Detail: port A/B
(dimensions in brackets for size 107)





1) To shaft collar

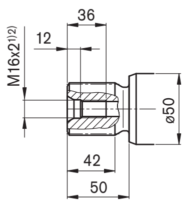
Dimensions sizes 107, 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

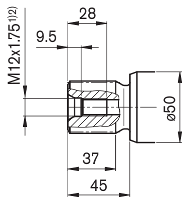
NG107, 125

A Splined shaft DIN 5480 W45x2x21x9g



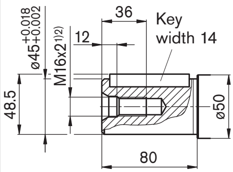
NG107

Z Splined shaft DIN 5480 W40x2x18x9g



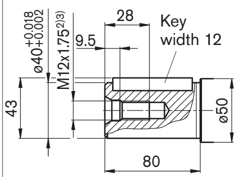
NG107, 125

B Parallel keyed shaft DIN 6885, AS14x9x63



NG107

P Parallel keyed shaft DIN 6885, AS12x8x63



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[7]
B (A)	Service line	SAE J518[5]	1 in (size 107) 1 1/4 in (size 125)	450	O
	Fastening thread B/A	DIN 13	M12 x 1.75; 17 deep (size 107) M14 x 2; 19 deep (size 125)		
S	Suction line Fastening thread	SAE J518[5] DIN 13	1 1/2 in M12 x 1.75; 20 deep	30	O
T_1	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	X[4]
T_2	Drain line	DIN 3852[6]	M18 x 1.5; 12 deep	3	O[4]
R	Air bleed	DIN 3852[6]	M14 x 1.5; 12 deep	3	X

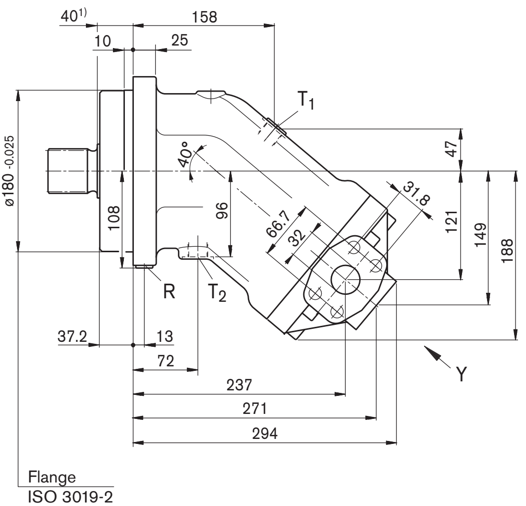
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

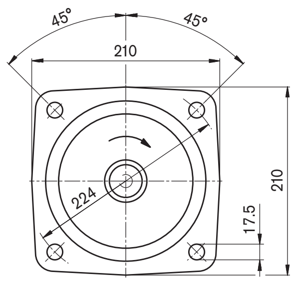
Dimensions sizes 160, 180

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

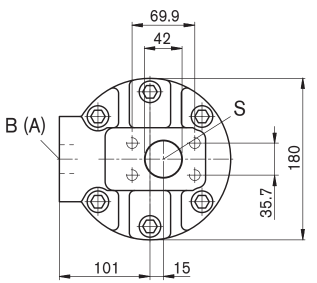
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)





View Y



1) To shaft collar

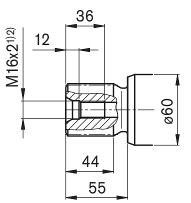
Dimensions sizes 160, 180

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

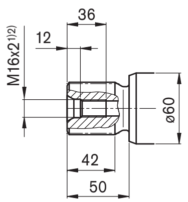
NG160, 180

A Splined shaft DIN 5480 W50x2x24x9g



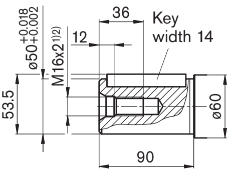
NG160

Z Splined shaft DIN 5480 W45x2x21x9g



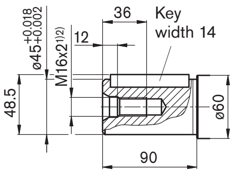
NG160, 180

B Parallel keyed shaft DIN 6885, AS14x9x70



NG160

P Parallel keyed shaft DIN 6885, AS14x9x70



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[7]
B (A)	Service line Fastening thread B/A	SAE J518[5] DIN 13	1 1/4 in M14 x 2; 19 deep	450	O
S	Suction line Fastening thread	SAE J518[5] DIN 13	1 1/2 in M12 x 1.75; 20 deep	30	O
T_1	Drain line	DIN 3852[6]	M22 x 1.5; 14 deep	3	X[4]
T_2	Drain line	DIN 3852[6]	M22 x 1.5; 14 deep	3	O[4]
R	Air bleed	DIN 3852[6]	M14 x 1.5; 12 deep	3	X

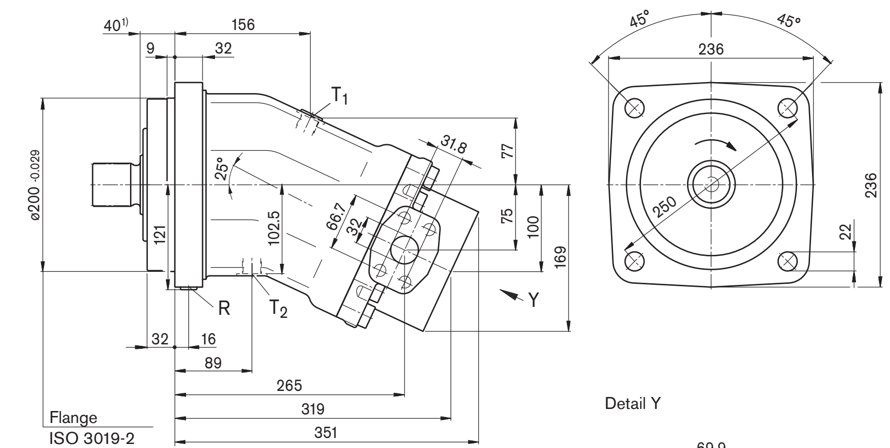
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 34 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
6) The spot face can be deeper than specified in the appropriate standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 200

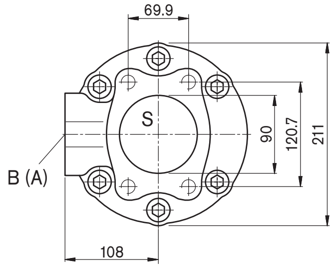
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

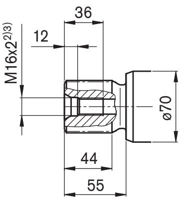


Detail Y

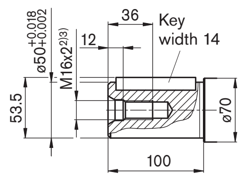


Drive shafts

A Splined shaft DIN 5480 W50x2x24x9g



B Parallel keyed shaft DIN 6885, AS14x9x80



Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[8)]
B (A)	Service line Fastening thread B/A	SAE J518[6)] DIN 13	1 1/4 in M14 x 2; 19 deep	450	O
S	Suction line Fastening thread	SAE J518[6)] DIN 13	3 1/2 in M16 x 2; 24 deep	30	O
T_1	Drain line	DIN 3852[7)]	M22 x 1.5; 14 deep	3	X[5)]
T_2	Drain line	DIN 3852[7)]	M22 x 1.5; 14 deep	3	O[5)]
R	Air bleed	DIN 3852[7)]	M14 x 1.5; 12 deep	3	X

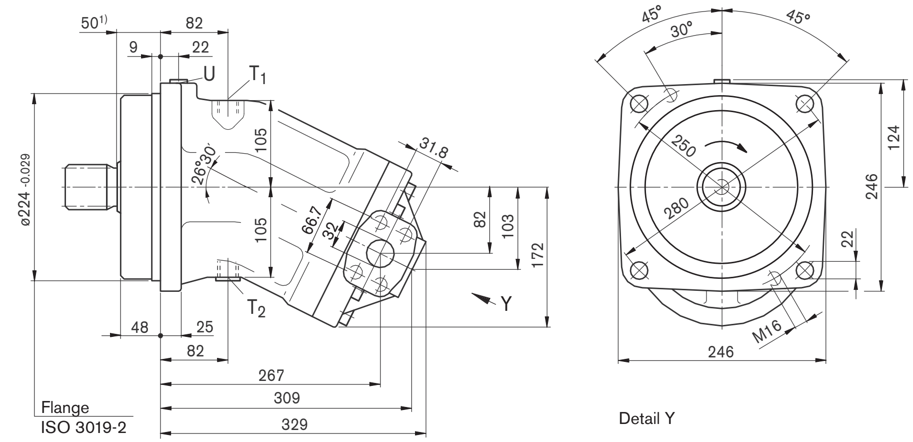
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 250

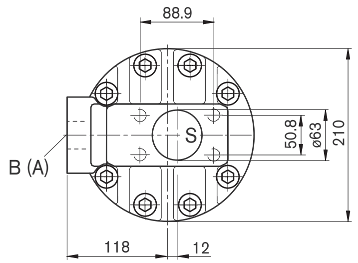
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

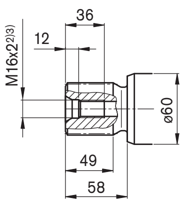


Detail Y

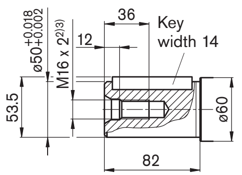


Drive shafts

Z Splined shaft DIN 5480 W50x2x24x9g



P Parallel keyed shaft DIN 6885, AS14x9x80



Ports

Designation	Port for	Standard	Size[3]	Maximum pressure [bar][4]	State[8]
B (A)	Service line Fastening thread B/A	SAE J518[6] DIN 13	1 1/4 in M14 x 2; 19 deep	400	O
S	Suction line Fastening thread	SAE J518[6] DIN 13	2 1/2 in M12 x 1.75; 17 deep	30	O
T_1	Drain line	DIN 3852[7]	M22 x 1.5; 14 deep	3	O[5]
T_2	Drain line	DIN 3852[7]	M22 x 1.5; 14 deep	3	X[5]
U	Bearing flushing	DIN 3852[7]	M14 x 1.5; 12 deep	3	X

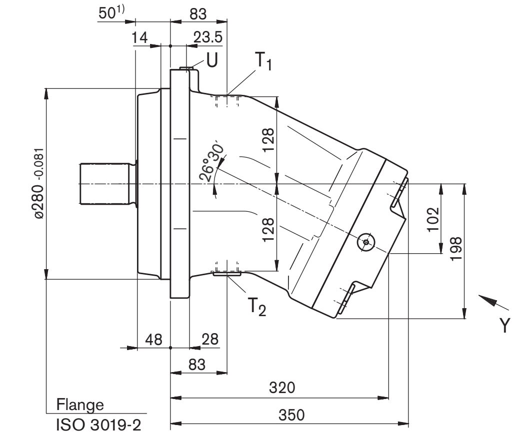
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

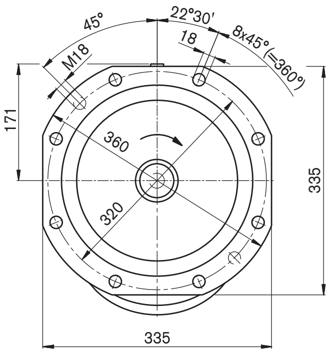
Dimensions size 355

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

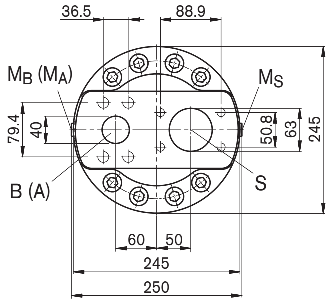
Port plate 11 – SAE flange ports A/B and S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



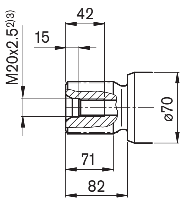


Detail Y

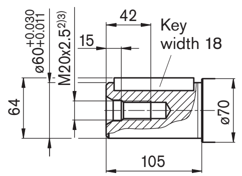


Drive shafts

Z Splined shaft DIN 5480 W60x2x28x9g



P Parallel keyed shaft DIN 6885, AS18x11x100



Ports

Designation	Port for	Standard	Size[3]	Maximum pressure [bar][4]	State[8]
B (A)	Service line Fastening thread B/A	SAE J518[6] DIN 13	1 1/2 in M16 x 2; 21 deep	400	O
S	Suction line Fastening thread	SAE J518[6] DIN 13	2 1/2 in M12 x 1.75; 17 deep	30	O
T_1	Drain line	DIN 3852[7]	M33 x 2; 18 deep	3	O[5]
T_2	Drain line	DIN 3852[7]	M33 x 2; 18 deep	3	X[5]
U	Bearing flushing	DIN 3852[7]	M14 x 1.5; 12 deep	3	X
M_A, M_B	Measuring operating pressure	DIN 3852[7]	M14 x 1.5; 12 deep	400	X
M_S	Measuring suction pressure	DIN 3852[7]	M14 x 1.5; 12 deep	30	X

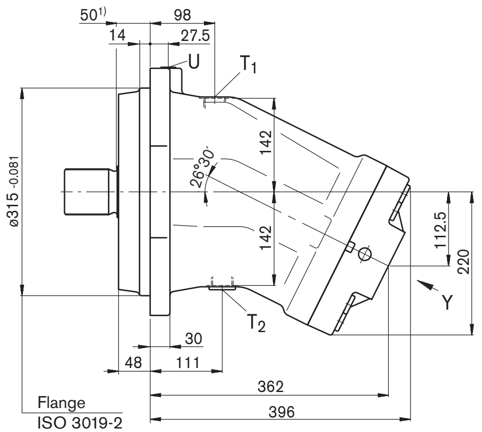
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

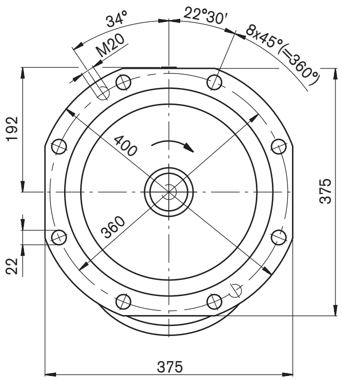
Dimensions size 500

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

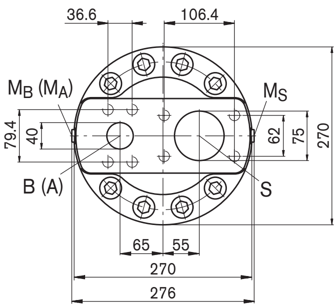
Port plate 11 – SAE flange ports A/B and S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



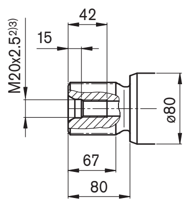


Detail Y

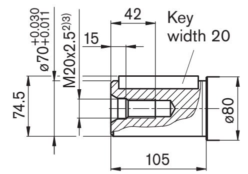


Drive shafts

Z Splined shaft DIN 5480 W70x3x22x9g



P Parallel keyed shaft DIN 6885, AS20x12x100



Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[8)]
B (A)	Service line fastening thread B/A	SAE J518[6)] DIN 13	1 1/2 in M16 x 2; 21 deep	400	O
S	Suction line fastening thread	SAE J518[6)] DIN 13	3 in M16 x 2; 24 deep	30	O
T_1	Drain line	DIN 3852[7)]	M33 x 2; 18 deep	3	O[5)]
T_2	Drain line	DIN 3852[7)]	M33 x 2; 18 deep	3	X[5)]
U	Bearing flushing	DIN 3852[7)]	M18 x 1.5; 12 deep	3	X
M_A, M_B	Operating pressure measurement	DIN 3852[7)]	M14 x 1.5; 12 deep	400	X
M_S	Suction pressure measurement	DIN 3852[7)]	M14 x 1.5; 12 deep	30	X

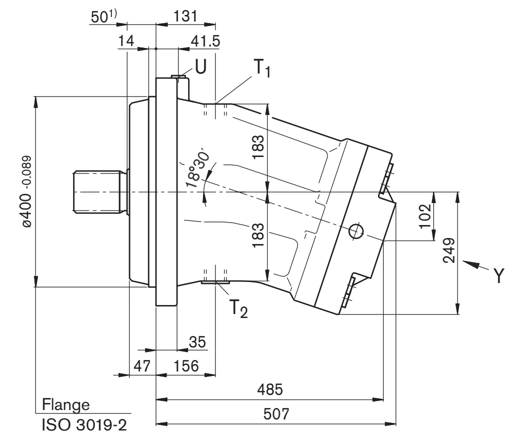
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

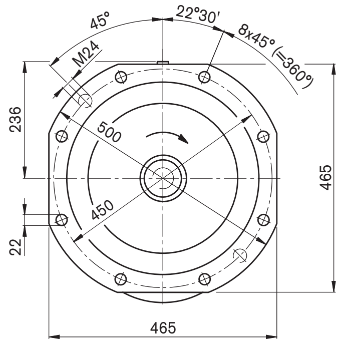
Dimensions size 710

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

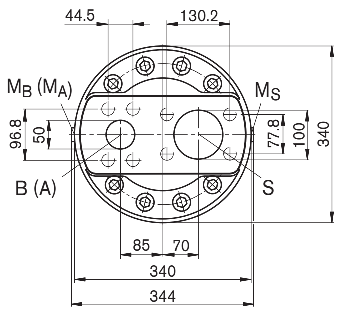
Port plate 11 – SAE flange ports A/B and S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



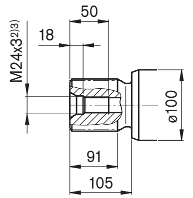


Detail Y

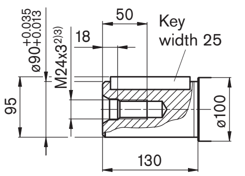


Drive shafts

Z Splined shaft DIN 5480 W90x3x28x9g



P Parallel keyed shaft DIN 6885, AS25x14x125



Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[8)]
B (A)	Service line Fastening thread B/A	SAE J518[6)] DIN 13	2 in M20 x 2.5; 30 deep	400	
S	Suction line Fastening thread	SAE J518[6)] DIN 13	4 in M16 x 2; 24 deep	30	O
T_1	Drain line	DIN 3852[7)]	M42 x 2; 20 deep	3	O[5)]
T_2	Drain line	DIN 3852[7)]	M42 x 2; 20 deep	3	X[5)]
U	Bearing flushing	DIN 3852[7)]	M18 x 1.5; 12 deep	3	X
M_A, M_B	Measuring operating pressure	DIN 3852[7)]	M14 x 1.5; 12 deep	400	X
M_S	Measuring suction pressure	DIN 3852[7)]	M14 x 1.5; 12 deep	30	X

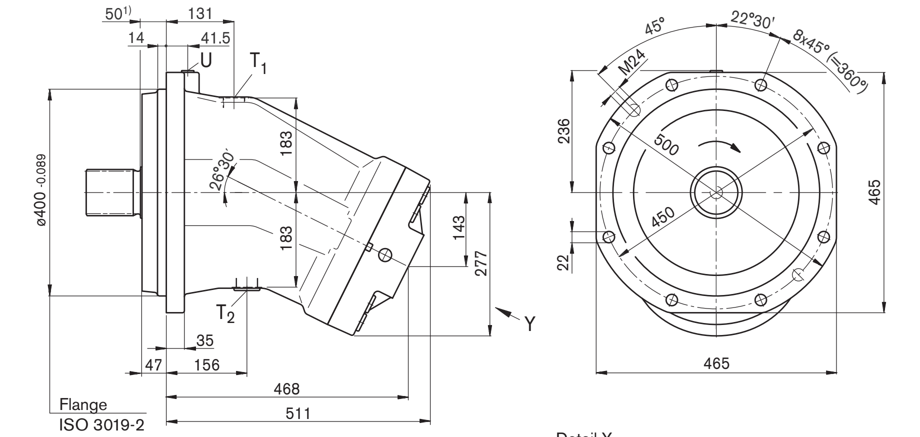
1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 1000

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

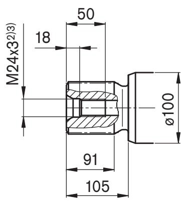
Port plate 11 – SAE flange ports A/B and S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

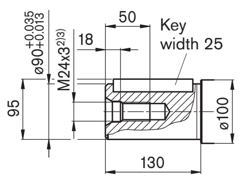


Drive shafts

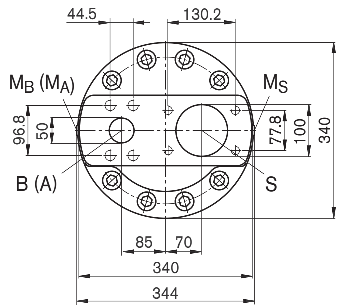
Z Splined shaft DIN 5480 W90x3x28x9g



P Parallel keyed shaft DIN 6885, AS25x14x125



Detail Y



2

Ports

Designation	Port for	Standard	Size[3)]	Maximum pressure [bar][4)]	State[8)]
B (A)	Service line fastening thread B/A	SAE J518[6)] DIN 13	2 in M20 x 2.5; 30 deep	400	
S	Suction line fastening thread	SAE J518[6)] DIN 13	4 in M16 x 2; 24 deep	30	O
T_1	Drain line	DIN 3852[7)]	M42 x 2; 20 deep	3	O[5)]
T_2	Drain line	DIN 3852[7)]	M42 x 2; 20 deep	3	X[5)]
U	Bearing flushing	DIN 3852[7)]	M18 x 1.5; 12 deep	3	X
M_A, M_B	Measuring operating pressure	DIN 3852[7)]	M14 x 1.5; 12 deep	400	X
M_S	Measuring suction pressure	DIN 3852[7)]	M14 x 1.5; 12 deep	30	X

1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) Observe the general instructions on page 34 for the maximum tightening torques.
4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
5) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 32 and 33).
6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
7) The spot face can be deeper than specified in the appropriate standard.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the motor housing must be directed to the reservoir via the highest available drain port (T_1, T_2).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction and drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\,max} = 800$ mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation and during cold start.

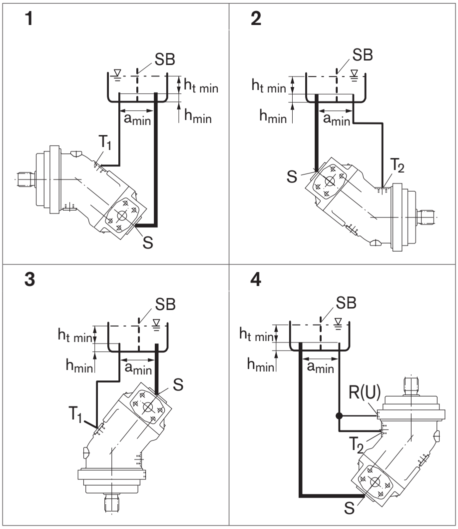
Installation position

See the following examples 1 to 8.
Further installation positions are possible upon request.

Recommended installation positions: 1 and 2.

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



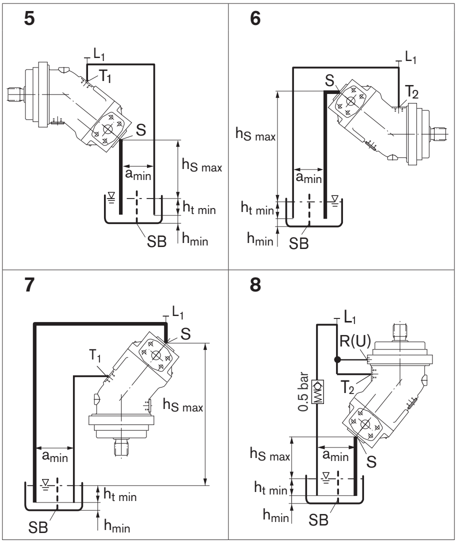
Installation position	Air bleed	Filling
1	–	T_1
2	–	T_2
3	–	T_1
4	R (U)	T_2

Installation instructions

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Recommendation for installation position 8 (drive shaft upward): A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the pump housing.



Installation position	Air bleed	Filling
5	L_1	T_1 (L_1)
6	L_1	T_2 (L_1)
7	L_1	T_1 (L_1)
8	R (U)	T_2 (L_1)

L_1 Filling / air bleed
R Air bleed port
U Bearing flushing / air bleed port
S Suction port
T_1, T_2 Drain port
$h_{t\ min}$ Minimum required immersion depth (200 mm)
h_{min} Minimum required spacing to reservoir bottom (100 mm)
SB Baffle (baffle plate)
$h_{S\ max}$ Maximum permissible suction height (800 mm)
a_{min} When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

General instructions

– The pump A2FO is designed to be used in open circuits.

– The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.

– Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit. Take appropriate safety measures (e. g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.

– Service line ports:

  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

  - The service line ports and function ports can only be used to accommodate hydraulic lines.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to ISO 13849.

– A pressure-relief valve is to be fitted in the hydraulic system.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instructions regarding tightening torques of the fittings used.

  - Mounting bolts:
    For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.

  - Female threads in the axial piston unit:
    The maximum permissible tightening torques $M_{G\,max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports **Standard**	**Size of thread**	**Maximum permissible tightening torque of the female threads $M_{G\,max}$**	**Required tightening torque of the threaded plugs M_V[1)]**	**WAF hexagon socket in the threaded plugs**
DIN 3852	M8 x 1	10 Nm	7 Nm	3 mm
	M10 x 1	30 Nm	15 Nm[2)]	5 mm
	M12 x 1.5	50 Nm	25 Nm[2)]	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.
2) In the "lightly oiled" state, the M_V is reduced to 10 Nm for M10 x 1 and 17 Nm for M12 x 1.5.

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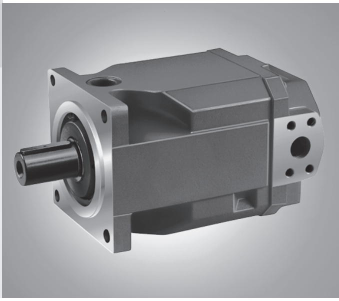
Rexroth
Bosch Group

Fixed Displacement Pump A4FO

RE 91 455/04.00
replaces: 01.94

for open circuits



Sizes 16...500
Series 1, Series 3
Nominal pressure up to 400 bar
Peak pressure up to 450 bar

Index

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Features

- A4FO axial piston fixed displacement pumps of swashplate design are used for hydraulic drives in open loop circuits.
- Flow is proportional to the drive speed and to the displacement.
- Good suction characteristic
- Low noise level
- Long service life
- Pump combinations possible
- Through drive for mounting other pumps

- Further Informations:
  Variable Pump A4VSO RE 92 050

Ordering Code

Fluid / Design

	16	22	28	40	71	125	250	500	
Mineral oil, HFD-Fluid	●	●	●	●	●	●	●	●	
HFA-, HFB-, HFC-Fluid	–	–	–	–	●	●	●	●	**E-**
High-Speed Design	–	–	–	–	–	–	●	●	**H-**

Axial piston unit

Fixed swashplate design	**A4F**

Operation

Pump in open circuits	**O**

Size

≙ Displacement V_g (cm^3)	**16**	**22**	**28**	**40**	**71**	**125**	**250**	**500**

Series

sizes 16...40, 125...500	**3**
size 71	**1**

Index

sizes 16...40	**2**
sizes 71...500	**0**

Direction of rotation

viewed on shaft end	clockwise	**R**
	anti-clockwise	**L**

Seals

NBR (nitril-caoutchouc), shaft seal in FKM (fluor-caoutchouc)	sizes 16...40	**N**
	sizes 71...500	**P**
FKM (fluor-caoutchouc)	sizes 71...500	**V**

Shaft end

	16	22	28	40	71	125	250	500	
splined shaft SAE	●	●	●	–	–	–	–	–	**S**
splined shaft SAE	–	–	–	●	–	–	–	–	**T**
Splined shaft DIN 5480	–	–	–	–	●	●	●	●	**Z**
parallel shaft, with key DIN 6885	–	–	–	–	●	●	●	●	**P**

Mounting flange

	16	22	28	40	71	125	250	500	
SAE 2-hole	●	●	●	●	–	–	–	–	**C**
ISO 4-hole	–	–	–	–	●	●	●	–	**B**
ISO 8-hole	–	–	–	–	–	–	–	●	**H**

Service line connections

	sizes 16...40	sizes 71...500	
Pressure and suction port SAE at side (opposite side) (metric fixing screws)	●	–	**12**
Pressure and suction port SAE at side, rotated by 90° (metric fixing screws) 2nd pressure port B_1 opposite B - when delivered plugged with a flange	–	●	**25**

● = available
○ = in preparation
– = not available

Ordering Code

	A4F	O		/				–					

Fluid

Axial piston unit

Operation

Size

Series

Index

Direction of rotation

Seals

Shaft end

Mounting flange

Service line connections

Through Drive

flange	hub	for mounting	16	22	28	40	71	125	250	500	
–	–		●	●	●	–	●	●	●	●	**N00**
SAE A, 2-hole	SAE A	G2, A10VSO 10	●	●	●	●	–	–	–	–	**K01**
SAE B, 2-hole	SAE B	A4FO 16...28	–	●	●	–	–	–	–	–	**K02**
ISO 80, 2-hole	SAE A-B	A10VSO 18	–	–	–	–	○	●	●	○	**KB2**
ISO 100, 2-hole	SAE B	A10VSO 28	–	–	–	–	○	○	○	○	**KB3**
ISO 100, 2-hole	SAE B-B	A10VSO 45	–	–	–	–	○	○	○	○	**KB4**
ISO 125, 2-hole	SAE C	A10VSO 71	–	–	–	–	○	○	○	○	**KB5**
ISO 125, 2-hole	SAE C-C	A10VSO 100	–	–	–	–	–	○	○	○	**KB6**
ISO 180, 4-hole	SAE D	A10VSO 140	–	–	–	–	–	–	○	○	**KB7**
ISO 125, 4-hole	N32 (DIN 5480)	A4VS 40	–	–	–	–	○	○	●	○	**K31**
ISO 140, 4-hole	N40 (DIN 5480)	A4FO 71 / A4VS 71	–	–	–	–	●	●	●	○	**K33**
ISO 160, 4-hole	N50 (DIN 5480)	A4FO 125 / A4VS 125, 180	–	–	–	–	–	●	●	○	**K34**
ISO 224, 4-hole	N60 (DIN 5480)	A4FO 250 / A4VS 250	–	–	–	–	–	–	●	○	**K35**
ISO 315, 8-hole	N80 (DIN 5480)	A4FO 500 / A4VS 500	–	–	–	–	–	–	–	○	**K43**
with through drive shaft, without hub, without adapter flange, with cover plate			–	–	–	–	○	●	●	○	**K99**

Technical Data

Fluid

To review the application of A4FO pumps with the selected hydraulic fluid, detailed fluid compatibility and application data can be found in data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistant fluids, HF).

When using HF- or environmentally acceptable hydraulic fluids possible limitations for the technical data have to be taken into consideration. If necessary please consult our technical department (please indicate type of the hydraulic fluid used for your application on the order sheet).
Sizes 16...40 of fixed pump A4FO are not suitable for operation with HFA, HFB or HFC-fluids.

Operating viscosity range

In order to optain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range:

ν_{opt} = operating viscosity 16...36 mm²/s

referred to the tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

Sizes 16...40
ν_{min} = 5 mm²/s,
short term at a max. permissible temperature of t_{max} = 115°C
ν_{max} = 1600, short term on cold start (t_{min} = -40°C)

Sizes 71...500
ν_{min} = 10 mm²/s,
short term at a max. permissible leakage oil temp. of t_{max} = 90°
ν_{max} = 1000 mm²/s, short term on cold start (t_{min} = -25°C)

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperatures of -25°C up to -40°C special measures may be required for certain installation positions. Please contact us.

Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.

Example: At an ambient temperature of X°C the operating temperature is 60°C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68. VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the tank temperature. However, at no point in the circuit may the temperature exceed 115°C for sizes 16…40 or 90°C for sizes 71…500.

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures please consult us.

Filtration

The finer the filtration the better the achieved cleanliness level of the pressure fluid and the longer the life of the axial piston unit.

To ensure the functioning of the axial piston unit a minimum cleanliness level of

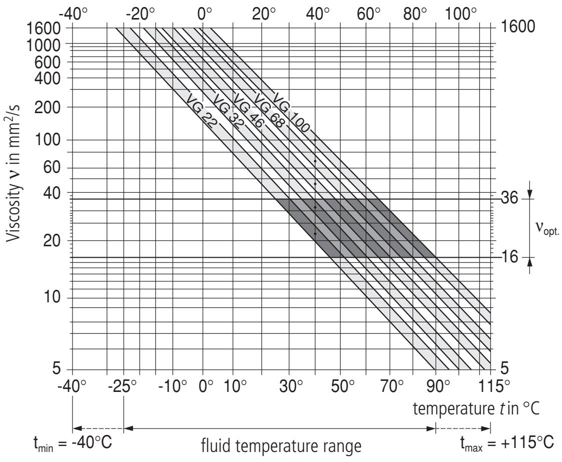
9 to NAS 1638
18/15 to ISO/DIS 4406 is necessary.

At very high temperatures of the hydraulic fluid (90°C to max. 115°C, not permissible for sizes 71…500) at least cleanliness level

8 to NAS 1638
17/14 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult us.

Selection diagram



Technical Data

valid for operation with mineral oils

Sizes 16...40

Working pressure range inlet

Absolut pressure at port S (suction port)

$p_{abs.\,min}$ ____ 0,8 bar

$p_{abs.\,max}$ ____ 2 bar

Working pressure range outlet

Maximum pressure at port A or B (pressure data to DIN 24312)

Nominal pressure p_N ____ 400 bar

Peak pressure p_{max} ____ 450 bar

Note:

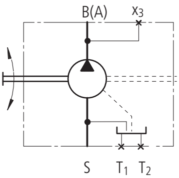
When mounting further pumps at the through drive of the A4FO the max. input torque of the drive shaft has not to be exceeded (as to page 15). This may necessitate a limitation of the max. admissible pressure values.

Direction of flow

	clockwise operation	anti-clockwise operation
Sizes 16...40	**S** to **B**	**S** to **A**

Symbol

A, B service line port
S suction port
T_1, T_2 drain port (plugged)
x_3 gauge port



Case drain pressure

Perm. case drain pressure (housing pressure)

p_L ____ 2 bar abs.

The leakage oil chamber is connected to the suction chamber. A case drain line is therefore not necessary.

Sizes 71...500

Working pressure range inlet

Absolut pressure at port S (suction port)

$p_{abs.\,min}$ ____ 0,8 bar

$p_{abs.\,max}$ ____ 30 bar

Working pressure range outlet

Maximum pressure at port A or B (pressure data to DIN 24312)

Nominal pressure p_N ____ 350 bar

Peak pressure p_{max} ____ 400 bar

2

Flushing of the bearings (Sizes 125...500)

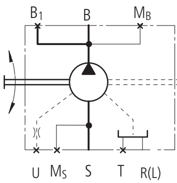
For informations about operating conditions, flushing quantities and notes on bearing flushing see data sheet RE 92 050 (A4VSO).

Direction of flow

	clockwise operation	anti-clockwise operation
Sizes 71...500	**S** to **B**	**S** to **B**

Symbol

B, B_1 service line port
S suction port
T, R(L) drain port (1 port plugged)
M_B gauge port working pressure
M_S gauge port suction pressure
U flushing port (sizes 125...500)



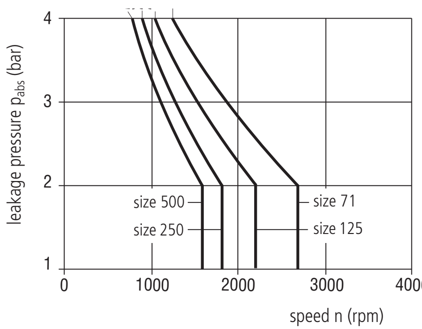
Leakage pressure

The max. permissible leakage pressure (housing pressure) is dependent on speed (see diagram). The pressure in the housing must be equal to or greater than the external pressure on the shaft sealing ring.

Max. leakage pressure (housing pressure)

p_L ____ 4 bar abs.

A case drain line to the tank is necessary.



Technical Data

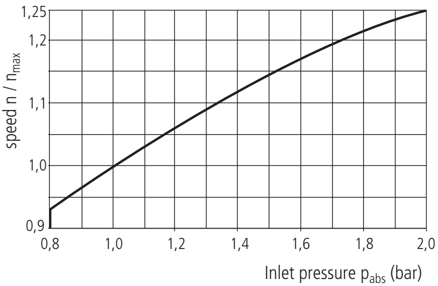
Table of values (theoretical values, without considering η_{mh} and η_v: values rounded)

Size			16	22	28	40	71	125	250/H*	500/H*
Displacement	V_g	cm^3	16	22	28	40	71	125	250	500
Max. speed [1])	n_{max}	rpm	4000	3600	3000	2750	2200	1800	1500/1900	1320/1500
Max. permissible speed (speed limit) with increased inlet pressure	$n_{max\ perm.}$	rpm	4800	4500	3750	3400	2700	2200	1800/2100	1600/1800
Output flow at n_{max} [2])	$q_{V\ max}$	L/min	62	77	81	107	152	218	364/461	640/728
Power at $q_{V\ max}$; Δp = 400 bar	P_{max}	kW	43	53	56	73	91 [3])	131 [3])	219/277 [3])	385/437 [3])
Max. torque at Δp = 400 bar	T_{max}	Nm	102	140	178	254	395 [3])	696 [3])	1391 [3])	2783 [3])
Case volume		L	0,3	0,3	0,3	0,4	2,0	3,0	7,0	11,0
Moment of inertia, about drive axis	J	kgm^2	0,0017	0,0017	0,0017	0,0030	0,0121	0,0300	0,0959	0,3325
Weight (approx.)	m	kg	13,5	13,5	13,5	16,5	34	61	120	220

[1]) The values shown are valid for an absolute pressure (p_{abs}) of 1 bar at the suction inlet S and when operated on mineral oil.
[2]) 3 % volumetric loss included [3]) Δp = 350 bar H*: High-speed-design

Maximum permissible speed (speed limit)

Maximum permissible speed with increased inlet pressure p_{abs} at suction port S (note: max. perm. speed $n_{max\ perm}$ (speed limit))



Calculation of size

Flow $$q_v = \frac{V_g \bullet n \bullet \eta_v}{1000}$$ in L/min

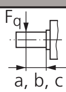
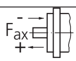
Torque $$T = \frac{1{,}59 \bullet V_g \bullet \Delta p}{100 \bullet \eta_{mh}} = \frac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}}$$ in Nm

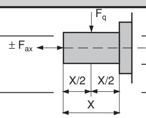
Power $$P = \frac{T \bullet n}{9549} = \frac{2\,\pi \bullet T \bullet n}{60\,000} = \frac{q_v \bullet \Delta p}{600 \bullet \eta_t}$$ in kW

V_g = displacement per revolution in cm^3
Δp = differential pressure in bar
n = speed in rpm
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency

Input drive

Permissible axial and radial force on drive shaft

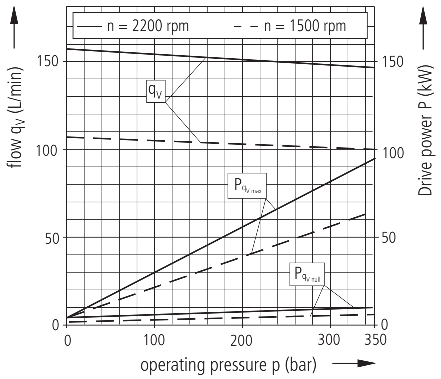
Size				16	22	28	40
Distance of F_q (from shaft collar) 		a	mm	17,5	17,5	17,5	17,5
		b	mm	30	30	30	30
		c	mm	42,5	42,5	42,5	42,5
max. permissible radial force at distance	a	$F_{q\ max}$	N	2800	2500	2050	3600
	b	$F_{q\ max}$	N	1600	1400	1150	2891
	c	$F_{q\ max}$	N	1150	1000	830	2416
max. permissible axial force 		$-F_{ax\ max}$	N	1557	1557	1557	2120
		$+F_{ax\ max}$	N	417	417	417	880



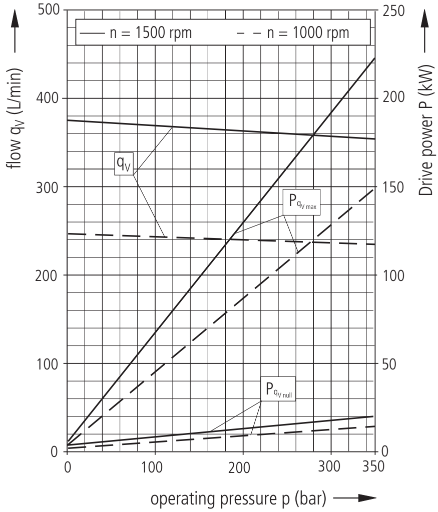
Size			71	125	250	500
Max. axial force at housing pressure p_{max} 1 bar abs.	$\pm F_{ax\ max}$	N	1400	1900	3000	4000
Max. axial force at housing pressure p_{max} 4 bar abs.	$+F_{ax\ max}$	N	810	1050	1850	2500
	$-F_{ax\ max}$	N	1990	2750	4150	5500
Max. shearing force	$F_{q\ max}$	N	1700	2500	4000	5000

Input Power and Flow

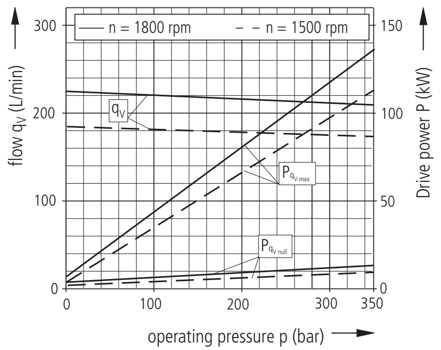
Size 71



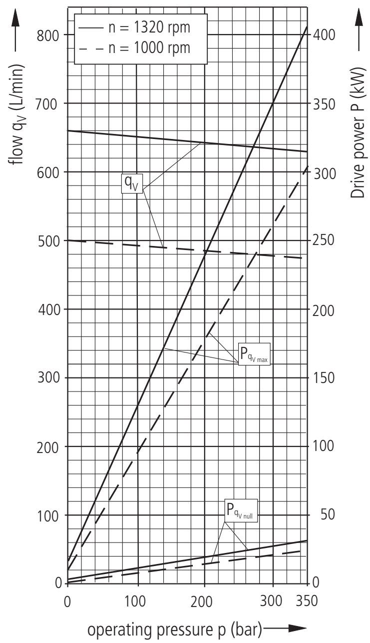
Size 250



Size 125



Size 500



Total efficiency: $$\eta_t = \frac{q_V \bullet p}{P_{q_{V\,max}} \bullet 600}$$

Volumetric efficiency: $$\eta_v = \frac{q_V}{q_{V,\,theor}}$$

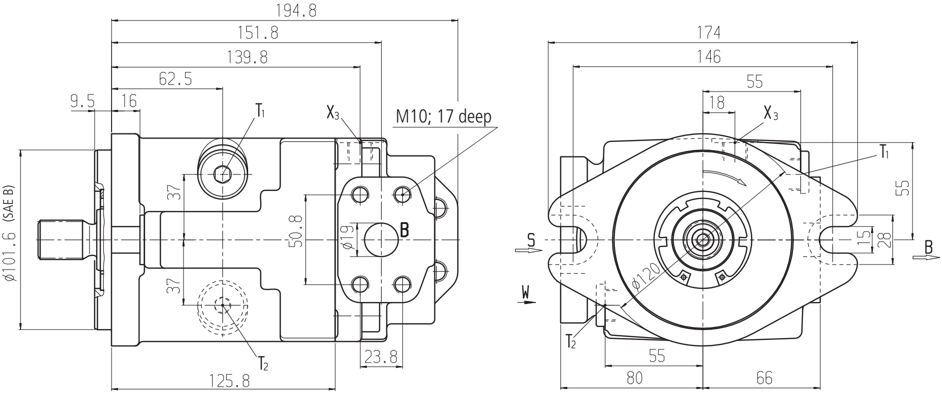
(Fluid: hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

Unit Dimensions, Sizes 16, 22, 28

Prior to finalising your design, please obtain a certified drawing.

Clockwise operation

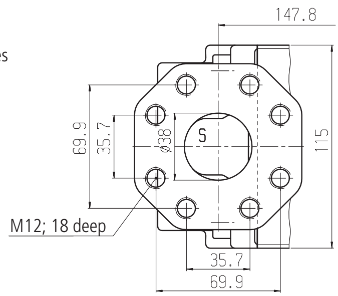
(port plate is rotated via 180° for anti-clockwise operation)



Connections

B (A)	Service line ports	SAE $^3/_4$" 420 bar (6000 psi) high pressure series
S	Suction port	SAE 1$^1/_2$" 35 bar (500 psi) standard series
T_1, T_2	Case drain port, oil filling	M18x1,5; 12 deep
X_3	Gauge port	M14x1,5; 12 deep

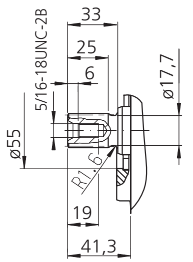
View W



Shaft ends

S

Splined shaft SAE $^7/_8$"(SAE B),
pressure angle 30°,
13 teeth, 16/32 Pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976

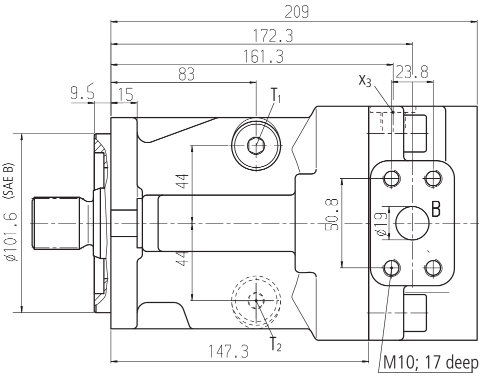


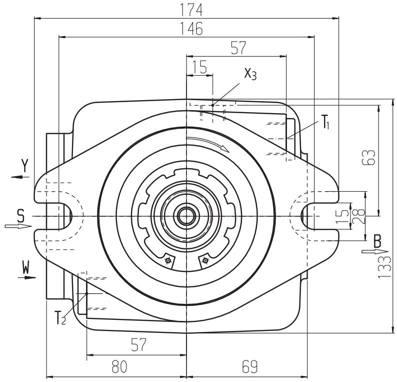
Unit Dimensions, Size 40

Prior to finalising your design, please obtain a certified drawing.

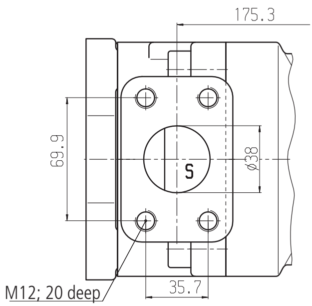
Clockwise operation

(port plate is rotated via 180° for anti-clockwise operation)





View W



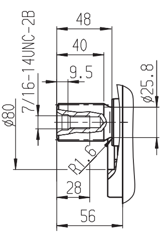
Connections

B (A)	Service line ports	SAE $^3/_4$" 420 bar (6000 psi) high pressure series
S	Suction port	SAE $1^1/_2$" 35 bar (500 psi) standard series
T_1, T_2	Case drain port, oil filling	M18x1,5; 12 deep
x_3	Gauge port	M14x1,5; 12 deep

Shaft ends

T

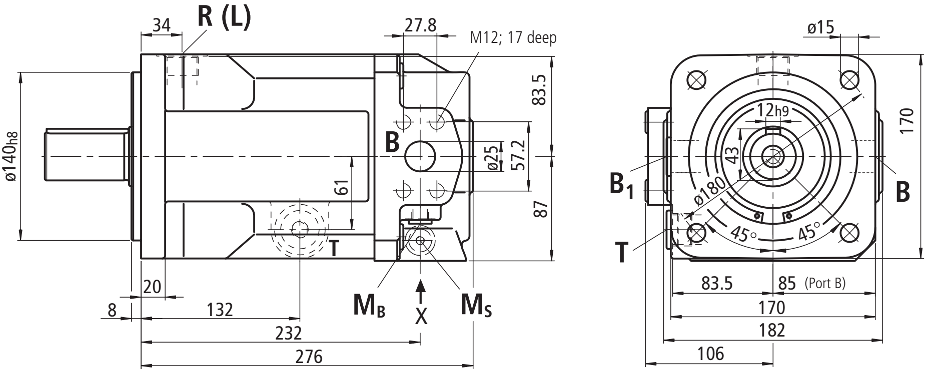
Splined shaft SAE $1^1/_4$"(SAE C)
pressure angle 30°,
14 teeth, 12/24 Pitch
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



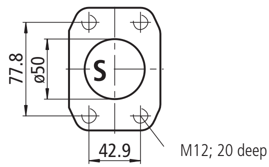
Unit Dimensions, Size 71

Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation



View X



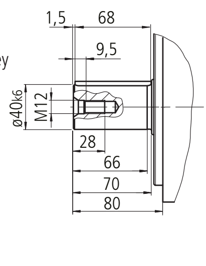
Connections

B	Service line port	SAE 1" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1" (high pressure series)
S	Suction port	SAE 2" (standard series)
R (L)	Case drain port, oil filling	M27x2
T	Oil drain (plugged)	M27x2
M_B	Gauge port operating pressure (plugged)	M14x1,5
M_S	Gauge port suction pressure (plugged)	M14x1,5

Shaft ends

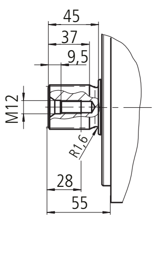
P

Parallel shaft with key
AS 12x8x68
DIN 6885



Z

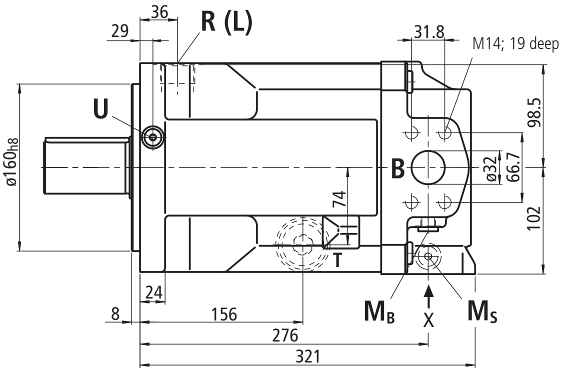
Splined shaft
W40x2x30x18x9g
DIN 5480

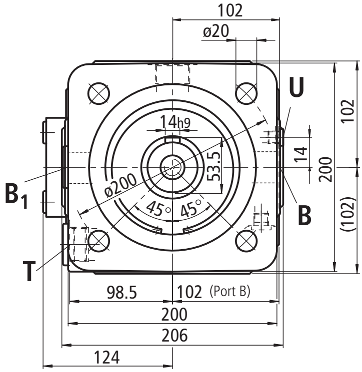


Unit Dimensions, Size 125

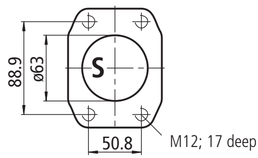
Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation





View X



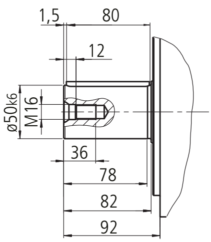
Connections

B	Service line port	SAE 1 1/4" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1 1/4" (high pressure series)
S	Suction port	SAE 2 1/2" (standard series)
R (L)	Case drain port, oil filling	M33x2
T	Oil drain (plugged)	M33x2
M_B	Gauge port operating pressure (plugged)	M14x1,5
M_S	Gauge port suction pressure (plugged)	M14x1,5
U	Flushing port (bearing flushing) (plugged)	M14x1,5

Shaft ends

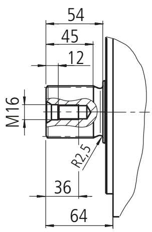
P

Parallel shaft with key
14x9x80
DIN 6885



Z

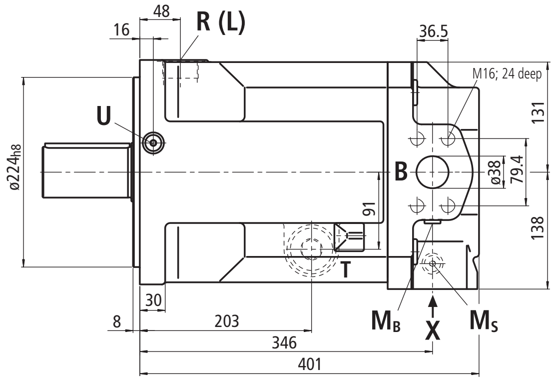
Splined shaft
W50x2x30x24x9g
DIN 5480

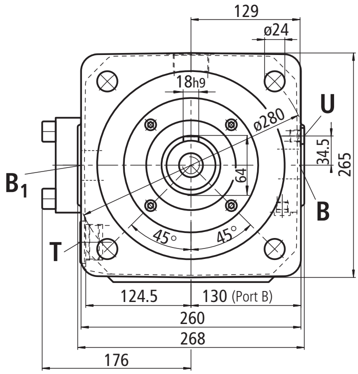


Unit Dimensions, Size 250

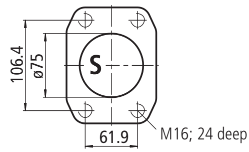
Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation





View X



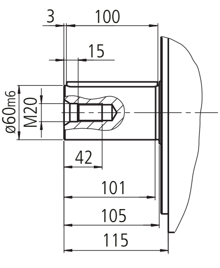
Connections

B	Service line port	SAE 1 1/2"	(high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1 1/2"	(high pressure series)
S	Suction port	SAE 3"	(standard series)
R (L)	Case drain port, oil filling	M42x2	
T	Oil drain (plugged)	M42x2	
M_B	Gauge port operating pressure (plugged)	M14x1,5	
M_S	Gauge port suction pressure (plugged)	M14x1,5	
U	Flushing port (bearing flushing) (plugged)	M14x1,5	

Shaft ends

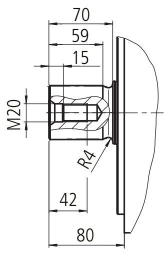
P

Parallel shaft with key
AS 18x11x100
DIN 6885



Z

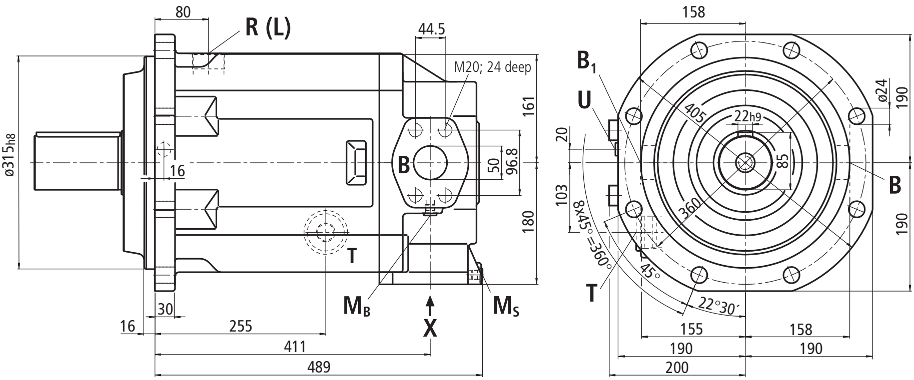
Splined shaft
W60x2x30x28x9g
DIN 5480



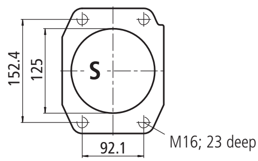
Unit Dimensions, Size 500

Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation



View X



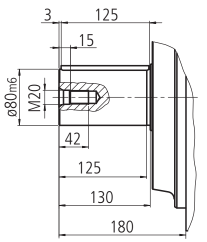
Connections

B	Service line port	SAE 2" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 2" (high pressure series)
S	Suction port	SAE 5" (standard series)
R (L)	Case drain port, oil filling	M48x2
T	Oil drain (plugged)	M48x2
M_B	Gauge port operating pressure (plugged)	M18x1,5
M_S	Gauge port suction pressure (plugged)	M18x1,5
U	Flushing port (bearing flushing) (plugged)	M18x1,5

Shaft ends

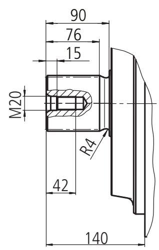
P

Parallel shaft with key
AS 22x14x125
DIN 6885



Z

Splined shaft
W80x3x30x25x9g
DIN 5480

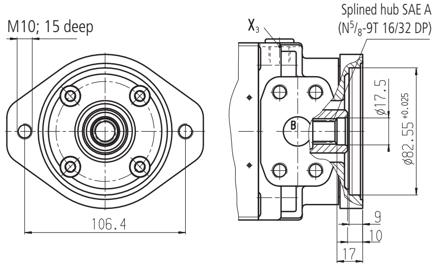


Unit Dimensions, Through Drives

Prior to finalising your design, please obtain a certified drawing.

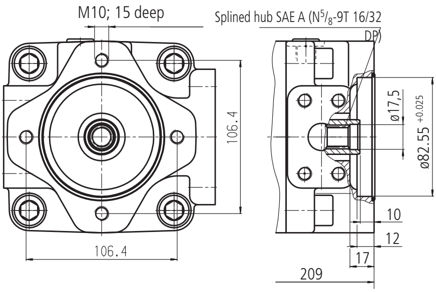
Through drive SAE A (K01)

Sizes 16, 22, 28



suitable for connection of:
– gear pump G2 (RE 10030)
– variable pump A10VSO10 (RE 92713)
– variable pump A10VSO18 (RE 92712)

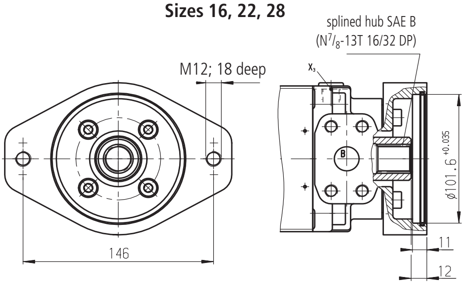
Size 40



suitable for connection of:
– gear pump G2 (RE 10030)
– variable pump A10VSO10 (RE 92713)
– variable pump A10VSO18 (RE 92712)

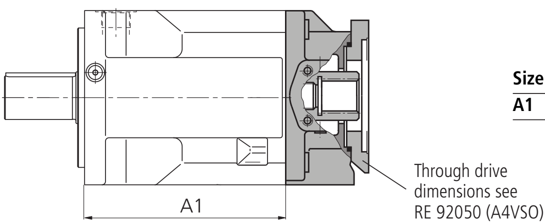
Through drive SAE B (K02)

Sizes 16, 22, 28



suitable for connection of:
– fixed pump A4FO 16, 22, 28
– gear pump G3 (RE 10039)
– gear pump G4 (RE 10042)
– variable pump A10VG18 (RE 92750)
– variable pump A10VO28 (RE 92701/ RE 92703)

Through drive sizes 71...500 (see RE 92050, A4VSO)



Size	71	125	250	500
A1	194	231	293	335

Permissible Input and Through Drive Rotation Torques

Size				16	22	28	40
Corner torque (at Δp = 400 bar) 1)		T_{max}	Nm	102	140	178	254
Max. perm. through drive torque 2)		$T_{D\ perm.}$	Nm	192	192	192	314
Max. perm. input torque 3)	shaft end S (SAE J744)	$T_{E\ perm.}$	Nm	192 (SAE B, W7/8")	192 (SAE B, W7/8")	192 (SAE B, W7/8")	–
	shaft end T (SAE J744)	$T_{E\ perm.}$	Nm	–	–	–	602 (SAE C, W1 1/4")
Size				**71**	**125**	**250**	**500**
Corner torque (at Δp = 350 bar) 1)		T_{max}	Nm	395	696	1391	2783
Max. perm. through drive torque 2)		$T_{D\ perm.}$	Nm	395	696	1391	2783
Max. perm. input torque3)	shaft end Z (DIN 5480)	$T_{E\ perm.}$	Nm	790 (W40)	1392 (W50)	2782 (W60)	5566 (W80)
	shaft end P (keyed shaft, DIN 6885)	$T_{E\ perm.}$	Nm	700 (AS12x8x68)	1392 (AS14x9x80)	2300 (AS18x11x100)	5200 (AS22x14x125)

2

1) efficiency not taken into consideration
2) note: max. perm. input torque $T_{E\ perm.}$ may not be exceeded
3) drive shaft without side load

Code explanations

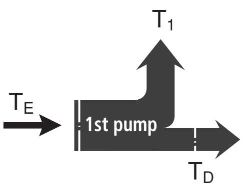
$T_{D\ perm.}$ = max. permissible through drive torque in Nm
$T_{E\ perm.}$ = max. permissible input torque at the drive shaft in Nm

T_1 = take off torque at 1st pump $= \dfrac{1{,}59 \bullet V_{g1} \bullet \Delta p_1}{100 \bullet h_{mh}}$ in Nm

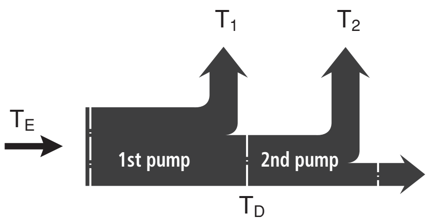
T_2 = take off torque at 2nd pump $= \dfrac{1{,}59 \bullet V_{g2} \bullet \Delta p_2}{100 \bullet h_{mh}}$ in Nm

V_{g1} = pump displacement per rev. 1st pump in cm^3
V_{g2} = pump displacement per rev. 2nd pump in cm^3
Δp_1 = differential pressure 1st pump in bar
Δp_2 = differential pressure 2nd pump in bar
η_{mh} = mechanical-hydraulic efficiency

Single pump



Combination pump



Installation and Commissioning Guidelines, Sizes 16...40

General

At start-up and during operation the pump housing has imperatively to be filled up with hydraulic fluid (filling of the case chamber). Start-up has to be carried out at low speed and without load till the system is completely bleeded.

At a longer standstill the case may discharge via operating line. At new start-up a sufficient filling of the housing has to be granted.

The min. suction pressure at port S should not fall below 0,8 bar absolute.

Installation position

Shaft horizontally resp. to the bottom. When mounting on top of the tank the installation position ”shaft horizontally, suction port to the bottom” is not admssible!

Installation below tank level

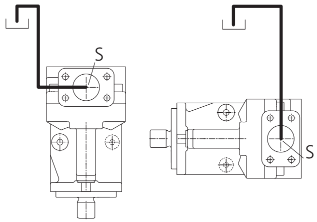
Pumps below min. oil level in the tank (standard)

➔ Fill up axial piston pump before start-up via highest positioned case drain port

➔ Recommendation: Fill up suction lines

➔ Operate pump at low speed (igniton speed) till pump system is completely filled up

➔ Minimum immersion depth of the suction line or drain line in the tank: 200 mm (relative to the min. oil level in the tank).



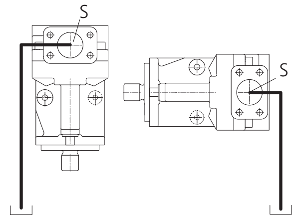
Installation on top of tank level

Pump on top of min. oil level in the tank

➔ Actions as installation below tank level

➔ Installation positions ”shaft to the top” and ”shaft horizontally, suction port at bottom” are not admissible (at standstill the pump case is bleeding via suction line).

➔ note: - max. perm. suction pipe lenght h_{max} = 800 mm
- min. admissible presssure at port S (min. suction pressure)



Installation and Commissioning Guidelines, Sizes 71...500

see RE 92050 (A4VSO)

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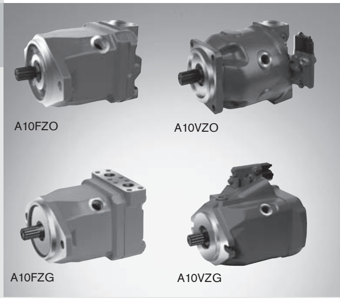
Variable-Speed Drive with Fixed Displacement Unit A10FZO/G Variable Displacement Unit A10VZO/G

RE 91485/06.11

Data sheet



Series 10
Size 6 to 180
For nominal pressure, maximum pressure, see Technical data, pages 9 to 11
Open and closed circuits

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Features

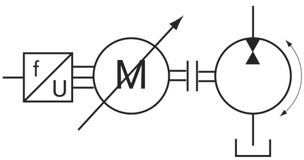
– Suitable for variable-speed operation with synchronous and asynchronous motors
– Suitable for start/stop operation
– Suitable for long pressure retention operation
– Proven A10 rotary group technology
– Through-drive option
– High efficiency
– For use in single-, double- and four-quadrant operation

Function and assembly of variable-speed drives

Rexroth has developed the proven axial piston units of the A10 product family further for use in energy-efficient variable-speed drive systems and optimized the interplay between the electric motor and the pump. The especially robust units are employed for small to medium sizes and satisfy individual requirements with their numerous combination options.
Variable-speed pump drives featuring Rexroth BlueHydraulics technology reduce energy consumption in industrial applications and at the same time avoid medium-level noise emissions. At the same time, the familiar performance is retained or even improved. The extensive spectrum of different variable-speed pump drives from Rexroth includes ready-to-use solutions that are finely scalable in both function and power. The energy-efficient hydraulic drive can be realized with internal gear pumps, fixed or variable axial piston units. Equipped with a suitable controller, exactly the required flow and pressure are provided which are needed at the machine.

The proven axial piston units have been developed further for use in speed-controlled drives. These are approved for start/stop operation and for changing directions of rotation. At the lowest speeds, between 0 and 200 rpm, they provide a constant pressure and are characterized by very high efficiency in pressure retention operation. Efficiency is achieved optimized by either a fixed or variable displacement, depending on the requirements of the cycle. The A10 units can be used as pumps and as motors in single-, double- or four-quadrant operation.
For the implementation of variable-speed drives, the new axial piston units offer numerous options for combination. The axial piston fixed displacement units A10FZO and A10FZG cover the sizes 6 to 63 cm^3. The axial piston variable displacement units are available in the sizes 10 to 180 cm^3 (A10VZO). Equipped with a torque controller and 2-point control, they are employed for dimensioning smaller servomotors. The numerous combination options allow a wide range of different customized system requirements to be satisfied.

A10FZO

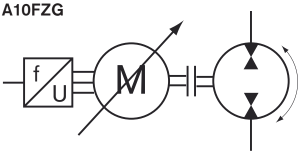


Axial piston fixed displacement units in **open circuit** with changing direction of rotation and unchanging pressure side (depends on the principal direction of rotation of the pump).

Single- or double-quadrant operation

For type codes, see page 3.
For technical data, see pages 12 and 13.

A10FZG

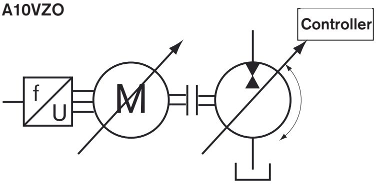


Axial piston fixed displacement unit in **closed circuit** with changing direction of rotation and two pressure sides.

Four-quadrant operation

For type codes, see page 4.
For technical data, see pages 14 and 15.

A10VZO

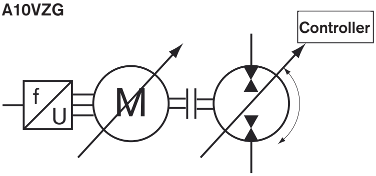


Axial piston variable displacement units in **open circuit** with changing direction of rotation and unchanging pressure side (depends on the principal direction of rotation of the pump).

Single- or double-quadrant operation

For type codes, see pages 6 and 7.
For technical data, see pages 16 and 17.

A10VZG



Axial piston variable displacement unit in **closed circuit** with changing direction of rotation and two pressure sides.

Four-quadrant operation

For type codes, see page 5.
Technical data on request.

Type codes for standard program, A10FZO

A10F	Z	O		/	10		–	V	S	C		
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swashplate design, fixed, nominal pressure 315 bar, maximum pressure 350 bar	**A10F**

Type of operation

02	Variable-speed drives	**Z**

Type of operation

03	Pump/motor, open circuit[1]	**O**

Size (NG)

04	Geometric displacement (see table of values on page 12)	**006**	**008**	**010**	**011**	**014**	**016**	**018**	**021**	**023**	**028**	**037**	**045**	**058**	**063**

Series

05	Series 1, Index 0	**10**

Direction of rotation[1]

06	With view on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Seal

07	FKM (fluoro-rubber)	**V**

Drive shaft

08	Splined shaft ANSI B92.1a	**S**

Mounting flange

09	ISO 3019-1 – 2-hole	**C**

	Service line ports	**006**	**008**	**010**	**011**	**014**	**016**	**018**	**021**	**023**	**028**	**037**	**045**	**058**	**063**	
10	SAE flange port A and B, opposite sides, metric fixing thread	●	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	**02**

	Through drive		**006**	**008**	**010**	**011**	**014**	**016**	**018**	**021**	**023**	**028**	**037**	**045**	**058**	**063**	
11	Without through drive																**N00**
	Flange ISO 3019-1	Coupling for splined shaft[2]															
	82-2 (A)	5/8 in 9T 16/32DP	●	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	**K01**
		3/4 in 11T 16/32DP	●	●	●	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	**K52**
	101-2 (B)	7/8 in 13T 16/32DP	–	–	–	–	–	–	–	❍	❍	❍	❍	❍	❍	❍	**K68**
		1 in 15T 16/32DP	–	–	–	–	–	–	–	❍	❍	❍	❍	❍	❍	❍	**K04**

1) Changing direction of rotation permissible with same pressure side (e.g. pressure drain)
2) 30° pressure angle, flat base, flank centering, tolerance class 5

● = Available ❍ = On request – = Not available

2

Type codes for standard program, A10FZG

A10F	Z	G		/	10	W	–	V		C		N00
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swashplate design, fixed, nominal pressure 315 bar, maximum pressure 350 bar	**A10F**

Application area

02	Variable-speed drives	**Z**

Type of operation

03	Pump/motor in closed circuit	**G**

Size (NG)

04	Geometric displacement (see table of values on page 14)	**006**	**008**	**010**	**011**	**018**	**028**	**045**	**063**

Series

05	Series 1, Index 0	**10**

Direction of rotation

06	With view on drive shaft, alternating	**W**

Seal

07	FKM (fluoro-rubber)	**V**

	Drive shaft	**006**	**008**	**010**	**011**	**018**	**028**	**045**	**063**	
08	Splined shaft ANSI B92.1a	●	●	●	–	–	❍	❍	–	**S**
	Splined shaft for higher torque, ANSI B92.1a	–	–	–	❍	❍	–	–	❍	**R**

Mounting flange

09	ISO 3019-1 – 2-hole	**C**

	Service line ports	**06**	**08**	**010**	**011**	**018**	**028**	**045**	**063**	
10	SAE flange port A and B, opposite sides, metric fixing thread	●	●	●	❍	❍	❍	❍	❍	**02**

Through drive

11	Without through drive	**N00**

● = Available ❍ = On request – = Not available

Type codes for standard program, A10VZG

A10V	Z	G			/	10	W		–	V	S	C	20	N00	H
01	02	03	04	05		06	07	08		09	10	11	12	13	14

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10V**

Application area

02	Variable-speed drives	**Z**

Type of operation

03	Pump/motor in closed circuit	**G**

Size (NG)

04	Geometric displacement $V_{g\ max}$ in cm^3	**010**	**018**	**028**	**045**	**063**

Control and adjustment device[1)]

			010	018	028	045	063	
05	Two-point control, electric	U = 12V	❍	❍	❍	❍	❍	**EZ1**
		U = 24V	❍	❍	❍	❍	❍	**EZ2**

Series

06	Series 1, Index 0	**10**

Direction of rotation

07	With view on drive shaft, alternating	**W**

Minimum displacement

			010	**018**	**028**	**045**	**063**	
08	$V_{g\ min}$ (in cm^3) steplessly adjustable State default setting in clear text	from to	–	–	8 28	12 25	16 38	**1**
		from to	–	–	–	26 45	40 42	**2**

Seal

09	FKM (fluoro-rubber)	**V**

Drive shaft

10	Splined shaft ANSI B92.1a–	**S**

Mounting flange

11	ISO 3019-1 – 2-hole	**C**

Service line ports

12	SAE flange port A and B, opposite sides, metric fixing thread	**02**

Through drive

13	Without through drive	**N00**

Connectors for solenoids[2)]

14	HIRSCHMANN connector – without suppressor diode	**H**

1) Other controllers on request
2) Connectors for other electric components can deviate.

● = Available ❍ = On request – = Not available

2

Type codes for standard program, A10VZO

A10V	Z	O			/	10		–	V	S				
01	02	03	04	05		06	07		08	09	10	11	12	13

Axial piston unit

		010	018	028	045	071	100	140	180	
01	Swashplate design, variable									A10V
	Nominal pressure 250 bar, maximum pressure 315 bar	●	–	–	–	–	–	–	–	
	Nominal pressure 280 bar, maximum pressure 350 bar	–	●	●	●	●	●	●	●	

Application area

02	Variable-speed drives	Z

Type of operation

03	Pump/motor, open circuit	O

Size (NG)

04	Geometric displacement (see table of values on page 16)	010	018	028	045	071	100	140	180

Control device

				010	018	028	045	071	100	140	180	
05	Pressure control			●	●	●	●	●	●	●	●	DR[1]
		hydraulic, remotely operated		●	●	●	●	●	●	●	●	DRG[1]
	Torque controller	size 10	size 18 to 180									
	Beginning of control	10 to 35 bar	up to 50 bar	–	●	●	●	●	●	●	●	LA5D
		36 to 70 bar	51 to 90 bar	–	●	●	●	●	●	●	●	LA6D
		71 to 105 bar	91 to 160 bar	–	●	●	●	●	●	●	●	LA7D
		106 to 140 bar	161 to 240 bar	–	●	●	●	●	●	●	●	LA8D
		141 to 230 bar	more than 240 bar	–	●	●	●	●	●	●	●	LA9D
	Two-point control, electric		U = 12V	–	●	●	●	●	●	●	●	EZ3[2]
			U = 24V	–	●	●	●	●	●	●	●	EZ4[2]

Series

06	Series 1, Index 0	10

Direction of rotation[3]

07	With view on drive shaft	clockwise	R
		counter-clockwise	L

Seal

08	FKM (fluoro-rubber)	V

Drive shaft

09	Splined shaft ANSI B92.1a	S

1) For DR and DRG in conjunction with changing direction of rotation, Please contact us
2) If a mechanical flow limitation is required, please refer to item 11, port plate 12.
3) Changing direction of rotation permissible with unchanging pressure side (e.g. pressure drain)

● = Available ❍ = On request – = Not available

2

Type codes for standard program, A10VZO

A10V	Z	O			/	10		–	V	S				
01	02	03	04	05		06	07		08	09	10	11	12	13

	Mounting flange	010	018	028	045	071	100	140	180	
10	ISO 3019-1 – 2-hole	●	●	●	–	–	–	–	–	**C**
	ISO 3019-1 – 4-hole	–	–	–	●	●	●	●	●	**D**

	Service line ports	010	018	028	045	071	100	140	180	
11	SAE flange port, top and bottom, opposite sides, metric fixing thread, with universal through drive	–	–	–	●	●	●	●	●	**22**
	SAE flange port, top and bottom, opposite sides, metric fixing thread, size 45 to 140 without through drive	–	●	●	●	●	●	●	❍	**12**[1]
	DIN metric threaded ports, rear, not for through drive	●	–	–	–	–	–	–	–	**14**
	DIN threaded ports, opposite sides	●	–	–	–	–	–	–	–	**7**

	Through drive		010	018	028	045	071	100	140	180	
12	With through-drive shaft, without coupling, without intermediate flange, sealed with functionally reliable cover; only port plate 22[3]		–	–	–	●	●	●	●	●	**U00**[2]
	Without through drive; only port plate 12[3]		●	●	●	●	●	●	●	●	**N00**
	Flange ISO 3019-1	Coupling for splined shaft[4]									
	82-2 (A)	5/8 in 9T 16/32DP	●	●	●	–	–	–	–	–	**K01**
		3/4 in 11T 16/32DP	●	●	●	–	–	–	–	–	**K52**
	101-2 (B)	7/8 in 13T 16/32DP	–	–	●	–	–	–	–	–	**K68**
	82-2 (A)	5/8 in 9T 16/32DP	–	–	–	●	●	●	●	●	**U01**
		3/4 in 11T 16/32DP	–	–	–	●	●	●	●	●	**U52**
	101-2 (B)	7/8 in 13T 16/32DP	–	–	–	●	●	●	●	●	**U68**
		1 in 15T 16/32DP	–	–	–	●	●	●	●	●	**U04**

	Connectors for solenoids[5]	
13	HIRSCHMANN connector – without suppressor diode	**H**

1) A mechanical flow limitation mechanism is only fitted as standard on the version 12 N00 with EZ control, sizes 18 to 140
$V_{g\,max}$: setting range $V_{g\,max}$ up to 50% $V_{g\,max}$ stepless
$V_{g\,min}$: setting range $V_{g\,min}$ up to 50% $V_{g\,max}$ stepless
State settings values in clear text.
$V_{g\,max}$ and $V_{g\,min}$ limitations for through drives with port plates 12K.. and 22U.. can only be made with permanently defined values. Again here, state in clear text.
2) See RE 95581 Universal through drive
3) When ordering sizes 45 to 180 with port plate 22U, please order the corresponding through drive **without** "K"
Example: A10VO180DRS/32R-VSD**22U01**
When ordering sizes 18 to 28 with port plate 12, please order the corresponding through drive **with** "K"
Example: A10VO18DRS/32R-VSD**12K01**
4) Coupling for splined shaft as per ANSI B92.1a (splined shaft assignment as per SAE J744)
5) Connectors for other electric components may differ.

● = Available ❍ = On request – = Not available

Technical data

Hydraulic fluid

Prior to project design, please see our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable hydraulic fluids) for detailed information on hydraulic fluid and operating conditions.

When using environmentally acceptable hydraulic fluids, the limitations regarding technical data and seals must be observed. Please contact us. When ordering, indicate the hydraulic fluid that is to be used.

Operating viscosity range

We recommend you to choose the operating viscosity (at operating temperature) in the optimum range for efficiency and useful life of

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

taking into account the reservoir temperature (open circuit) or circuit temperature (closed circuit).

Limits of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods ($t \leq 1$ min)
at a max. perm. case drain temperature
of 90 °C.

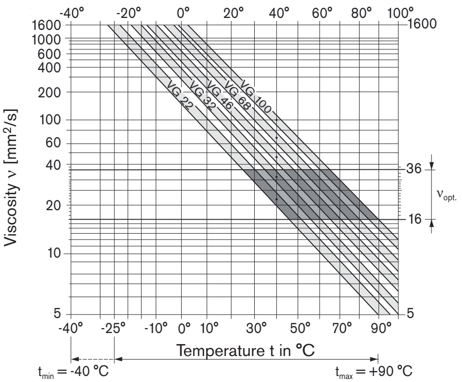
Note that the maximum case drain temperature of 90 °C may not be exceeded even locally (e.g. in the bearing area). The temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

ν_{max} = 1600 mm²/s
for short periods ($t \leq 1$ min)
on cold start
($p \leq 30$ bar, $n \leq 1000$ rpm, t_{min} -25 °C)

Depending on the installation situation, special measures are necessary at temperatures between -40 °C and -25 °C. Please contact us.

For detailed information about operation with low temperatures, see RE 90300-03-B.

Selection diagram



Hydraulic fluid temperature range

Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the reservoir (open circuit) in relation to the ambient temperature: in an open circuit, the reservoir temperature; in a closed circuit, the circuit temperature.

The hydraulic fluid should be selected so that the viscosity in the operating temperature range is within the optimum range (ν_{opt}), see shaded area of the selection diagram. We recommended that the higher viscosity class be selected in each case.

Example: at an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68. VG 68 should be selected.

Note
The case drain temperature, which is influenced by pressure and speed, is always higher than the reservoir temperature. However, at no point in the component may the temperature exceed 90 °C. The temperature difference specified on the left is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be met due to extreme operating parameters, please contact us.

Filtration of the hydraulic fluid
The finer the filtration, the better the hydraulic fluid cleanliness class, and the longer the service life of the axial piston unit.

In order to guarantee the functional reliability of the axial piston unit, it is necessary to carry out a gravimetric evaluation of the hydraulic fluid to determine the particle contamination and the cleanliness class according to ISO 4406. The minimum cleanliness class to be observed is 20/18/15.
At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness class of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be maintained, please contact us.

Technical data

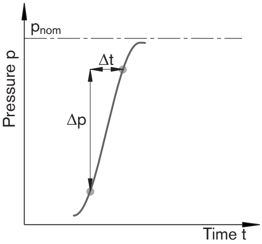
Operating pressure range, A10FZO

Pressure at service line port B

Nominal pressure p_{nom} ______ 315 bar absolute
Maximum pressure p_{max} ______ 350 bar absolute
Individual operating period ______ 2.0 s
Total operating period ______ 300 h

Minimum pressure (high-pressure side) ______ 10 bar

Rate of pressure change R_A ______ 16,000 bar/s



Pressure at suction port A (inlet)

Minimum pressure $p_{S\ min}$ ______ 0.8 bar absolute

Maximum pressure $p_{S\ max}$ ______ 5 bar absolute

Operating pressure range, A10FZG

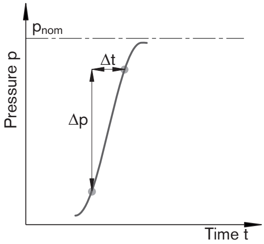
Pressure at service line port A or B

Nominal pressure p_{nom} ______ 315 bar absolute
Maximum pressure p_{max} ______ 350 bar absolute
Individual operating period ______ 2.0 s
Total operating period ______ 300 h

Minimum pressure (high-pressure side) ______ 10 bar

Minimum pressure (low-pressure side) ______ 0.8 bar absolute

Rate of pressure change R_A ______ 16,000 bar/s



Case drain pressure

Maximum permissible case drain pressure
(at port L, L_1):
Maximum 0.5 bar higher than inlet pressure at port S,
but not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ______ 2 bar

Case drain pressure

Maximum permissible case drain pressure
(at port L, L_1):
Maximum 0.5 bar higher than inlet pressure at port A or B,
but not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ______ 2 bar

Flow direction

Direction of rotation, with view on drive shaft		
Type of operation	clockwise	counter-clockwise
Pump mode	**A** to **B**	**B** to **A**
Motor mode	**A** to **B**	**B** to **A**

Flow direction

Direction of rotation, with view on drive shaft		
Type of operation	clockwise	counter-clockwise
Pump mode	**A** to **B**	**B** to **A**
Motor mode	**A** to **B**	**B** to **A**

For pressure definitions, see page 11

Technical data

Operating pressure range, A10VZO size 10

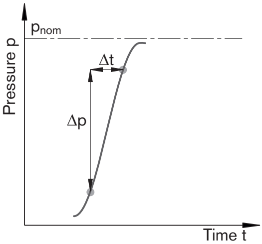
Pressure at service line port B

Nominal pressure p_{nom} ________________ 250 bar absolute

Maximum pressure p_{max} ________________ 315 bar absolute
Individual operating period ________________ 2.0 s
Total operating period ________________ 300 h

Minimum pressure (high-pressure side) __________ 10 bar

Rate of pressure change R_A ________________ 16,000 bar/s



Pressure at suction port S (inlet)

Minimum pressure $p_{abs\ min}$ ________________ 0.8 bar absolute
Maximum pressure $p_{abs\ max}$ ________________ 5 bar absolute

Case drain pressure

Maximum permissible case drain pressure (at port L, L_1):
Maximum 0.5 bar higher than inlet pressure at port S, but not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ________________ 2 bar

Flow direction

Direction of rotation, with view on drive shaft		
Type of operation	clockwise	counter-clockwise
Pump	**S** to **B**	**S** to **B**[1)]
Pressure drain	**B** to **S**[1)]	**B** to **S**

1) Note: Comply with installation drawings for counter-clockwise rotation

Operating pressure range, A10VZO, size 18 to 180

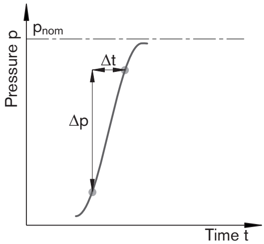
Pressure at service line port B

Nominal pressure p_{nom} ________________ 280 bar absolute
For 10% actuated time ________________ 315 bar absolute

Maximum pressure p_{max} ________________ 350 bar absolute
Individual operating period ________________ 2.5 s
Total operating period ________________ 300 h

Minimum pressure (high-pressure side) __________ 10 bar

Rate of pressure change R_A ________________ 16,000 bar/s



Pressure at suction port S (inlet)

Minimum pressure $p_{abs\ min}$ ________________ 0.8 bar absolute
Maximum suction pressure $p_{abs\ max}$ ________________ 10 bar absolute

Case drain pressure

Maximum permissible case drain pressure (at port L, L_1):
Maximum 0.5 bar higher than inlet pressure at port S, but not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ________________ 2 bar

Flow direction

Direction of rotation, with view on drive shaft		
Type of operation	clockwise	counter-clockwise
Pump	**S** to **B**	**S** to **B**[1)]
Pressure drain	**B** to **S**[1)]	**B** to **S**

For pressure definitions, see page 11

Technical data

Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

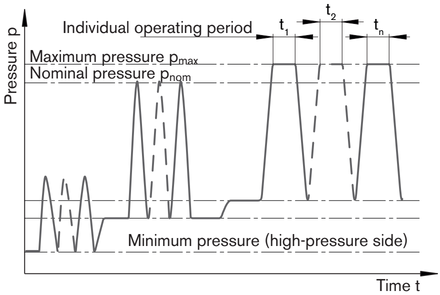
Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the individual operating period. The sum of the individual operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure on high-pressure side (A or B) that is required to prevent damage to the axial piston unit.

Minimum pressure (inlet) open circuit
Minimum pressure at suction port S (inlet) that is required to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

Minimum pressure (low-pressure side) closed circuit
Minimum pressure on the low-pressure side (A or B) that is required to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure build-up and pressure reduction with a pressure change over the entire pressure range.



Total operating period $= t_1 + t_2 + ... + t_n$

2

Technical data, A10FZO

Table of values (theoretical values, without efficiency levels and tolerances; values rounded)

Size		NG		6	8	10
Displacement, geometric (per revolution)		V_g	cm^3	6	8.1	10.6
Speed, maximum at V_g						
Suspion speed, pump mode[1]		n_{nom}	rpm	3600	3600	3600
Max. speed, pressure drain mode[2]		n_{nom}	rpm	3600	3600	3600
Flow						
at n_{nom}		$q_{vol\ max}$	l/min	21.6	28.8	38.2
at $n_E = 1500$ rpm		$q_{vE\ max}$	l/min	9	12	15.9
Power, pump mode						
at n_{nom}, $\Delta p = 315$ bar		P_{max}	kW	11.3	15.3	20
at $n_E = 1500$ rpm		P_{max}	kW	4.7	6.4	8.3
Torque						
at V_g and	$\Delta p = 315$ bar	T_{max}	Nm	30	40.5	53
	$\Delta p = 100$ bar	T	Nm	9.5	12.7	16.8
Torsional stiffness	Drive shaft S	c	Nm/rad	8100	8100	8100
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0006	0.0006	0.0006
Angular acceleration[3]		α	rad/s^2	14000	14000	14000
Filling capacity		V	L	0.14	0.14	0.14
Mass (without filling capacity) approx.		m	kg	6.4	6.4	6.4

1) The values are applicable:
- for absolute pressure $p_{abs} = 1$ bar at suction port S
- for the optimum viscosity range of $\nu_{opt} = 16$ to $36\ mm^2/s$
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

2) Higher values on request

3) Values are only permissible if a pressure of 1 bar absolute is maintained at the suction port, and only for single pumps. Multiple-pump configurations on request.

Important

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or the total destruction of the axial piston unit. We recommend checking the loading through tests or calculation / simulation and comparison with the permissible data.

Determination of size

Flow (absorbed volume flow)
$$q_v = \frac{V_g \cdot n \cdot \eta_V}{1000 \cdot (\eta_V)} \quad [l/min]$$

Torque, pump mode (pressure drain mode)
$$T = \frac{1.59 \cdot V_g \cdot \Delta p \cdot (\eta_{mh})}{100 \cdot \eta_{mh}} \quad [Nm]$$

Power, pump mode (pressure drain mode)
$$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p \cdot (\eta_t)}{600 \cdot \eta_t} \quad [kW]$$

Drive speed (output speed)
$$n = \frac{q_V \cdot 1000 \cdot (\eta_V)}{V_g \cdot \eta_V} \quad [rpm]$$

V_g = Displacement per revolution in cm^3

Δp = Differential pressure in bar

n = Speed in rpm

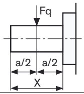
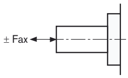
η_V = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data, A10FZO

Permissible radial and axial loading on drive shaft

Size					06 to 10
Radial force, maximum		at a/2	$F_{q\ max}$	N	250
Axial force, maximum			$F_{ax\ max}$	N	400

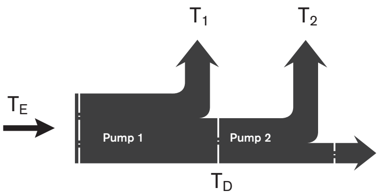
2

Permissible input and through-drive torques

Size		NG		6 to 10
Torque at V_g and $\Delta p = 315$ bar[1)]		T_{max}	Nm	See table of values on page 12
Input torque at drive shaft, maximum[2)]				
	S	$T_{E\ max}$ Ø drive shaft	Nm in	126 3/4
Through-drive torque at drive shaft, maximum	S	$T_{D\ max}$	Nm	42

1) Without considering efficiency
2) For drive shafts free of radial load

Distribution of torque



Technical data, A10FZG

Table of values (theoretical values, without efficiency levels and tolerances; values rounded)

Size		NG		6	8	10
Displacement, geometric (per revolution)		V_g	cm^3	6	8.1	10.6
Speed, maximum at V_g						
Suction speed, pump mode[1]		n_{nom}	rpm	3000	3000	3000
Maximum speed, motor mode[2]		n_{nom}	rpm	3000	3000	3000
Flow, pump mode						
at n_{nom}		$q_{vol\ max}$	l/min	18	24.3	32
at $n_E = 1500$ rpm		$q_{vE\ max}$	l/min	9	12	15.9
Displacement, motor mode						
at n_{nom}		$q_{vol\ max}$	l/min	18	24.3	32
at $n_E = 1500$ rpm		$q_{vE\ max}$	l/min	9	12	15.9
Power, pump mode						
at n_{nom}, $\Delta p = 315$ bar		P_{max}	kW	9.4	12.8	16.7
at $n_{E =}$ 1500 rpm		P_{max}	kW	4.7	6.4	8.3
Power, motor mode						
at n_{nom}, $\Delta p = 315$ bar		P_{max}	kW	9.4	12.8	16.7
at $n_{E =}$ 1500 rpm		P_{max}	kW	4.7	6.4	8.3
Torque						
at V_g and	$\Delta p = 315$ bar	T_{max}	Nm	30.1	40.5	53.1
	$\Delta p = 100$ bar	T	Nm	9.5	12.7	16.8
Torsional stiffness of drive shaft	S	c	Nm/rad	9370	9370	9370
	R	c	Nm/rad	–	–	–
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0006	0.0006	0.0006
Angular acceleration[3]		α	rad/s^2	14000	14000	14000
Filling capacity		V	L	0.14	0.14	0.14
Mass (without filling capacity) approx.		m	kg	6.4	6.4	6.4

1) The values are applicable:
- for absolute pressure $p_{abs} = 1$ bar at ports A or B
- for the optimum viscosity range of $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

2) Higher values on request (could possibly cause an increase in low pressure)

3) Values are only permissible if a pressure of 1 bar absolute is maintained at the suction port, and only for single pumps. Multiple-pump configurations on request.

Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or the total destruction of the axial piston unit. We recommend checking the loading through tests or calculation / simulation and comparison with the permissible data.

Technical data, A10FZG

Determining the size

Absorbed volume flow (flow)

$$q_v = \frac{V_g \cdot n \cdot (\eta_v)}{1000 \cdot \eta_v} \quad \text{[l/min]}$$

Torque, motor mode (pump mode)

$$T = \frac{1.59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100 \cdot (\eta_{mh})} \quad \text{[Nm]}$$

Power, motor mode (pump mode)

$$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600 \cdot (\eta_t)} \quad \text{[kW]}$$

Output speed (drive speed)

$$n = \frac{q_v \cdot 1000 \cdot \eta_v}{V_g \cdot (\eta_v)} \quad \text{[rpm]}$$

V_g = Displacement per revolution in cm³

Δp = Differential pressure in bar

n = Speed in rpm

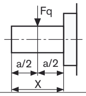
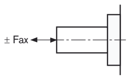
η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

2

Permissible radial and axial loading on drive shaft

Size					06	08	10
Radial force, maximum		at a/2	$F_{q\ max}$	N	250	250	250
Axial force, maximum			$F_{ax\ max}$	N	400	400	400

Technical data, A10VZO

Table of values (theoretical values, without efficiency levels and tolerances; values rounded)

Size		NG		10	18	28	45	71	100	140	180
Displacement, geometric (per revolution)		$V_{g\,max}$	cm^3	10.5	18	28	45	71.1	100	140	180
Speed, maximum at $V_{g\,max}$											
Suction speed, pump mode[1)]		n_{nom}	rpm	3600	3300	3000	3000	2550	2300	2200	1800
Maximum speed, pressure drain mode[2)]		n_{nom}	rpm	3600	3300	3000	3000	On request			
Flow											
at n_{nom}		$q_{vo\,max}$	l/min	38	59	84	135	181	230	308	324
at $n_E = 1500$ rpm		$q_{vE\,max}$	l/min	15	27	42	68	106.6	150	210	270
Power, pump mode											
at n_{nom} and $\Delta p =$	250 bar	P_{max}	kW	16	–	–	–	–	–	–	–
	280 bar	P_{max}	kW	–	27.7	39	63	84.5	107	143	151
at $n_E = 1500$ rpm		P_{max}	kW	7.5	12.5	20	31	50	70	98	125
Torque											
at $V_{g\,max}$ and $\Delta p =$	250 bar	T_{max}	Nm	42	–	–	–	–	–	–	–
	280 bar	T_{max}	Nm	–	80	125	200	317	445	623	801
$\Delta p =$	100 bar	T	Nm	17	29	45	72	113	159	223	286
Torsional stiffness	Drive shaft S	c	Nm/rad	8100	10000	21500	35000	71884	121142	169537	171107
Moment of inertia for rotary group		J_{GR}	kg/m^2	0.0006	0.00093	0.0017	0.0033	0.0087	0.0185	0.0276	0.033
Angular acceleration[3)]		α	rad/s^2	14000	12600	11200	9500	7500	6200	5000	4000
Filling capacity		V	L	0.2	0.25	0.3	1.0	1.6	2.2	3.0	2.7
Mass (without filling) approx.		m	kg	8	12	15	30	47	69	73	78

1) The values are applicable:
- for absolute pressure $p_{abs} = 1$ bar at the suction port S
- for the optimum viscosity range of $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

2) Higher values on request.

3) Values are only permissible if a pressure of 1 bar absolute is maintained at the suction port, and only for single pumps. Multiple-pump configurations on request.

Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or the total destruction of the axial piston unit. We recommend checking the loading through tests or calculation / simulation and comparison with the permissible data.

Determination of size

Flow (absorbed volume flow)
$$q_v = \frac{V_g \cdot n \cdot \eta_V}{1000 \cdot (\eta_V)} \quad \text{[l/min]}$$

Torque, pump mode (pressure drain mode)
$$T = \frac{1.59 \cdot V_g \cdot \Delta p \cdot (\eta_{mh})}{100 \cdot \eta_{mh}} \quad \text{[Nm]}$$

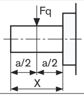
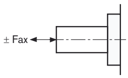
Power, pump mode (pressure drain mode)
$$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p \cdot (\eta_t)}{600 \cdot \eta_t} \quad \text{[kW]}$$

Drive speed (output speed)
$$n = \frac{q_V \cdot 1000 \cdot (\eta_V)}{V_g \cdot \eta_V} \quad \text{[rpm]}$$

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data, A10VZO

Permissible radial and axial loading on drive shaft

Size					10	18	28	45	71	100	140	180
Radial force, maximum		at a/2	$F_{q\ max}$	N	250	250	1200	1500	1900	2300	2800	2300
Axial force, maximum			F_{ax}	N	400	400	1000	1500	2400	4000	4800	800

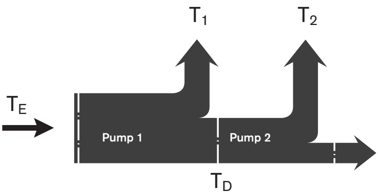
2

Permissible input and through-drive torques

Size		NG		10	18	28	45	71	100	140	180
Torque at $V_{g\ max}$ and $\Delta p = 280$ bar[1]		T_{max}	Nm	50	90	140	225	356	500	701	901
Input torque at drive shaft, maximum[2]											
ANSI B92.1a	S	$T_{E\ max}$ Ø drive shaft	Nm in	126 3/4	124 3/4	198 7/8	319 1	626 1 1/4	1104 1 1/2	1620 1 3/4	1620 1 3/4
Through-drive torque at drive shaft, maximum											
	S	$T_{D\ max}$	Nm	42	108	160	319	492	778	1266	1266

1) Without considering efficiency
2) For drive shafts free of radial load

Distribution of torque



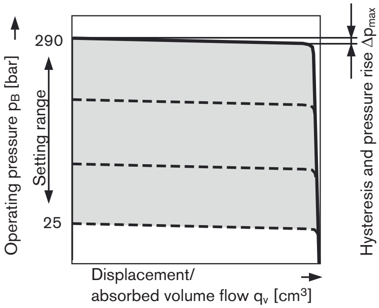
DR-Pressure control, A10VZO

The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will adjust towards a smaller displacement. The pressure can be set steplessly at the control valve.

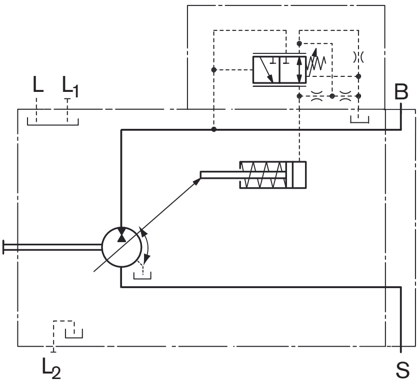
Please contact us with respect to applications with pressure control and changing direction of rotation.

Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)

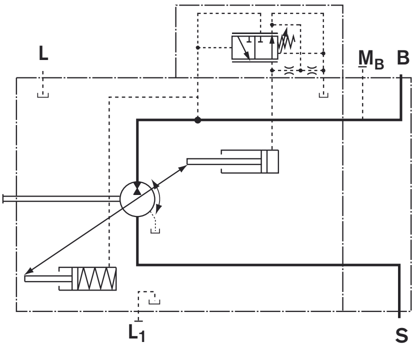


Schematic, A10VZO; size 10



Ports for	
B	Service line
S	Suction line
L, L_1	Case drain (L_1, L_2 plugged)

Schematic, A10VZO; size 18 to 180
port plate 22



Port for	
B	Service line
S	Suction line
L, L1	Case drain (L_1 plugged)
MB	Measuring operating pressure (plugged)

Control data

Hysteresis and repeatability Δp ________________ max. 3 bar

Pressure rise, max.

NG		10	18	28	45	71	100	140	180
Δp	bar	6	6	6	6	8	10	12	14

Control fluid consumption, __________ max. approx. 4.5 l/min

DRG-Pressure control, remotely operated

The DRG control valve overrides the function of the DR pressure control, see page 18.

A pressure-relief valve can be externally connected to port X as a remote control. This pressure-relief valve is included in the delivery contents of the DRG control.

The differential pressure at the control valve is set as standard to 20 bar. The pilot oil flow at port X is approx. 1.5 l/min. If another setting is required (range 10 to 22 bar), please state in clear text.

As a separate pressure-relief valve we recommend:

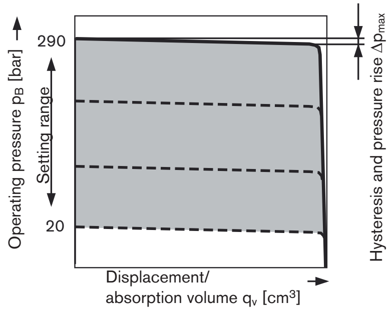
DBDH 6 (hydraulic) as per RE 25402 or
DBETR-SO 381 with orifice Ø 0.8 mm in P (electric) to RE 29166.

The maximum line length must not exceed 2 m.

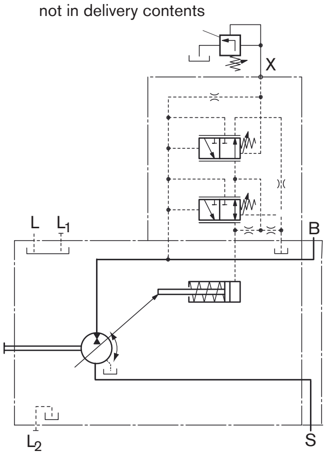
Please contact us with respect to applications with remotely operated pressure control and changing direction of rotation.

Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50 °C)

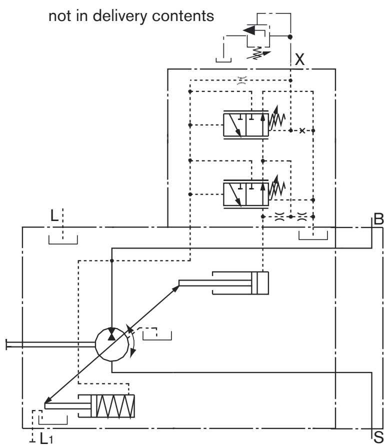


Schematic, A10VZO; size 10



Port for	
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain (L_1, L_2 plugged)
X	Pilot pressure (plugged)

Schematic, A10VZO; size 18 to 180
port plate 22



Port for	
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure (plugged)
M_B	Measuring operating pressure (plugged)

Control data

Hysteresis and repeatability Δp ________________ max. 3 bar

Pressure rise, max.

NG		10	18	28	45	71	100	140	180
Δp	bar	6	6	6	6	8	10	12	14

Control fluid consumption___________ max. approx. 4.5 l/min

LA.D-Pressure/torque controller (A10VZO)

Pressure control equipment as DR, see page 18.

In order to achieve a constant drive torque with varying operating pressure, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant.

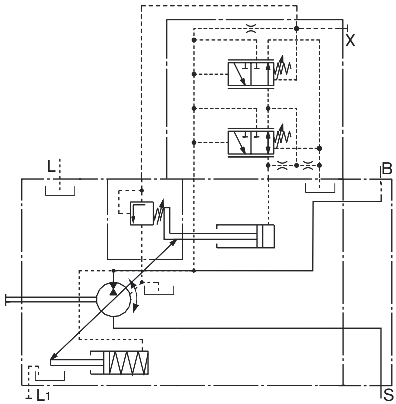
The torque characteristics are set at the plant. Please state in clear text, e.g. T = 50 Nm.

Control data

For data and notes about the DR pressure control, see page 18.

For data and notes about the remotely operated DRG pressure control, see page 19.

Schematic, A10VZO LAxD with pressure cut-off, size 18 to 180

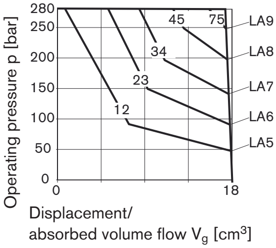


	Port for
B	Service line
S	Suction line
L, L_1,	Case drain (L_1, L_2 plugged)

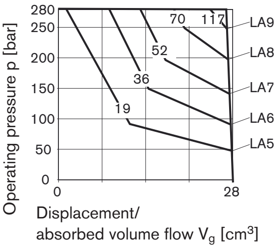
LA.D-Pressure/torque controller, characteristic curve (A10VZO)

Torque characteristic fields in Nm

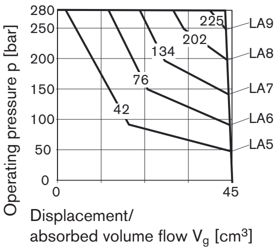
Size 18



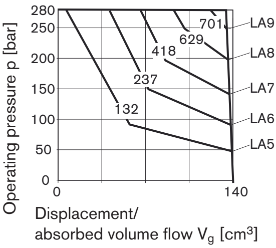
Size 28



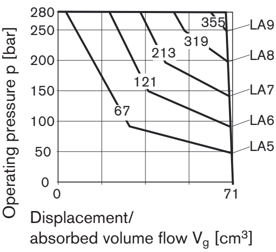
Size 45



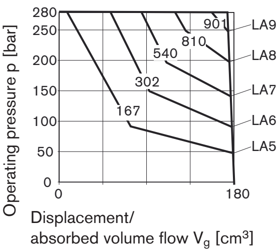
Size 140



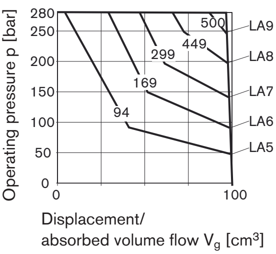
Size 71



Size 180



Size 100



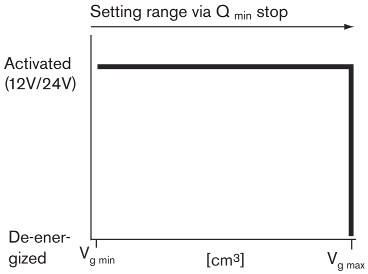
EZ-Two-point control, electric (A10VZO, A10VZG)

The variable displacement unit is set to minimum swivel angle by operating the switching solenoids. This supplies control pressure to the stroke piston via the switching valve.

The control pressure is taken internally from the respective high-pressure side, whereby a minimum operating pressure differential of $\Delta_{pA,B} \geq 20$ bar is required.

The axial piston unit can only be activated between $V_{g\,max}$ and $V_{g\,min}$.

Please state $V_{g\,min}$ default setting in clear text when ordering.



De-energized $\hat{=} V_{g\,max}$

Current energized $\hat{=} V_{g\,min}$

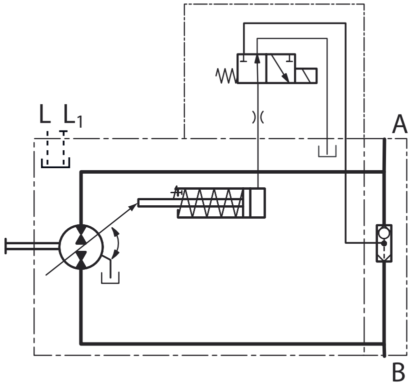
Technical data, solenoid	EZ1/3	EZ2/4
Voltage	12V (±15%)	24V (±15%)
Position $V_{g\,max}$	De-energized	De-energized
Position $V_{g\,min}$	Current energized	Current energized
Rated current at 20 °C	1.5 A	0.8 A
Actuated time	100%	100%
Type of protection see connector design, page 55		

Ambient temperature range -20 °C to +60 °C.
If these temperatures cannot be achieved, please contact us.

For further information, please refer to page 55

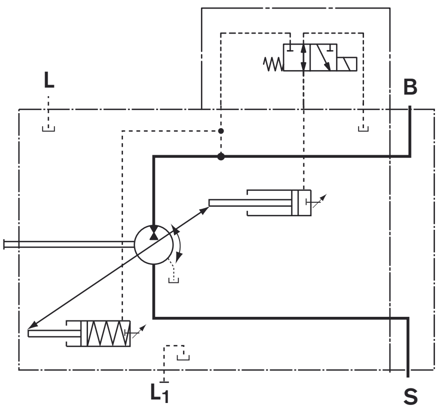
EZ-Two-point control, electric (A10VZO, A10VZG)

Schematic, A10VZG EZ1/2,



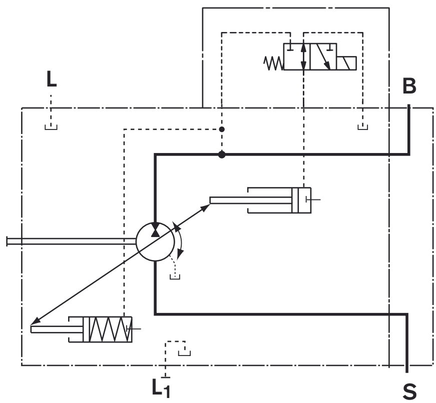
Port for	
A, B	Service line
L, L_1	Case drain (L_1 plugged)

Schematic, A10VZO EZ3/4; size 18 to 140 port plate 12



Port for	
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)

Schematic, A10VZO EZ3/4; size 45 to 180 port plate 22



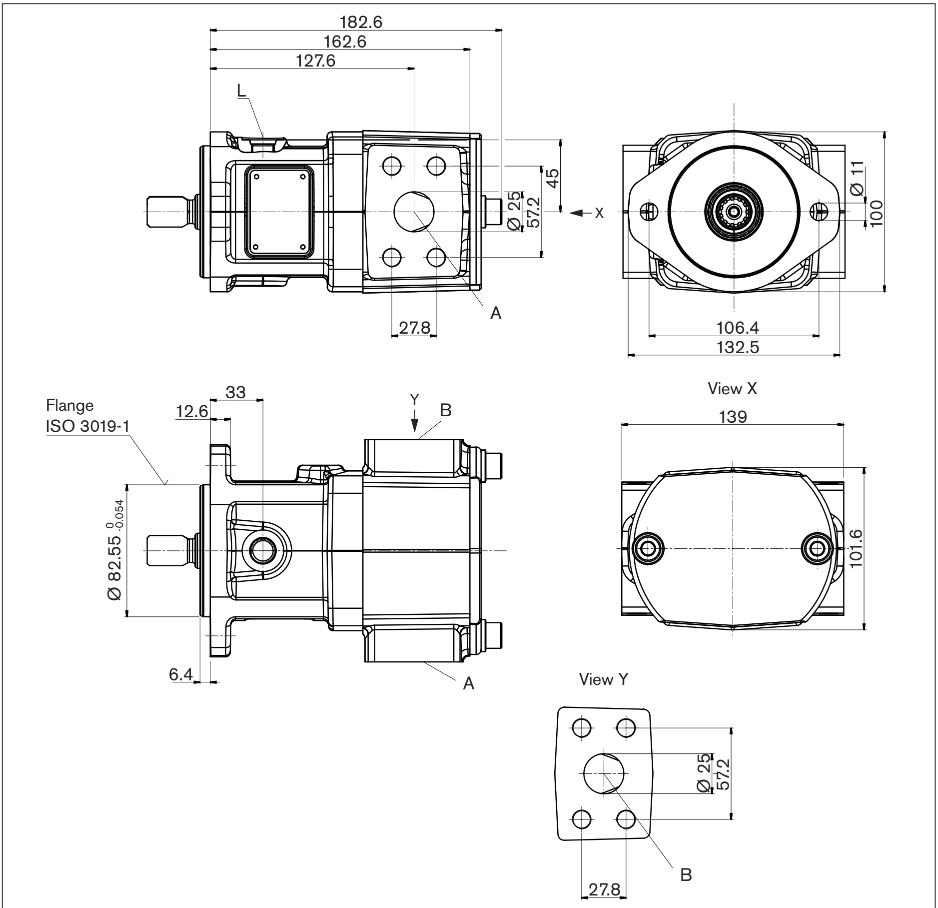
Port for	
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)

Dimensions, A10FZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 06 to 10

Port plate 02: SAE flange port on opposite side, clockwise rotation



Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
A, B	Suction and Service line[5] Fixing thread	SAE J518[3] DIN 13	1 in M12 x 1.75; 17 deep	350	O
L	Case drain fluid	ISO 11926[4]	9/16-18UNF-2B; 10 deep	2	O

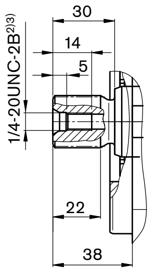
1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
4) The countersink may be deeper that specified in the standard.
5) See table on side 9
O = Must be connected (plugged on delivery)

Dimensions, A10FZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 3/4 in
11T 16/32DP[1)] (SAE J744)



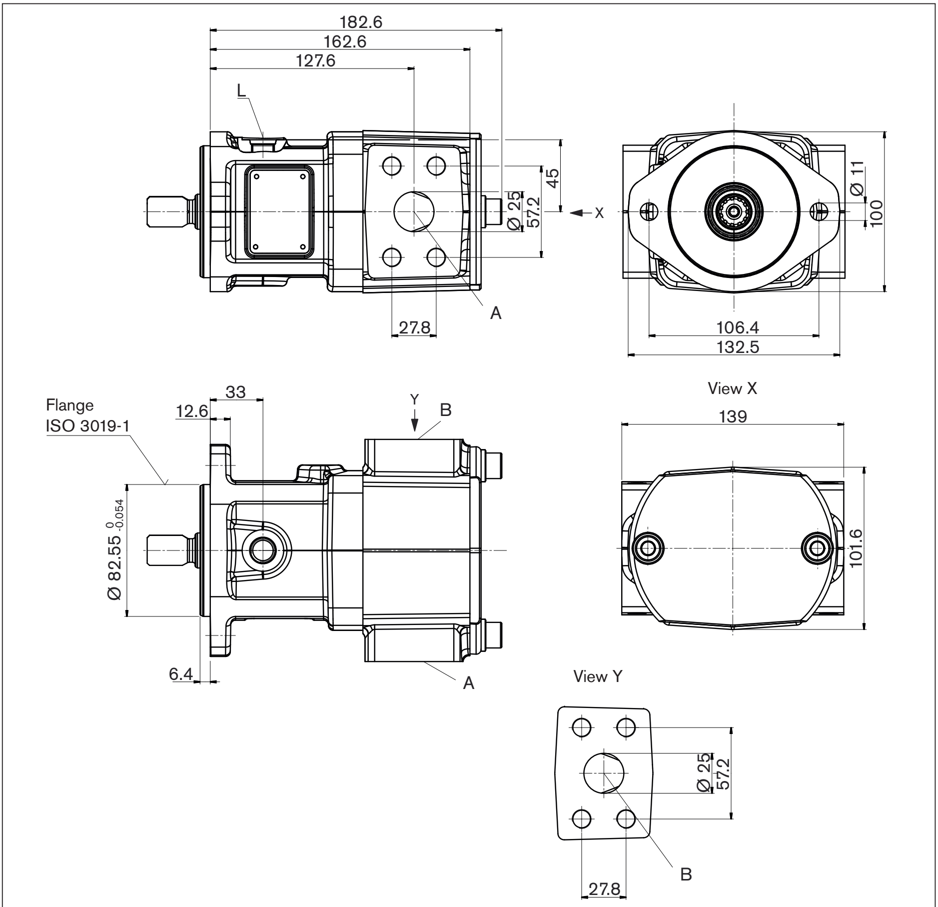
1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 68 for the maximum tightening torques.

Dimensions, A10FZG

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 06 to 10

Port plate 02: SAE flange port on opposite side, clockwise rotation



Ports

Designation	Port for	Standard	Size [1)]	Maximum pressure [bar] [2)]	State
A, B	Service line Fixing thread	SAE J518[3)] DIN 13	1 in M12 x 1.75; 17 deep	350	O
L	Case drain fluid	ISO 11926[4)]	9/16-18UNF-2B; 10 deep	2	O

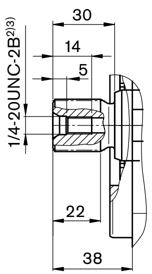
1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
4) The countersink may be deeper that specified in the standard.
O = Must be connected (plugged on delivery)

Dimensions, A10FZG

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



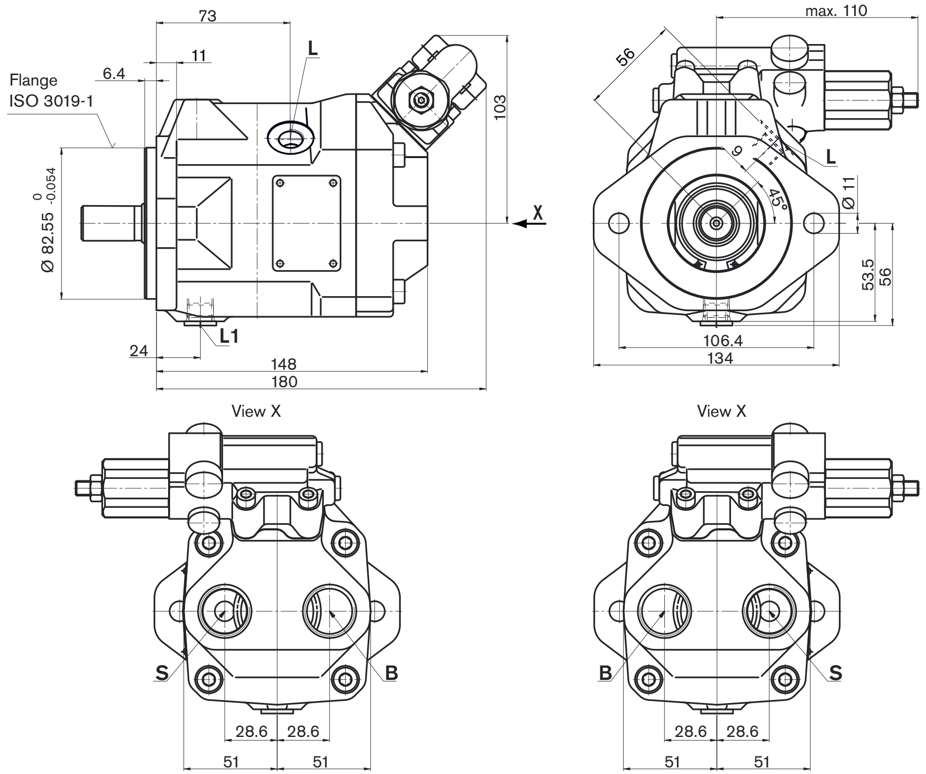
1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 68 for the maximum tightening torques.

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 10

DR pressure control, hydraulic, **port plate 14** – DIN threaded ports at rear, clockwise rotation



For valve mounting and service line ports with clockwise rotation, please refer to notes on flow direction on page 10

For valve mounting and service line ports with counter-clockwise rotation, please refer to notes on flow direction on page 10

Ports

Designation	Port for	Standard	Size [1)]	Maximum pressure [bar] [2)]	State
B	Service line	DIN 3852-1	27 x 2; 16 deep	315	O
S	Suction line	DIN 3852-1	27 x 2; 16 deep	5	O
L	Case drain fluid	ISO 11968 [4)]	9/16-18UNF-2B; 10 deep	2	O [3)]
L_1	Case drain fluid	ISO 11968 [4)]	9/16-18UNF-2B; 10 deep	2	X [3)]

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.

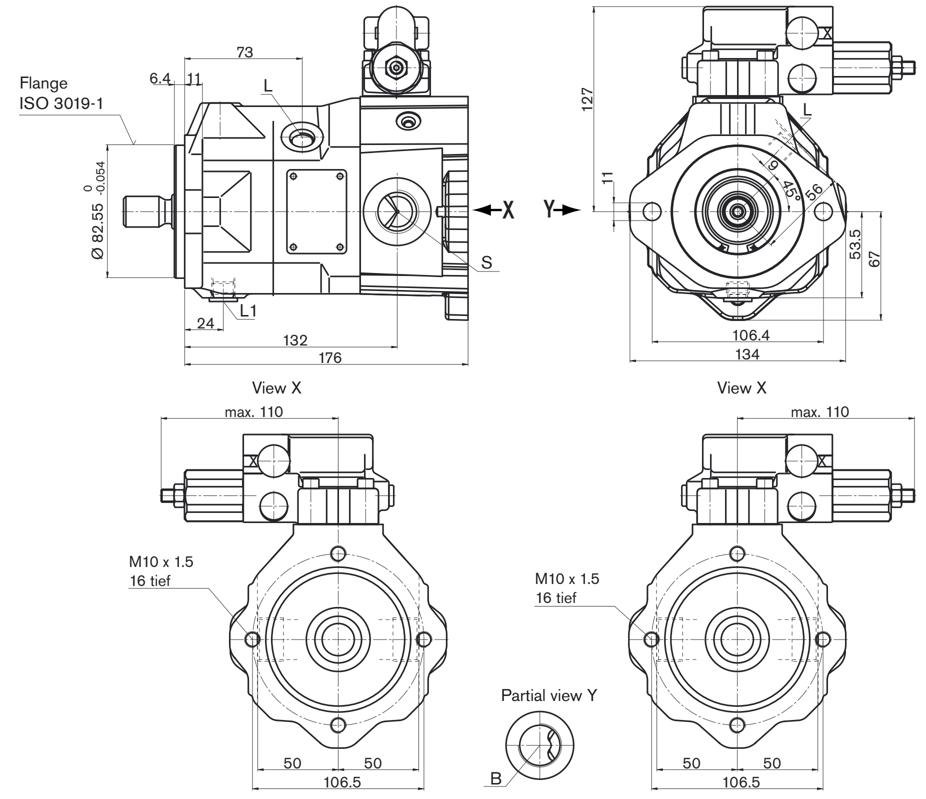
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 10

DR pressure control, hydraulic, **port plate 07** – DIN threaded ports on opposite side, clockwise rotation



For valve mounting and service line ports with clockwise rotation, please refer to notes on flow direction on page 10

For valve mounting and service line ports with counter-clockwise rotation, please refer to notes on flow direction on page 10

Ports

Designation	Port for	Standard	Size 1)	Maximum pressure [bar] 2)	State
B	Service line	DIN 3852-1	27 x 2; 16 deep	315	O
S	Suction	DIN 3852-1	27 x 2; 16 deep	5	O
L	Case drain fluid	ISO 11968 4)	9/16-18UNF-2B; 10 deep	2	O 3)
L_1	Case drain fluid	ISO 11968 4)	9/16-18UNF-2B; 10 deep	2	X 3)

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

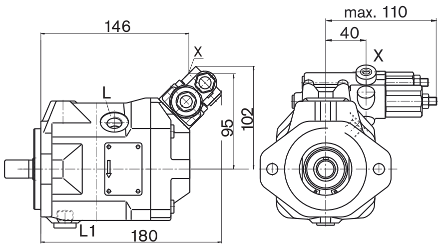
2

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

DRG

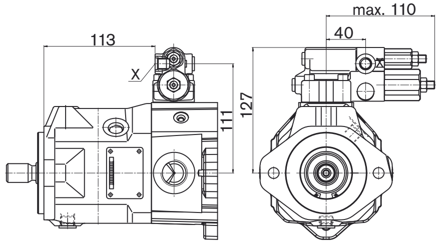
Remotely operated pressure control, **port plate 14**



For valve mounting with counter-clockwise rotation, see page 28

DRG

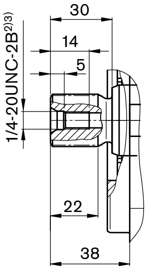
Remotely operated pressure control, **port plate 7**



For valve mounting with counter-clockwise rotation, see page 29

Drive shaft

S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



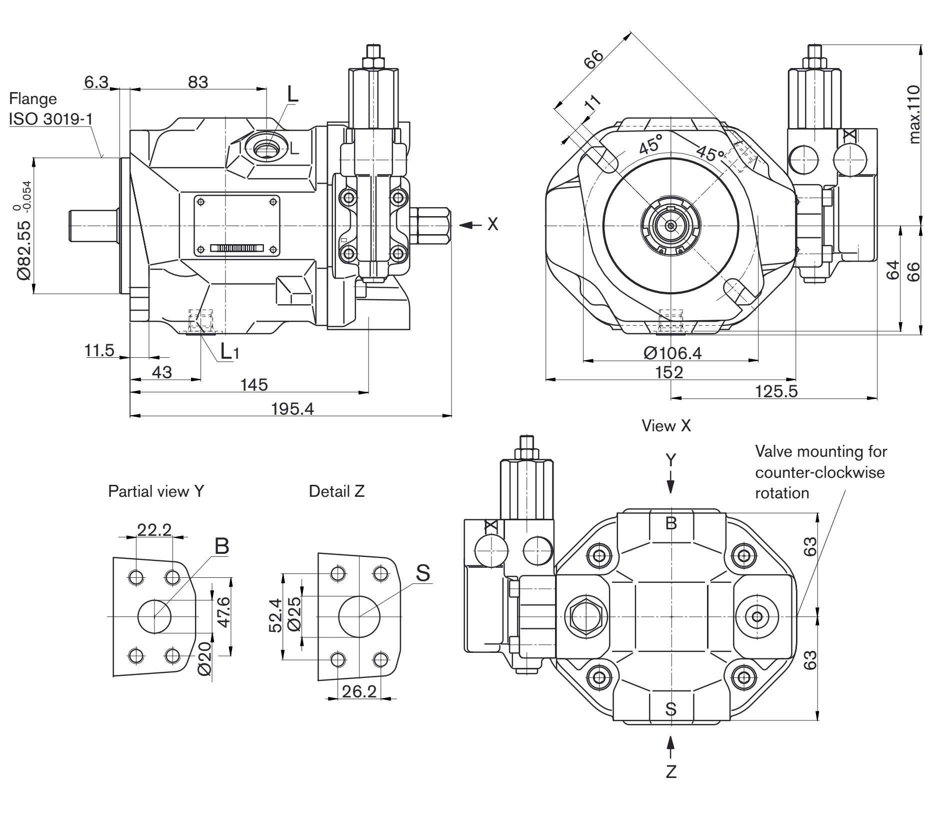
1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 60 for the maximum tightening torques.

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 18

DR pressure control, hydraulic, port plate 12: SAE flange port on opposite side, clockwise rotation



Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	1 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	ISO 11926 [4]	9/16-18 UNF-2B; 10 deep	2	O [3]
L_1	Case drain fluid	ISO 11926 [4]	9/16-18 UNF-2B; 10 deep	2	X [3]
X	Pilot pressure	ISO 11926 [4]	7/16-20UNF-2B; 11.5 deep	350	O

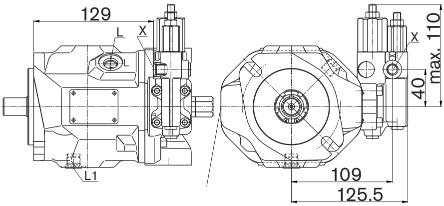
1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.

O = Must be connected (plugged on delivery)
X = Plugged in normal operation

Dimensions, A10VZO

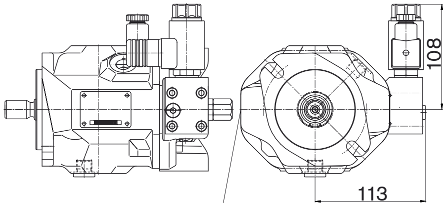
Before finalizing your design, request a certified installation drawing. Dimensions in mm.

DRG
Pressure control, remotely operated



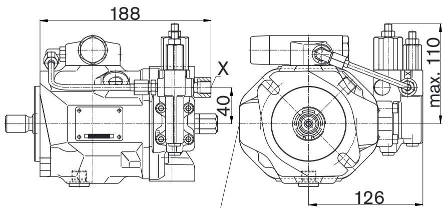
Valve mounting for counter-clockwise rotation

EZx
Two-point control, electric



Valve mounting for counter-clockwise rotation

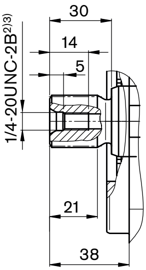
LAxD
Torque controller



Valve mounting for counter-clockwise rotation

Drive shaft

S Splined shaft 3/4 in 11T 16/32DP[1] (SAE J744)



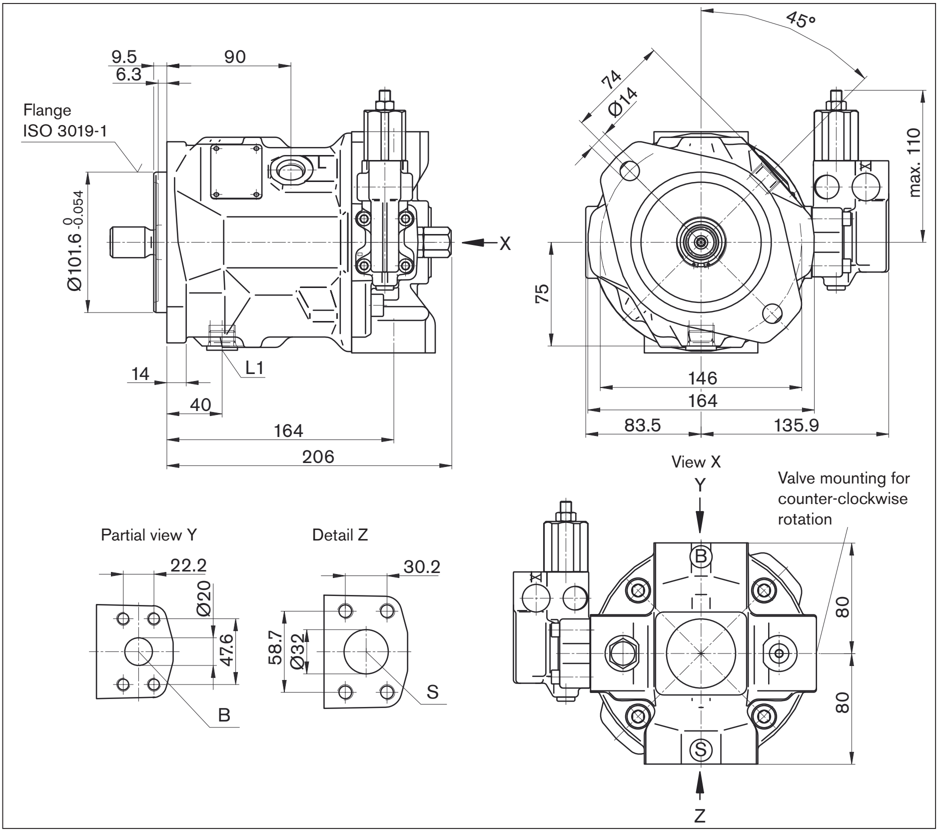
1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 60 for the maximum tightening torques.

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 28

DR pressure control, hydraulic, port plate 12: SAE flange port on opposite side, clockwise rotation



Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	1 1/4 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	ISO 11926 [4]	3/4-16 UNF-2B; 11 deep	2	O [3]
L_1	Case drain fluid	ISO 11926 [4]	3/4-16 UNF-2B; 11 deep	2	X [3]
X	Pilot pressure	ISO 11926 [4]	7/16-20UNF-2B; 11.5 deep	350	O

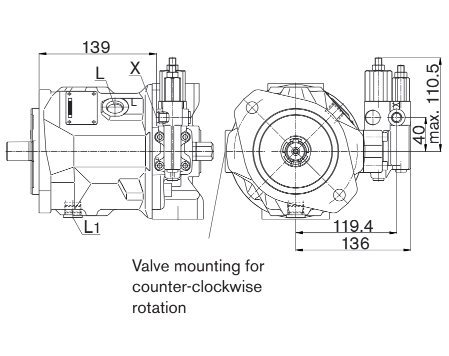
1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.

O = Must be connected (plugged on delivery)
X = Plugged in normal operation

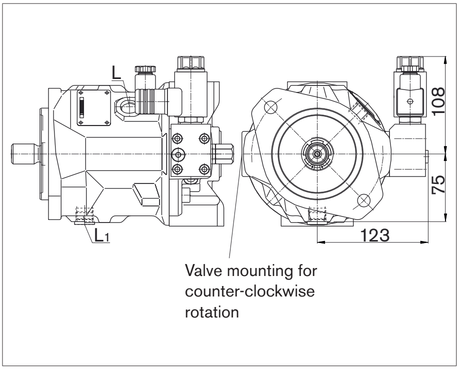
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

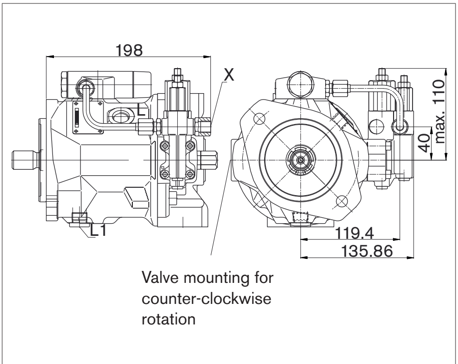
DRG
Pressure control, remotely operated



EZx
Two-point control, electric

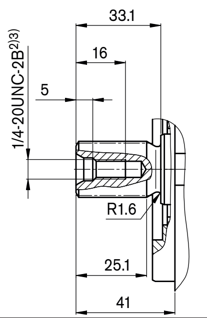


LAxD
Torque controller



Drive shaft

S Splined shaft 7/8 in 13T 16/32DP[1] (SAE J744)



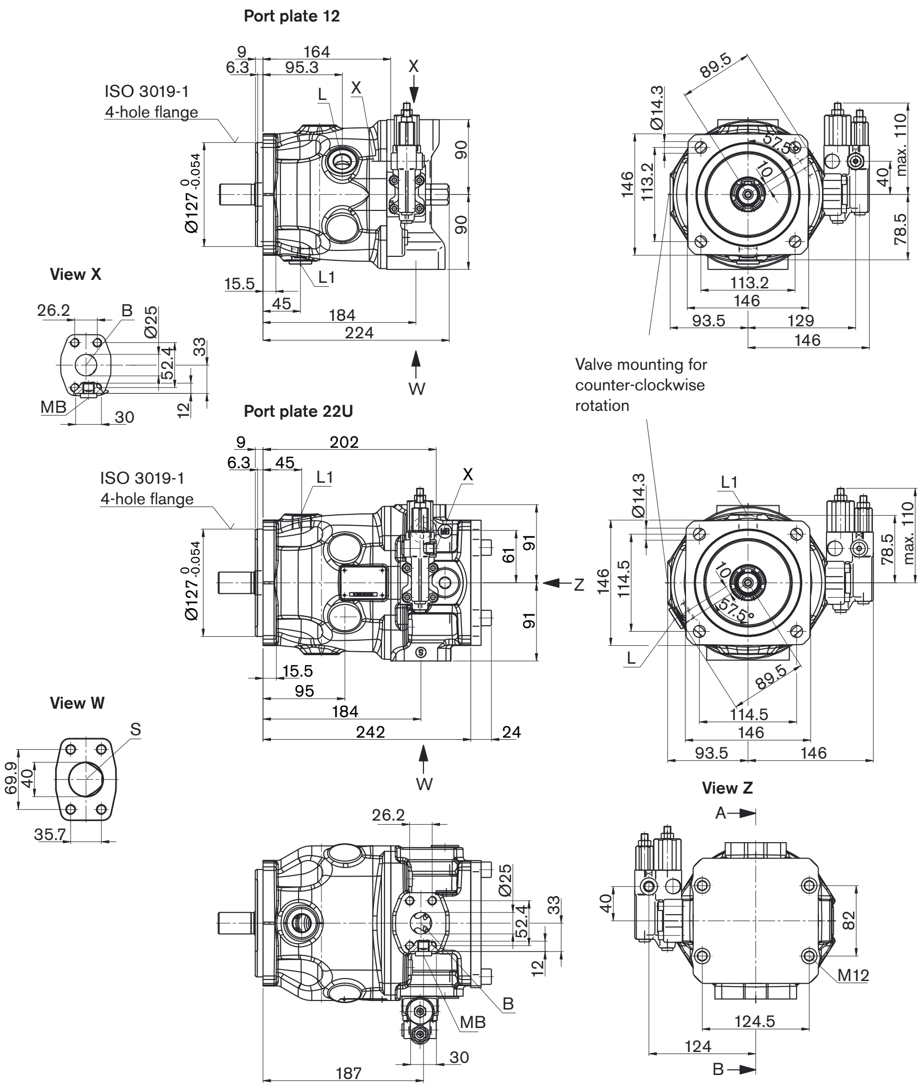
1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 60 for the maximum tightening torques.

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 45

DRG pressure control, remotely operated, port plate 12/22: SAE flange port on opposite side, clockwise rotation



Please refer to notes on flow direction on page 10

For dimensions of ports, please refer to page 36

2

Dimensions, A10VZO

Size 45

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Ports

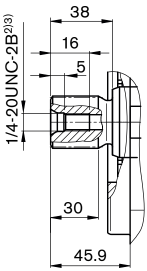
Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	1 1/2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	ISO 11926[4]	7/8-14 UNF-2B; 13 deep	2	O [3]
L_1	Case drain fluid	ISO 11926[4]	7/8-14 UNF-2B; 13 deep	2	X [3]
X	Pilot pressure	ISO 11926[4]	7/16-20UNF-2B; 11.5 deep	350	O
M_B	Measuring, pressure B	DIN 3852[4]	G 1/4 in; 12 deep	350	X

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.

O = Must be connected (plugged on delivery)
X = Plugged in normal operation

Drive shaft

S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)

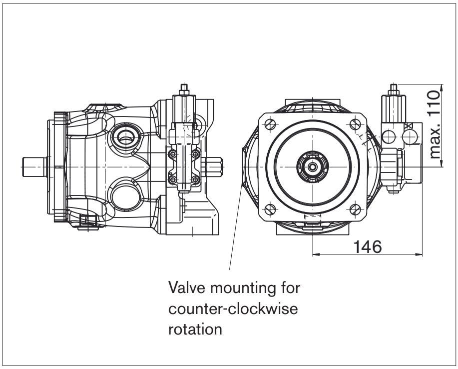


1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 60 for the maximum tightening torques.

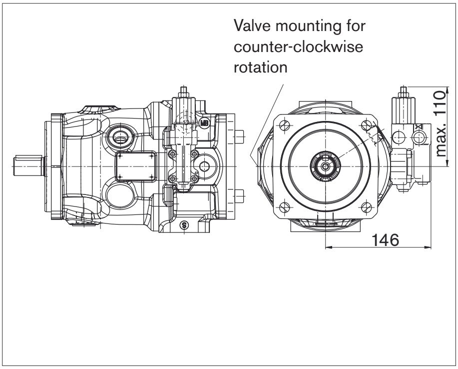
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

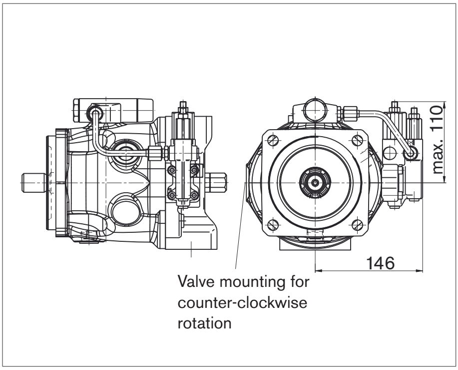
DR
Hydraulic pressure control, port plate 12



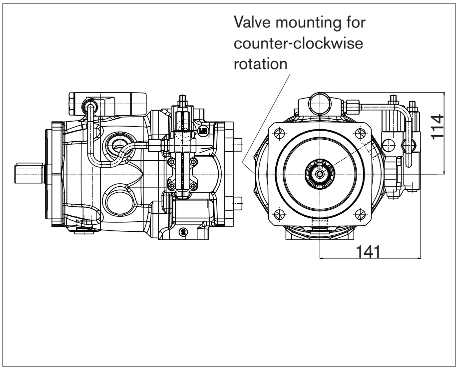
DR
Hydraulic pressure control, port plate 22



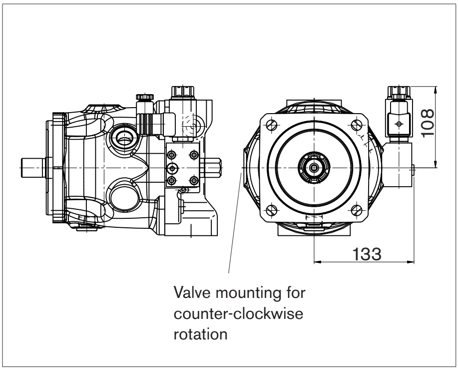
LAxD
Torque controller, port plate 12



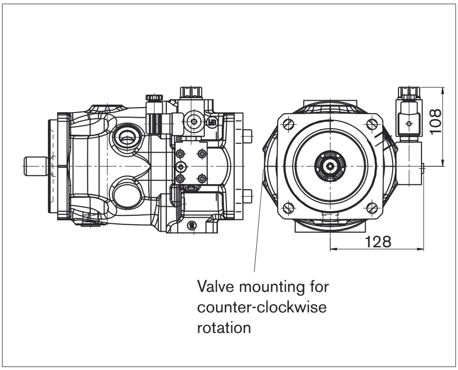
LAxD
Torque controller, port plate 22



EZx
Two-point control, electric, port plate 12



EZx
Two-point control, electric, port plate 22

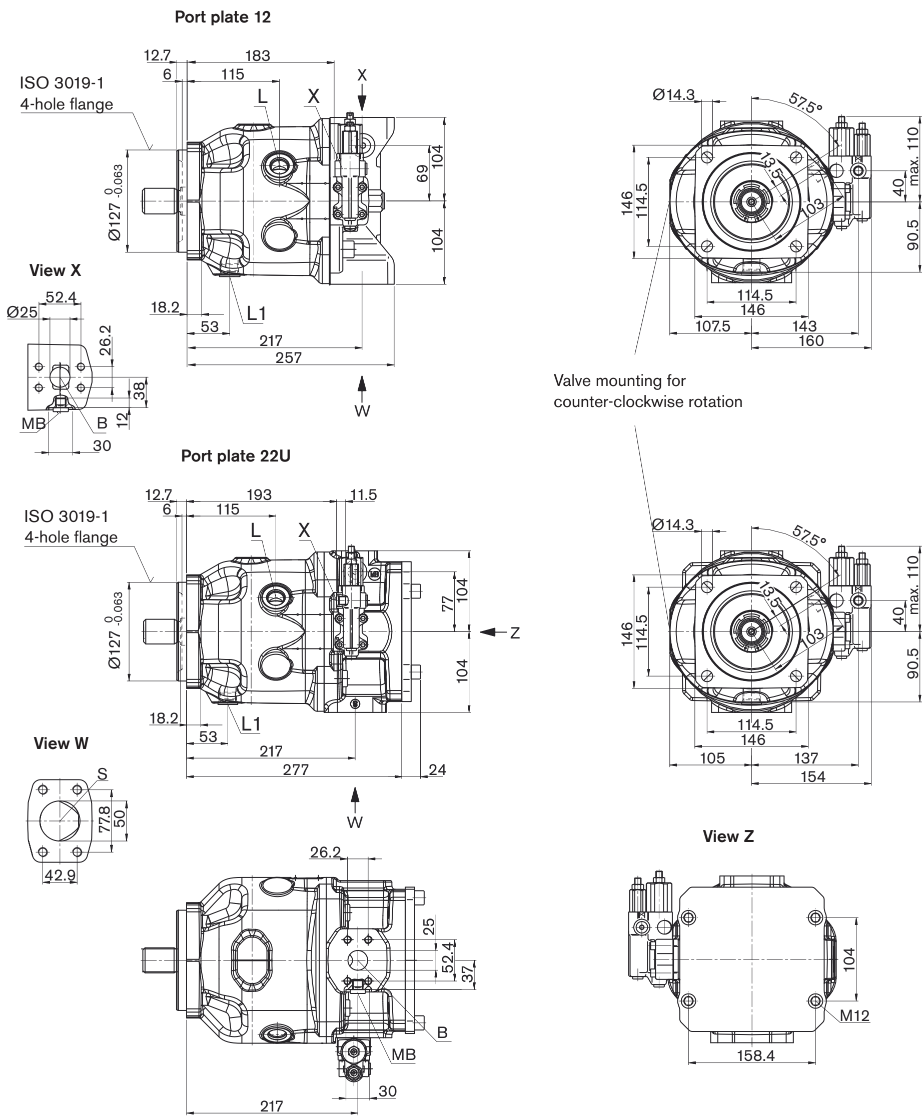


Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 71

DRG pressure control, remotely operated, port plate 12/22: SAE flange port on opposite side, clockwise rotation



Please refer to notes on flow direction on page 10

For dimensions of ports, please refer to page 39

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 71

Ports

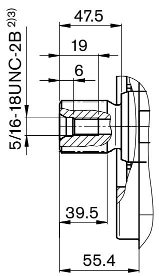
Designation	Port for	Standard	Size 1)	Maximum pressure [bar] 2)	State
B	Service line, Fixing thread	SAE J518 5) DIN 13	1 in M10 x 1.5 ; 17 deep	350	O
S	Suction line, fixing thread	SAE J518 5) DIN 13	2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	ISO 11926 4)	7/8-14 UNF-2B; 12 deep	2	O 3)
L_1	Case drain fluid	ISO 11926 4)	7/8-14 UNF-2B; 12 deep	2	X 3)
X	Pilot pressure	ISO 11926 4)	7/16-20UNF-2B; 11.5 deep	350	O
M_B	Measuring, pressure B	DIN 3852 4)	G 1/4 in; 12 deep	350	X

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

2

Drive shaft

S Splined shaft 1 1/4 in
14T 12/24DP 1) (SAE J744)

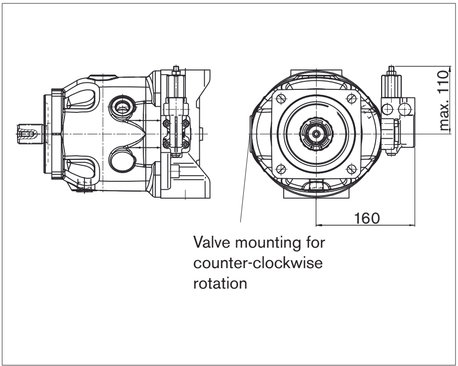


1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 60 for the maximum tightening torques.

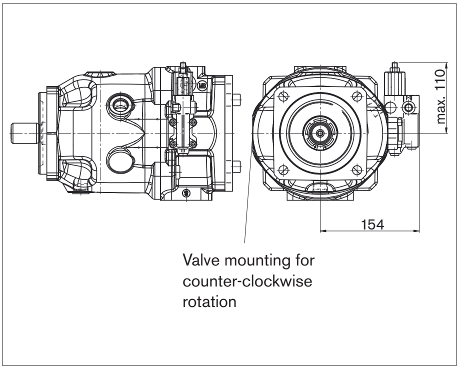
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

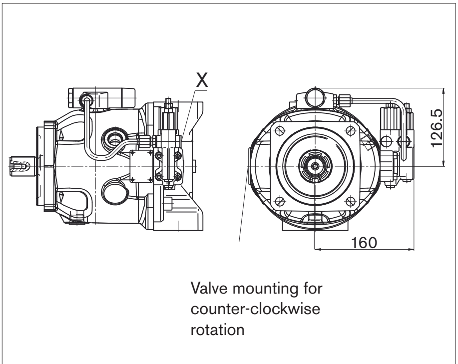
DR
Hydraulic pressure control, port plate 12



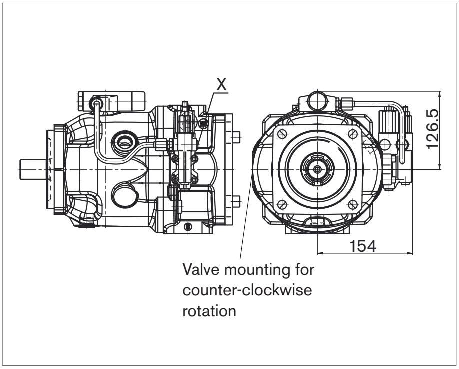
DR
Hydraulic pressure control, port plate 22



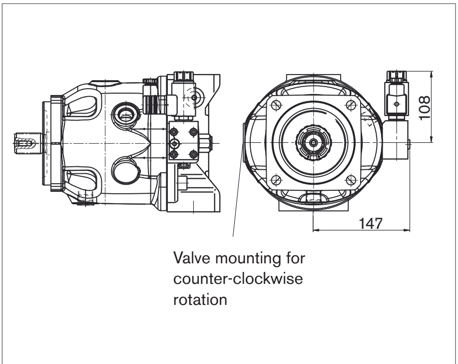
LAxD
Torque controller, port plate 12



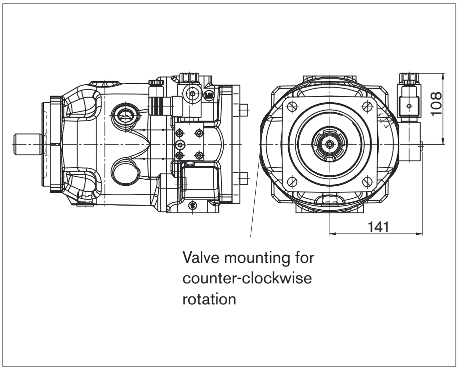
LAxD
Torque controller, port plate 22



EZx
Two-point control, electric, port plate 12



EZx
Two-point control, electric, port plate 22

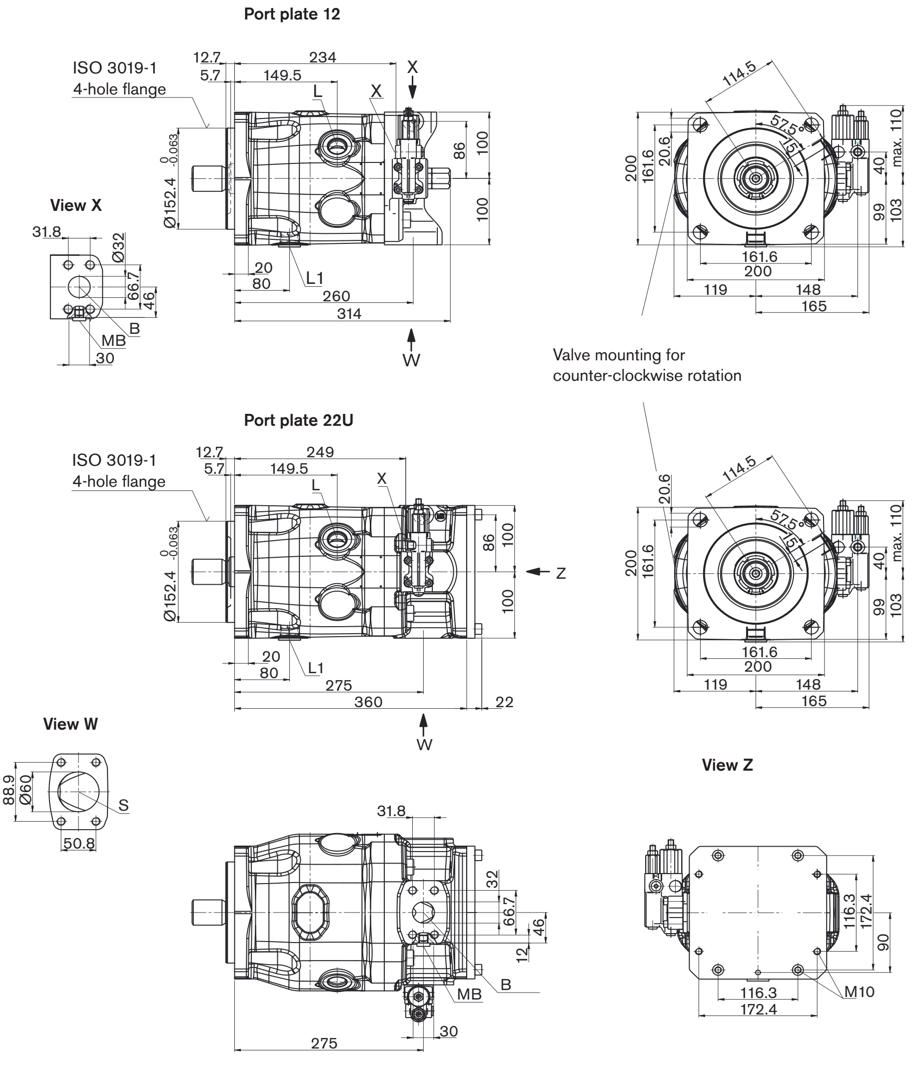


Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 100

DRG pressure control, remotely operated, port plate 12/22: SAE flange port on opposite side, clockwise rotation



Please refer to notes on flow direction on page 10

For dimensions of ports, please refer to page 42

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 100

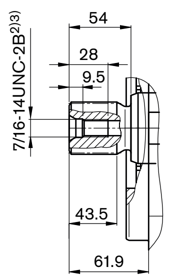
Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	1 1/4 in M14 x 2 ; 19 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	ISO 11926[4]	1 1/16-12 UNF-2B; 15 deep	2	O [3]
L_1	Case drain fluid	ISO 11926[4]	1 1/16-12 UNF-2B; 15 deep	2	X [3]
X	Pilot pressure	ISO 11926[4]	7/16-20UNF-2B; 11.5 deep	350	O
M_B	Measuring pressure in B	DIN 3852[4]	G 1/4 in; 12 deep	350	X

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

Drive shaft

S Splined shaft 1 1/2 in
17T 12/24DP[1] (SAE J744)

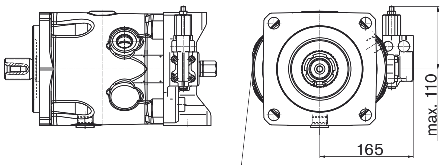


1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 68 for the maximum tightening torques.

Dimensions, A10VZO

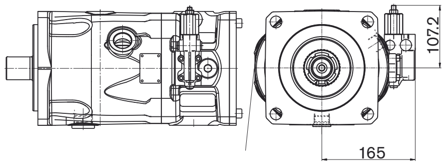
Before finalizing your design, request a certified installation drawing. Dimensions in mm.

DR
Hydraulic pressure control, port plate 12



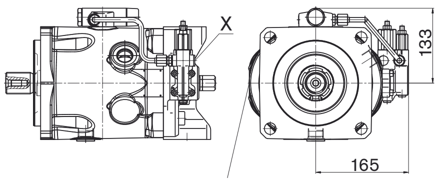
Valve mounting for counter-clockwise rotation

DR
Hydraulic pressure control, port plate 22



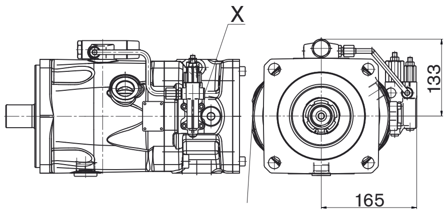
Valve mounting for counter-clockwise rotation

LAxD
Torque controller, port plate 12



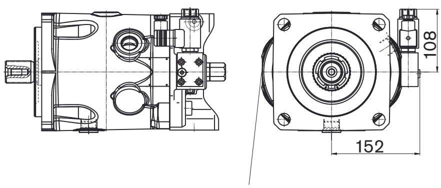
Valve mounting for counter-clockwise rotation

LAxD
Torque controller, port plate 22



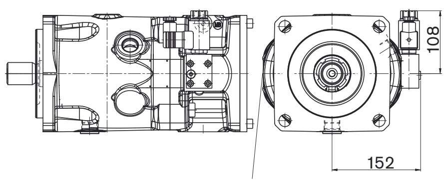
Valve mounting for counter-clockwise rotation

EZx
Two-point control, electric, port plate 12



Valve mounting for counter-clockwise rotation

EZx
Two-point control, electric, port plate 22



Valve mounting for counter-clockwise rotation

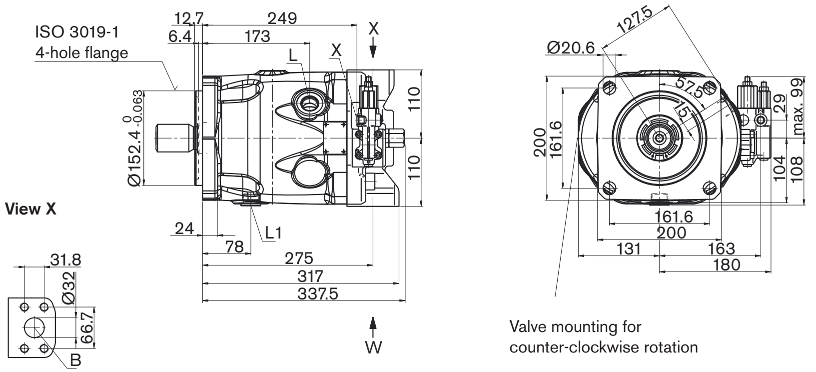
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

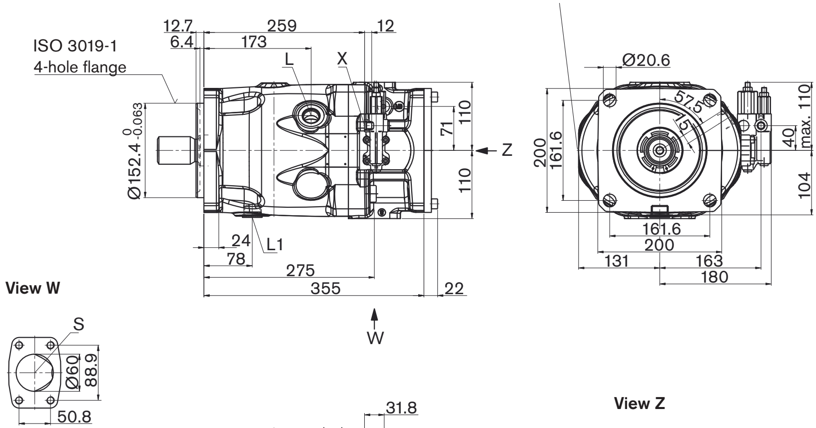
Size 140

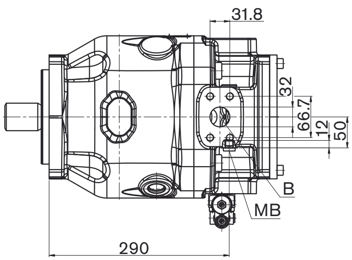
DRG pressure control, remotely operated, port plate 12/22: SAE flange port on opposite side, clockwise rotation

Port plate 12

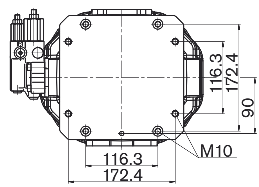


Port plate 22U





View Z



Please refer to notes on flow direction on page 10

For dimensions of ports, please refer to page 45

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 140

Ports

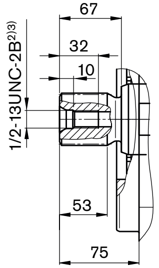
Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	1 1/4 in M14 x 2 ; 19 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	ISO 11926[4]	1 1/16-12 UNF-2B; 15 deep	2	O [3]
L_1	Case drain fluid	ISO 11926[4]	1 1/16-12 UNF-2B; 15 deep	2	X [3]
X	Pilot pressure	ISO 11926[4]	7/16-20UNF-2B; 12 deep	350	O
M_B	Measuring, pressure B	DIN 3852[4]	G 1/4 in; 12 deep	350	X

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

2

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)

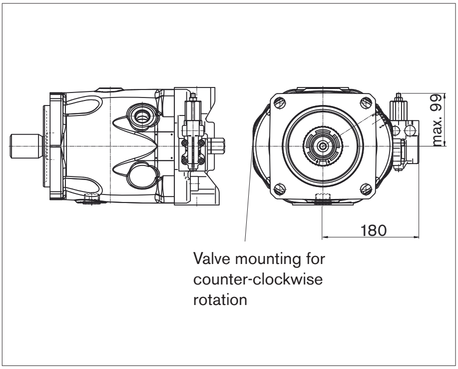


1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 68 for the maximum tightening torques.

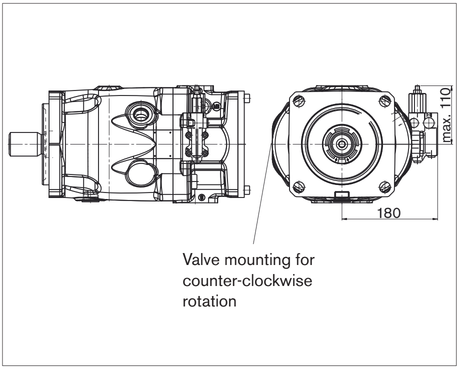
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

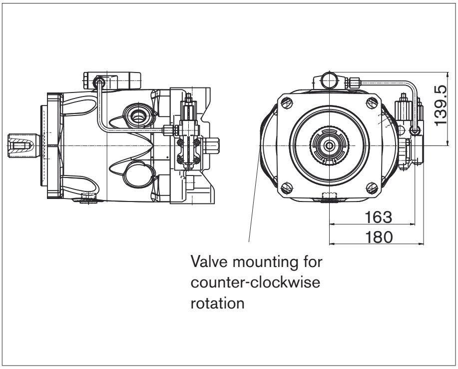
DR
Hydraulic pressure control, port plate 12



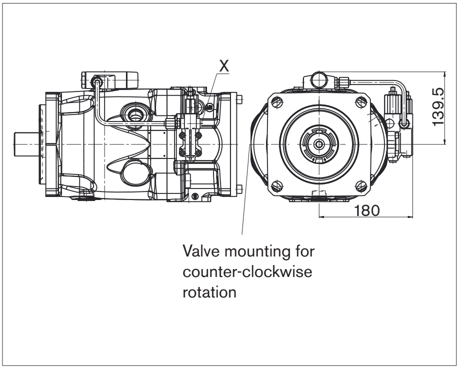
DR
Hydraulic pressure control, port plate 22



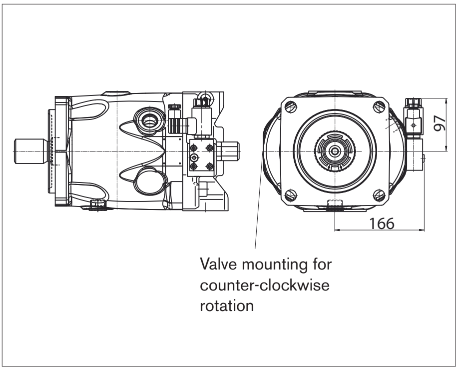
LAxD
Torque controller, port plate 12



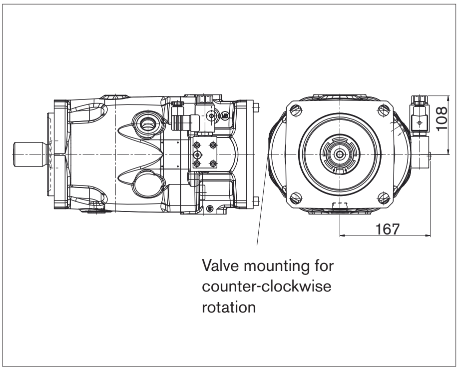
LAxD
Torque controller, port plate 22



EZx
Two-point control, electric, port plate 12



EZx
Two-point control, electric, port plate 22

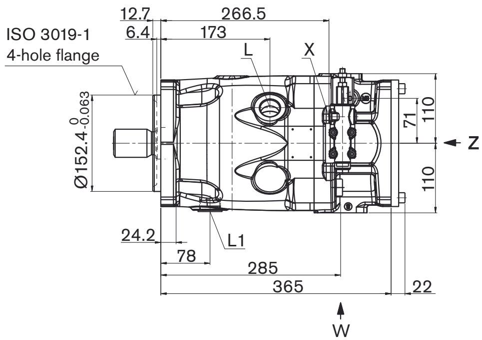


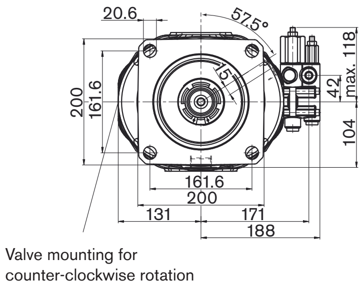
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

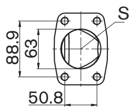
Size 180

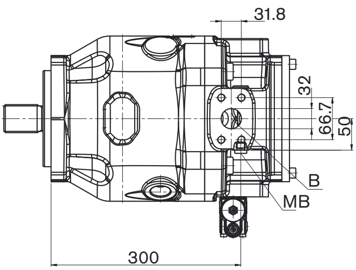
DRG pressure control, remotely operated, port plate 22: SAE flange port on opposite side, clockwise rotation



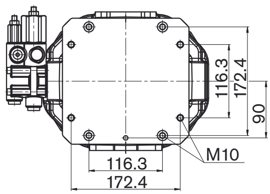


View W





View Z



Please refer to notes on flow direction on page 10

For dimensions of ports, please refer to page 48

2

Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

Size 180

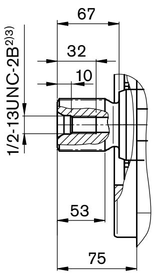
Ports

Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line, Fixing thread	SAE J518[5] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction line, fixing thread	SAE J518[5] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	ISO 11926[4]	1 5/16-12 UNF-2B; 15 deep	2	O [3]
L_1	Case drain fluid	ISO 11926[4]	1 5/16-12 UNF-2B; 15 deep	2	X [3]
X	Pilot pressure	ISO 11926[4]	7/16-20UNF-2B; 12 deep	350	O
M_B	Measuring, pressure B	DIN 3852[4]	G 1/4 in; 12 deep	350	X

1) Please observe the general information on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Depending on the installation position, L or L_1 must be connected (see installation notes on page 56, 57)
4) The countersink may be deeper that specified in the standard.
5) Only dimensions complying with SAE J518. A metric fixing thread is a deviation from standard.
O = Must be connected (plugged on delivery)
X = Plugged in normal operation

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



1) ANSI B92.1a, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to ASME B1.1
3) Please observe the general information on page 68 for the maximum tightening torques.

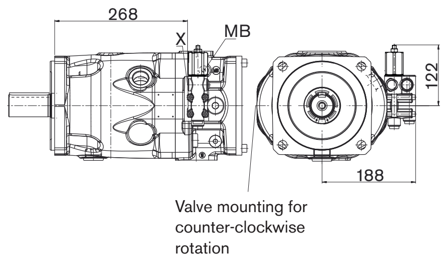
Dimensions, A10VZO

Before finalizing your design, request a certified installation drawing. Dimensions in mm.

DR
Hydraulic pressure control, port plate 12

on request

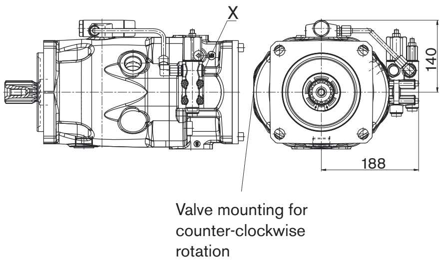
DR
Hydraulic pressure control, port plate 22



LAxD
Torque controller, port plate 12

on request

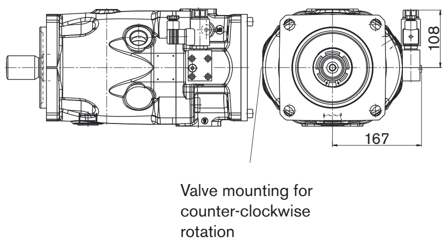
LAxD
Torque controller, port plate 22



EZx
Two-point control, electric, port plate 12

on request

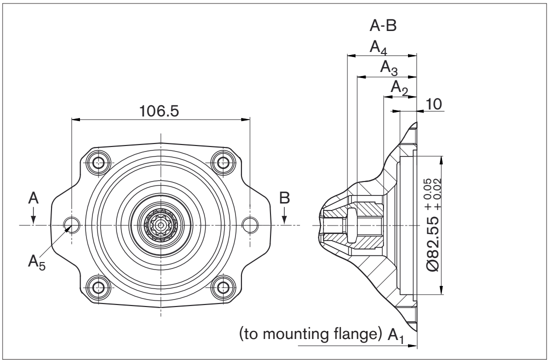
EZx
Two-point control, electric, port plate 22



Through drive dimensions

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

K01 Flange SAE J744 - 82-2 (A)
Coupling for splined shaft to ANSI B92.1a 5/8in 9T 16/32 DP[1]) (SAE J744 - 16-4 (A))



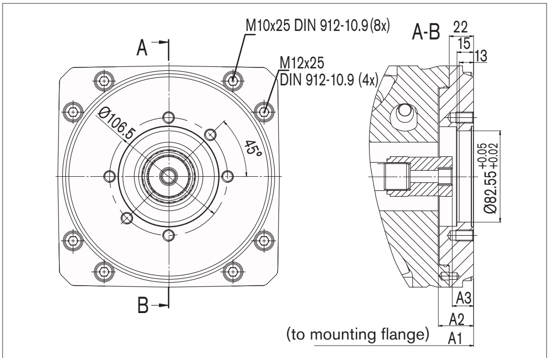
A10FZO

NG	A_1	A_2	A_3	A_4	A_5[2]
06 - 10	162.6	20	35.5	41.5	M10x1.5; 15 deep
11 - 18	on request				
21 - 28					
37 - 45					
58 - 63					

A10VZO

NG	A_1	A_2	A_3	A_4
10	on request			

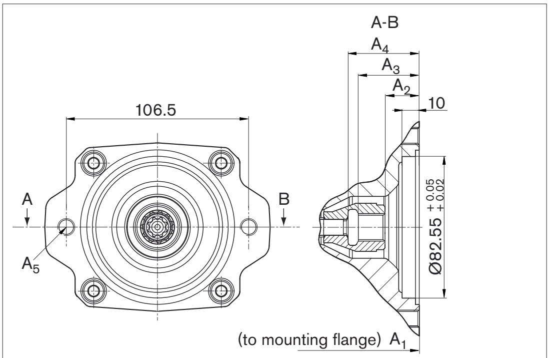
U01 Flange SAE J744 - 82-2 (A)
Coupling for splined shaft to ANSI B92.1a 5/8in 9T 16/32 DP[1]) (SAE J744 - 16-4 (A))



A10VZO

NG	A_1	A_2	A_3	A_4[2]
45	264	31.8	19.3	M10x1.5; 16 deep
71	299	31.8	19.3	M10x1.5; 16 deep
100	360	31.8	Inquiry	M10x1.5; 16 deep
140	377	31.8	Inquiry	M10x1.5; 16 deep
180	387	31.8	Inquiry	M10x1.5; 16 deep

K52 Flange SAE J744 - 82-2 (A)
Coupling for splined shaft to ANSI B92.1a 3/4in 11T 16/32 DP[1]) (SAE J744 - 19-4 (A-B))



A10FZO

NG	A_1	A_2	A_3	A_4	A_5[2]
06 - 10	162.6	20	35.5	41.5	M10x1.5; 15 deep
11 - 18	on request				
21 - 28					
37 - 45					
58 - 63					

A10VZO

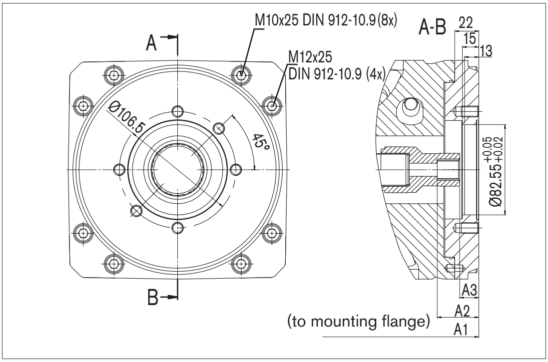
NG	A_1	A_2	A_3	A_4
10	on request			

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, observe the general information on page 60 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

U52 Flange SAE J744 - 82-2 (A)
Coupling for splined shaft to ANSI B92.1a 3/4in 11T 16/32 DP1) (SAE J744 - 19-4 (A-B))

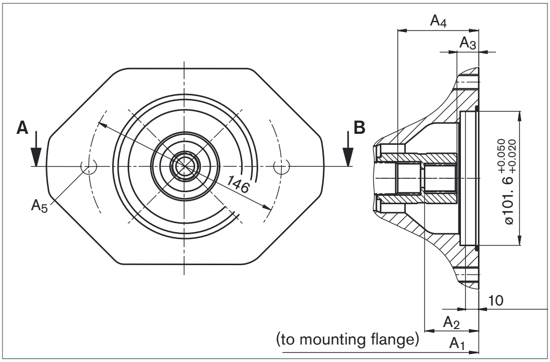


A10VZO

NG	A_1	A2	A_3	A_4 2)
45	264	38	17.5	M10x1.5; 16 deep
71	299	38	17.5	M10x1.5; 16 deep
100	360	38	17.5	M10x1.5; 16 deep
140	377	38	17.5	M10x1.5; 16 deep
180	387	38	17.5	M10x1.5; 16 deep

2

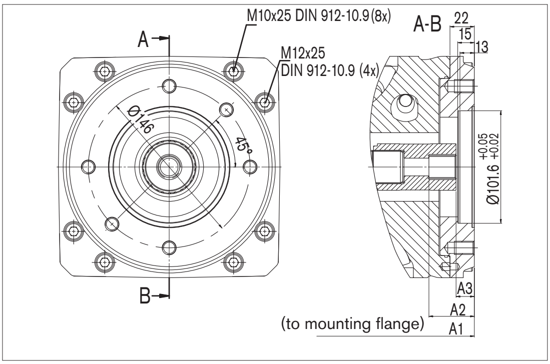
K68 Flange SAE J744 - 101-2 (B)
Coupling for splined shaft to ANSI B92.1a 7/8in 13T 16/32 DP1) (SAE J744 - 22-4 (B))



A10FZO

NG	A_1	A2	A_3	A_4	A_5 2)
21-28	on request				
37-45					

U68 Flange SAE J744 - 101-2 (B)
Coupling for splined shaft to ANSI B92.1a 7/8in 13T 16/32 DP1) (SAE J744 - 22-4 (B))



A10VZO

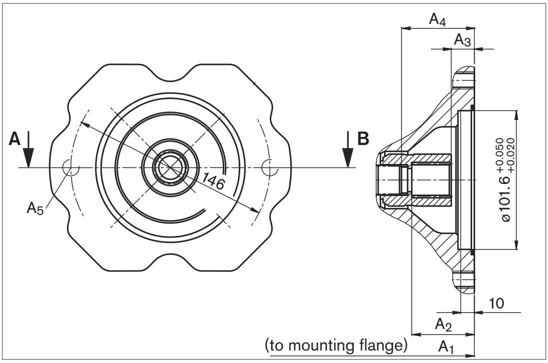
NG	A_1	A2	A_3	A_4 2)
45	264	41	16.5	M12x1.75; 18 deep
71	299	41	16.5	M12x1.75; 18 deep
100	360	41	16.5	M12x1.75; 18 deep
140	377	41	16.5	M12x1.75; 18 deep
180	387	41	16.5	M12x1.75; 18 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, observe the general information on page 60 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

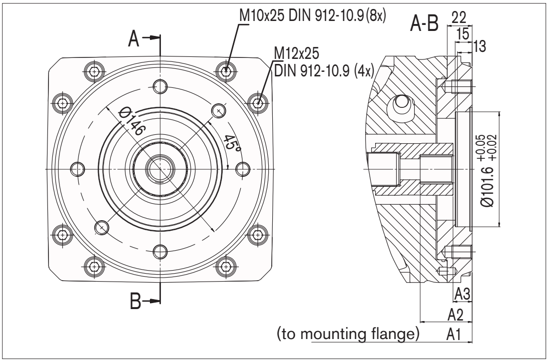
K04 Flange SAE J744 - 101-2 (B)
Coupling for splined shaft to ANSI B92.1a-1996 1in 15T 16/32 DP1) (SAE J744 - 25-4 (B-B))



A10FZO

NG	A_1	A2	A_3	A_4 2)
21-28	on request			
37-45				

U04 Flange SAE J744 - 101-2 (B)
Coupling for splined shaft to ANSI B92.1a-1996 1in 15T 16/32 DP1) (SAE J744 - 25-4 (B-B))



A10VZO

NG	A_1	A2	A_3	A_4 2)
45	264	45.9	16.9	M12x1.75; 18 deep
71	299	45.9	16.9	M12x1.75; 18 deep
100	360	45.9	16.9	M12x1.75; 18 deep
140	377	45.9	16.9	M12x1.75; 18 deep
180	387	45.9	16.9	M12x1.75; 18 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, observe the general information on page 60 for the maximum tightening torques.

Overview of attachments

Through drive - A10FZO			Attachment of 2nd pump			Through drive
Flange ISO 3019-1	Coupling for splined shaft	Short code	A10FZO Size (shaft)	A10VZO Size (shaft)	External gear pump Size (NG)	Available for size
82-2(A)	5/8 in	**K01**	06 to 10, 11 to 18 (S)	10, 18 (S)	F (5 to 22)	11 to 63
	3/4 in	**K52**	06 to 10, 11 to 18 (S)	10, 18 (S)	–	06 to 63
101-2(B)	7/8 in	**K68**	21 to 28 (S)	28 (S)	N/G (26 to 49)	21 to 63
	1 in	**K04**	21 to 28 (S)	28 (S)	–	21 to 63

Through drive - A10VZO			Attachment of 2nd pump			Through drive
Flange ISO 3019-1	Coupling for splined shaft	Short code	A10FZO Size (shaft)	A10VZO Size (shaft)	External gear pump Size (NG)	Available for size
82-2(A)	5/8 in	**K01**	06 to 10, 11 to 18 (S)	10, 18 (S)	F (5 to 22)	18 to 28
	3/4 in	**K52**	06 to 10, 11 to 18 (S)	10, 18 (S)	–	18 to 28
101-2(B)	7/8 in	**K68**	21 to 28 (S)	28 (S)	N/G (26 to 49)	28
	1 in	**K04**	21 to 28 (S)	28 (S)	–	28
82-2(A)	5/8 in	**U01**	06 to 10, 11 to 18 (S)	10, 18 (S)	F (5 to 22)	45 to 180
	3/4 in	**U52**	06 to 10, 11 to 18 (S)	10, 18 (S)	–	45 to 180
101-2(B)	7/8 in	**U68**	21 to 28 (S)	28 (S)	N/G (26 to 49)	45 to 180
	1 in	**U04**	21 to 28 (S)	28 (S)	–	45 to 180

The A10VZO in sizes 45 to 180 is equipped with a flexible universal through-drive (U..). This allows the through drive to be exchanged without having to machine the port plate. Details of the add-on parts can be found in data sheet RE 95581.

Combination pumps A10VZO + A10VZO; A10FZO + A10FZO

When using combination pumps, it is possible to have multiple, independent hydraulic circuits without the need for a splitter gearbox.

When ordering combination pumps, the model codes of the 1st and 2nd pumps must be joined by a "+".

Order example: A10VZO45DR/32R-VPD22U01 + A10VZO45DR/32R-VSD22U00
A10FZO 28/10R-VSC12K01 + A10FZO 28/10R-VSC11N00

Permissible moments of inertia

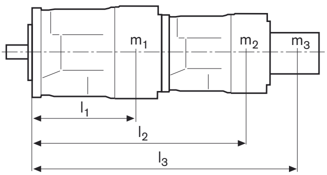
The arrangement of two single pumps in line is permissible up to the same size (tandem pump), taking into account a dynamic mass acceleration of max. 10 g (98.1 m/s2) without additional support.

A10VZO

NG			10	18	28	45	71	100	140	180
Permissible moment of inertia			on request							
Static	T_m	Nm		500	880	1370	3000	4500	4500	4500
Dynamic at 10 *g* (98.1 m/s²)	T_m	Nm		50	88	137	300	450	450	450
Ground	m_1	kg		18	18	30	47	69	73	78
Distance of center of gravity	l_1	mm		90	110	130	142	169	172	196

A10FZO

NG			06-10	11-18	21-28	37-45	58-63
Permissible moment of inertia							
Static	T_m	Nm					
Dynamic at 10 *g* (98.1 m/s²)	T_m	Nm		on request			
Ground	m_1	kg					
Distance of center of gravity	l_1	mm					



m1, m2, m3 mass of pumps [kg]

l1, l2, l3 Distance of center of gravity [mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ [Nm]}$$

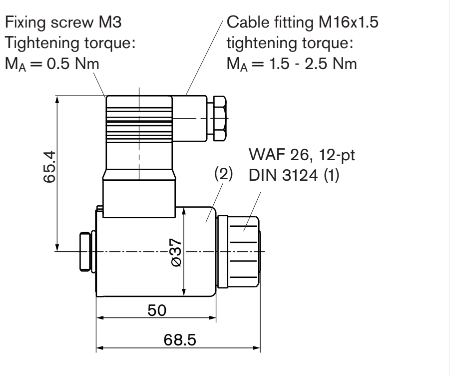
Connector for solenoids

HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

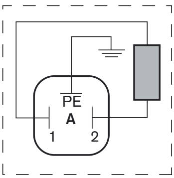
Without bidirectional suppressor diode ____________________ H
type of protection as per DIN/EN 43650_________________IP65

The sealing ring in the screw cable fitting is suitable for line diameters of 4.5 mm to 10 mm.

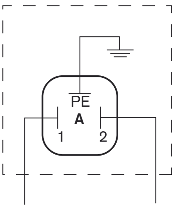
The line connector is not included in the delivery contents. This can be supplied by Rexroth on request.
Rexroth material number: R902602623



Equipment connector as per DIN 43650



Line connector DIN EN 175301-803-A Wiring screw connector M 16x1.5



Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid.
   To do this, turn the mounting nut (1) one revolution counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut of the solenoid.
   Tightening torque of the mounting nut: 5+1 Nm.
   (size WAF26, 12-pt DIN 3124)

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

Control	Electronics function	Electronics		Further information
Electric two point control	Controlled power outlet	RA	Analog	RE 95 230
		VT2000	Analog	RE 29 904
		RC2-2/21 [1]	Digital	RE 95 201

[1] Power outlets for 2 valves, can be actuated separately

Installation notes

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit empty via the hydraulic lines.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the case interior must be directed to the reservoir via the highest case drain port (L_1, $L_{2,}$ $_{L3}$).

For combinations comprising several units, make sure that the respective case pressure is not exceeded. If there is a pressure difference at case drain port L, each pump is to be fitted with a separate case drain line.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating states, the suction line and case drain line must flow into the reservoir below the minimum fluid level . The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\ max} = 800$ mm. The minimum suction pressure at port S of $p_{S\ min} = 0.8$ bar absolute must not be exceeded in operation.

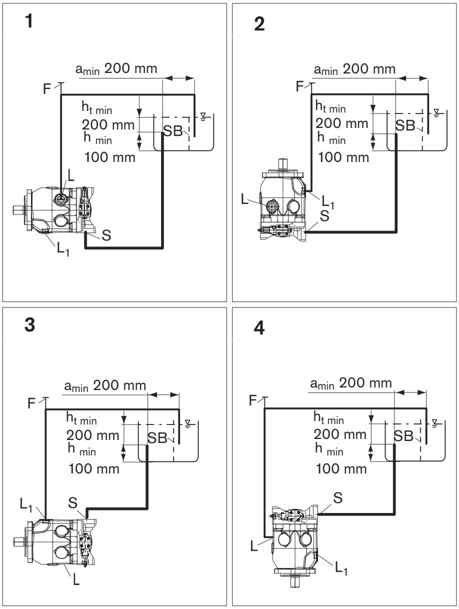
Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

Below-reservoir installation (standard)

Below-reservoir installation means the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1, 3	F	S + L, L_1 (F)
2, 4	F	S + L, L_1 (F)

Key, see page 51.

Installation notes

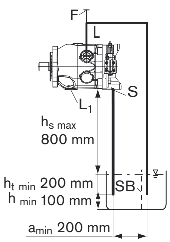
Above-reservoir installation

Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm is required in installation position 6

Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

A check valve in the case drain line is only permissible in individual cases. Consult us for approval.

5



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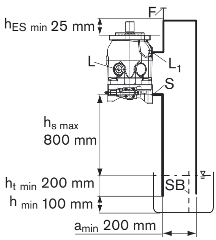

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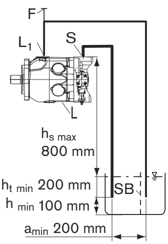

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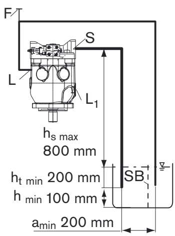
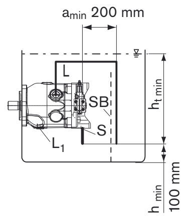


Installation position	Air bleed	Filling
5, 7	F	L, L_1 (F)
6, 8	F	S + L, L_1 (F)

Inside-reservoir installation

Inside-reservoir installation means the pump is installed within the minimum reservoir fluid level.

9



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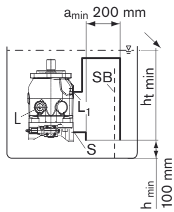

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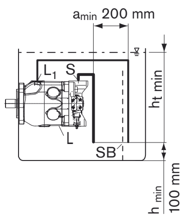
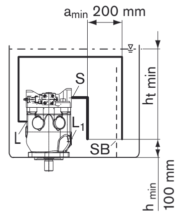


12



Installation position	Air bleed	Filling
9, 11	L, L_1	L, L_1
10, 12	L, L_1	S + L, L_1

S Filling / air bleeding
F Air bleed port
S Suction port
L, L_1 Case drain port
SB Baffle (baffle plate)
$h_{t\ min}$ Minimum necessary immersion depth (200 mm)
h_{min} Minimum necessary spacing to reservoir base (100 mm)
$h_{ES\ min}$ Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
$h_{S\ max}$ Maximum permissible suction height (800 mm)
a_{min} When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Notes

Notes

General information

– The axial piston units A10FZO and A10VZO are designed to be used in open circuits.
  The axial piston unit A10FZG and A10VZG is specified for use in closed circuits.
– Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel.
– Before operating the axial piston unit, please read the appropriate operating instructions thoroughly and completely.
  If necessary, request these from Rexroth.
– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids.
  Take appropriate safety measures (e.g. by wearing protective clothing).
– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.
– Service line ports:
  - The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports are only designed to accommodate hydraulic lines.
– Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.
– The data and notes contained herein must be adhered to.
– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.
– The following tightening torques apply:
  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.
  - Fixing screws:
    For fixing screws with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.
  - Female threads in axial piston unit:
    The maximum permissible tightening torques $M_{G\,max}$ are maximum values for the female threads and must not be exceeded.
    For values, see the following table.

Threaded plugs:
For the metal threaded plugs supplied with the axial piston unit, the required tightening torques of the threaded plugs M_V apply. For values, see the following table.

Ports		Maximum permissible tightening torque for female threads $M_{G\,max}$	Required tightening torque for threaded plugs M_V	WAF hexagon socket for threaded plugs
Standard	Thread size			
ISO 11936	7/16-20 UNF-2B	40 Nm	15 Nm	3/16 in
	9/16-18UNF-2B	80 Nm	25 Nm	1/4 in
	3/4-16UNF-2B	160 Nm	62 Nm	5/16 in
	7/8-14UNF-2B	240 Nm	127 Nm	3/8 in
	1 1/16-12 UNF-2B	360 Nm	147 Nm	9/16 in
DIN 3852	G 1/4 in	70 Nm	–	–
	M14x1.5	80 Nm	35 Nm	6 mm
	M16x1.5	100 Nm	50 Nm	8 mm
	M18x1.5	140 Nm	60 Nm	8 mm
	M22x1.5	210 Nm	80 Nm	10 mm
	M27x2	330 Nm	135 Nm	12 mm

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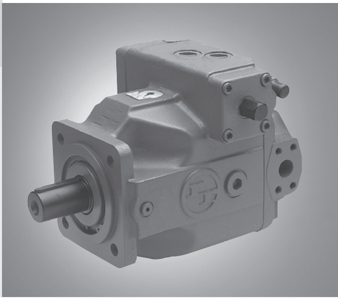
Axial piston variable pump A4VSO

RE 92050/04.09 **1**/68
Replaces: 03.09

Data sheet



Series 10, 11 and 30
Size 40...1000
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

Contents

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Features

- Axial piston pump in swash plate design for hydrostatic drives in open circuit operation
- The flow is proportional to the input drive speed and displacement. By adjusting the swash plate angle it is possible to infinitely vary the output flow.
- Excellent suction characteristics
- Low noise level
- Long service life
- Modular design
- Short response times
- Variable through drive options
- Visual swivel angle indicator
- Optional mounting position
- Operation on HF-fluids under reduced operational data possible

  A special version is available for operation with HFC-fluid see data sheet RE 92053

For the descriptions of the control devices see the separate RE data sheets
RE 92056, RE 92060, RE 92064,
RE 92072, RE 92076, RE 92080, RE 92088

Type code for Standard program

	A4VS		O			/			–						
01	02	03	04	05	06		07	08		09	10	11	12	13	14

Hydraulic fluid / Version

		40	71	125	180	250	355	500	750	1000	
01	Mineral oil and HFD-fluids (no code)	●	●	●	●	●	●	●	●	●	
	HFA-, HFB- and HFC-Fluids	●	●	–	–	–	–	●	–	–	E
	For operation on HFC-special performance version see RE 92053 (HFA and HFB see RE 90223)			●	●	●	●				
	High-Speed-Version	–	–	–	–	●	●	●	–	–	H

Axial piston unit

02	Swash plate design, variable	A4VS

Boost pump (Impeller)

		40	71	125	180	250	355	500	750	1000	
03	without boost pump (no coden)	●	●	●	●	●	●	●	●	●	
	with boost pump (Impeller) only with port plate 25 (service port connections)	–	–	–	–	–	–	–	●	–	L

Type of operation

04	Pump, open circuit	O

Size

		40	71	125	180	250	355	500	750	1000
05	Displacement $V_{g\,max}$ [cm³]	40	71	125	180	250	355	500	750	1000

Control devices

				40	71	125	180	250	355	500	750	1000	
06	Pressure control	(RE 92060)	DR	●	●	●	●	●	●	●	●	●	DR..
	Pressure control for parallel operation		DP	●	●	●	●	●	●	●	●	●	DP..
	Flow control		FR	●	●	●	●	●	●	–	–	–	FR..
	Pressure and flow control		DFR	●	●	●	●	●	●	–	–	–	DFR..
	Power control with hyperbolic curve	(RE 92064)	LR	●	●	●	●	●	●	●	●	●	LR..[1])
	Manual control	(RE 92072)	MA	●	●	●	●	●	●	●	–	–	MA..
	Electric motor control		EM	●	●	●	●	●	●	●	–	–	EM..
	Hydraulic control, control volume dependent	(RE 92076)	HM	●	●	●	●	●	●	●	●	●	HM..
	Hydr. control, with servo/proportional valve		HS	●	●	●	●	●	●	●	●	●	HS..[1])
	Electronic control		EO	●	●	●	●	●	●	●	●	●	EO..[1])
	Hydraulic control, pilot pressure dependent	(RE 92080)	HD	●[2])	●[2])	●	●	●	●	●	●	●	HD..[1])
	Secundary speed control	(RE 92056)	DS1	●	●	●	●	●	●	●	●	o	DS1..[1])
	Electro-hydraulic control system DFE1 System solution SYHDFEE	(RE 92088) (RE 30035)		●	●	●	●	●	●	–	–	–	DFE1..[1])

Series

		40	71	125	180	250	355	500	750	1000	
07		●	●	–	–	–	–	–	–	–	10(11)[2])
		–	–	●	●	●	●	●	●	●	30

● available o in preparation – not available [grey box] = preferred program

[1]) when operating on HF-fluids, observe the limitations as shown in the relevant data sheets of the control devices and the mounted valves

[2]) Versions with HD-controls only in series 11

Type code for Standard program

	A4VS		O			/			–						
01	02	03	04	05	06		07	08		09	10	11	12	13	14

Direction of rotation

08	with view on shaft end	right hand	**R**
		left hand	**L**

	Seals	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**	
09	NBR (Nitrile-rubber), Shaft seal FKM (Fluoro-rubber)	●	●	●	●	●	●	●	●	●	**P**
	FKM (Fluoro-rubber) / for operation on HFD	●	●	●	●	●	●	●	●	●	**V**
	HFC-special performance version see RE 92053	–	–	●	●	●	●	–	–	–	**F**

Shaft end

10	Keyed parallel shaft to DIN 6885	**P**
	Splined shaft to DIN 5480	**Z**

	Mounting flange		**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**	
11	similar to ISO 3019-2 metric	4-hole	●	●	●	●	●	●	–	–	–	**B**
		8-hole	–	–	–	–	–	–	●	●	●	**H**

	Service line connections										
12	Port B and S: SAE flange on side, 90° offset, metric fixing screws	●	●	●	●	●	●	–	–	–	**13** [1]
	Port B and S: SAE flange on side, 90° offset, metric fixing screws 2. pressure port B_1, opposite B – closed with blanking plate on delivery	●	●	●	●	●	●	●	●	●	**25**

● available ○ in preparation ▭ = preferred program

[1]) only with through drive code N00 and K..

continuation of type code see page 4

Type code for Standard program

	A4VS		O			/			–					
01	02	03	04	05	06		07	08		09	10	11	12	13	14

Through drive

				40	71	125	180	250	355	500	750	1000	
13	without auxiliary pump, without through drive			●	●	●	●	●	●	●	●	●	**N00**
	with through drive for mounting an axial piston unit, gear or radial piston pump			●	●	–	–	–	–	●	●	●	**K...**
	Universal through drive, can be adapted			–	–	●	●	●	●	–	–	–	**U...**
	Flange	splined shaft coupler [1])	to mount										
	125, 4-hole (ISO[2]))	32x2x14x9g	A4VSO/G 40	●	●	●	●	●	●	●	○	○	**31**
	140, 4-hole (ISO[2]))	40x2x18x9g	A4VSO/G 71	–	●	●	●	●	●	●	●	○	**33**
	160, 4-hole (ISO[2]))	50x2x24x9g	A4VSO/G 125	–	–	●	●	●	●	●	●	○	**34**
	160, 4-hole (ISO[2]))	50x2x24x9g	A4VSO/G 180	–	–	–	●	●	●	●	●	○	**34**
	224, 4-hole (ISO[2]))	60x2x28x9g	A4VSO/G, A4CSG 250	–	–	–	–	●	●	●	●	○	**35**
	224, 4-hole (ISO[2]))	70x3x22x9g	A4VSO/G, A4CSG 355	–	–	–	–	–	●	●	○	○	**77**
	315, 8-hole (ISO[2]))	80x3x25x9g	A4VSO/G, A4CSG 500	–	–	–	–	–	–	●	●	○	**43**
	400, 8-hole (ISO[2]))	90x3x28x9g	A4VSO/G, A4CSG 750	–	–	–	–	–	–	–	●	○	**76**
	400, 8-hole (ISO[2]))	100x3x32x9g	A4VSO/G 1000	–	–	–	–	–	–	–	–	●	**88**
	80, 2-hole (ISO[2]))	3/4in 19-4 (SAE A-B)	A10VSO 10/52, 18/31	○	●	○	○	○	○	○	○	○	**B2**
	100, 2-hole (ISO[2]))	7/8in 22-4 (SAE B)	A10VSO 28/31	●	●	●	●	○	○	○	○	○	**B3**
	100, 2-hole (ISO[2]))	1in 25-4 (SAE B-B)	A10VSO 45/31	●	●	●	●	●	●	●	○	○	**B4**
	125, 2-hole (ISO[2]))	1 1/4in 32-4 (SAE C)	A10VSO 71/31	–	●	●	●	●	●	○	○	○	**B5**
	160, 4-hole (ISO[2]))	1 1/4in 32-4 (SAE C)	A10VSO 71/32	–	○	○	○	●	○	○	○	○	**B8**
	125, 2-hole (ISO[2]))	1 1/2in 38-4(SAE C-C)	A10VSO 100/31	–	–	○	○	○	○	○	○	○	**B6**
	180, 4-hole (ISO[2]))	1 1/2in 38-4 (SAE C-C)	A10VSO 100/32	–	–	○	○	○	○	○	○	○	**B9**
	180, 4-hole (ISO[2]))	1 3/4in 44-4 (SAE D)	A10VSO 140/31/32	–	–	–	●	●	●	●	○	○	**B7**
	82-2 (SAE A)	5/8in 16-4 (SAE A)	AZ-PF-1X-004...022	●	●	●	●	●	●	●	●	○	**01**
	82-2 (SAE A)	3/4in 19-4 (SAE A-B)	A10VSO 10, 18/31/52(3)	●	●	○	○	○	○	○	○	○	**52**
	101-2 (SAE B)	7/8in 22-4 (SAE B)	AZ-PN-1X-020...032, A10VO 28/31/52(3)	●	●	●	●	●	●	●	○	○	**68**
	101-2 (SAE B)	1in 25-4 (SAE B-B)	PGH4, A10VO45/31	●	●	●	●	●	●	●	○	○	**04**
	127-2 (SAE C)	1 1/4in 32-4 (SAE C)	A10VO 71/31	–	●	●	●	●	●	●	○	○	**07**
	127-2 (SAE C)	1 1/2in 38-4 (SAE C-C)	PGH5, A10VO100/31	–	–	●	●	●	●	●	○	○	**24**
	152-4 (SAE D)	1 3/4in 44-4 (SAE D)	A10VO 140/31	–	–	–	●	●	●	●	○	○	**17**
	Ø 63, metr.4-hole	for keyed shaft Ø 25	R4	●	●	○	○	○	○	○	○	○	**57**
	with through drive shaft, without coupler, without adapter flange, closed with cover plate			●	●	●	●	●	●	●	●	●	**99**

Filtration (only with HS- and DS-control)

14	without filter	**N**
	Sandwich plate filter (with HS- and DS-control see RE 92076 and RE 92056)	**Z**

[1]) Keyed shaft coupler on K/U 57 through drive [2]) to ISO 3019-2 metric

Combination pumps

1. Combination pumps consisting of axial piston units – ordering example see page 38; overview mounting options see page 39
2. if delivery with mounted gear or radial piston pump is desired, please consult us.

● available ○ in preparation – not available = preferred program

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and application conditions please consult our data sheets RE 90220 (mineral oils), RE 90221 (ecologically acceptable fluids) and RE 90223 (HF-fluids).

The variable pump A4VSO is suitable for operation on HF-fluids. (HFA, HFB, and HFC: ***E***A4VSO or A4VSO....***F***
HFD: standard version A4VSO with FKM seals)

However, limitations to the technical data, according to RE 90223 must be observed.

On certain selected HFC-fluids, pump sizes **125...355**, executed in accordance to RE 92053 can be operated with the **same pressures and speeds** as on mineral oil.

On operation with HFA and HFB-fluids, limitations of the technical data must be observed according to RE 90223.
On operation with rolling oil please consult us.

When ordering, please state the fluid to be used.

Operating viscosity range

Within the operating viscosity range between 16...100 mm²/s the units can be operated without limitations of the technical data.
In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected in the range

ν_{opt} = opt. viscosity range 16...36 mm²/s

referred to tank temperature (open circuit).

Limit of viscosity range

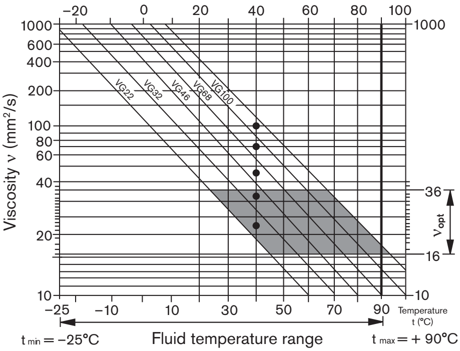
For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 3 min)
at max. permissible case drain temperature
t_{max} = +90°C.

ν_{max} = 1000 mm²/s
for short periods (on cold start, operating viscosity should be below 100 mm²/sec within 15 minutes)
t_{min} = −25°C

For detailed information on operation with low temperatures see RE 90300-03-B.

Selection diagram



Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}); see shaded section in the selection diagram. We recommend, that the higher viscosity grade is selected in each case.

Temperature range (see selection diagram)

t_{min} = − 25° C
t_{max} = + 90° C

Example: at an ambient temperature of X° C the operating temperature in the tank is 60° C. In the optimum viscosity range (ν_{opt} ; shaded area), this corresponds to grades VG 46 or VG 68; select: VG 68.
Important: The case drain temperature is influenced by pressure and speed and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 90° C.

Technical data

Bearing flushing

For the following operating conditions bearing flushing is required for a safe, continuous operation:

– Applications with special fluids (non mineral oils) due to limited lubricity and narrow operating temperature range
– Operation at critical conditions of temperature and viscosity with mineral oil

Flushing is recommended with vertical mounting (drive shaft facing upwards) in order to ensure lubrication of the front bearing and shaft seal.

Flushing is carried out via port „U“, located in the front flange area of the pump. The flushing fluid flows through the front bearing and leaves the pump together with the case drain flow.

Depending on pump size, the following flushing flows are recommended:

Size			40	71	125	180	250
recommended flushing flow	q_{Sp}	L/min	3	4	5	7	10

Size			355	500	750	1000
recommended flushing flow	q_{Sp}	L/min	15	20	30	40

These recommended flushing flows will cause a pressure drop of approx. 2 bar (series 1) and 3 bar (series 3) between the entrance to port„U“ and the pump case (including the pipe fittings).

Notes regarding series 30

When using external bearing flushing the throttle screw at port U must be turned in to the end stop.

Filtration of the fluid (Axial piston unit)

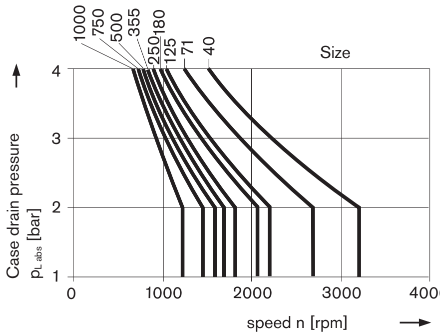
The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston pump.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness class of

20/18/15 acc. to ISO 4406 is necessary.

Case drain pressure

The permissible case drain pressure (housing pressure) is dependent on the drive speed (see diagram).



Max. case drain pressure (housing pressure)

$p_{L\ abs\ max}$ ________________ 4 bar absolute

These are approximate values; under certain operating conditions a reduction in these values may be necessary.

Direction of flow

S to B.

Technical data

Operating pressure range

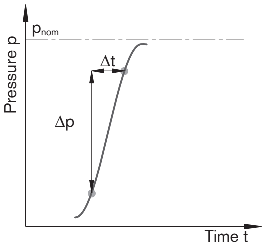
Pressure at service line port (pressure port) B

Nominal pressure p_{nom} ______ 350 bar absolute

Peak pressure p_{max} ______ 400 bar absolute
Total operating period ______ 300 h
Single operating period ______ 1 s

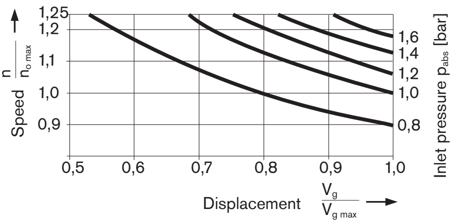
Minimum pressure (high-pressure side) ______ 15 bar
For lower pressures please consult us.

Rate of pressure change R_A ______ 16000 bar/s



Pressure at suction port S (inlet)
Minimum suction pressure $p_{S\,min}$ ______ 0.8 bar absolute
Maximum suction pressure $p_{S\,max}$ ______ 30 bar absolute

Minimum pressure (inlet)
In order to avoid damage to the axial piston unit, a minimum pressure must be ensured at the suction port S (inlet). The minimum pressure is dependent on the speed and displacement of the axial piston unit.



The inlet pressure is the static feed pressure or the minimum dynamic value of the boost pressure.

Please note:
Max. permissible drive speed $n_{o\,max.\,perm.}$ (speed limit) see page 8

Please contact us if these conditions cannot be satisfied.

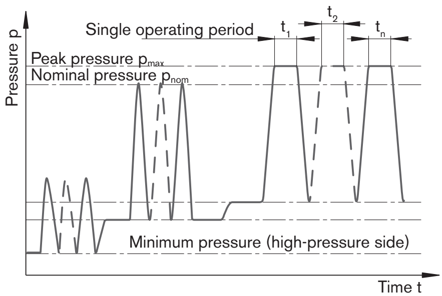
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Peak pressure p_{max}
The peak pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

Technical data

Table of values (theoretical values, without considering efficiencies and tolerances; values rounded off)

Size			40	71	125	180	250/ H 1)	355/ H 1)	500/ H 1)	750	750 with Impeller	1000
Displacement	$V_{g\ max}$	cm^3	40	71	125	180	250/ 250	355/ 355	500/ 500	750	750	1000
Speed 2) max. at $V_{g\ max}$	$n_{o\ max}$	rpm	2600	2200	1800	1800	1500/ 1900	1500/ 1700	1320/ 1500	1200	1500	1000
max. at $V_g \leq V_{g\ max}$ (speed limit)	$n_{o\ max\ zul.}$	rpm	3200	2700	2200	2100	1800/ 2100	1700/ 1900	1600/ 1800	1500	1500	1200
Flow at $n_{o\ max}$	$q_{vo\ max}$	L/min	104	156	225	324	375/ 475	533/ 604	660/ 750	900	1125	1000
at $n_E = 1500$ rpm	$q_{VE\ max}$	L/min	60	107	186	270	375	533	581 3)	770 3)	1125	–
Power $\Delta p = 350$ bar at $n_{o\ max}$	$P_{o\ max}$	kW	61	91	131	189	219/ 277	311/ 352	385/ 437	525	656	583
at $n_E = 1500$ rpm	$P_{E\ max}$	kW	35	62	109	158	219	311	339 3)	449 3)	656	–
Torque bat $V_{g\ max}$ $\Delta p = 350$ bar	T_{max}	Nm	223	395	696	1002	1391	1976	2783	4174	4174	5565
$\Delta p = 100$ bar	T	Nm	64	113	199	286	398	564	795	1193	1193	1590
Rotary stiffness Shaft end P	c	kNm/rad	80	146	260	328	527	800	1145	1860	1860	2730
Shaft end Z	c	kNm/rad	77	146	263	332	543	770	1136	1812	1812	2845
Moment of inertia rotary group	J_{TW}	kgm^2	0,0049	0,0121	0,03	0,055	0,0959	0,19	0,3325	0,66	0,66	1,20
Angular acceleration max. 4)	α	rad/s^2	17000	11000	8000	6800	4800	3600	2800	2000	2000	1450
Case volume	V	L	2	2,5	5	4	10	8	14	19	22	27
Weight (with press. contr.) approx.	m	kg	39	53	88	102	184	207	320	460	490	605

1) High-Speed-Version

2) Values are valid with inlet pressure p_{abs} 1 bar at inlet port S, with increased speed up to speed limit please observe diagram, page 7

3) $V_g < V_{g\ max}$

4) – The range of validity lies between zero and the maximum permissible drive speeds.
Valid for external excitation (eg. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
– The limiting value is only valid for a single pump.
– The loading capacity of the connecting parts must be considered.

Notes
Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit.
The permissible values can be determined through calculation.

Determination of pump size

Flow $$q_V = \frac{V_g \cdot n \cdot \eta_V}{1000} \quad [L/min]$$

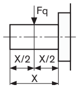
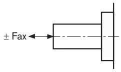
Drive torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad [Nm]$$

Power $$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \quad [kW]$$

V_g = geometr. displacement per rev. in cm^3
Δp = pressure difference in bar
n = speed in rpm
η_V = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces on the drive shaft

Size					40	71	125	180	250	355	500	750*	1000
Radial force, max.		at X/2	$F_{q\ max}$	N	1000	1200	1600	2000	2000	2200	2500	3000	3500
Axial force, max.			$\pm F_{ax\ max}$	N	600	800	1000	1400	1800	2000	2000	2200	2200

* also valid for versions with boost pump

2

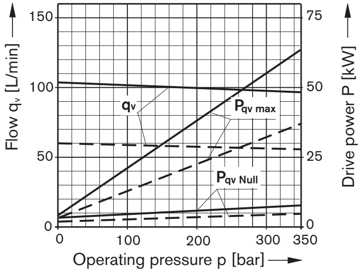
Characteristics

Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

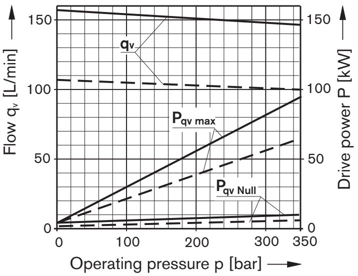
Overall efficiency: $\eta_t = \dfrac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ Volumetric efficiency: $\eta_v = \dfrac{q_v}{q_{v\,theor}}$

Size 40



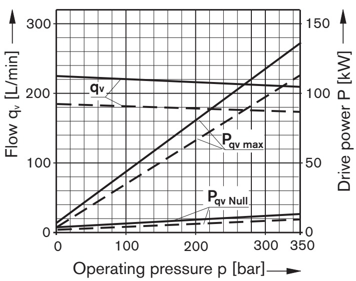
n = 2600 rpm
n = 1500 rpm

Size 71



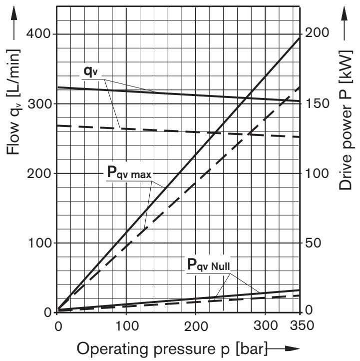
n = 2200 rpm
n = 1500 rpm

Size 125



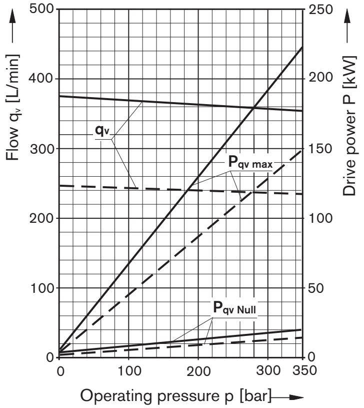
n = 1800 rpm
n = 1500 rpm

Size 180



n = 1800 rpm
n = 1500 rpm

Size250



n = 1500 rpm
n = 1000 rpm

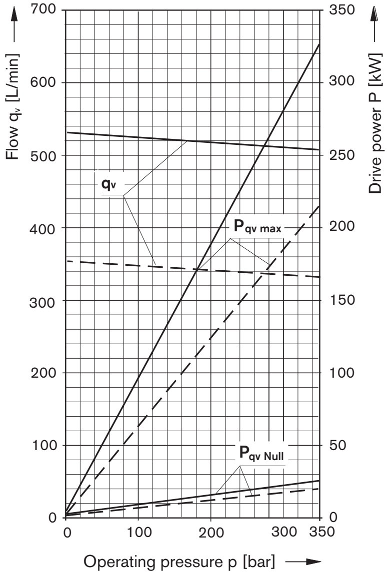
Characteristics

Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

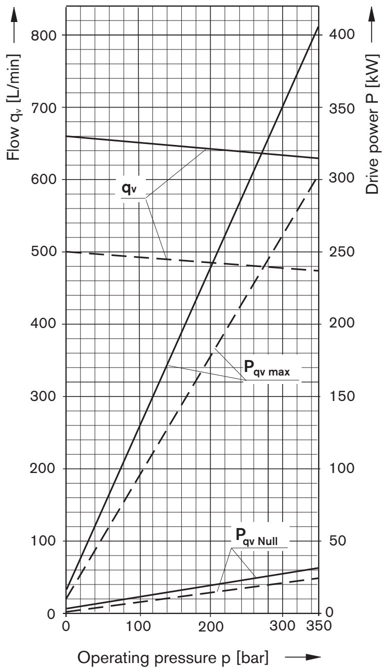
Overall efficiency: $\eta_t = \dfrac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ Volumetric efficiency: $\eta_v = \dfrac{q_v}{q_{v\,theor}}$

Size 355



n = 1500 rpm
n = 1000 rpm

Size 500



n = 1320 rpm
n = 1000 rpm

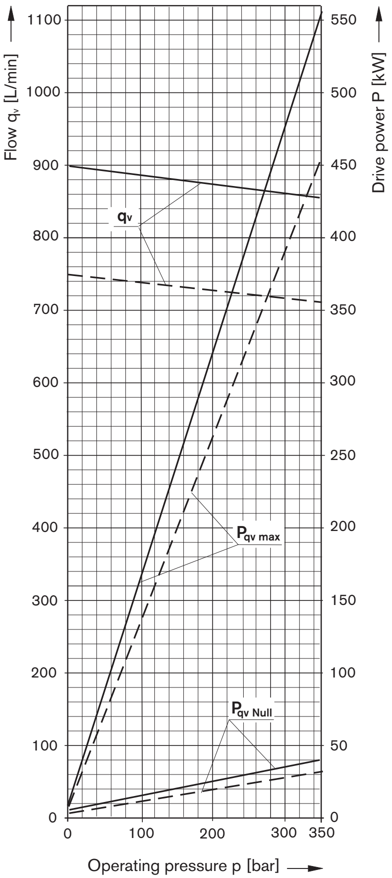
Characteristics

Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

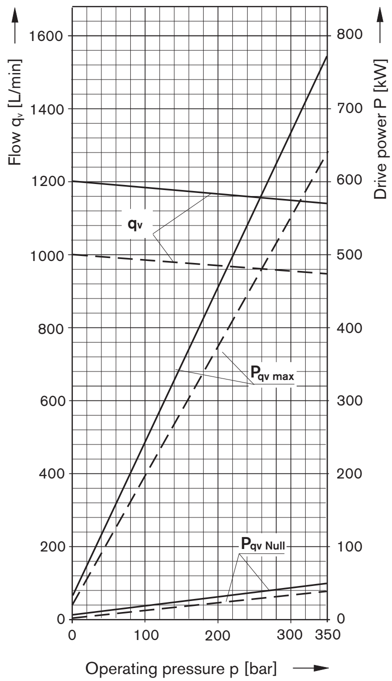
Overall efficiency: $\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ Volumetric efficiency: $\eta_v = \frac{q_v}{q_{v\,theor}}$

Size 750



n = 1200 rpm
n = 1000 rpm

Size 1000



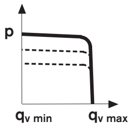
n = 1200 rpm
n = 1000 rpm

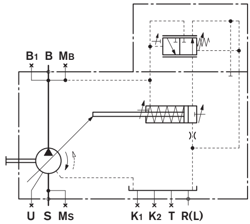
Summary of controls

Pressure control DR (see RE 92060)

The DR- pressure control limits the maximum pressure at the pump outlet within the pump‘s control range. This max. pressure level can be steplessly set at the control valve.
Setting range 20...350 bar

Optional:
Remote control (DRG)

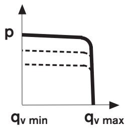


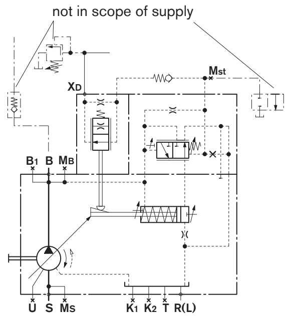


Pressure control for parallel operation DP (see RE 92060)

Suitable for pressure control with multiple A4VSO axial piston pumps in parallel operation.

Optional:
Flow control (DPF)

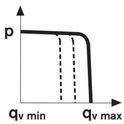


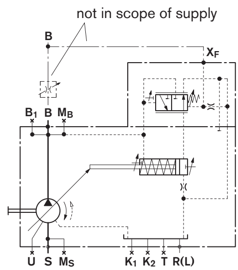


Flow control FR (see RE 92060)

Maintains a constant flow in a hydraulic system.

Optional:
Remote pressure control (FRG)
connection between X_F and tank closed
(FR1, FRG1)

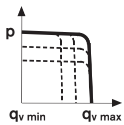


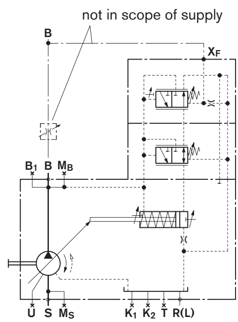


Pressure and flow control DFR (see RE 92060)

This control maintains a constant flow from the pump even under varying operating conditions. Overriding this control is a mechanically adjustable pressure control.

Optional:
connection between X_F and tank closed (DFR1)



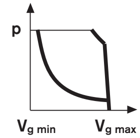


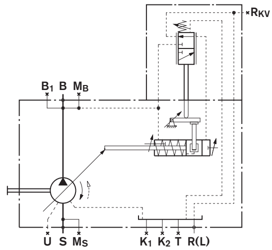
Summary of controls

Power control LR2 with hyperbolic characteristic (see RE 92064)

The hyperbolic power control maintains a constant preset drive power at the same input speed.

Optional:
Pressure control (LR2D), remotely controlled (LR2G);
Flow control (LR2F, LR2S);
Hydraulic stroke limiter (LR2H);
Mechanical stroke limiter (LR2M);
Hydraulic two-point control (LR2Z);
with electric unloading valve for easy start (LR2Y).

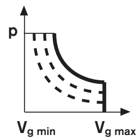


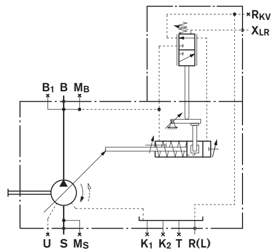


Power control LR3 with remote control of power characteristics (see RE 92064)

This power control maintains a constant preset drive power, with remote control of the power characteristics.

Optional:
Pressure control (LR3D), remotely controlled (LR3G);
Flow control (LR3F, LR3S);
Hydraulic stroke control (LR3H);
Mechanical stroke control (LR3M);
Hydraulic two-point control (LR3Z).
with electric unloading valve for easy start (LR3Y)



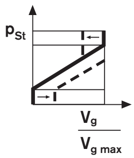


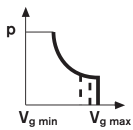
Hydraulic control LR2N and LR3N pilot pressure dependent, initial position $V_{g\ min}$ (see RE 92064)

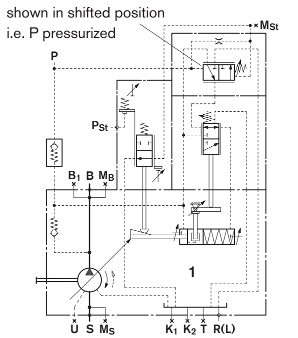
With overriding power control.

The pump displacement is proportional to a pilot pressure signal in P_{St}.
The additional hyperbolic power control overrides the pilot pressure signal and holds the preset drive power constant.

Optional:
Remote control of power characteristics (LR3N)
Pressure control (LR.DN),
Remote pressure control (LR.GN)
Electric control of pilot pressure signal (LR.NT)



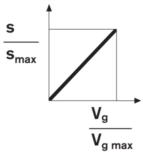


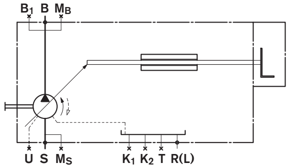


Summary of controls

Manual control MA (see RE 92072)

Stepless adjustment of displacement by means of a handwheel.

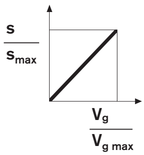


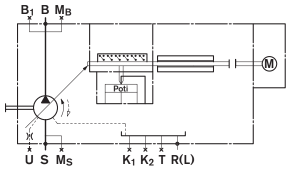


Electric motor control EM (see RE 92072)

Stepless adjustment of displacement via an electric motor.

Various intermediate displacement values can be selected with a programmed sequence control, by means of built on limit switches and an optional potentiometer for feedback signal.

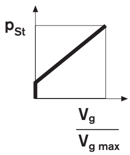


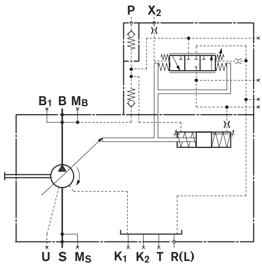


Hydraulic control HD pilot pressure dependent (see RE 92080)

Stepless adjustment of displacement proportional to a pilot pressure signal. The displacement is proportional to the applied pilot pressure (Difference between pilot pressure level and pump case pressure).

Optional:
Pilot pressure curves (HD1, HD2, HD3)
Pressure control (HD.B),
Remote pressure control (HD.GB)
Power control (HD1P)
with electric control of pilot pressure (HD1T)



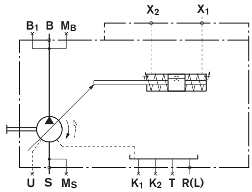


Summary of controls

Hydraulic control HM 1/2, control volume dependent (see RE 92076)

The pump displacement is infinitely variable in relation to the control oil volume in ports X_1 and X_2.

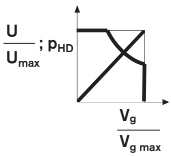
Application:
– 2-point control
– basic control device for servo or proportional valve control

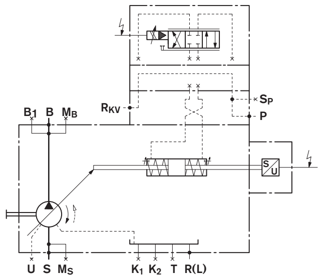


Control system HS, HS4, with servo or proportional valve (see RE 92076)

The stepless displacement control is accomplished by by means of servo or proportional valve with electrical feedback of the swivel angle.
The HS4P-control system is fitted with a built on pressure transducer so that it can be utilized for electrical pressure and power control.

Optional:
Servo valve (HS);
Proportional valve (HS4);
Short circuit valve (HSK, HS4K, HS4KP);
Without valves (HSE, HS4E).
For oil-immersed use (HS4M)

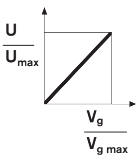


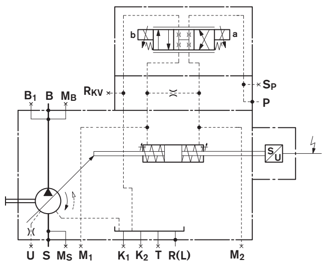


Control system EO1/2 (see RE 92076)

The stepless adjustment of the displacement is accomplished by means of a proportional valve with electrical feedback of the swivel angle.
This control can be utilized as an electric control of displacement.

Optional:
Control pressure range (EO1, EO2)
Short circuit valve (EO1K, EO2K)
Without valves (EO1E, EO2E)

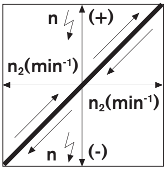


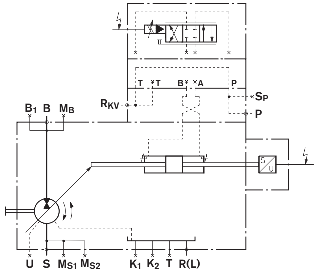


Summary of controls

Speed control DS1, secundary controlled (see RE 92056)

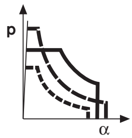
The speed control DS1 controls the secundary unit (motor) in such a manner, that this motor delivers sufficient torque to maintain the required output speed. When connected to a constant pressure system, this torque is proportional to motor displacement and thus also proportional to the swivel angle.

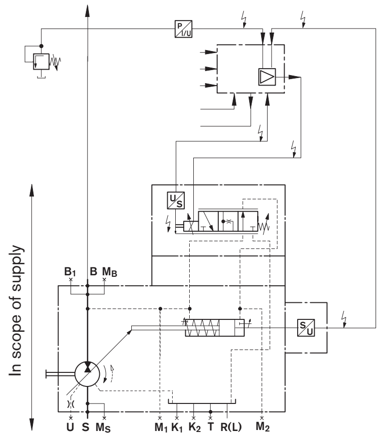




Electro hydraulic control system DFE1 (see RE 92088)

The power, pressure and swivel angle control of the variable pump A4VSO...DFE1 is accomplished by means of an electrically controlled proportional valve. A current signal to the proportional valve moves the control piston and determines via an integrated positional transducer the cradle‘s swivel angle and thus the pump flow. When the electric drive motor is switched off and the system is pressureless, the bias spring in the control chamber will swivel the pump to max. displacement ($V_{g\,max}$).



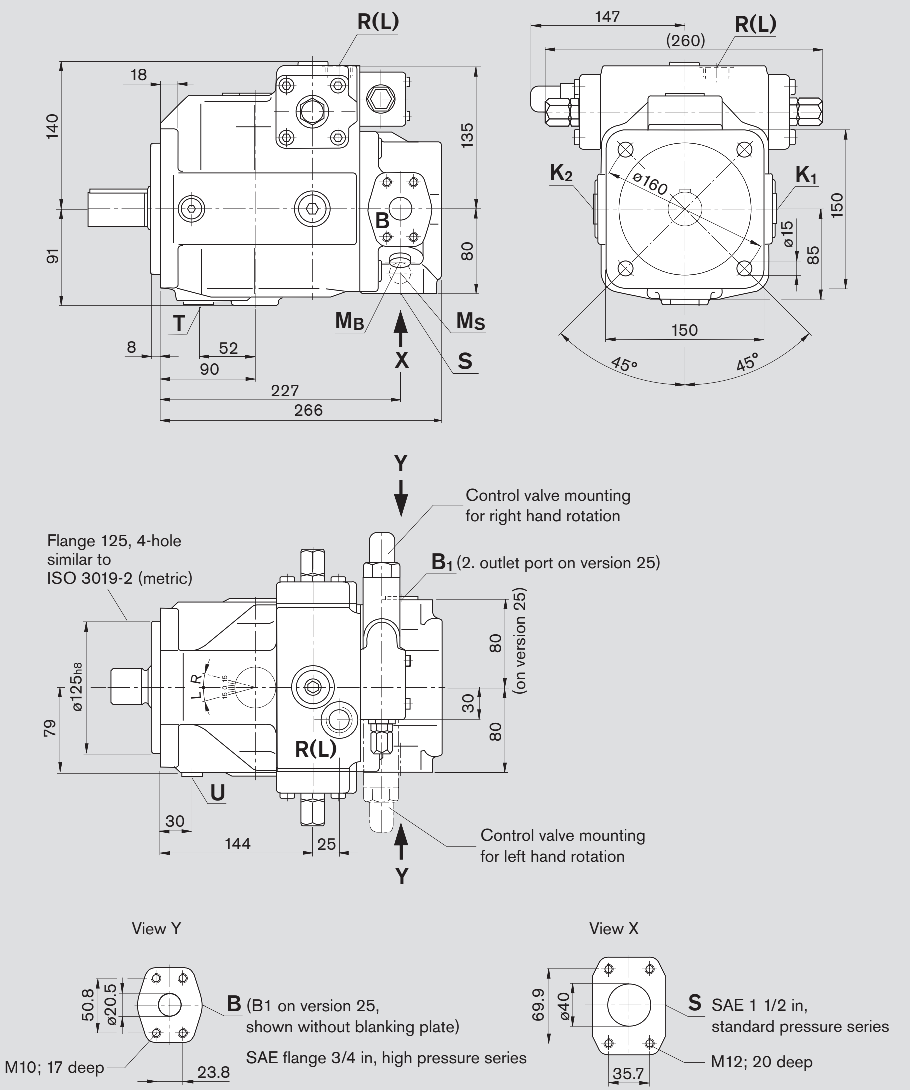


Dimensions, size 40

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 1

(Example: pressure control; for exact dimensions of the control devices see separate data sheets)



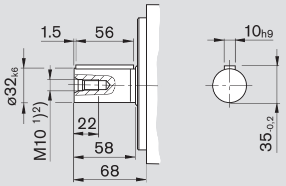
For dimensions of shaft ends and ports see page 19

Dimensions, size 40

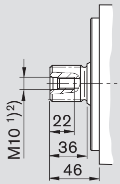
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS10x8x56



Z Splined to DIN 5480
W32x2x14x9g



Ports

Ports				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/2 in M12x1,75; 20 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M22x1,5;14 deep (plugged)	210 Nm
T	Drain	DIN 3852	M22x1,5;14 deep (plugged)	210 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
R(L)	Fill and bleed (case drain port)	DIN 3852	M22x1,5; 14 deep	210 Nm
U	Flushing port	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
on version 13				
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	3/4 in M10x1,5; 17 deep [2]	
B_1	Additional port	DIN 3852	M22x1,5;14 deep (plugged)	210 Nm
on version 25				
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	3/4 in M10x1,5; 17 deep [2]	
B_1	2. press. port (high pressre series) Fixing thread	SAE J518 [3] DIN 13	3/4 in (closed with blanking plate) M10x1,5; 17 deep [2]	

[1]) Center bore to DIN 332 (threaded to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

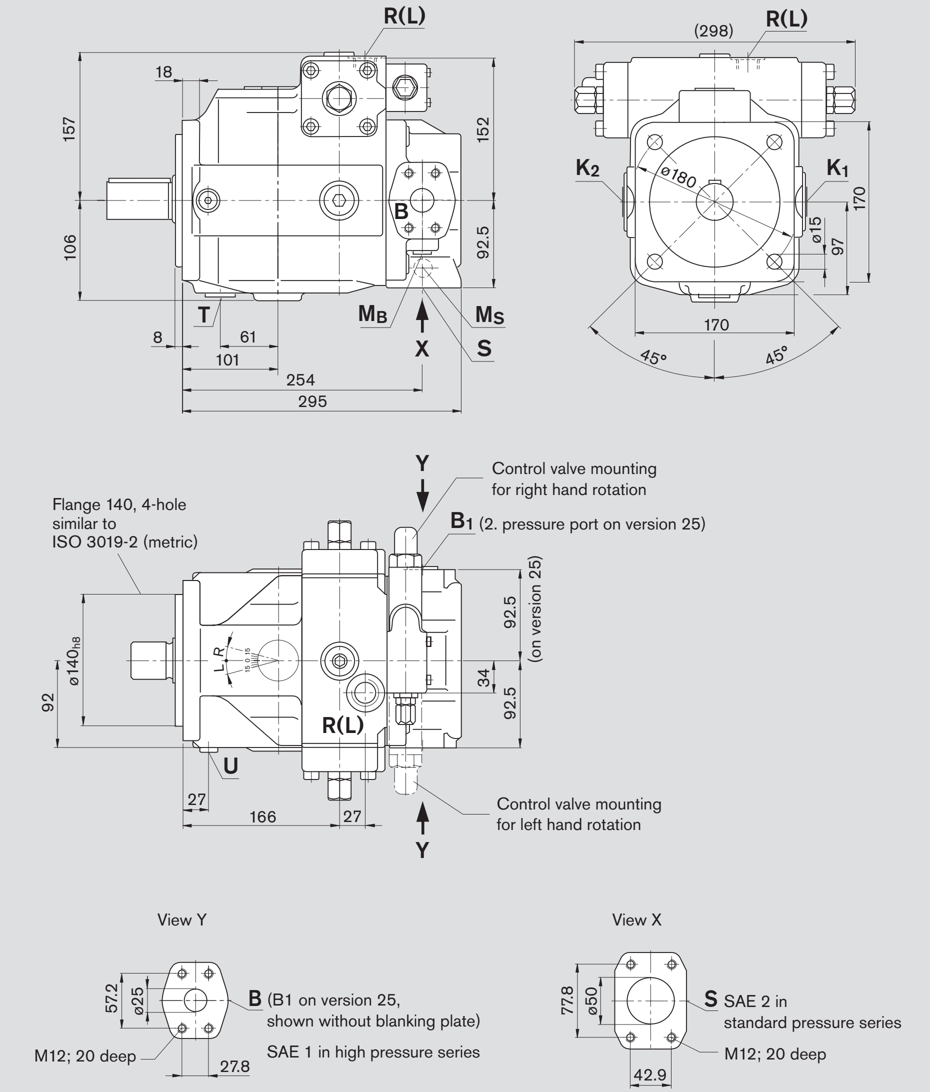
[3]) Caution: metric thread deviates from standard

Dimensions, size 71

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 1

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



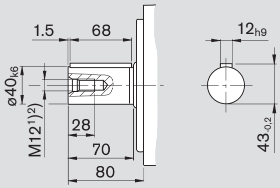
For dimensions of shaft ends or ports see page 21

Dimensions, size 71

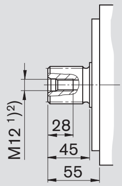
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS12x8x68



Z Splined to DIN 5480
W40x2x18x9g



2

Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	2 in M12x1,75; 20 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M27x2;16 deep (plugged)	330 Nm
T	Drain	DIN 3852	M27x2;16 deep (plugged)	330 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M27x2; 16 deep	330 Nm
U	Flushing port	DIN 3852	M14x1,5;12 deep (plugged)	80 Nm
on version 13				
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 in M12x1,75; 20 deep [2]	
B_1	Additional port	DIN 3852	M27x2;16 deep (plugged)	330 Nm
on version 25				
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 in M12x1,75; 20 deep [2]	
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 in (closed with blanking plate) M12x1,75; 20 deep [2]	

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

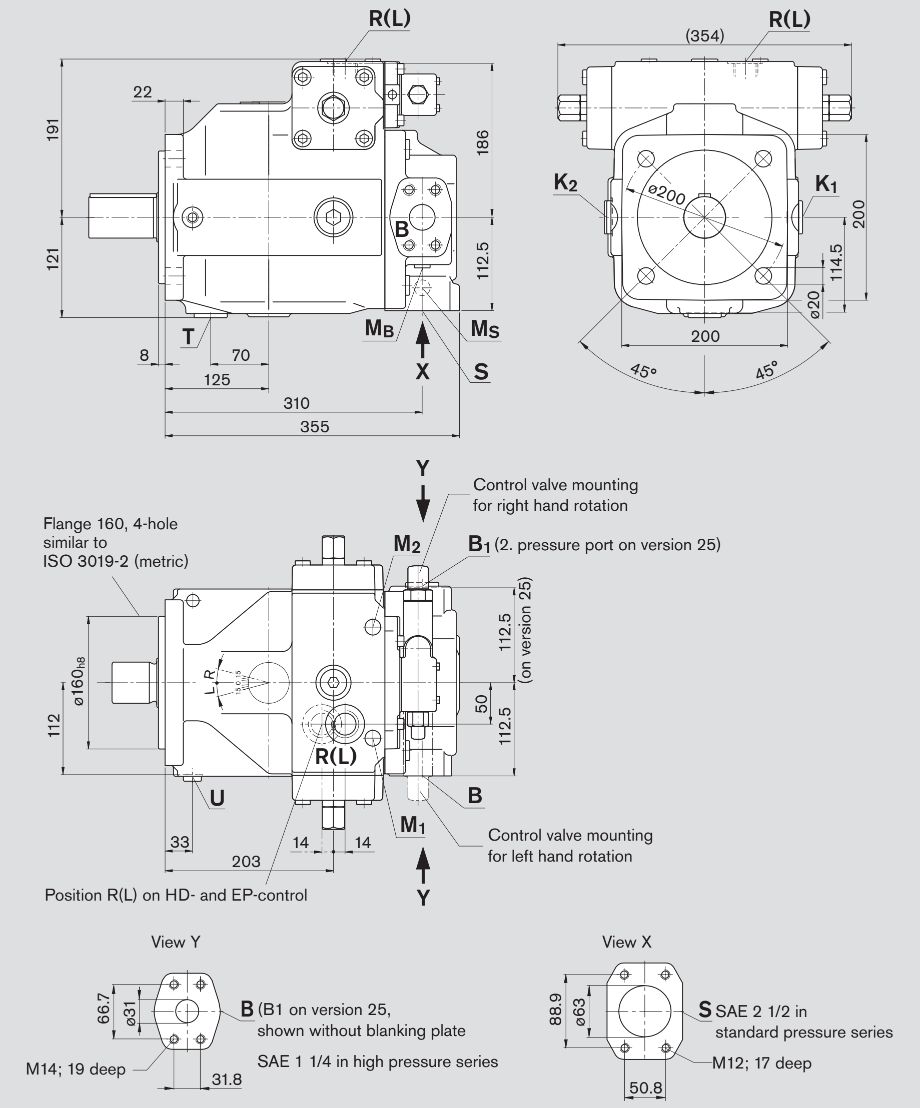
[3]) Caution: metric thread deviates from standard

Dimensions, size 125

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



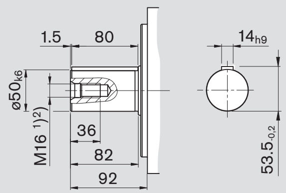
For dimensions of shaft ends and ports see page 23

Dimensions, size 125

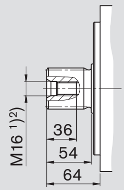
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS14x9x80



Z Splined to DIN 5480
W50x2x24x9g



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	2 1/2 in M12x1,75; 17 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M33x2; 18 deep (plugged)	540 Nm
T	Drain	DIN 3852	M33x2; 18 deep (plugged)	540 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M33x2; 18 deep	540 Nm
U	Flushing port	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_1, M_2	Measuring port control chamber press.	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm

on version 13

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in M14x2; 19 deep [2]	
B_1	Additional port	DIN 3852	M33x2; 18 deep (plugged)	540 Nm

on version 25

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in M14x2; 19 deep [2]
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in (closed with blanking plate) M14x2; 19 deep [2]

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

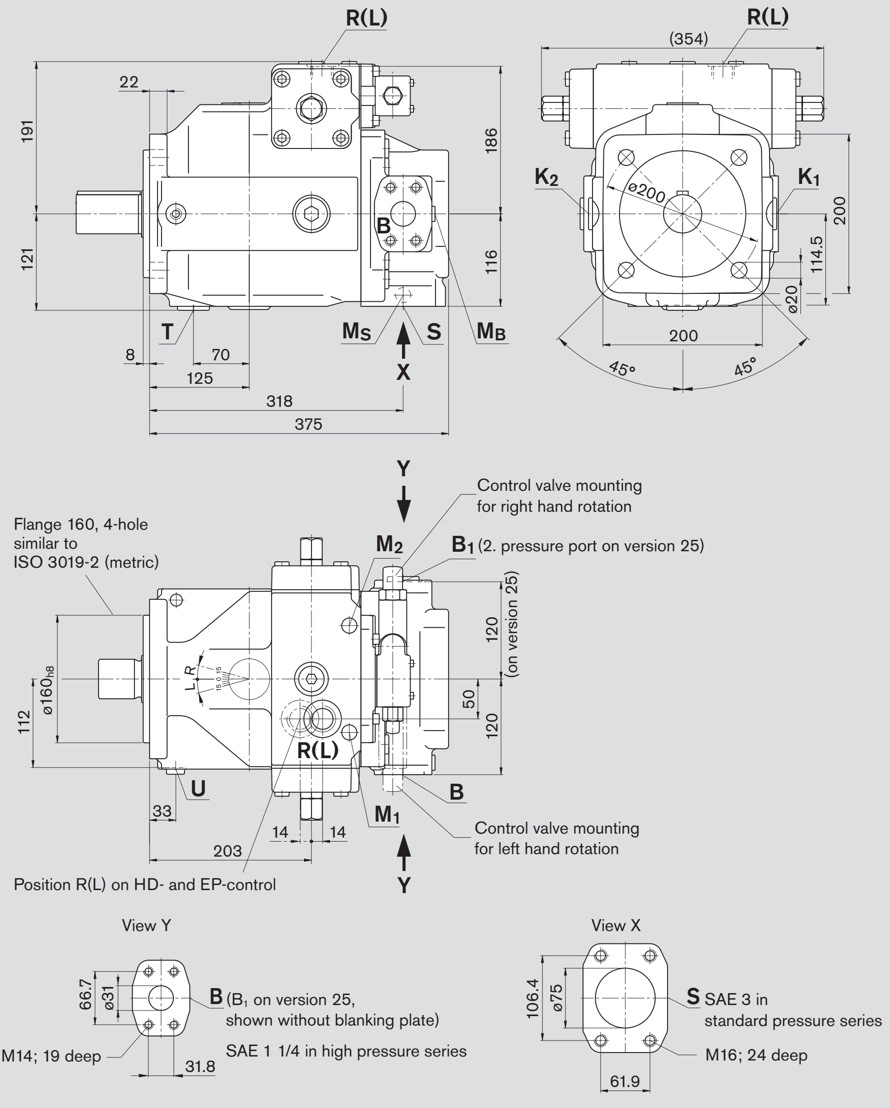
[3]) Caution: metric thread deviates from standard

Dimensions, size 180

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



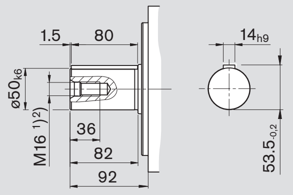
For dimensions of shaft ends and ports see page 25

Dimensions, size 180

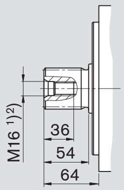
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS14x9x80



Z Splined to DIN 5480
W50x2x24x9g



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	3 in M16x2; 24 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M33x2; 18 deep (plugged)	540 Nm
T	Drain	DIN 3852	M33x2; 18 deep (plugged)	540 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M33x2; 18 deep	540 Nm
U	Flushing port	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_1, M_2	Measuring port control chamber pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm

on version 13

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in deep [2] M14x2; 19 deep [2]	
B_1	Additional port	DIN 3852	M33x2;18 deep (plugged)	540 Nm

on version 25

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in M14x2; 19 deep [2]
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/4 in (closed with blanking plate) M14x2; 19 deep [2]

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer‘s information on the used fittings and the general information on page 68

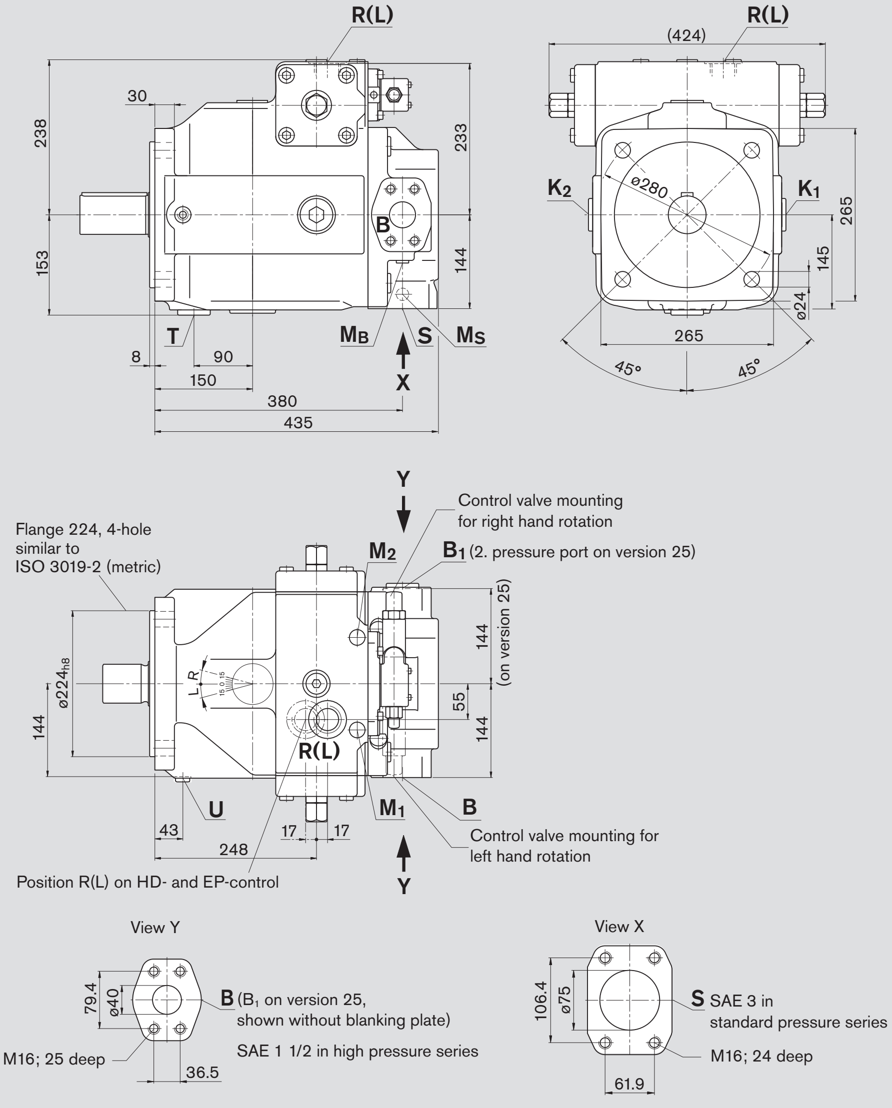
[3]) Caution: metric thread deviates from standard

Dimensions, size 250

Before finalising your design please request a certified installation drawing. Dimension in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



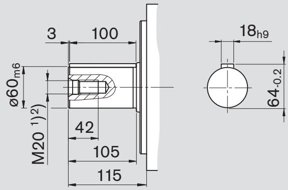
For dimensions on shaft ends and ports see page 27

Dimensions, size 250

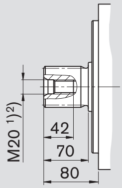
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS18x11x100



Z Splined to DIN 5480
W60x2x28x9g



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	3 in M16x2; 24deep [2]	
K_1, K_2	Flushing port	DIN 3852	M42x2; 20 deep (plugged)	720 Nm
T	Drain	DIN 3852	M42x2; 20 deep (plugged)	720 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M42x2; 20 deep	720 Nm
U	Flushing port	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
M_1, M_2	Measuring port control chamber pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm

on version 13

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/2 in M16x2; 25 deep [2]	
B_1	Additional port	DIN 3852	M42x2; 20 deep (plugged)	720 Nm

on version 25

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/2 in M16x2; 25 deep [2]
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	1 1/2 in (closed with blanking plate) M16x2; 25 deep [2]

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

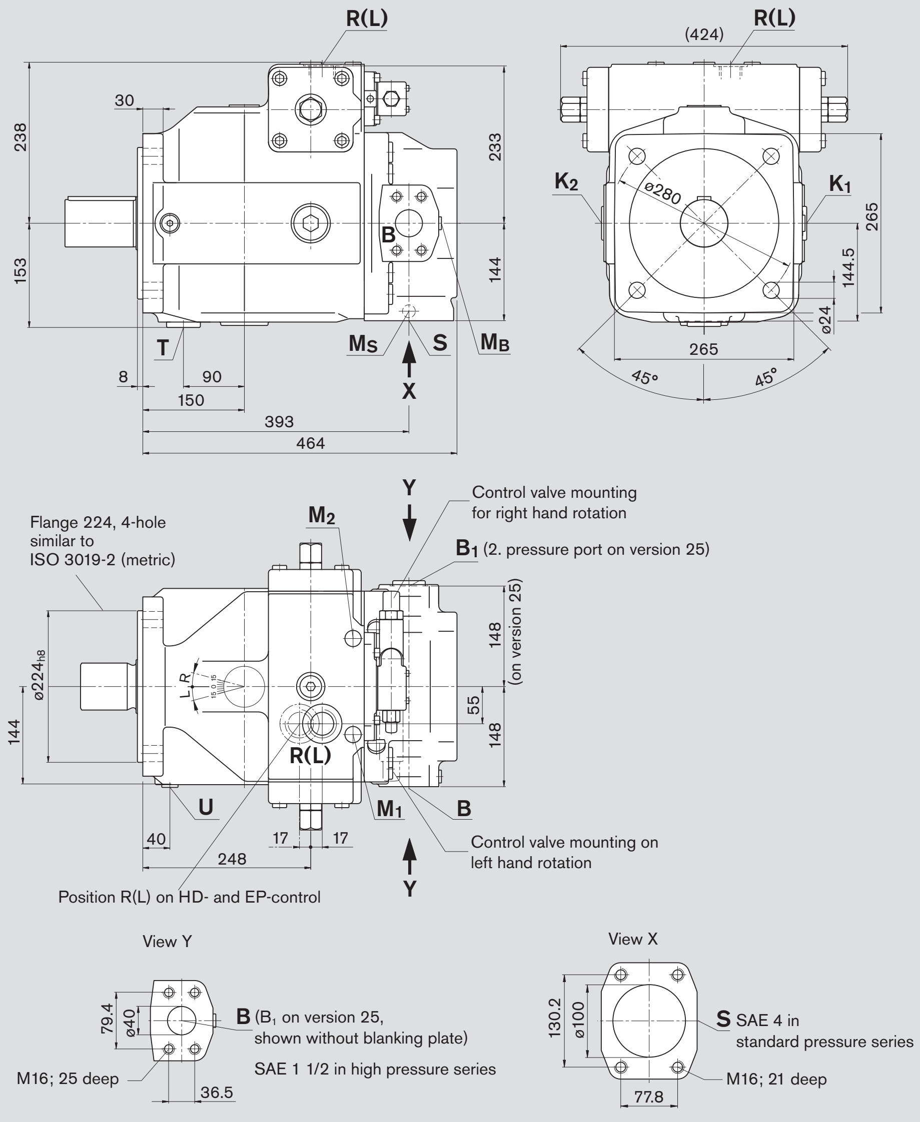
[3]) Caution: thread deviates from standard

Dimensions, size 355

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



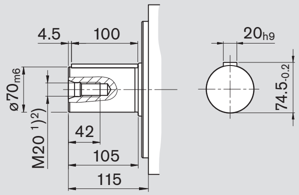
For dimensions of shaft ends and ports see page 29

Dimensions, size 355

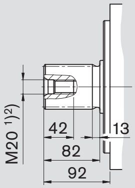
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS20x12x100



Z Splined to DIN 5480
W70x3x22x9g



2

Ports

				max. tightening torque [2])
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3]) DIN 13	4 in M16x2; 21 deep [2])	
K_1, K_2	Flushing port	DIN 3852	M42x2; 20 deep (plugged)	720 Nm
T	Drain	DIN 3852	M42x2; 20 deep (plugged)	720 Nm
M_B	Measuring port outlet pressure	DIN 3852	M14x1,5; 12deep (plugged)	80 Nm
M_S	Measuring port suction pressure	DIN 3852	M14x1,5; 12 deep (plugged)	80 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M42x2; 20 deep	720 Nm
U	Flushing port	DIN 3852	M18x1,5;12 deep (plugged)	140 Nm
M_1, M_2	Measuring port control chamber pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm

on version 13

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	1 1/2 in M16x2; 25 deep [2])	
B_1	Additional port	DIN 3852	M42x2; 20 deep (plugged)	720 Nm

on version 25

B	Pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	1 1/2 in M16x2; 25 deep[2])
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	1 1/2 in (closed with blanking plate) M16x2; 25 deep [2])

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer‘s information on the used fittings and the general information on page 68

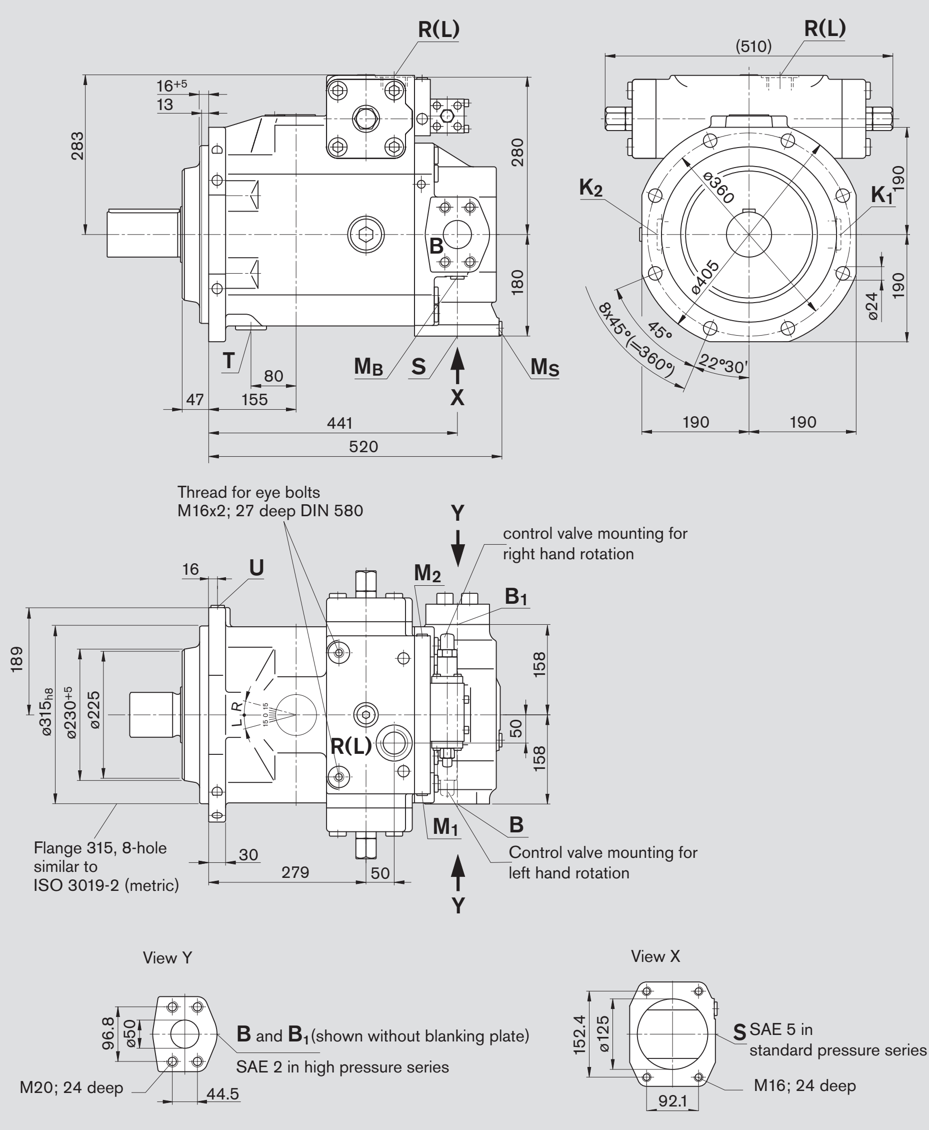
[3]) Caution: metric thread deviates from standard

Dimensions, size 500

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



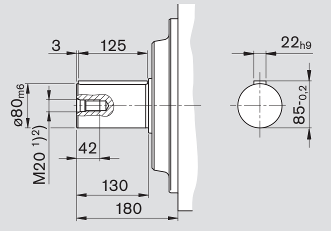
For dimensions of shaft ends and ports see page 31

Dimensions, size 500

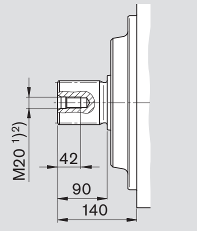
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS22x14x125



Z Splined to DIN 5480
W80x3x25x9g



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	5 in M16x2; 24 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M48x2; 22 deep (plugged)	960 Nm
T	Drain	DIN 3852	M48x2; 22 deep (plugged)	960 Nm
M_B	Measuring port outlet pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_S	Measuring port suction pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 22 deep	960 Nm
U	Flushing port	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_1, M_2	Measuring port control chamber pressure or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 12 deep (plugged) M14x1,5; 12 deep (plugged)	140 Nm 80 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	2 in M20x2,5; 24 deep [2]	
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	2 in (closed with blanking plate) M20x2,5; 24 deep [2]	

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

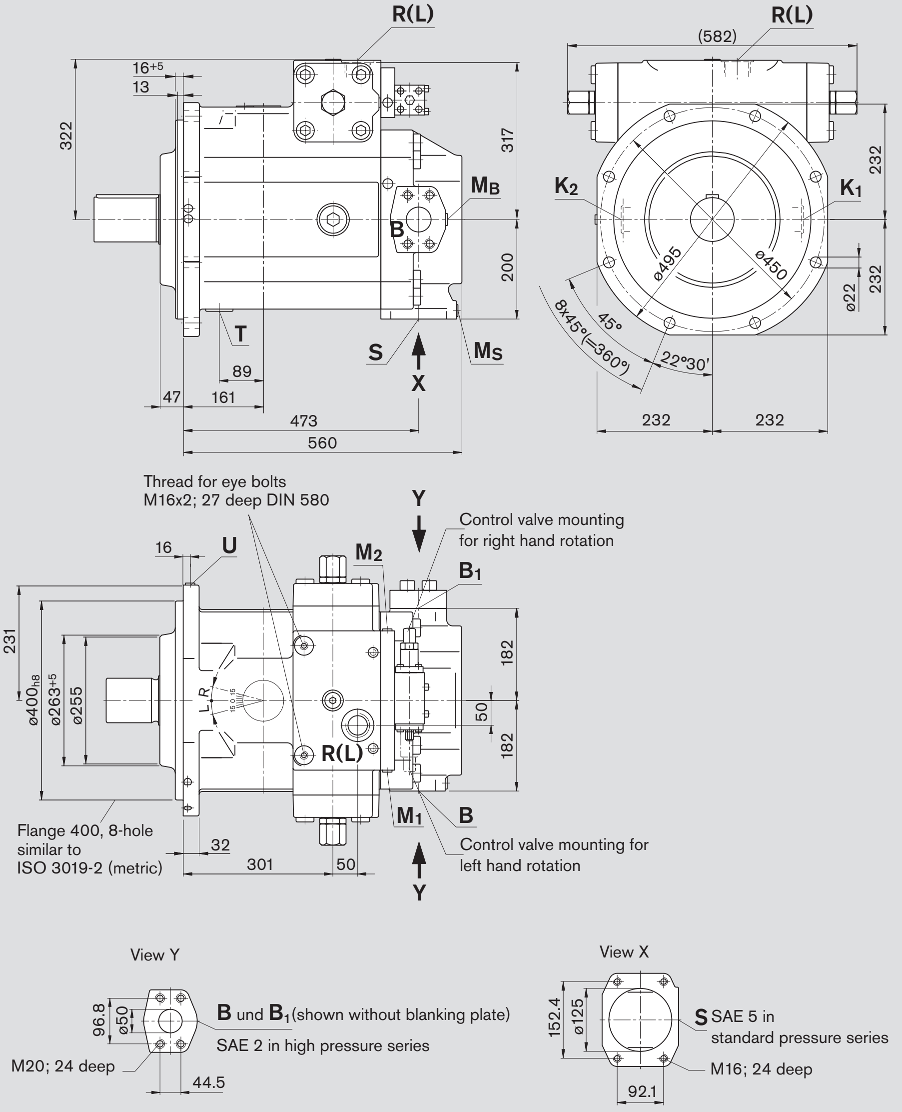
[3]) Caution: metric thread deviates from standard

Dimensions, size 750

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate dData sheets)



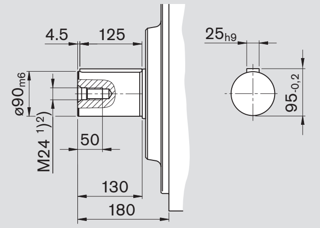
For dimensions of shaft ends and ports see page 33

Dimensions , size 750

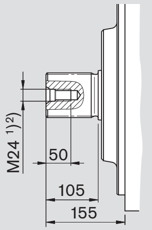
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS25x14x125



Z Splined to DIN 5480
W90x3x28x9g



Ports

				max. tightening torques [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3]) DIN 13	5 in M16x2; 24 deep [2])	
K_1, K_2	Flushing port	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
T	Drain	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
M_B	Measuring port outlet pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_S	Measuring port suction pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 20 deep	960 Nm
U	Flushing port	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_1, M_2	Measuring port control chamber press. or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 12 deep (plugged) M14x1,5; 12 deep (plugged)	140 Nm 80 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	2 in M20x2,5; 24 deep [2])	
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	2 in (closed with blanking plate) M20x2,5; 24 deep [2])	

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

[3]) Caution: metric thread deviates from standard

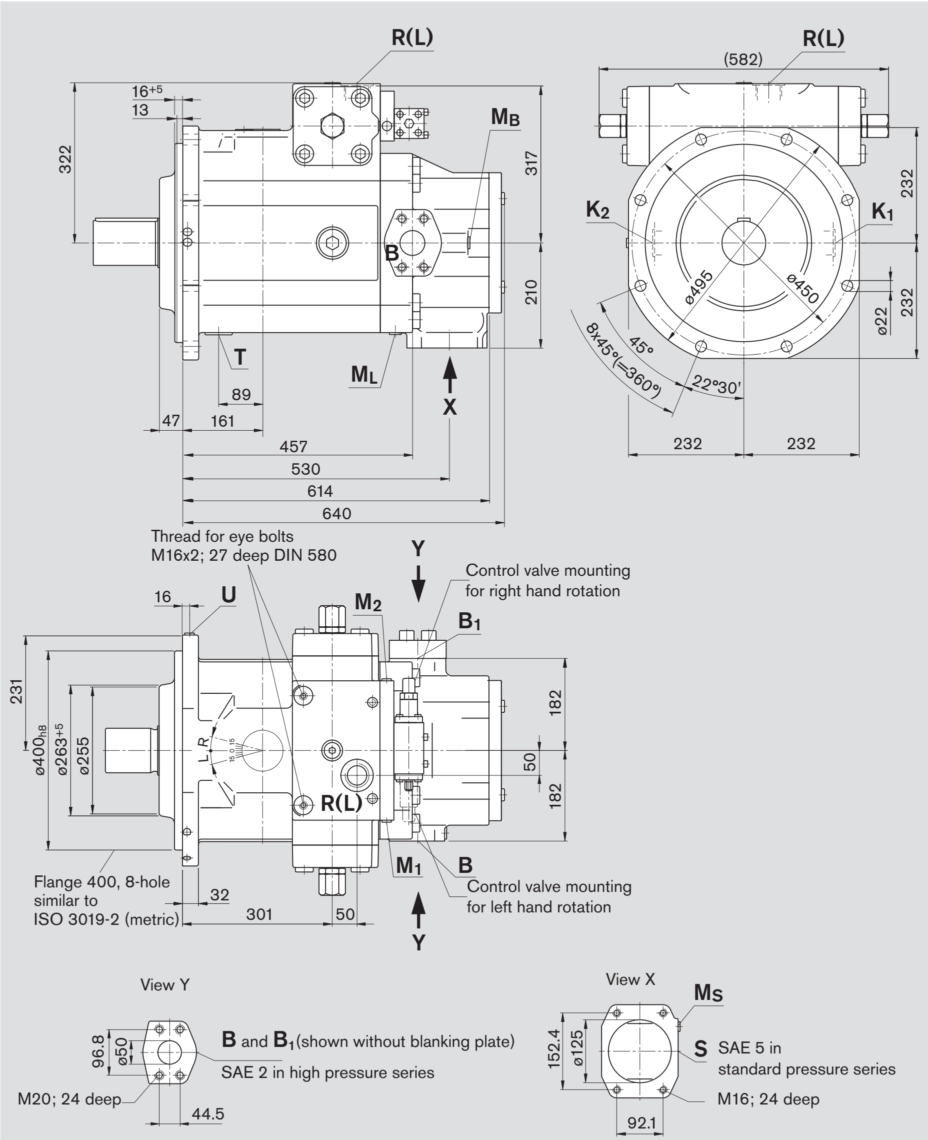
Dimensions, size 750

Before finalising your design please request a certified installation drawing. Dimensions in mm.

with boost pump (Impeller)

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



For dimensions of shaft ends and ports see page 35

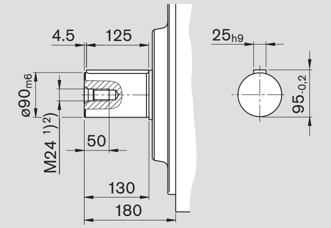
Dimensions, size 750

Before finalising your design please request a certified installation drawing. Dimensions in mm.

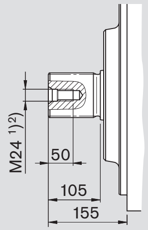
with boost pump (Impeller)

Shaft ends

P Keyed to DIN 6885
AS25x14x125



Z Splined to DIN 5480
W90x3x28x9g



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3] DIN 13	5 in M16x2; 24 deep [2]	
K_1, K_2	Flushing port	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
T	Drain	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
M_B	Measuring port outlet pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_S	Measuring port suction pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_L	Measuring port boost pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 20 deep	960 Nm
U	Flushing port	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_1, M_2	Measuring port control chamber press. or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 12 deep (plugged) M14x1,5; 12 deep (plugged)	140 Nm 80 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	2 in M20x2,5; 24 deep [2]	
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3] DIN 13	2 in (closed with blanking plate) M20x2,5; 24 deep [2]	

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

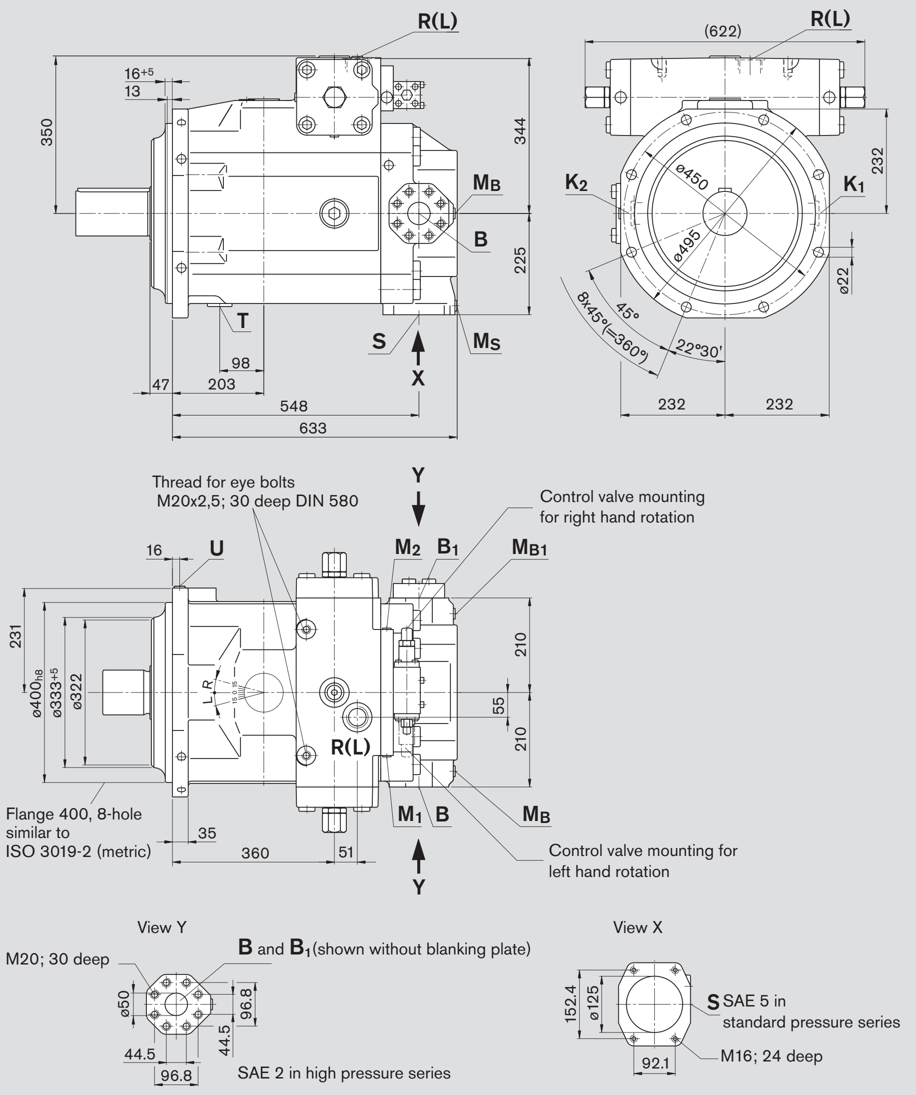
[3]) Caution: metric thread deviates from standard

Dimensions, size 1000

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Series 3

(Example: pressure control; for exact dimensions of control devices see separate data sheets)



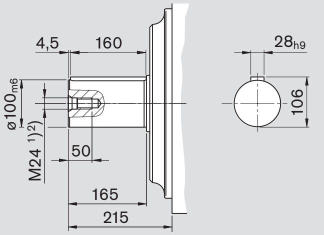
For dimensions of shaft ends and ports see page 37

Dimensions, size 1000

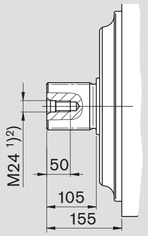
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Shaft ends

P Keyed to DIN 6885
AS28x16x160



Z Splined to DIN 5480
W100x3x32x9g



2

Ports

				max. tightening torque [2])
S	Suction port (standard pressure series) Fixing thread	SAE J518 [3]) DIN 13	5 in M16x2; 24 deep [2])	
K_1, K_2	Flushing port	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
T	Drain	DIN 3852	M48x2; 20 deep (plugged)	960 Nm
M_B, M_{B1}	Measuring port outlet pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_S	Measuring port suction pressure	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 20 deep	960 Nm
U	Flushing port	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_1, M_2	Measuring port control chamber press.or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 12 deep (plugged) M14x1,5; 12 deep (plugged)	140 Nm 80 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	2 in M20x2,5; 30 deep [2])	
B_1	2. pressure port (high pressure series) Fixing thread	SAE J518 [3]) DIN 13	2 in (closed with blanking plate) M20x2,5; 30 deep [2])	

[1]) Center bore to DIN 332 (thread to DIN 13)

[2]) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 68

[3]) Caution: metric thread deviates from standard

Through drive

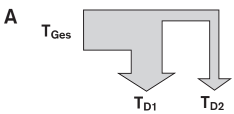
The axial piston unit A4VSO can be equipped with a through drive, as shown in the type code on page 4.
The through drive execution is designated by the code K/U 31...99.

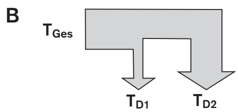
We recommend, that no more than three pumps be coupled together.

Permissible input and through drive torques

Size			40	71	125	180	250	355	500	750	1000
Splined shaft											
Max. perm. total input torque at shaft of pump 1 (Pump 1 + pump 2)	$T_{tot\ max}$	Nm	446	790	1392	2004	2782	3952	5566	8348	11130
A Perm.through drive torque	$T_{D1\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565
	$T_{D2\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565
B Perm. through drive torque	$T_{D1\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565
	$T_{D2\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565
Keyed shaft											
Max. perm. total input torque at shaft of pump 1 (Pump 1 + pump 2)	$T_{tot\ max}$	Nm	380	700	1392	1400	2300	3557	5200	7513	9444
A Perm. through drive torque	$T_{D1\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565
	$T_{D2\ max}$	Nm	157	305	696	398	909	1581	2417	3339	3879
B Perm. through drive torque	$T_{D1\ max}$	Nm	157	305	696	398	909	1581	2417	3339	3879
	$T_{D2\ max}$	Nm	223	395	696	1002	1391	1976	2783	4174	5565

Distribution of torques





Single pump with through drive

If no further pumps are factory-mounted the simple type code is sufficient.

included in this case are:

on all through drives except K/U 99
shaft coupler, mounting screws, seal and if required an adapter flange

on K/U 99
with through drive shaft, without shaft coupler, without adapter flange; unit is closed with pressure tight cover.

Universal through drive

On pump sizes 125...355 all through drives are supplied as universal through drives „U“ .

These have the advantage, that they can be adapted later on.

Simply by exchanging the adapter flange and the shaft coupler it is possible to convert the through drive option.
The conversion sets must be ordered separately, see RE 95581.

Combination pumps

Independent circuits are available for the user when further pumps are built on.

1. If the combination consists of **2 Rexroth axial piston pumps**, and if this must be **factory mounted**, the two individual type codes must be joined by a „+“ .

   Ordering example:
   A4VSO 125 DR / 30 R – PPB13K33 **+** A4VSO 71 DR / 10 R – PZB13N00

2 If a **gear** or a radial piston pump must be **factory mounted** as the second pump please consult us.

Overview of A4VSO through drive options

Through drive - A4VSO			Mounting option 2. pump					Through drive
Flange	Coupler for splined shaft [6])	Code	A4VSO/G size (shaft)	A4CSG size (shaft)	A10V(S)O/31(2) [5]) size (shaft)	A10V(S)O/52(3) size (shaft)	External/internal gear pump	available for size
Flange ISO 3019-2 (metric)								
80, 2-hole	19-4 (3/4in, 11T) [3])	**K/UB2**	–	–	18 (S)/31	10 (S)	–	71
100, 2-hole	22-4 (7/8in, 13T) [3])	**K/UB3**	–	–	28 (S)/31	–	–	40...180
	25-4 (1in, 15T) [3])	**K/UB4**	–	–	45 (S)/31	–	–	40...500
125, 2-hole	32-4 (1 1/4in, 14T) [3])	**K/UB5**	–	–	71 (S)/31	–	–	71...355
	38-4(1 1/2in, 17T) [3])	**UB6**	–	–	100 (S)/31	–	–	in preparation
125, 4-hole	W 32x2x14x9g [2])	**K/U31**	40 (Z)	–	–	–	–	40...500
140, 4-hole	W 40x2x18x9g [2])	**K/U33**	71 (Z)	–	–	–	–	71...750
160, 4-hole	W 50x2x24x9g [2])	**K/U34**	125 (Z)	–	–	–	–	125...750
			180 (Z)	–	–	–	–	180...750
	32-4 (1 1/4in, 14T) [3])	**UB8**	–	–	71 (S)/32	–	–	250
180, 4-hole	44-4 (1 3/4in, 13T) [3])	**K/UB7**	–	–	140 (S)/31/32	–	–	180... 500
	38-4 (1 1/2in, 17T) [3])	**UB9**	–	–	100 (S)/32	–	–	in preparation
224, 4-hole	W 60x2x28x9g [2])	**K/U35**	250 (Z)	250 (Z)	–	–	–	250...750
	W 70x3x22x9g [2])	**K/U77**	355 (Z)	355 (Z)	–	–	–	355, 500
315, 8-hole	W 80x3x25x9g [2])	**K43**	500 (Z)	500 (Z)	–	–	–	500, 750
400, 8-hole	W 90x3x28x9g [2])	**K76**	750 (Z)	750 (Z)	–	–	–	750
	W 100x3x32x9g [2])	**K88**	1000 (Z)	–	–	–	–	1000
Flange SAE J 744 (ISO 3019-1)								
82-2 (A) [1])	16-4 (5/8in, 9T) [3])	**K/U01**	–	–	–	–	AZ-PF-1X-004...022 [4])	40...750
	19-4 (3/4in, 11T) [3])	**K/U52**	–	–	18 (S)/31	10, 18 (S)	–	40 u. 71
101-2 (B) [1])	22-4 (7/8in, 13T) [3])	**K/U68**	–	–	28 (S)/31	28 (S)	AZ-PN-1X-020...032 [4])	40...500
	25-4 (1in, 15T) [3])	**K/U04**	–	–	45 (S)/31	45 (S)	PGH4	40...500
127-2 (C) [1])	32-4 (1 1/4in, 14T) [3])	**K/U07**	–	–	71 (S)/31	–	–	71...500
	38-4 (1 1/2in, 17T) [3])	**K/U24**	–	–	100 (S)/31	85 (S)	PGH5	125...500
152-4 (D) [1])	44-4 (1 3/4in, 13T) [3])	**K/U17**	–	–	140 (S)/31	–	–	180...500
Dia 63-4, metr.	Keyed dia 25	**K/U57**	–	–	–	–	R4	40 u. 71

[1]) 2 = 2-hole, 4 = 4-hole

[2]) to DIN 5480

[3]) Splined shafts acc. to SAEJ744 OCT83

[4]) Rexroth recommends special executions of the gear pumps. Please consult us.

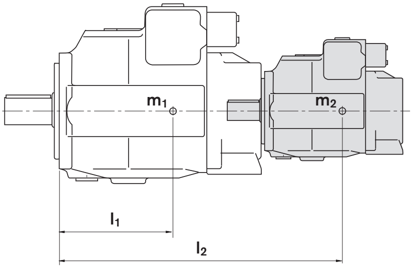
[5]) If a through drive for an A10V(S)O with R-shaft is desired, please consult us.

[6]) Keyed shaft on through drive code K/U57

2

Permissible mass moment of inertia

referred to the mounting flange of the main pump



m_1, m_2 [kg] Weight of pump

l_1, l_2 [mm] Distance center of gravity

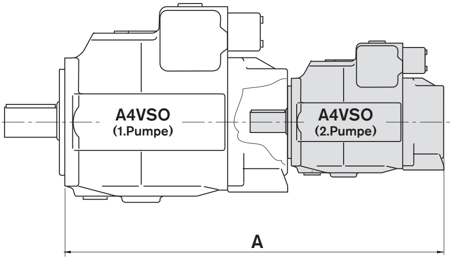
$$T_m = m_1 \bullet l_1 \bullet \frac{1}{102} + m_2 \bullet l_2 \bullet \frac{1}{102} \text{ [Nm]}$$

Size			40	71	125	180	250	355	500	750	1000
Perm. mass moment of inertia	$T_{m\ perm.}$	Nm	1800	2000	4200	4200	9300	9300	15600	19500	19500
Perm. mass moment at dynam. acceleration of 10 g ≙ 98,1 m/sec^2	$T_{m\ perm.}$	Nm	180	200	420	420	930	930	1560	1950	1950
Weight (A4VSO...DR)	m	kg	39	53	88	102	184	207	320	460	605
Distance center of gravity	l_1	mm	120	140	170	180	210	220	230	260	290

Dimensions combination pumps

Before finalising your design please request a certified installation drawing. Dimensions in mm.

A4VSO + A4VSO



Overall lenght A

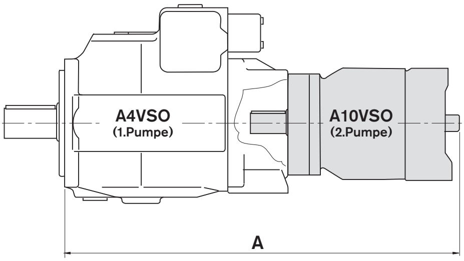
A4VSO (1. pump)	A4VSO..DR..N00 (2. pump) Size 40	Size 71	Size 125	Size 180	Size 250	Size 355	Size 500	size 750	Size 1000
Size 40	554	–	–	–	–	–	–	–	–
Size 71	582	611	–	–	–	–	–	–	–
Size 125	635	664	724	–	–	–	–	–	–
Size 180	659	688	748	768	–	–	–	–	–
Size 250	719	748	808	828	904	–	–	–	–
Size 355	748	777	837	857	933	962	–	–	–
Size 500	771	800	860	880	976	1005	1110	–	–
Size 750	821	850	910	930	1026	1055	1160	1214	–
Size 1000	*	*	*	*	*	*	*	*	1368

* on request

Dimensions combination pumps

Before finalising your design please request a certified installation drawing. Dimensions in mm.

A4VSO + A10VSO



Overall lenght A

A4VSO (1. pump)	A10VSO.../31 (2. pump) Size 18	Size 28	Size 45	Size 71	Size 100	Size 140
Size 40	458	496	514	–	–	–
Size 71	486	497	540	580	–	–
Size 125	564	575	593	628	698	–
Size 180	588	599	617	652	722	744
Size 250	648	659	677	712	782	791
Size 355	*	*	706	741	*	820
Size 500	700	711	729	764	857	868
Size 750	750	761	779	812	907	917
Size 1000	*	*	*	*	*	*

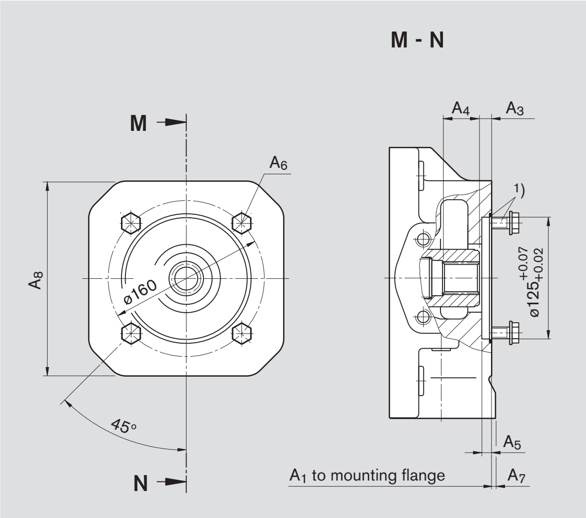
* on request

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K31 **Flange** ISO 3019-2 125, 4-hole
Shaft coupler to DIN 5480 N32x2x14x8H

for mounting an A4VSO/G 40 splined shaft



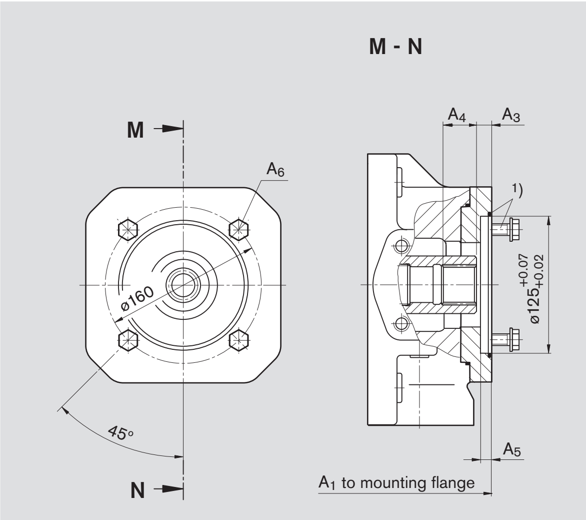
Size	A_1	A_3	A_4	A_5	A_6 [2]
40	288	12,5	40	9	M12
71	316	12,5	33,6	9	M12
500	505	12,5	38,5	9	M12
750	in preparation				
1000	in preparation				

Size	A_7	A_8
40	–	–
71	–	–
500	15	240
750	in preparation	
1000	in preparation	

2

U31 **Flange** ISO 3019-2 125, 4-hole
Shaft coupler to DIN 5480 N32x2x14x8H

for mounting an A4VSO/G 40 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 [2]
125	369	12,5	35,6	9	M12
180	393	12,5	35,6	9	M12
250	453	12,5	38	9	M12
355	482	12,5	38	9	M12

[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

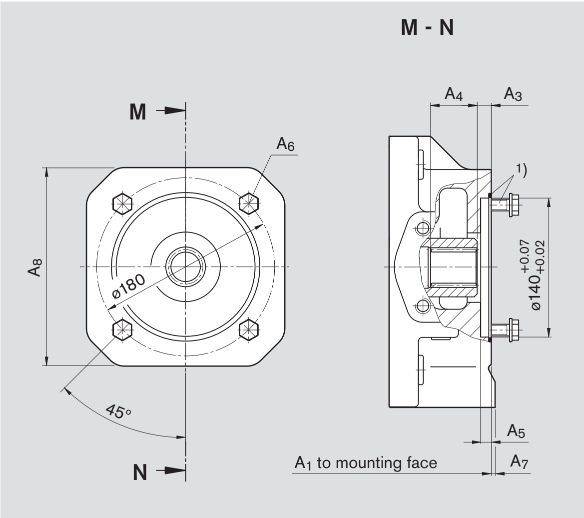
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K33

Flange ISO 3019-2 140, 4-hole
Shaft coupler to DIN 5480 N40x2x18x8H

for mounting an A4VSO/G 71 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 [2]
71	316	11,5	42,8	9	M12
500	505	12,5	57	9	M12
750	555	12,5	44,5	9	M12
750 *	in preparation				
1000	in preparation				

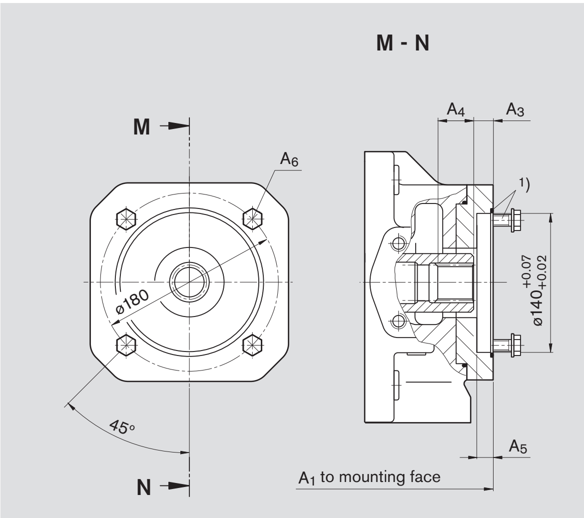
Size	A_7	A_8
71	–	–
500	15	240
750	–	–
750 *	in preparation	
1000	in preparation	

* with boost pump

U33

Flange ISO 3019-2 140, 4-hole
Shaft coupler to DIN 5480 N40x2x18x8H

for mounting an A4VSO/G 71 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 [2]
125	369	12,5	43,8	9	M12
180	393	12,5	43,8	9	M12
250	453	12,5	48,9	9	M12
355	482	12,5	48	9	M12

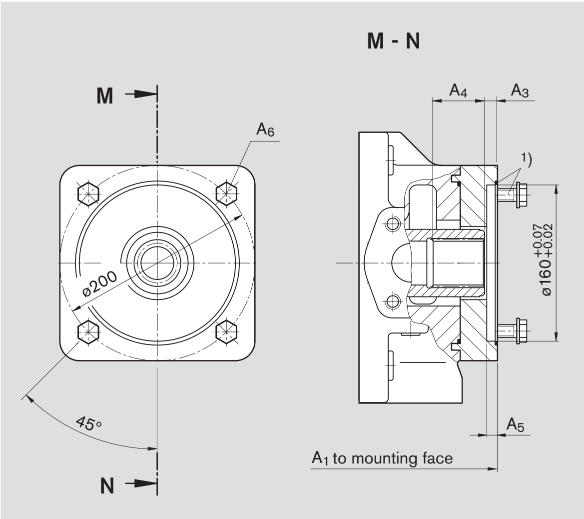
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K34 **Flange** ISO 3019-2 160, 4-hole
Shaft coupler to DIN 5480 N50x2x24x8H

for mounting an A4VSO/G 125 or 180 splined shaft

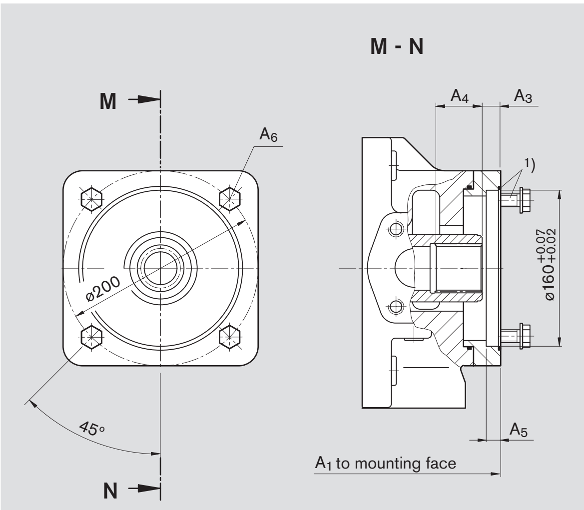


Size	A_1	A_3	A_4	A_5	A_6 2)
500	505	13,5	54,5	9	M16
750	555	12,5	55,5	9	M16
750 *	in preparation				
1000	in preparation				

* with boost pump

U34 **Flange** ISO 3019-2 160, 4-hole
Shaft coupler to DIN 5480 N50x2x24x8H

for mounting an A4VSO/G 125 or 180 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 2)
125	369	12,5	51,6	9	M16
180	393	12,5	51,6	9	M16
250	453	12,5	54	9	M16
355	482	12,5	54	9	M16

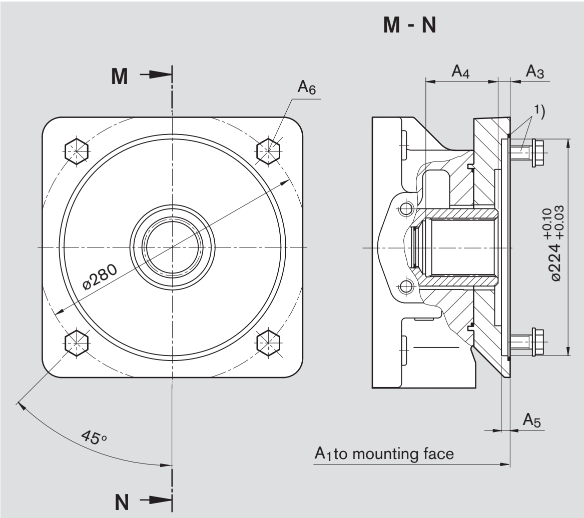
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K35 **Flange** ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N60x2x28x8H

for mounting an A4VSO/G or A4CSG 250 splined shaft

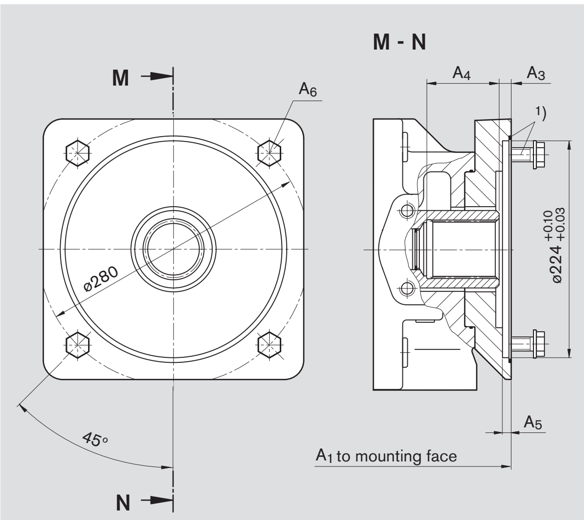


Size	A_1	A_3	A_4	A_5	A_6 2)
500	541	12,5	74	9	M20
750	591	12,5	74	9	M20
750*	in preparation				
1000	in preparation				

* with boost pump

U35 **Flange** ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N60x2x28x8H

for mounting an A4VSO/G or A4CSG 250 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 2)
250	469	12,5	75	9	M20
355	498	12,5	75	9	M20

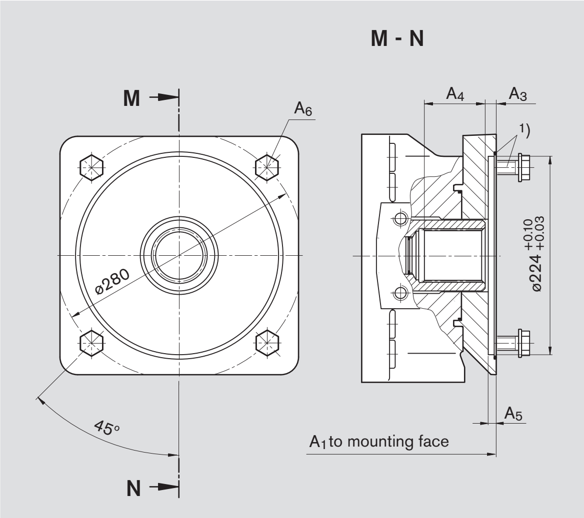
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K77 **Flange** ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N70x3x22x8H

for mounting an A4VSO/G or A4CSG 355 splined shaft

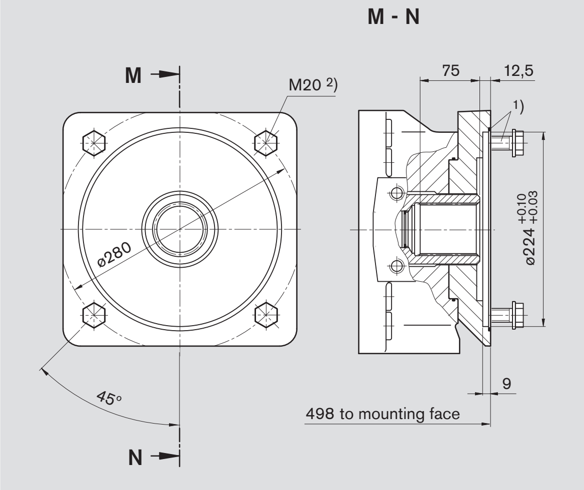


Size	A_1	A_3	A_4	A_5	A_6 2)
500	541	12,5	76	9	M20
750	in preparation				
1000	in preparation				

U77 **Flange** ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N70x3x22x8H

for mounting an A4VSO/G or A4CSG 355 splined shaft

Size 355



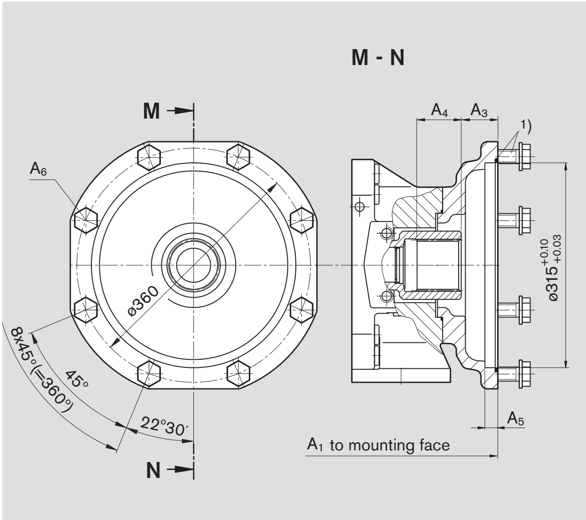
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K43 **Flange** ISO 3019-2 315, 8-hole
Shaft coupler to DIN 5480 N80x3x25x8H

for mounting an A4VSO/G or A4CSG 500 splined shaft

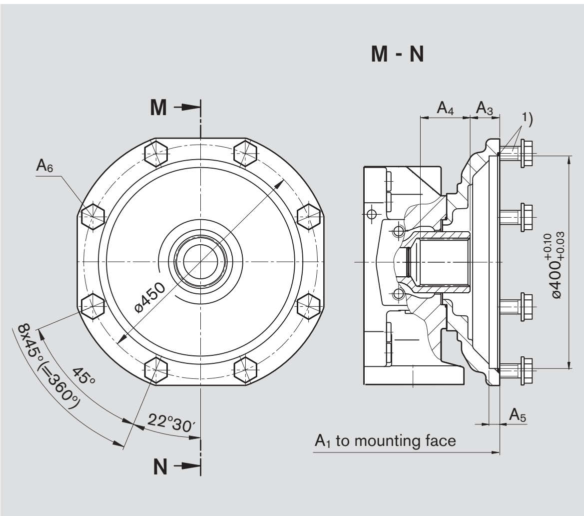


Size	A_1	A_3	A_4	A_5	A_6 2)
500	590	53,5	71,9	19	M20
750	640	53,5	71,9	19	M20
750*	in preparation				
1000	in preparation				

* with boost pump

K76 **Flange** ISO 3019-2 400, 8-hole
Shaft coupler to DIN 5480 N90x3x28x8H

for mounting an A4VSO/G or A4CSG 750 splined shaft



Size	A_1	A_3	A_4	A_5	A_6 2)
750	655	104	53	19	M20
750*	in preparation				
1000	in preparation				

* with boost pump

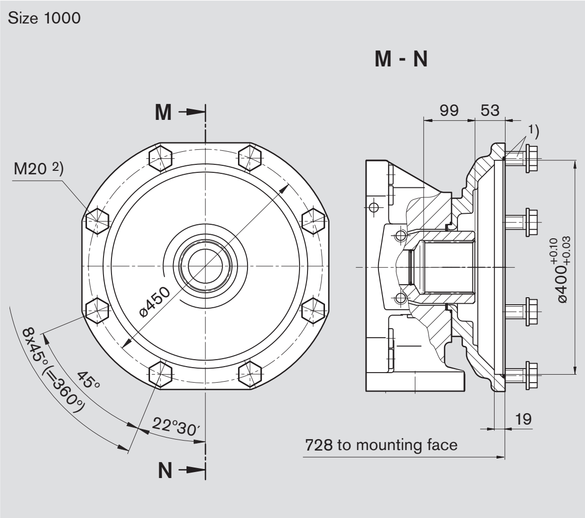
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

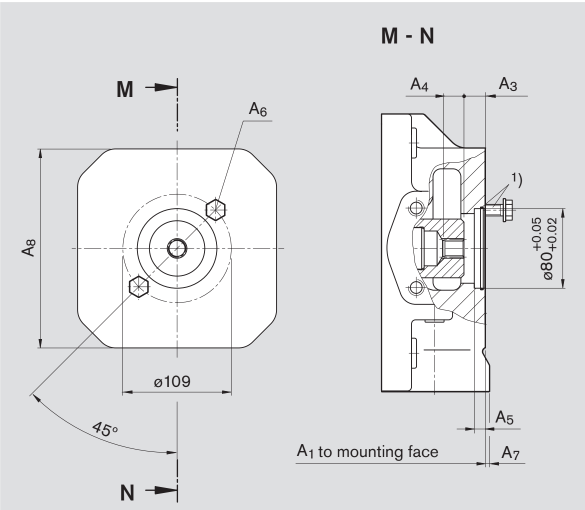
K88 **Flange** ISO 3019-2 400, 8-hole
Shaft coupler to DIN 5480 N100x3x32x8H

for mounting an A4VSO/G 1000 splined shaft



KB2 **Flange** ISO 3019-2 80, 2-hole
Shaft coupler for splined shaft, 19-4 SAE A-B, 3/4 in, 16/32 DP; 11T [3])

for mounting an A10VSO 18/31 shaft S – see RE 92712 or an A10VSO 10/52 shaft S – see RE 92703



Size	A_1	A_3	A_4	A_5	A_6 [2])
40	in preparation				
71	291	21,5	19	10	M10
500	in preparation				
750	in preparation				
1000	in preparation				

Size	A_7	A_8
40	in preparation	
71	2	140
500	in preparation	
750	in preparation	
1000	in preparation	

Sizes 125...355 with U-through drive in preparation

[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

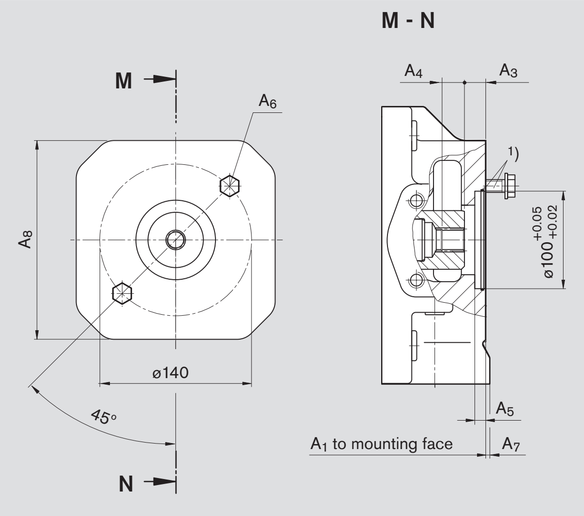
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

KB3

Flange ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft, 22-4 SAE B, 7/8 in, 16/32 DP; 13T [3])

for mounting an A10VSO 28/31 splined shaft S (see RE 92711)



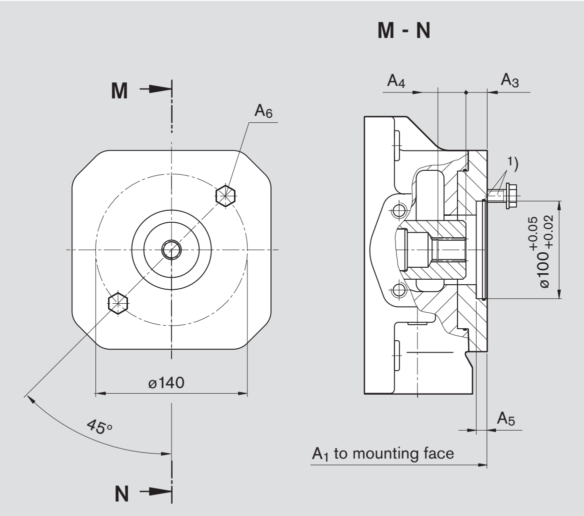
Size	A_1	A_3	A_4	A_5	A_6 [2])
40	290	20,3	23	10	M12
71	291	20,4	23	10	M12
500	in preparation				
750	in preparation				
1000	in preparation				

Size	A_7	A_8
40	–	–
71	2	140
500	in preparation	
750	in preparation	
1000	in preparation	

UB3

Flange ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft, 22-4 SAE B, 7/8 in, 16/32 DP; 13T [3])

for mounting an A10VSO 28/31 splined shaft S (see RE 92711)



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	369	20,5	24,9	10	M12
180	393	20,5	24,9	10	M12
250	in preparation				
355	in preparation				

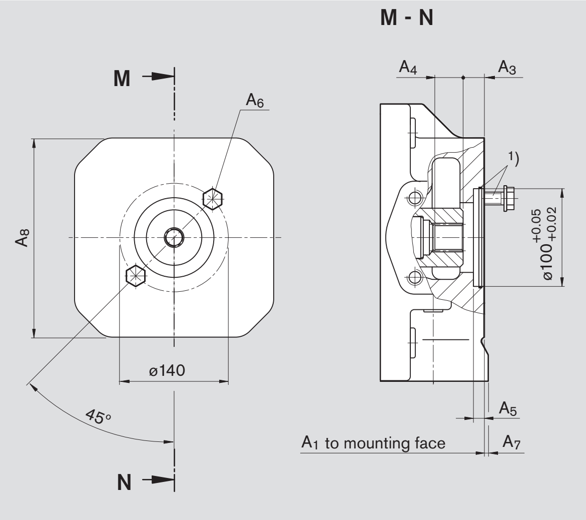
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30°pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

KB4 **Flange** ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft, 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VSO 45/31 splined shaft S – see RE 92711

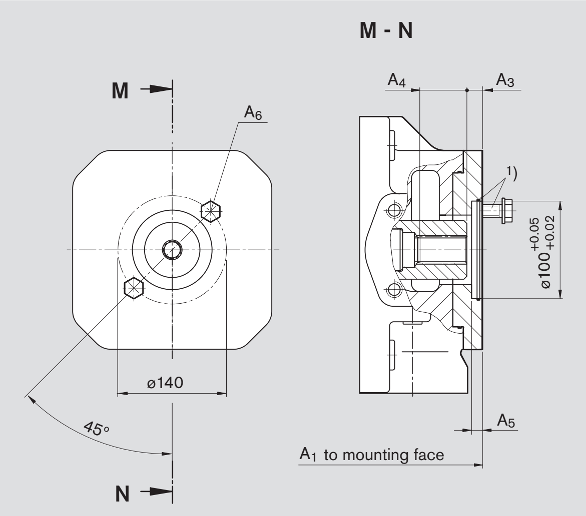


Size	A_1	A_3	A_4	A_5	A_6 [2])
40	290	20,8	27,5	10	M12
71	316	20,8	27,5	8	M12
500	505	20,4	28,9	10	M12
750	in preparation				
1000	in preparation				

Size	A_7	A_8
40	–	–
71	–	–
500	15	240
750	in preparation	
1000	in preparation	

UB4 **Flange** ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft, 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VSO 45/31 splined shaft S – see RE 92711



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	369	18,9	29,5	10	M12
180	393	18,9	29,5	10	M12
250	453	20,9	29,5	10	M12
355	482	20,9	29,5	10	M12

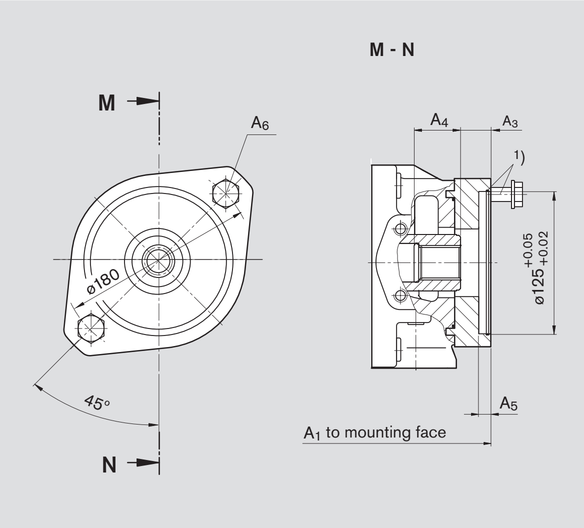
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

KB5 **Flange** ISO 3019-2 125, 2-hole
Shaft coupler for splined shaft, 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T 3)

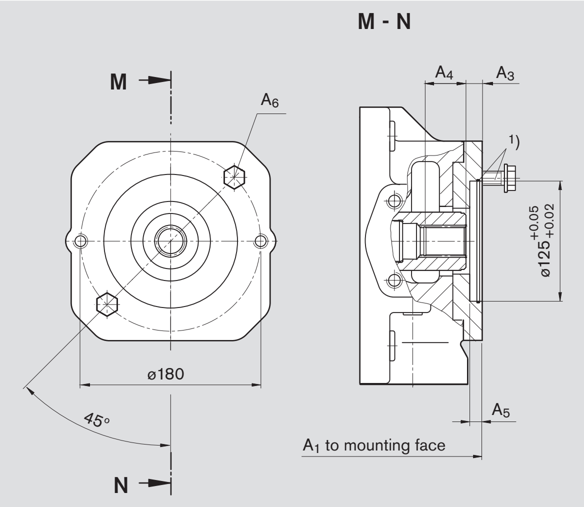
for mounting an A10VSO 71/31 splined shaft S (see RE 92711)



Size	A_1	A_3	A_4	A_5	A_6 2)
71	321	23	38	10	M20
500	in preparation				
750	in preparation				
1000	in preparation				

UB5 **Flange** ISO 3019-2 125, 2-hole
Shaft coupler for splined shaft, 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T 3)

for mounting an A10VSO 71/31 splined shaft S (see RE 92711)



Size	A_1	A_3	A_4	A_5	A_6 2)
125	369	20	38	9	M16
180	393	20	38	9	M16
250	453	20,9	37,9	9	M16
355	482	20,9	37,9	9	M16

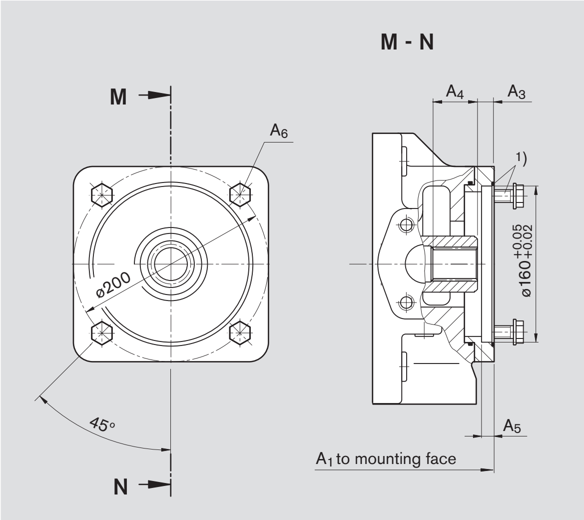
1) 2 mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
3) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

UB8 **Flange** ISO 3019-2 160, 4-hole
Shaft coupler for splined shaft, 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T [3])

for mounting an A10VSO 71/32 splined shaft S (see RE 92714)



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	in preparation				
180	in preparation				
250	453	20,9	38	9	M16
355	in preparation				

[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

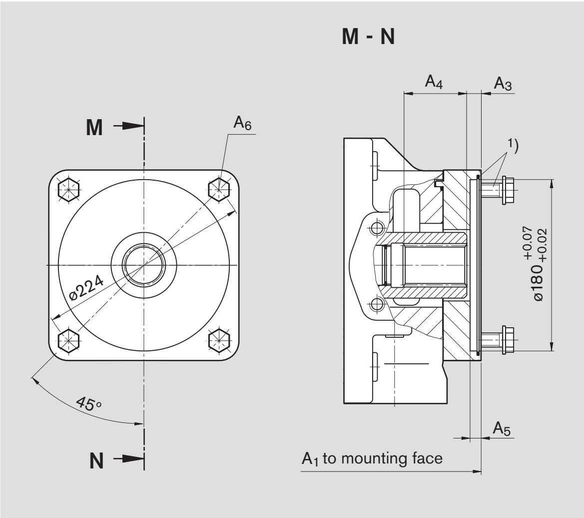
2

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

KB7 **Flange** ISO 3019-2 180, 4-hole
Shaft coupler for splined shaft, 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T [3])

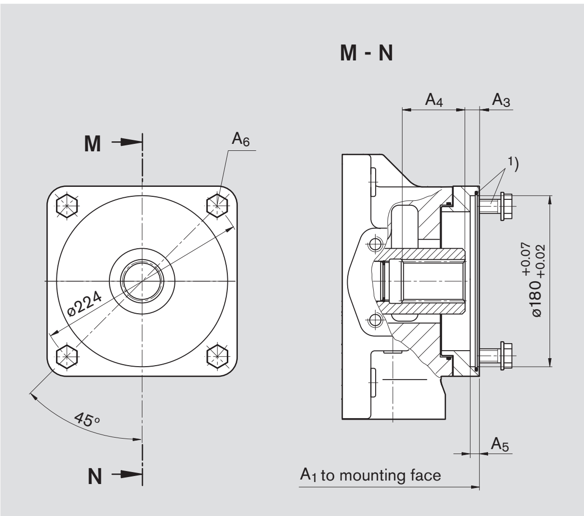
for mounting an A10VSO 140/31(32) splined shaft S – see RE 92711 (RE 92714)



Size	A_1	A_3	A_4	A_5	A_6 [2])
500	530	10,4	63,6	10	M16
750	in preparation				
1000	in preparation				

UB7 **Flange** ISO 3019-2 180, 4-hole
Shaft coupler for splined shaft, 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T [3])

for mounting an A10VSO 140/31(32) splined shaft S – see RE 92711 (RE 92714)



Size	A_1	A_3	A_4	A_5	A_6 [2])
180	406	10,6	62	9	M16
250	453	10,6	64	9	M16
355	482	10,6	64	9	M16

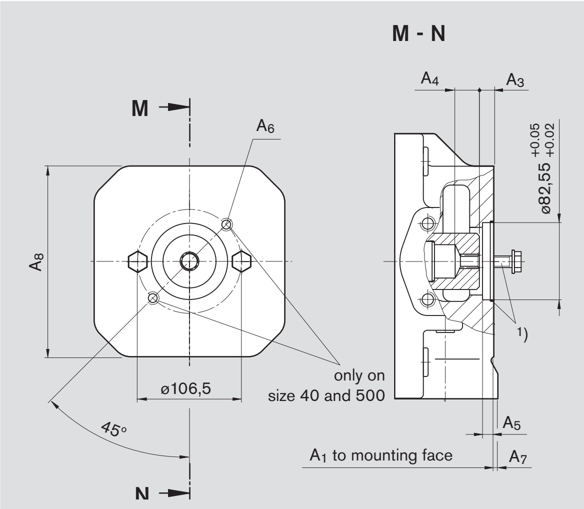
[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K01 **Flange** ISO 3019-1 82-2 (SAE A)
Shaft coupler for splined shaft, 16-4 SAE A, 5/8 in, 16/32 DP; 9T 3)

for mounting an external gear pump AZ-PF-1X-004 ... 022 (see RE 10089)
Rexroth recommends a special execution of the gear pump, please consult us



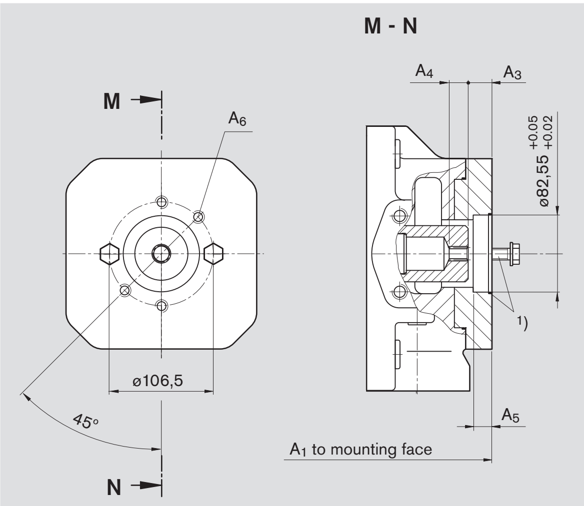
Size	A_1	A_3	A_4	A_5	A_6 2)
40	263	10,3	25,9	10	M10
71	291	10,3	24,6	10	M10
500	505	10,3	32,7	10	M10
750	555	10,3	32,7	10	M10
750*	in preparation				
1000	in preparation				

NG	A_7	A_8
40	–	–
71	2	140
500	15	240
750	–	–
750*	in preparation	
1000	in preparation	

* with boost pump

U01 **Flange** ISO 3019-1 82-2 (SAE A)
Shaft coupler for splined shaft, 16-4 SAE A, 5/8 in, 16/32 DP; 9T 3)

for mounting an external gear pump AZ-PF-1X-004 ... 022 (see RE 10089)
Rexroth recommends a special execution of the gear pump, please consult us



Size	A_1	A_3	A_4	A_5	A_6 2)
125	369	16	19,4	13	M10
180	393	16	19,4	13	M10
250	453	16	19,4	13	M10
355	482	16	19,4	13	M10

1) 2 mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
3) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

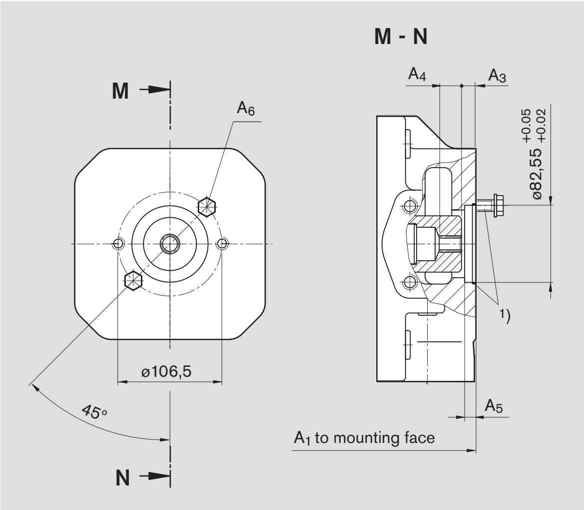
2

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K52 **Flange** ISO 3019-1 82-2 (SAE A)
Shaft coupler for splined shaft, 19-4 SAE A-B, 3/4 in, 16/32 DP; 11T [3])

for mounting an A10VSO 18/31 splined shaft S (see RE 92711) or A10VSO10 or 18/52 splined shaft S (see RE 92703)



Size	A_1	A_3	A_4	A_5	A_6 [2])
40	263	10,5	33,8	10	M10
71	315	10,5	30	10	M10
500	in preparation				
750	in preparation				
1000	in preparation				

Sizes 125...355 with U-through drive in preparation

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

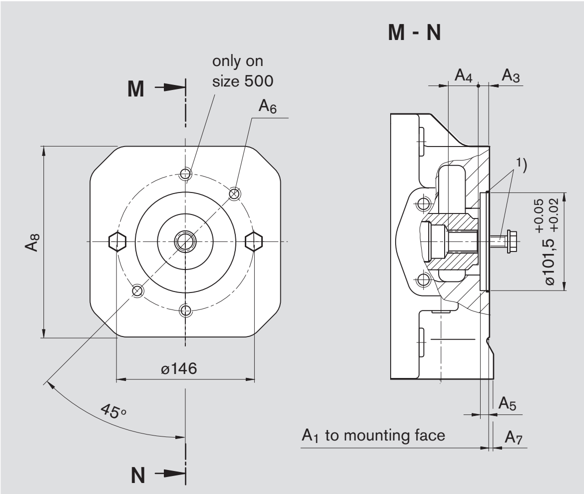
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensionse in mm.

K68

Flange ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13T ³)

for mounting an external gear pump AZ-PN-1X020...032 (see RE 10091 or an A10VO 28/31 and 52(53) splined shaft S (see RE 92701 and 92703)
Rexroth recommends a special excution of the gear pump, please consult us



Size	A_1	A_3	A_4	A_5	A_6 ²)
40	290	20,4	23,1	10	M12
71	322	10,4	35,1	10	M12
500	505	19,5	25	10	M12
750	in preparation				
1000	in preparation				

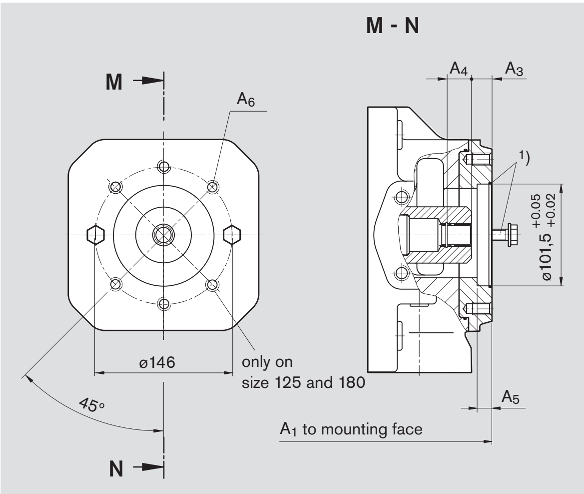
Size	A_7	A_8
40	–	–
71	–	–
500	15	240
750	in preparation	
1000	in preparation	

2

U68

Flange ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13T ³)

for mounting an external gear pump AZ-PN-1X020...032 (see RE 10091 or an A10VO 28/31 and 52(53) splined shaft S (see RE 92701 and 92703)
Rexroth recommends a special execution of the gear pump, please consult us



Size	A_1	A_3	A_4	A_5	A_6 ²)
125	369	28	25	13	M12
180	393	28	25	13	M12
250	453	19,5	23,1	13	M12
355	482	19,5	23,1	13	M12

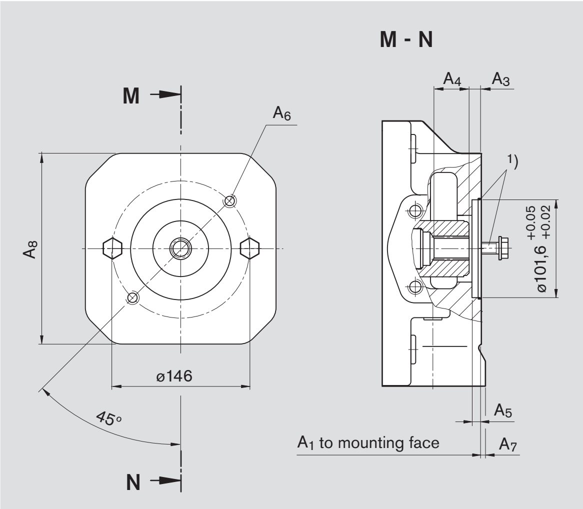
¹) 2 mounting screws and O-ring seal are included with supply
²) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
³) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K04 **Flange** ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VO 45/31 and 52 (53) splined shaft S (see RE 92701 and 92703) or an internal gear pump PGH4 (see RE 10223)

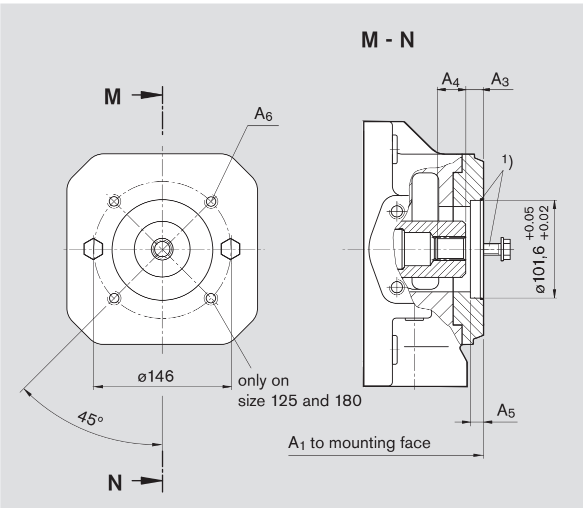


Size	A_1	A_3	A_4	A_5	A_6 [2])
40	290	10,4	37,9	10	M12
71	322	10,3	35,7	10	M12
500	505	10,3	28,9	10	M12
750	in preparation				
1000	in preparation				

Size	A_7	A_8
40	–	–
71	–	–
500	15	240
750	in preparation	
1000	in preparation	

U04 **Flange** ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VO 45/31 and 52 (53) splined shaft S (see RE 92701 and 92703) or an internal gear pump PGH4 (see RE 10223)



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	369	18,9	29,4	13	M12
180	393	18,9	29,4	13	M12
250	453	18,9	29,4	13	M12
355	482	18,9	29,4	13	M12

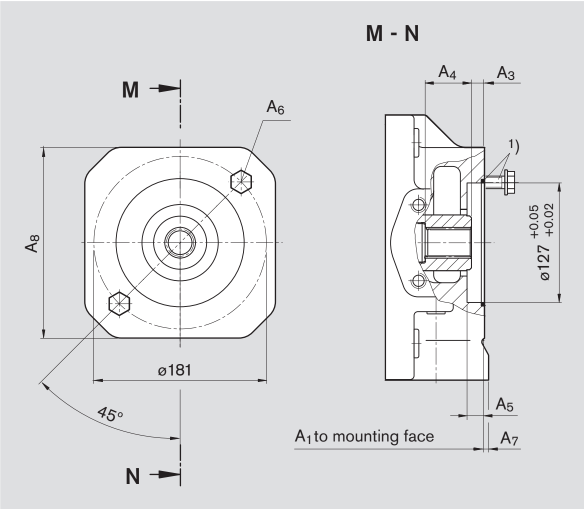
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K07 **Flange** ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T [3])

for mounting an A10VO 71/31 splined shaft S (see RE 92701)

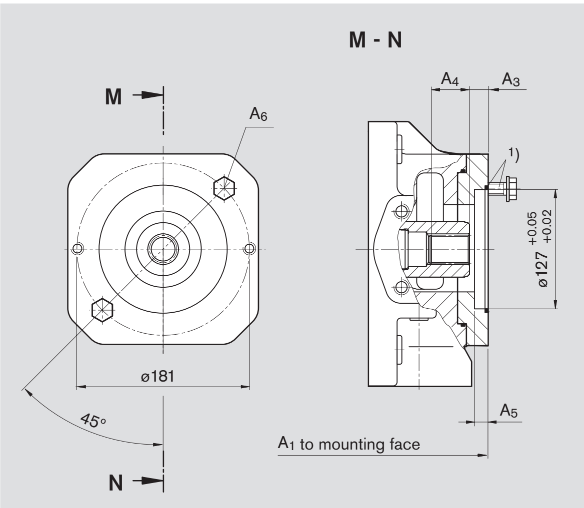


Size	A_1	A_3	A_4	A_5	A_6 [2])
71	321	10,4	47,6	13	M16
500	505	11,3	40,2	13	M16
750	in preparation				
1000	in preparation				

Size	A_7	A_8
71	–	–
500	15	240
750	in preparation	
1000	in preparation	

U07 **Flange** ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T [3])

for mounting an A10VO 71/31 splined shaft S (see RE 92701)



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	369	20,9	37,9	13	M16
180	393	20,9	37,9	13	M16
250	453	20,9	37,9	13	M16
355	482	20,9	37,9	13	M16

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

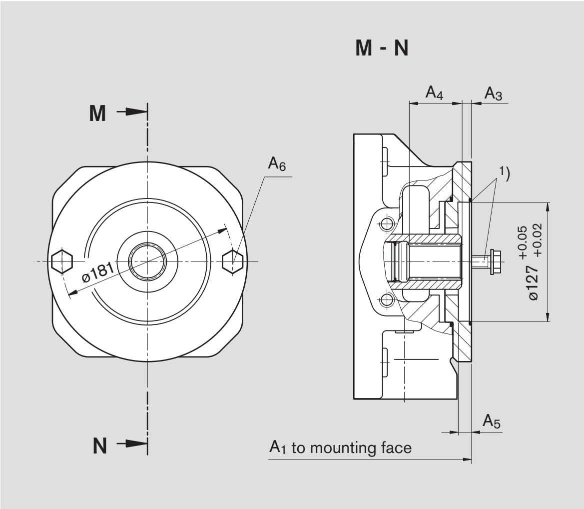
2

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K24 **Flange** ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17T [3])

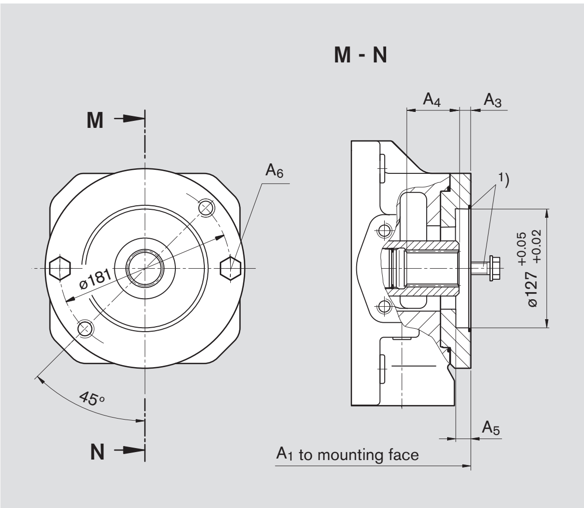
for mounting an A10VO 100/31 splined shaft S (see RE 92701) or an A10VO 85/52(53) splined shaft S (see RE 92703) or an internal gear pump PGH5 (see RE 10223)



Size	A_1	A_3	A_4	A_5	A_6 [2])
500	505	10,3	56,7	13	M16
750	in preparation				
1000	in preparation				

U24 **Flange** ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17T [3])

for mounting an A10VO 100/31 splined shaft S (see RE 92701) or an A10VO 85/52(53) splined shaft S (see RE 92703) or an internal gear pump PGH5 (see RE 10223)



Size	A_1	A_3	A_4	A_5	A_6 [2])
125	369	10,4	50	13	M16
180	393	10,4	50	13	M16
250	453	12,4	55	13	M16
355	482	12,4	55	13	M16

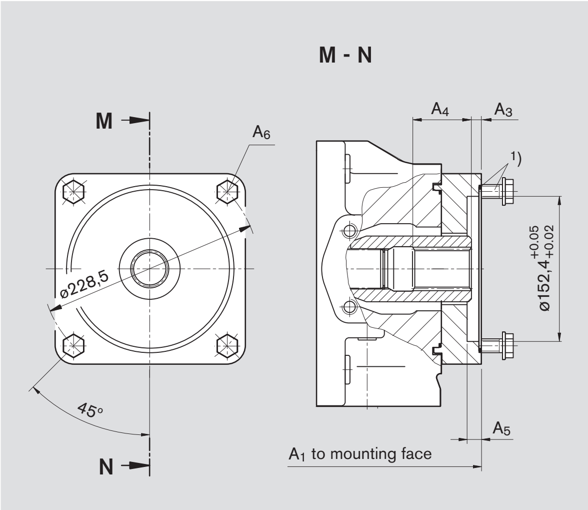
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K17 **Flange** ISO 3019-1 152-4 (SAE D)
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T 3)

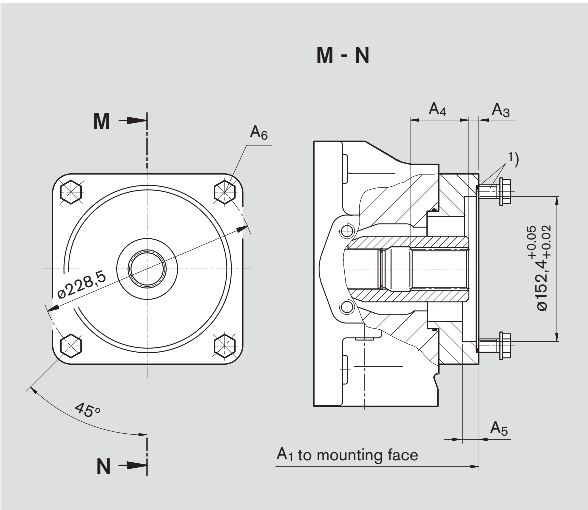
for mounting an A10VO 140/31 splined shaft S (see RE 92701)



Size	A_1	A_3	A_4	A_5	A_6 2)
500	505	10,4	59,6	13	M16
750	in preparation				
1000	in preparation				

U17 **Flange** ISO 3019-1 152-4 (SAE D)
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T 3)

for mounting an A10VO 140/31 splined shaft S (see RE 92701)



Size	A_1	A_3	A_4	A_5	A_6 2)
180	406	10,4	62	13	M16
250	453	10,6	62	13	M16
355	482	10,6	62	13	M16

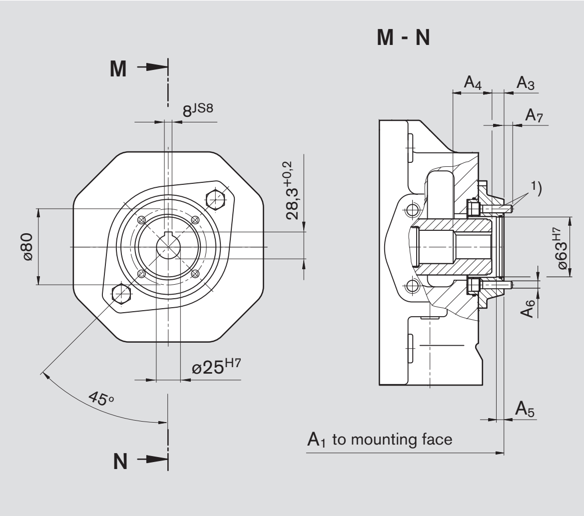
1) 2 mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 68
3) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K57 **dia. 63 metric**, 4-hole
Shaft coupler for keyed shaft dia. 25

for mounting a radial piston pump R4 (see RE 11263)



Size	A_1	A_3	A_4	A_5	A_6 [2]	A_7
40	288	11	56	8	M8	9
71	319	10,9	42	8	M8	9
500	in preparation					
750	in preparation					

Sizes 125...355 with U-through drive in preparation

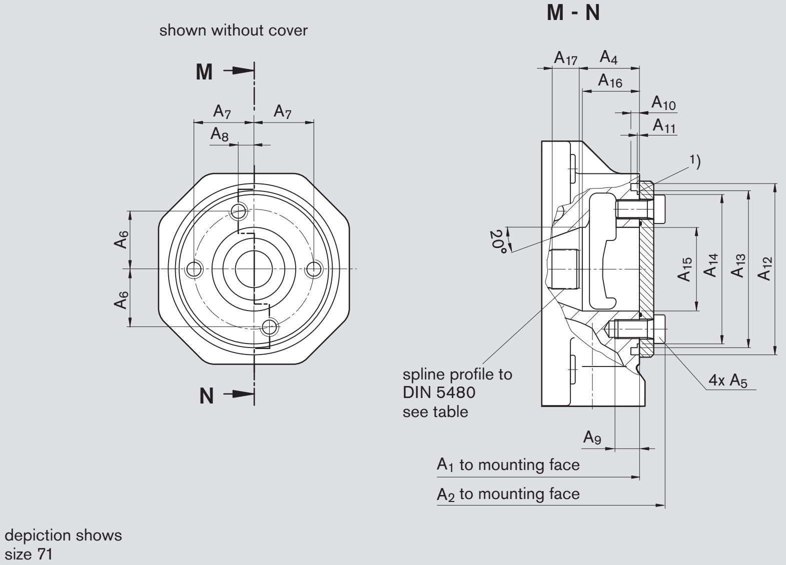
[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 68

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K99 Sizes 40 and 71

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



Size Main pump	A_1	A_2	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}
40	263	280	$51.3^{\pm1}$	M12x25	$37^{\pm0.2}$	$37^{\pm0.2}$	0	18	9	$2.3^{+0.1}$	ø118	ø105_{g6}
71	291	310	$48^{\pm1}$	M12x25	$42{,}3^{\pm0{,}15}$	$45^{\pm0{,}15}$	$15.4^{\pm0.15}$	18	9	$2.7^{+0.1}$	ø130	ø116_{g6}

Size Main pump	A_{14}	A_{15}	A_{16}	A_{17}	Spline profile to DIN 5480	1) O-Ring for retrofitting (not in supply)
40	ø$97.6_{-0.4}$	ø52	44	14	W25x1,25x18x9g	99 x 3
71	ø$106.4_{-0.4}$	ø63	38	16	W30x1,25x22x9g	110,72 x 3,53

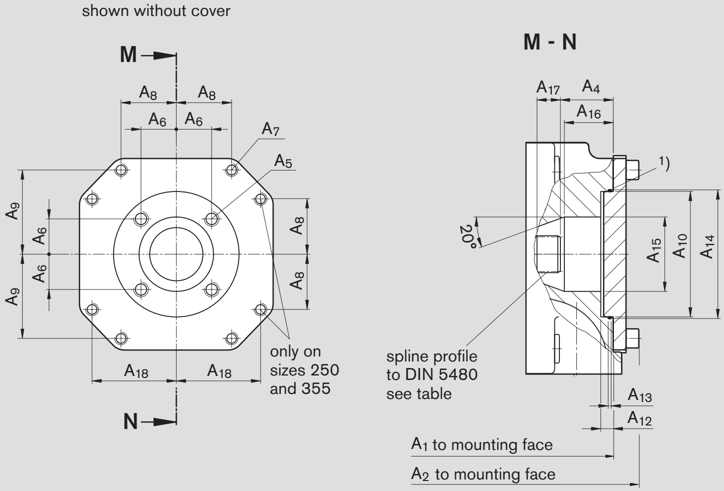
Sizes 125...1000 see pages 65 and 66

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

U99 Sizes 125...355

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



Size Main pump	A_1	A_2	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{12}	A_{13}
125	347	368	$49.7^{\pm 1}$	M14; 15 deep	$33,2^{+0.15}$	M12; 18 deep	–	$79,2^{+0.15}$	ø118^{H7}	9	$2,8^{+0,2}$
180	371	392	$49.7^{\pm 1}$	M14; 15 deep	$33,2^{+0.15}$	M12; 18 deep	–	$79,2^{+0.15}$	ø118^{H7}	9	$2,8^{+0,2}$
250	431	455	$61.4^{\pm 1}$	M20; 22 deep	$44,5^{+0.15}$	M10; 15 deep	$58,15^{+0.15}$	$86,2^{+0.15}$	ø160^{H7}	9	$2,8^{+0,2}$
355	460	487	$61.4^{\pm 1}$	M20; 22 deep	$44,5^{+0.15}$	M10; 15 deep	$58,15^{+0.15}$	$86,2^{+0.15}$	ø160^{H7}	9	$2,8^{+0,2}$

Size Main pump	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}	Spline profile to DIN 5480	1) O-Ring for retrofitting (included in supply)
125	ø$121^{+0.1}$	ø70	46	22	–	W35x1,25x26x9g	118 x 2
180	ø$121^{+0.1}$	ø70	46	25	–	W35x1,25x26x9g	118 x 2
250	ø$163^{+0.1}$	ø87	64	30,5	$86,2^{+0,15}$	W42x1,25x32x9g	160 x 2
355	ø$163^{+0.1}$	ø87	64	34	$86,2^{+0,15}$	W42x1,25x32x9g	160 x 2

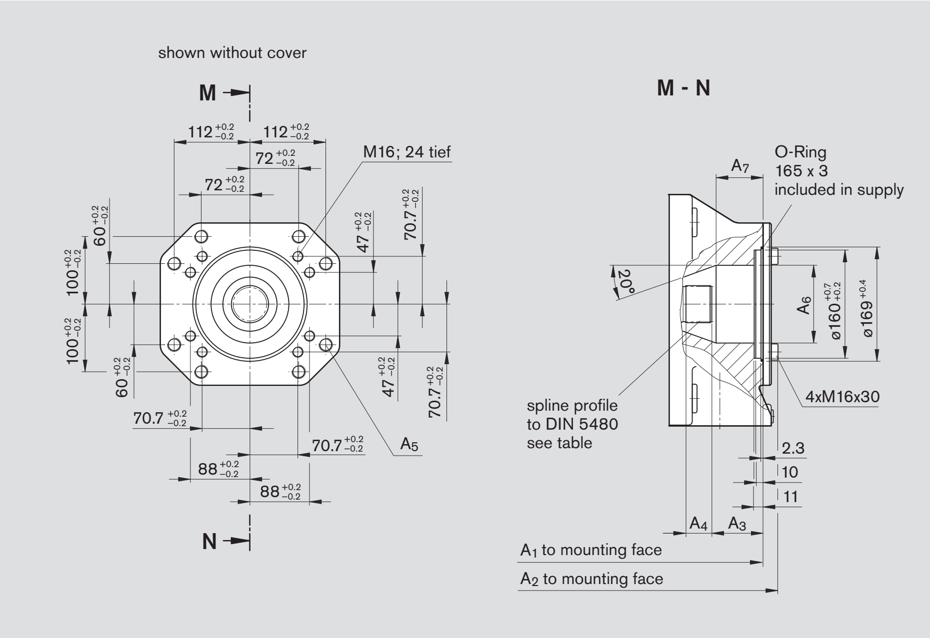
Sizes 500...1000 see page 66

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in mm.

K99 Sizes 500...1000

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



Size Main pump	A_1	A_2	A_3	A_4	A_5	A_6	A_7	Spline profile to DIN 5480
500	505	527	73	41	M20; 24 deep	ø115	75	W55x1,25x42x9g
750	555	577	73	41	M20: 24 deep	ø115	75	W55x1,25x42x9g
750*	in preparation							
1000	628	650	77	66,5	M20; 30 deep	ø138	65	W65x1,25x50x9g

* with boost pump

Sizes 40 and 71 see page 64 and sizes 125...355 see page 65

Installation notes

Mounting position:

Optional. The pump case must be filled with fluid during commissioning and remain full when operating.
In order to reduce the operating noise level, all connecting lines (suction, pressure and case drain lines) must be de-coupled from the tank, using flexible elements.
The use of check valves in the case drain line must be avoided. The case drain line must be returned directly to tank without a reduction in cross section.
Exceptions maybe possible, please consult us first.

1. **Vertical installation** (shaft end pointing upwards)
   With a vertical installation, bearing flushing is recommended to provide lubrication for the front bearing, see page 6.

   The following installation conditions must be taken into account:

1.1 Installation into the reservoir

a) When the minimum fluid level is equal to or above the pump mounting flange area: ports »R/L«, »T« and »S« open (see fig. 1).

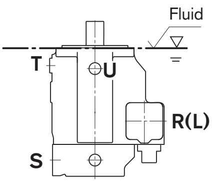


Fig. 1

b) When the minimum fluid level is below the mounting flange area: ports»R/L«,»T« und possibly »S« must be piped as shown in fig. 2. Also observe the conditions as shown in point 1.2.

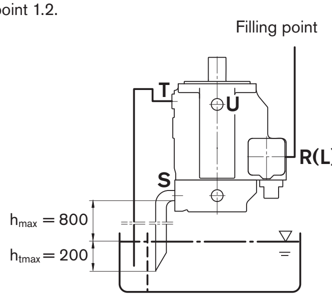


Fig. 2

1.2 Installation outside the reservoir

Before installation, fill the pump housing with the pump in a horizontal position.
Pipe port »T« to tank, »R/L« plugged.
Filling in mounted condition: fill via »R« and bleed via»T«, afterwards plug port»R«.
Conditions: A minimum pump inlet pressure (suction pressure) of 0,8 bar abs. is necessary. Avoid mounting above the reservoir in order to reduce the noise level.

2. **Horizontal installation**
   The highest situated of the ports»T«,»K_1«, »K_2« or »R/L« must be used for filling/bleeding and subsequently to connect the case drain line.

2.1 Installation inside the reservoir

a) When the minimum fluid level is equal to or lies above the upper edge of the pump: case drain port and suction port »S« open (see fig. 3).

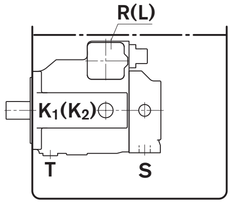


Fig. 3

b) When the minimum fluid level lies below the upper edge of the pump: case drain port and possibly port »S« must be piped, see fig. 4. Observe conditions as shown in point 1.2.

Fill pump housing prior to commissioning.

2.2 Installation outside the reservoir

Fill the pump housing before commissioning.
a) Mounting above the reservoir see fig. 4.
Observe conditions as shown in point 1.2.
b) Mounting below the reservoir
Case drain port and port »S« must be piped (see fig. 5).

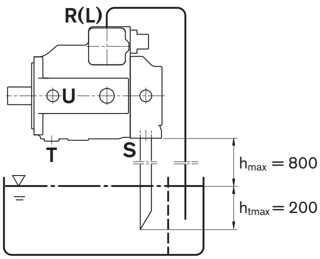


Fig. 4

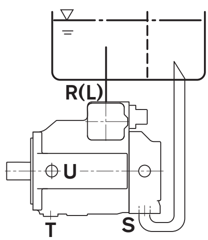


Fig. 5

Notes

General information

– The pump A4VSO was designed for operation in open loop circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques:
  - All tightening torques mentioned in this data sheet are maximum values and may not be exceeded (Maximum values for the female threads in the castings).
    Please comply with the manufacturer's information regarding the max. permissible tightening torques for the used fittings.
  - For fastening screws to DIN 13 we recommend to check the permissible tightening torque in each individual case acc. to VDI 2230 issue 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot. Take suitable safety measures (e.g. wear protective clothing).

– All given data and information has to be adhered to.

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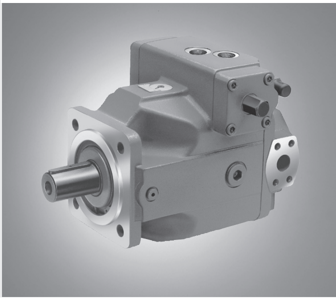
Rexroth
Bosch Group

Axial Piston Variable Pump A4VSO for HFC Fluids

RE 92053/03.09 **1**/8
Supplementary to RE 92050
Replaces: 02.05

Data sheet



Series 10, 11 and 30
Size NG71 to 355
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

Contents

Ordering code for standard program	2
Technical data	3
Installation notes	7
Safety information	8

Features

- Axial piston pump in swash plate design for hydrostatic drives in open circuit operation
- Especially suitable for operation with HFC fluids
- With the approved HFC fluids the units can be operated with the same speeds and pressures as on mineral oil
- The flow is proportional to the input drive speed and displacement. By adjusting the swash plate angle it is possible to infinitely vary the output flow.
- Good suction characteristics
- Low noise level
- Long service life
- High power/weight ratio
- Drive shaft capable of absorbing axial and radial loads
- Modular design
- Short control times
- Through drive and pump combinations possible
- Swivel angle indicator
- Optional mounting position

Note

This data sheet shows only the particular information which is valid for operation of the axial piston pump with HFC-fluids.
All fundamental details on the A4VSO must be taken from the main data sheet RE 92050.

Ordering code for standard program

A4VS	O			/			–	F					
01	02	03	04		05	06		07	08	09	10	11	12

Axial piston unit

01	Swashplate design, variable	**A4VS**

Type of operation

02	Pump, open circuit	**O**

Size

				71	125	180	250	355	
03	Displacement $V_{g\,max}$ in cm^3			71	125	180	250	355	

Control device

				71	125	180	250	355	
04	Pressure control	(RE 92060)	DR	❍	●	●	●	●	**DR..**
	Pressure control for parallel operation	(RE 92060)	DP	❍	●	●	●	●	**DP..**
	Flow control	(RE 92060)	FR	❍	●	●	●	●	**FR..**
	Pressure and flow control	(RE 92060)	DFR	❍	●	●	●	●	**DFR..**
	Power control with hyperbolic curve	(RE 92064)	LR	❍	●	●	●	●	**LR..**[1]
	Manual control	(RE 92072)	MA	❍	●	●	●	●	**MA..**
	Electric motor control	(RE 92072)	EM	❍	●	●	●	●	**EM..**
	Hydraulic control, control volume dependent	(RE 92076)	HM	❍	●	●	●	●	**HM..**
	Hydr. control, with servo/proportional valve	(RE 92076)	HS	❍	●	●	●	●	**HS..**[1]
	Electronic control	(RE 92076)	EO	❍	●	●	●	●	**EO..**[1]
	Hydraulic control, pilot pressure dependent	(RE 92080)	HD	❍	●	●	●	●	**HD..**[1]
	Electro-hydraulic control system DFE1 System solution SYHDFEE	(RE 92088) (RE 30035)		❍	●	●	●	●	**DFE1..**[1]

Series

		71	125	180	250	355	
05		❍	–	–	–	–	**10(11)**[2]
		–	●	●	●	●	**30**

Direction of rotation

06	With view on drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals and fluid

07	NBR Nitrile-rubber, shaft seal PTFE Teflon, special version for HFC-fluids	**F**

08	**Shaft end**	For further details see: RE 92050 – A4VSO index number 10 to 14
09	**Mounting flange**	
10	**Ports for service connections**	
11	**Through drive**	
12	**Filtration**	

[1] On operation with HFC-fluids make sure to observe the limitations in the individual data sheets of the control devices or the mounted control valves

[2] Versions with HD-controls only in series 11

● = available ❍ = in preparation – = not available

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and for application conditions, please consult our data sheet RE 90223 (HF fluids).

In comparison with mineral oil based fluids, HFC fluids demonstrate other, at times unfavourable properties. The following guidelines will show how these special properties may be taken into account in the project design, operation and servicing of hydraulic systems.

The following fluids, with a water content of approx. 35 to 55% in weight, are approved without any restrictions for speed and pressure in comparison with operation on mineral oil based fluids.

– Fuchs Hydrotherm 46M
– Petrofer Ultrasafe 620
– Fuchs Renosafe 500
– Houghton Houghto Safe 620
– Union Carbide HP 5046

Operation on HFC-fluids is only possible when their properties and values correspond to ISO 12922.

For HFC-fluids, other than the above mentioned ones, limitations of the technical data according to RE 90223 must be observed.

For operation on rolling oils and HFA-fluids, please consult us.

The notes on filtration, limit of viscosity and temperature range must also be observed.

Operating viscosity range

see RE 92050

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 1 min),
t_{max} < +50 °C

ν_{max} = 1000 mm²/s
only during start (cold start, within 15 min an operating viscosity below 100 mm²/s should be reached)
t_{min} > −10 °C

Selection diagram and notes on the selection of hydraulic fluid

see RE 92050

Temperature range

$t_{min} \geq -10$ °C

$t_{max} \leq +50$ °C

$t_{opt} = +40$ °C

Higher temperatures are not permissible since this will result in a substantial loss of water content.

2

When meeting the limits of viscosity and temperature, operation on HFC-fluids is also allowed at low temperatures.

Important: The case drain fluid temperature is influenced by speed and pressure, and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 50 °C.

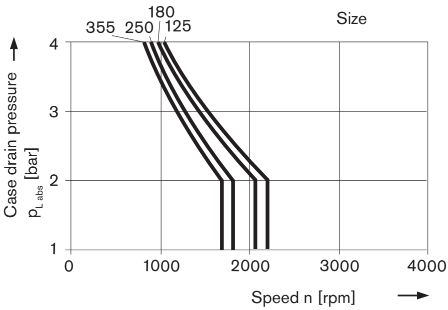
Filtration of the hydraulic fluid

Filtration improves the cleanliness level of the hydraulic fluid, which, in turn, increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric evaluation (weight of filtrations membranes) is necessary for the hydraulic fluid to determine the amount of contamination by solid matter and to determine the cleanliness level similar to ISO 4406. A cleanliness level of at least –/18/15 is to be maintained.

Case drain pressure

The permissible case drain pressure (housing pressure) depends on drive speed (see diagram).



Maximum case drain pressure (housing pressure)

$p_{L\,abs\,max}$ ________ 4 bar absolute

These are approximate values; under certain operating conditions a reduction in these values may be necessary

Direction of flow

S to B (like in RE 92050)

Technical data

Bearing flushing

Operating with HFC-fluids **requires external bearing flushing**.

The flushing flow is carried out via port „U“, located in the front flange of the axial piston pump. The flushing fluid flows through the front bearing and leaves the housing together with the case drain flow.

Important

1. Minimum required flushing flow $q_{fl\ min}$ in port U see table
2. Maximum permissible pressure p_{max} in port U see table
3. Reference flushing flow $q_{fl\ ref}$ to check the minimum required flushig flow (see example)

Size		125	180	250	355
$q_{fl\ min}$	L/min	1.0	1.5	2.0	3.0
p_{max}	bar	5.0	5.0	5.0	5.0
$q_{fl\ ref}$	L/min	3.5	5.0	6.5	10.0

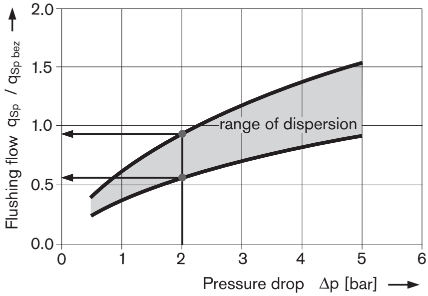
Note

Make sure that the throttle screw in port U is turned in all the way.

Notes for setting and checking the flushing flow:

The flushing flow is dependent on the pressure difference Δp between U-port inlet and housing ($\Delta p = p_U - p_{hous}$).
This correlation is depicted, independently of the pump size, in the following diagram.

Flushing flow through the U-port



Example:

Type: A4VSO 250...F
Housing pressure: p_{hous} = 1 bar
Pressure in port U: p_U = 3 bar
Δp = 2 bar

– The table on the left side of this page shows a reference flushing flow $q_{fl\ ref}$ = 6.5 L/min

– The above diagram shows the limits of the flushing flow range
$q_{fl\ 1} = 0.56 \cdot q_{fl\ ref} = 3.6$ L/min
$q_{fl\ 2} = 0.94 \cdot q_{fl\ ref} = 6.1$ L/min

– with this pressure drop of 2 bar the minimum required flushing flow of $q_{fl\ min}$ = 2 L/min is reached. A flow check should confirm a flushing flow within this range

Technical data

Operating pressure at pump inlet

Absolute pressure at port S (inlet port)

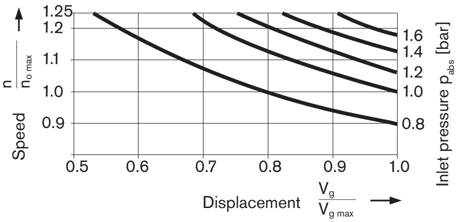
$p_{abs\ min}$ ______ 0.8 bar absolute

$p_{abs\ max}$ ______ 30 bar absolute

The density of almost all HF-fluids is higher than the density of mineral oil. It is therefore absolutely necessary to ensure, that the inlet pressure $p_{abs\ min}$ does not fall below the min. permissible 0.8 bar value.

All measures, which could obstruct the suction performance must be avoided (eg. suction filter).

Determination of inlet pressure p_{abs} at the inlet port S or reduction of displacement with increase of drive speed



The inlet pressure is the static feed pressure or the minimum dynamic value of the boost pressure.

Important:
Observe the maximum permissible drive speed $n_{o\ max.\ zul.}$ (speed limit) see page 6

Operating pressure range outlet

see RE 92050

2

Technical data

Table of values (theoretical values, without considering efficiencies and tolerances; values rounded)

Size			125	180	250	355
Displacement	$V_{g\ max}$	cm³	125	180	250	355
Speed [1]						
maximum at $V_{g\ max}$	$n_{o\ max}$	rpm	1800	1800	1500	1500
maximum at $V_g \leq V_{g\ max}$ (speed limit)	$n_{o\ max\ zul.}$	rpm	2200	2100	1800	1700
minimum	$n_{o\ min}$	rpm	800	800	800	800
Flow						
at $n_{o\ max}$	$q_{vo\ max}$	L/min	225	324	375	533
at $n_E = 1500$ rpm	$q_{VE\ max}$	L/min	186	270	375	533
Power $\Delta p = 350$ bar						
at $n_{o\ max}$	$P_{o\ max}$	kW	131	189	219	311
at $n_E = 1500$ rpm	$P_{E\ max}$	kW	109	158	219	311
Torque						
at $V_{g\ max}$ $\Delta p = 350$ bar	T_{max}	Nm	696	1002	1391	1976
$\Delta p = 100$ bar	T	Nm	199	286	398	564
Torsional stiffness						
Shaft end P	c	kNm/rad	260	328	527	800
Shaft end Z	c	kNm/rad	263	332	543	770
Moment of inertia Rotary unit	J_{TW}	kgm²	0.03	0.055	0.0959	0.19
Angular acceleration maximum [2]	α	rad/s²	8000	6800	4800	3600
Case volume	V	L	4	5	10	8
Weight (with pressure control) approx.	m	kg	88	102	184	207

[1] Values are valid with inlet pressure p_{abs} 1 bar at inlet port S, with increased speed up to speed limit please observe diagram, page 5
[2] – The range of validity lies between the minimum required and the maximum permissible drive speeds.
Valid for external excitation (eg. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2 fold rotary frequency).
– The limiting value is only valid for a single pump.
– The loading capacity of the connecting parts must be considered.

Caution: Exceeding the maximum or minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit.
The permissible values can be determined through calculation.

Determination of pump size

Flow $$q_V = \frac{V_g \cdot n \cdot \eta_V}{1000} \quad \text{[L/min]}$$

Drive torque $$T = \frac{1{,}59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} \quad \text{[Nm]}$$

Power $$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{T \cdot n}{9549} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

V_g = geometr. displacement per rev. in cm³
p = pressure difference in bar
n = speed in rpm
η_V = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Permissible radial and axial forces on the drive shaft

see RE 92050

Installation notes

General check on components

It must be checked, that every component in the system is suitable for the chosen hydraulic fluid. At the same time it must be ascertained, that seal and hose materials and casings, as well as paint finishes are compatible with the hydraulic fluid.

Reservoir

HF fluids feature poor air and contamination seperating properties.

The seperating capacity can be improved by a longer dwell time in the tank, thus by using a larger reservoir. In addition, baffles may be installed, either with openings or as weirs, with meshes fitted in the openings (settling of the fluid).

The lower temperature limits require a controlled cooling of the fluid. A large reservoir surface improves the natural cooling capacity of the sysrem.

Evaporation losses may be considerably reduced by using a tank breather.

Installation position

No restrictions in comparison with the A4VSO (RE 92050).

Commissioning

Following correct filling with the operating fluid, start the system under partial load and gradually increase to full load. After operation of all components, the system must carefully bled.

Filters and fluid must be carefully monitored, especially during the first few days of operation. Paint deposits and any remaining old fluid must be removed.

Literature references

ISO 12922 similar to the 7. Luxembourg report

VDMA standard 24314 (Conversion guidelines)

General information

– The pump A4VSO was designed for operation in open loop circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques:
  - All tightening torques mentioned in this data sheet are maximum values and may not be exceeded.
  (Maximum values for the female threads in the castings).
  Please comply with the manufacturer‘s information regarding the max. permissible tightening torques for the used fittings.
  - For fastening screws to DIN 13 we recommend to check the permissible tightening torque in each individual case acc. to VDI 2230 issue 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot. Take suitable safety measures (e.g. wear protective clothing).

– All given data and information has to be adhered to.

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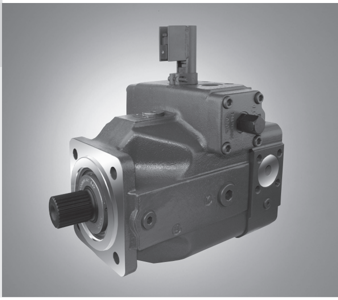
Rexroth
Bosch Group

Axial Piston Variable Pump A4VBO

RE 92122/04.12 1/28
Replaces: 06.10

Data sheet



Series 10, 30
Size 71, 125, 450
Nominal pressure 450 bar
Maximum pressure 500 bar
Open circuit

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Features

- Axial piston variable pump in swash plate design for hydrostatic drives in open circuit as well as operation with boosted inlet
- The flow is proportional to the input drive speed and displacement. By adjusting the swash plate angle it is possible to infinitely vary the output flow.
- Slot-controlled swash plate design
- Infinitely variable displacement
- Low noise level
- Long service life
- Axial and radial loading on the drive shaft
- Excellent power to weight ratio
- Modular design
- Short response times
- Visual swivel angle indicator
- Bearing flushing

Ordering code for standard program

A4VB	O			/			V		–		25	
01	02	03	04		05	06	07	08		09	10	11

Axial piston unit

01	Swash plate design, variable, nominal pressure 450 bar, maximum pressure 500 bar	**A4VB**

Type of operation

02	Pump, open circuit	**O**

Size

03	≈ Displacement V_g max in cm^3	**071**	**125**	**450**

Control devices

		071	125	450	
04	Hydraulic control with proportional valve (see RE 92076)	●	●	●	**HS4**
	Electro-hydraulic control system DFE1 (see RE 92088)	●	●	–	**DFE1**

Series

		071	125	450	
05	Series 1, Index 0	●	–	–	**10**
	Series 3, Index 0	–	●	●	**30**

Direction of rotation

06	Viewed from drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals

07	FKM (fluor-caoutchouc)	**V**

Drive shaft

		071	125	450	
08	Splined shaft DIN 5480 without clearance groove	–	–	●	**R**
	Splined shaft DIN 5480	●	●	–	**Z**

Mounting flange

			071	125	450	
09	Similar to ISO 3019-2 metric	4-Loch	●	●	–	**B**
		8-Loch	–	–	●	**H**

Service line connections

10	Port B and S on side 90° off set, fixing thread metric, 2. outlet port B1 opposite B - closed with blind plate on delivery	**25**

● = Available ❍ = On request – = Not available ▭ = Preferred program

Ordering code for standard program

A4VB	O			/			V		–		25	
01	02	03	04		05	06	07	08		09	10	11

	Through drive			071	125	450	
11	With through drive for mounting an axial piston pump or gear unit			●	●	●	K...
	Flange	Coupler for splined shaft	to mount				
	140, 4-bolt (ISO[1])	40x2x18x9g	A4VBO, A4VSO, A4VSG 71	●	–	–	33
	160, 4-bolt (ISO[1])	50x2x24x9g	A4VBO, A4VSO, A4VSG 125; A4VSO, A4VSG 180	–	●	❍	34
	315, 8-bolt (ISO[1])	80x3x25x9g	A4VBO 450	–	–	●	97
	82-2 (SAE A)	5/8in 16-4 (SAE A)	AZ-PF-1X-004...022	❍	❍	❍	01
	101-2 (SAE B)	7/8in 22-4 (SAE B)	A10V(S)O 28/31(2)/52(3), AZ-PN-1X-020...032	❍	❍	❍	68
	101-2 (SAE B)	1in 25-4 (SAE B-B)	A10V(S)O 45/31, A10V(S)O 45/52(3), PGH4	❍	❍	❍	04
	127-2 (SAE C)	1 1/2in 38-4 (SAE C-C)	A10V(S)O 100/31, A10V(S)O 85/52(3), PGH5	–	❍	❍	24
	With through drive shaft, without coupler, without adaptor flange, closed with cover			●	●	●	99

1) To ISO 3019-2 metric

● = Available ❍ = On request – = Not available ▭ = Preferred program

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and application conditions please consult our data sheet RE 90220 (mineral oils) prior to system design.

The variable pump A4VBO is not suitable for operation on HFA, HFB and HFC fluids. For operation on HFD or ecologically acceptable fluids please consult us.

Operating viscosity range

Within the operating viscosity range between 16...100 mm²/s the unit can be operated without limitations of the technical data.

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) lies in the range

ν_{opt} = opt. viscosity range 16...36 mm²/s

referred to tank temperature (open circuit).

Limit of viscosity range

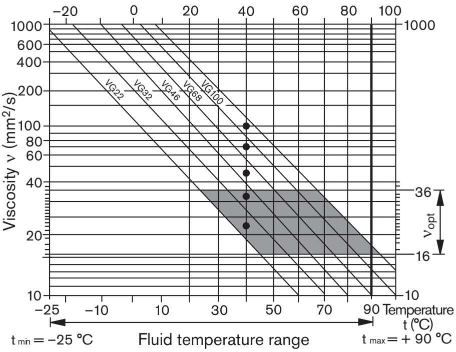
For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 3 min)
at max. permissible case drain temperature
t_{max} = +90° C.

ν_{max} = 1000 mm²/s
for short periods (on cold start maximum operating viscosity of 100 mm²/s should be reached within 15 min)
t_{min}= −25° C

For detailed information on operation with low temperatures see RE 90300-03-B.

Selection diagram



Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}); see shaded section in the selection diagram. We recommend, that the higher viscosity grade is selected in each case.

Temperature range (see selection diagram)

t_{min} = − 25° C
t_{max} = + 90° C

Example: at an ambient temperature of X° C the operating temperature in the tank is 60° C. In the optimum viscosity range (ν_{opt}; shaded area), this corresponds to grades VG 46 or VG 68; select: VG 68.

Important: The case drain temperature is influenced by pressure and speed and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 90° C.

Technical data

Bearing flushing

For the following operating conditions bearing flushing is required for a safe, continuous operation:

– Operation at critical conditions of temperature and viscosity with mineral oil

Flushing is recommended with vertical mounting (drive shaft facing upwards) in order to ensure lubrication of the front bearing and shaft seal ring.

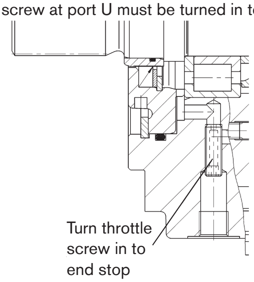
Flushing is carried out via port U, located in the front flange area of the pump. The flushing fluid flows through the front bearing and leaves the pump together with the case drain flow.

Depending on pump size, the following flushing flows are recommended:

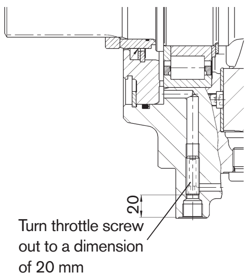
Size		71	125	450
recommended flushing flow	q_{Sp} L/min	4	5	20

These recommended flushing flows will cause a pressure drop of approx. 2 bar (series 10) and approx. 3 bar (series 30) between the entrance to port U and the pump case (including the pipe fittings.

Note regarding size 125
When using external bearing flushing the throttle screw at port U must be turned in to the end stop.



Note regarding size 450
In the size 450, the flushing fluid is taken out of the existing boost pressure source. When using an external flushing flow source, the throttle screw in port U must be turned out to a dimension of 20 mm.



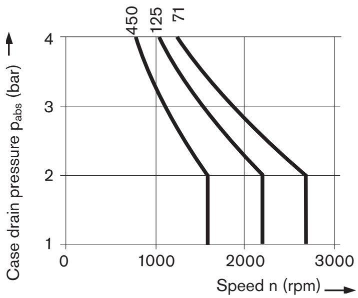
Filtration of the fluid (axial piston unit)

The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston unit.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness class of 20/18/15 acc. to ISO 4406 is necessary.

Case drain pressure

The permissible case drain pressure (housing pressure) depends on the drive speed (see diagram).



Max.case drain pressure (housing pressure)

$p_{L\ abs\ max}$ ______ 4 bar absolute

These figures are approx. values; under special operating conditions restrictions may be necessary.

Flow direction

S to B

Temperature range for the shaft seal ring

The FKM-shaft seal ring is suitable for case drain temperatures between -25 °C to +90 °C.

Hinweis
For applications below -25 °C a NBR-shaft seal ring must be used (permissible temperature range: -40 °C to +90 °C). NBR-shaft seal ring must be stated in clear text when ordering. Please consult us.

2

Technical data

Operating pressure range

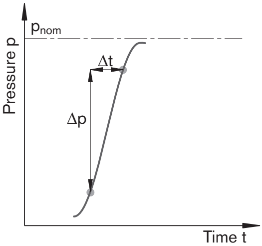
Pressure at service line (pressure port) B

Nominal pressure p_{nom} ________________ 450 bar absolute

Maximum pressure p_{max} ______________ 500 bar absolute
Single operating period ________________________________ 1 s
Total operating period ______________________________ 300 h

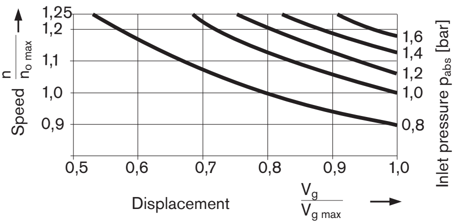
Minimum pressure (high pressure side) __________15 bar
At lower pressures, please consult us.

Rate of pressure change R_A _______________ 16000 bar/s



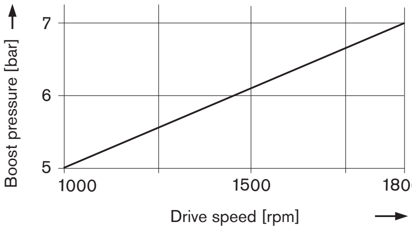
Size 71/125: pressure at suction port S (inlet)
Minimum inlet pressure $p_{S\,min}$ ____________ 0.8 bar absolute
Maximum inlet pressure $p_{S\,max}$ ______________30 bar absolute

Size 71/125: minimum pressure (inlet)
In order to avoid damage to the axial piston unit, a minimum pressure must be ensured at the inlet suction port S (inlet). This minimum pressure is dependent on the speed and displacement of the axial piston unit.



Size 450: pressure at suction port S (inlet)
Minimum suction pressure $p_{S\,min}$ _____________5 bar absolute
Maximum suction pressure $p_{S\,max}$ ___________30 bar absolute

Boost pressure (at size 450 compulsory)



The inlet pressure is the static feed pressure or the minimum dynamic value of the boost pressure.

Please note:
Max. permissible speed $n_{o\,max.\,zul.}$ (speed limit) see page 7

If the above conditions cannot be met, please consult us.

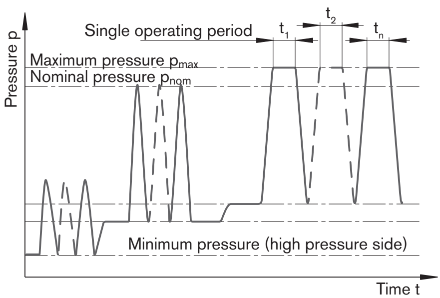
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

Technical data

Table of values (theoretical values, without efficiencies and tolerances; values rounded)

Size				71	125	450
Displacement		$V_{g\ max}$	cm^3	71	125	450
Speed [1)]						
max. at $V_{g\ max}$		$n_{o\ max}$	min^{-1}	2200	1800	1800
max. at $V_g \leq V_{g\ max}$ (speed limit)		$n_{o\ max\ zul.}$	min^{-1}	2700	2200	1800
Flow						
at $n_{o\ max}$		$q_{vo\ max}$	L/min	156	225	810
at $n_E = 1500$ rpm		$q_{VE\ max}$	L/min	107	188	675
Power	$\Delta p = 450$ bar					
at $n_{o\ max}$		$P_{o\ max}$	kW	117	169	608
at $n_E = 1500\ min^{-1}$		$P_{E\ max}$	kW	80	141	506
Torque						
at $V_{g\ max}$	$\Delta p = 450$ bar	T_{max}	Nm	508	894	3220
	$\Delta p = 100$ bar	T	Nm	113	199	716
Torsional stiffness	shaft R	c	kNm/rad	–	–	1234
	shaft Z	c	kNm/rad	146	263	–
Moooment of inertia rotary group		J_{TW}	kgm^2	0.0121	0.03	0.3325
Angular acceleration max.[2)]		α	rad/s^2	11000	8000	2800
Filling capacity		V	L	2.5	5	14
Weight (with HS4) approx.		m	kg	65	100	390

1) The values are valid for sizes 71 and 125 with an inlet pressure of p_{abs} 1 bar at suction port S, for increase of speed up to the speed limit observe the diagram on page 6. For the size 450 observe the diagram „Compulsory boost requirements“ on page 6.
2) The range of validity lies between the minimum required and the maximum permissible drive speeds.
Valid for external excitation (eg. diesel engine 2-8 fold rotary frequency, cardan shaft 2 fold rotary frequency).
The limiting value is only valid for a single pump.
The loading capacity of the connecting parts must be considered.

Note
Exceeding the maximum or minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. The permissible values can be determined through calculation.

Determining the operating characteristics

Flow $$q_V = \frac{V_g \cdot n \cdot \eta_V}{1000} \quad \text{[L/min]}$$

Torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{[Nm]}$$

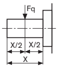
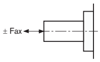
Power $$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

2

Technical data

Permissible radial and axial loading on drive shaft

Size	NG			71	125	450
Radial force maximum		$F_{q\,max}$	N	1200	1600	3000
Axial force maximum		$\pm F_{ax\,max}$	N	800	1000	2200

Note

Special requirements apply in the case of belt drives. Please contact us.

Force transfer direction of the permissible axial force:

$+ F_{ax\,max}$ = Increase in service life of bearings

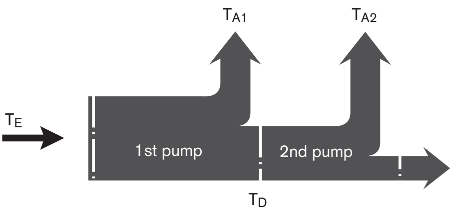
$- F_{ax\,max}$ = Reduction in service life of bearings (avoid)

Permissible input and through-drive torques

Size		NG		71	125	450
Torque at $V_{g\,max}$ and $\Delta p = 450$ bar)[1]		T_{max}	Nm	508	894	3220
Input torque for shaft end, maximum[2]						
	R	$T_{E\,max}$	Nm	–	–	6440
	Z	$T_{E\,max}$	Nm	790	1392	–
Through drive torque maximum		$T_{D\,max}$		395	696	3220

1) Efficiency not considered
2) For drive shafts with no radial force

Torque distribution



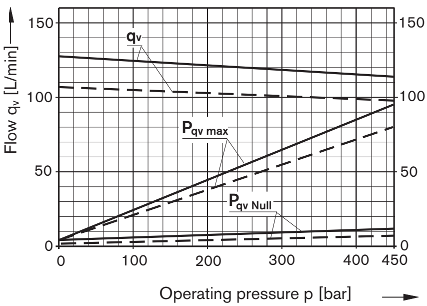
Characteristics

Drive power and flow

(Fluid: hydraulic oil ISO VG 46 DIN 51519, t = 50 °C)

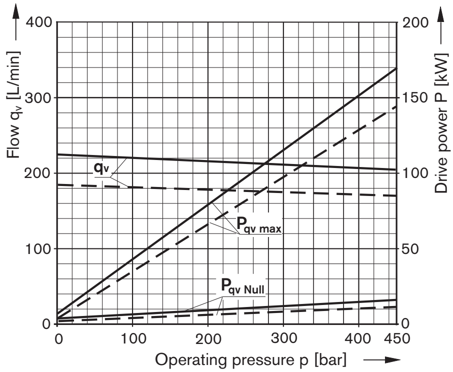
Overall efficiency: $\eta_t = \dfrac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ Volumetric efficiency: $\eta_v = \dfrac{q_v}{q_{v\,theor}}$

Size 71



n = 1800 rpm
n = 1500 rpm

Size 125



n = 1800 rpm
n = 1500 rpm

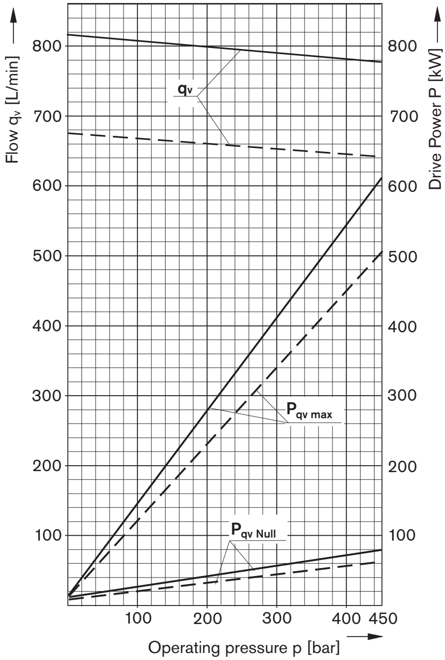
Characteristics

Drive power and flow

(Fluid: hydraulic oil ISO VG 46 DIN 51519, t = 50 °C)

Overall efficiency: $\eta_t = \dfrac{q_v \cdot p}{P_{qv\ max} \cdot 600}$ Volumetric efficiency: $\eta_v = \dfrac{q_v}{q_{v\ theor}}$

Size 450

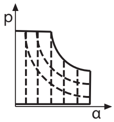


n = 1800 rpm (solid line)
n = 1500 rpm (dashed line)

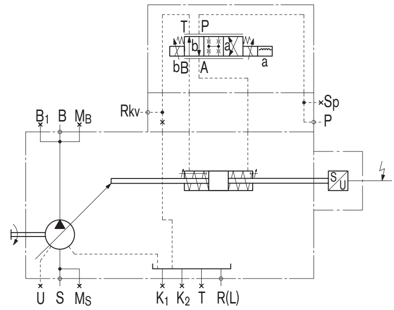
Control devices

Control system HS4, with proportional valve (see RE 92076)

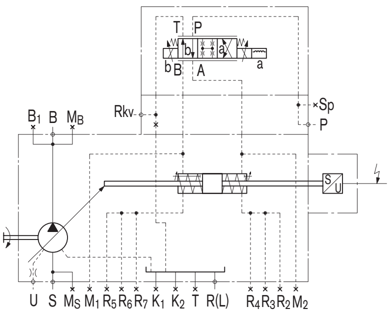
The stepless displacement adjustment is achieved with a proportional valve and an electric feedback of the swivel angle. With an external pressure signal, the HS4-control device can be completed into a pressure-power control system.



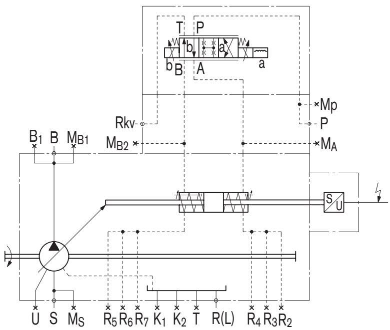
Size 71



Size 125



Size 450

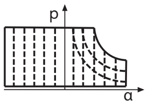


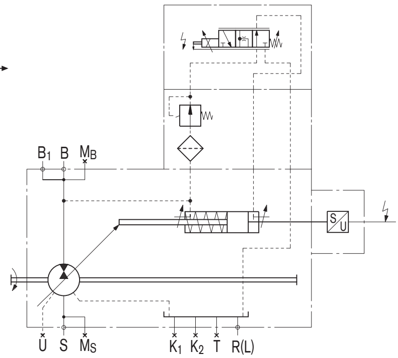
Size			71	125	450
Control pressure	p_{min}	bar	130	130	190
	p_{max}	bar	315	315	315

Control devices

Electro hydraulic control system DFE1 (see RE 92088)

The power, pressure and swivel angle control of the variable displacement pump A4VBO...DFE1 is accomplished with an electrically driven proportional valve. Through a swivle angle feedback the current signal to the proportional valve determines via the control piston the swivel angle and thus the pump displacement.

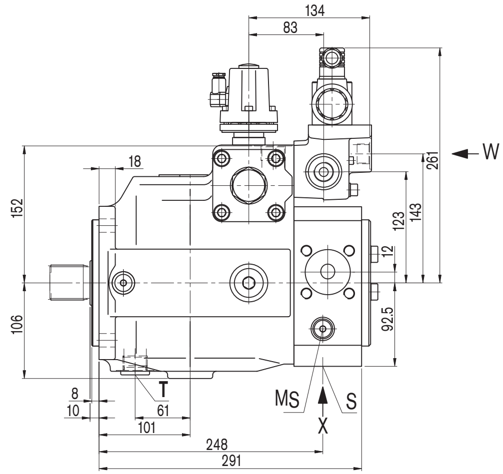


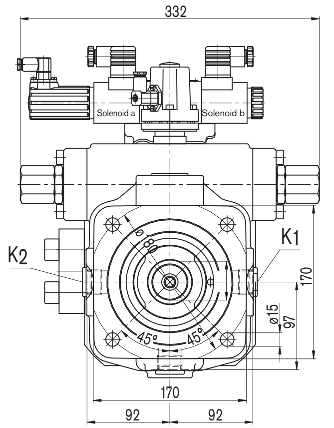


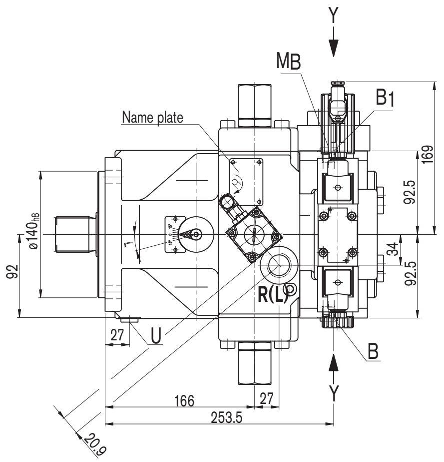
Dimensions size 71

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

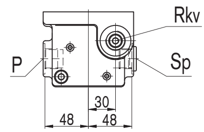
HS4 - hydraulic control, with proportional valve



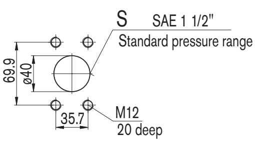




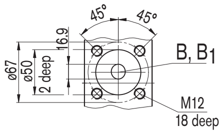
Partial view W



Partial view X



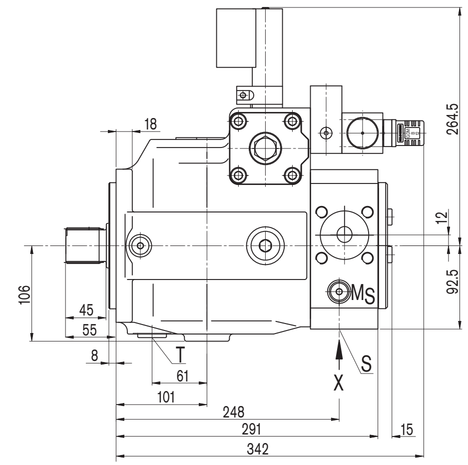
Partial view Y

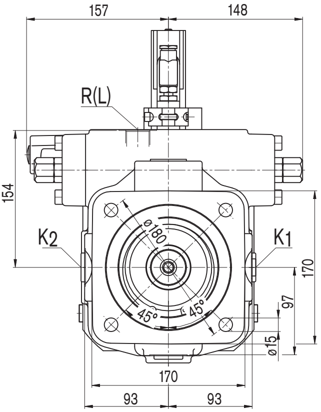


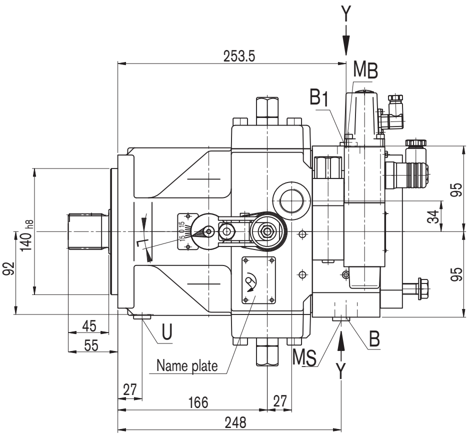
Dimensions size 71

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

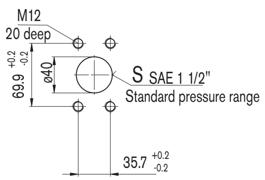
DFE1 - Electro hydraulic control system



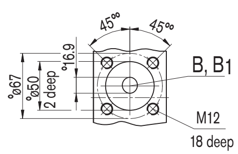




Partial view X



Partial view Y

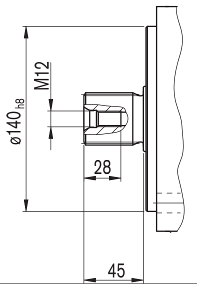


Dimensions size 71

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shaft

Z Splined shaft DIN 5480 W40x2x18x9g



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure absolute [bar][2]	State
B	Service line	ISO/DIS 6164-3	DN-16	500	O
	Fixing thread B	DIN 13	M12 x 1.75; 18 deep		
B_1	Additional port	ISO/DIS 6164-3	DN-16	500	X
	Fixing thread B_1	DIN 13	M12 x 1.75; 18 deep		
S	Suction port	SAE J518[3]	SAE 1 1/2 in	30	O
	Fixing thread S	DIN 13	M12 x 1.75; 20 deep		
K_1, K_2	Housing flushing	ISO 6149[4]	M27 x 2; 19 deep	4	X
M_B	Measuring pressure B	ISO 6149	M14 x 1.5; 11.5 deep	500	X
M_S	Measuring suction pressure	ISO 6149	M14 x 1.5; 11.5 deep	30	X
P, Sp	Control pressure	DIN 3852	M22 x 1.5; 15.5 deep	315	O
Rkv	Return line control fluid	DIN 3852	M22 x 1.5; 15.5 deep	210	O
R(L)	Fluid filling and air bleed (case drain port)	ISO 6149[4]	M27 x 2; 19 deep	4	O
T	Fluid drain	ISO 6149[4]	M27 x 2; 19 deep	4	X
U	Bearing flushing	ISO 6149[4]	M14 x 1.5; 11.5 deep	4	X

1) Observe the general instructions on page 28 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Note: metric thread deviates from standard
4) The spot face can be deeper than specified in the appropriate standard.
O = Must be connected (on delivery closed with a plastic plug or flange cover)
X = Plugged (in normal operation)

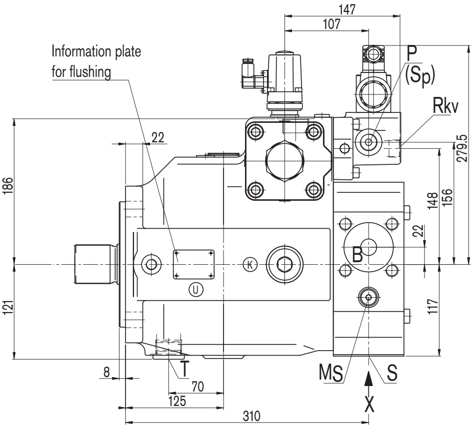
Note

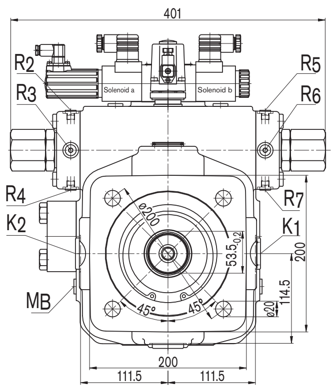
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

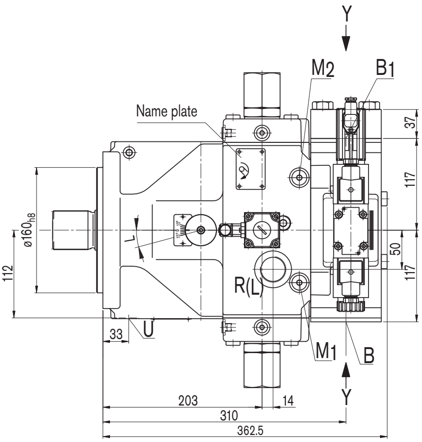
Dimensions size 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

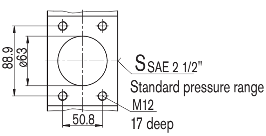
HS4 - Hydraulic control, with proportional valve, clockwise rotation



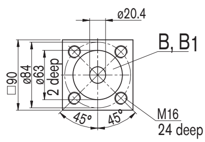




Partial view X



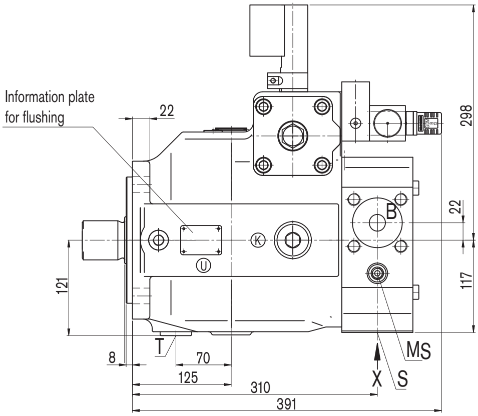
Partial view Y

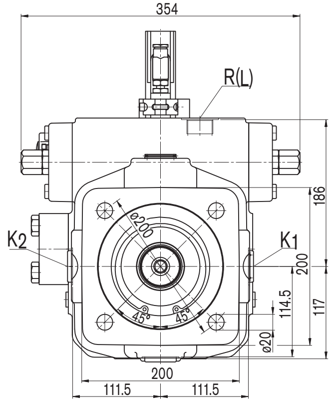


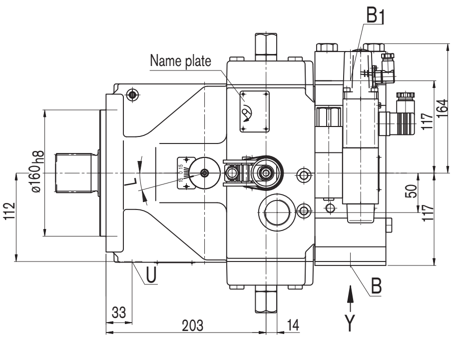
Dimensions size 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

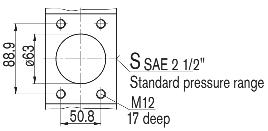
DFE1 - Electro hydraulic control system



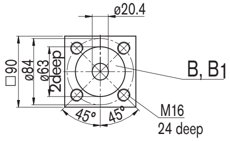




Partial view X



Partial view Y

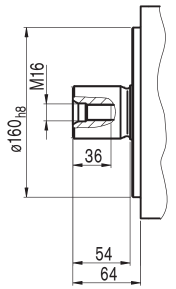


Dimensions size 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shaft

Z Splined shaft DIN 5480 W50x2x24x9g



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure absolute [bar][2]	State
B	Service line	ISO/DIS 6164-3	DN-20	500	O
	Fixing thread B	DIN 13	M16 x 2; 24 deep		
B_1	Additional port	ISO/DIS 6164-3	DN-20	500	X
	Fixing thread B1	DIN 13	M16 x 2; 24 deep		
S	Suction line	SAE J518[3]	SAE 2 1/2´´	30	O
	Fixing thread S	DIN 13	M12 x 1.75; 18 deep		
K_1, K_2	Housing flushing	ISO 6149[4]	M33 x 2; 18 deep	4	X
M_B	Measuring pressure B	ISO 6149	M14 x 1.5; 11.5 deep	500	X
M_S	Measuring suction pressure	ISO 6149	M14 x 1.5; 11.5 deep	30	X
M_1, M_2	Measuring control pressure	ISO 6149[4]	M14 x 1.5; 11.5 deep	315	X
P, Sp	Control pressure	DIN 3852	M22 x 1.5; 15.5 deep	315	O
Rkv	Return line control fluid	DIN 3852	M22 x 1.5; 15.5 deep	210	O
R(L)	Fluid filling and air bleed (case drain port)	ISO 6149[4]	M33 x 2; 18 deep	4	O
R_2-R_7	Air bleed control unit	DIN 3852	M10 x 1; 10 deep	315	X
T	Fluid drain	ISO 6149[4]	M33 x 2; 18 deep	4	X
U	Bearing flushing	ISO 6149[4]	M14 x 1.5; 11.5 deep	7	X

1) Observe the general instructions on page 28 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Note: metric thread deviates from standard
4) The spot face can be deeper than specified in the appropriate standard.
O = Must be connected (on delivery closed with a plastic plug or flange cover)
X = Plugged (in normal operation)

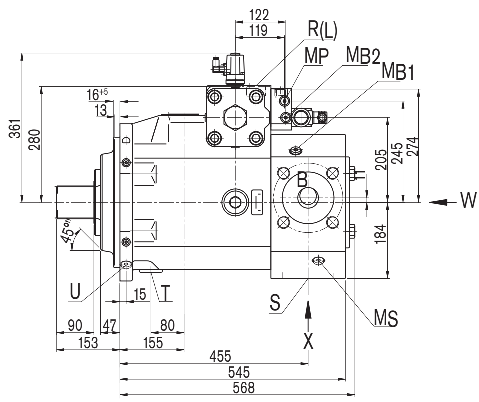
Note

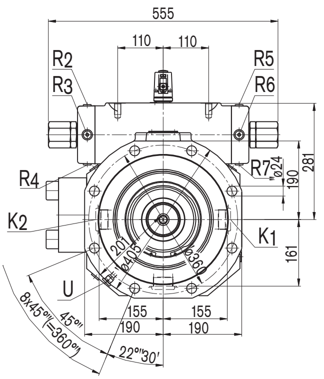
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

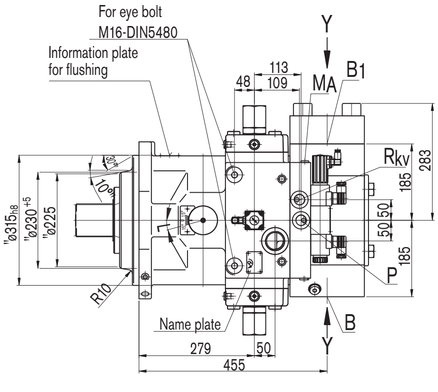
Dimensions size 450

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

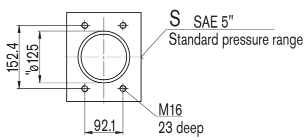
HS4 - Hydraulic control, with proportional valve



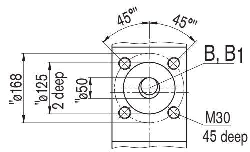




Partial view X



Partial view Y

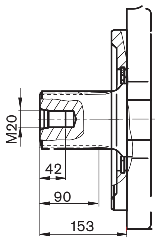


Dimensions size 450

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shaft

R Splined shaft DIN 5480 without clearance groove W80x3x25x9g



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure absolute [bar][2]	State
B	Service line	ISO/DIS 6164-3	DN-50	500	O
	Fixing thread B	DIN 13	M30 x 3.5; 45 deep		
B_1	Additional port	ISO/DIS 6164-3	DN-50	500	X
	Fixing thread B1	DIN 13	M30 x 3.5; 45 deep		
S	Suction	SAE J518[3]	SAE 5 in	30	O
	Fixing thread S	DIN 13	M16 x 2; 24 deep		
K_1, K_2	Housing flushing	DIN 3852	M48 x 2; 22 deep	4	X
M_{B1}	Measuring pressure B1	ISO 6149	M18 x 1.5; 14.5 deep	500	X
M_S	Measuring suction pressure	ISO 6149	M18 x 1.5; 14.5 deep	30	X
M_A, M_{B2}, M_P	Measuring control pressure	DIN 3852	M14 x 1.5; 11.5 deep	315	X
P	Control pressure	DIN 3852	M27 x 2; 19 deep	315	X
Rkv	Return line control fluid	DIN 3852	M27 x 2; 19 deep	210	O
R (L)	Fluid filling and air bleed (case drain port)	DIN 3852	M48 x 2; 22 deep	4	O
R_2-R_7	Air bleed control device	DIN 3852	M14 x 1.5; 11.5 deep	315	X
T	Fluid drain	DIN 3852	M48 x 2; 22 deep	4	X
U	Bearing flushing	ISO 6149[4]	M18 x 1.5; 14.5 deep	8	X

1) Observe the general instructions on page 28 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Note: metric thread deviates from standard
4) The spot face can be deeper than specified in the appropriate standard.
O = Must be connected (on delivery closed with a plastic plug or flange cover)
X = Plugged (in normal operation)

Note

The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Overview of attachments

Through drive - A4VBO			Mounting option 2nd pump						Through drive
Flange	Coupler for splined shaft	Code	A4VBO size (shaft)	A4VSO/G size (shaft)	A4CSG size (shaft)	A10V(S) O/31(2)[1] size (shaft)	A10V(S) O/52(3) size (shaft)	External/ internal gear pump	Available for size
ISO 3019-2 (metric)									
140, 4-bolt	W 40x2x18x9g[3]	**K33**	71 (Z)	71 (Z)	–	–	–	–	71/In preparation
160, 4-bolt	W 50x2x24x9g[3]	**K34**	125 (Z)	125 (Z)	–	–	–	–	In preparation
			–	180 (Z)	–	–	–	–	In preparation
315, 8-bolt	W 80x3x25x9g[3]	**K97**	450 (R)	–	–	–	–	–	450
ISO 3019-1 (SAE J744)									
82-2 (A)[4]	16-4 (5/8in, 9T)[2]	**K01**	–	–	–	–	–	AZ-PF-1X-004...022[5]	In preparation
101-2 (B)[4]	22-4 (7/8in, 13T)[2]	**K68**	–	–	–	28 (S)/31	28 (S)	AZ-PN-1X-020...032[5]	71/In preparation
	25-4 (1in, 15T)[2]	**K04**	–	–	–	45 (S)/31	45 (S)	PGH4	In preparation
127-2 (C)[4]	38-4 (1 1/2in, 17T)[2]	**K24**	–	–	–	100 (S)/31	85 (S)	PGH5	In preparation

1) If a through drive for an A10V(S)O with R-shaft is desired, please consult us.
2) Allocation of drive shafts to SAEJ744 OCT83
3) Acc. to DIN 5480
4) 2 = 2-bolt, 4 = 4-bolt
5) Rexroth recommends a special execution of the gear pumps. Please consult us.

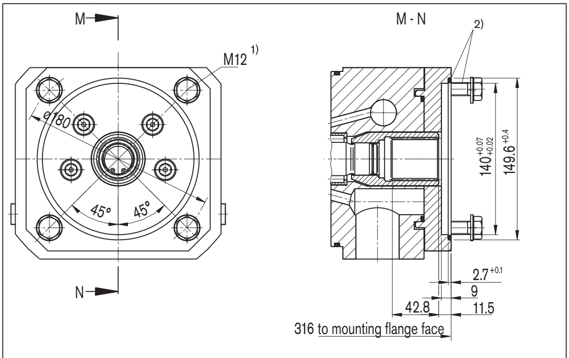
Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K33 Size 71

Flange ISO 3019-2 140, 4-bolt
Shaft coupler to DIN 5480 N40x2x18x8H

for mounting an A4VSO/G 71 with splined shaft



K34 Size 125 and 450

Flange ISO 3019-2 160, 4-bolt
Shaft coupler to DIN 5480 N50x2x24x8H

for mounting an A4VSO/G 125 or 180 with splined shaft

In preparation

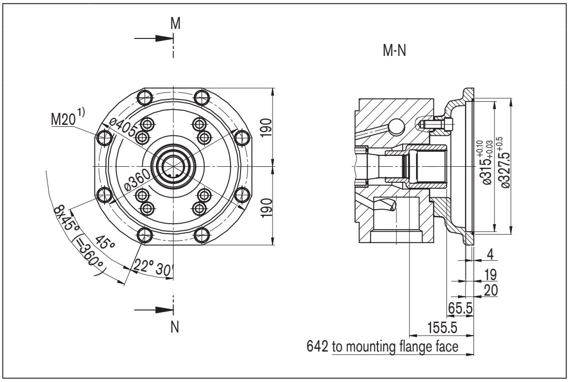
1) Thread according to DIN 13, observe the general instructions on page 28 for the maximum tightening torques.
2) Fixing screws and O-ring seal are included with supply.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

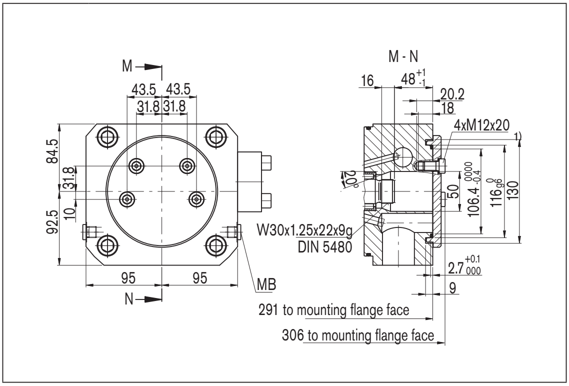
K97 Size 450

Flange ISO 3019-2 315-8-bolt
Shaft coupler to DIN 5480 N80x3x25x8H



K99 Size 71

with through drive shaft, without shaft coupler, without adaptor flange, **closed with pressure tight cover**



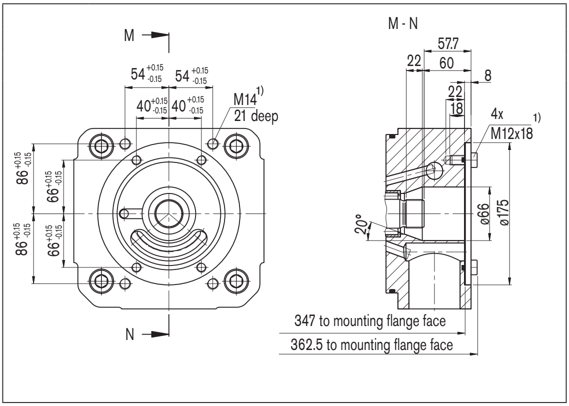
1) Thread according to DIN 13, observe the general instructions on page 28 for the maximum tightening torques

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

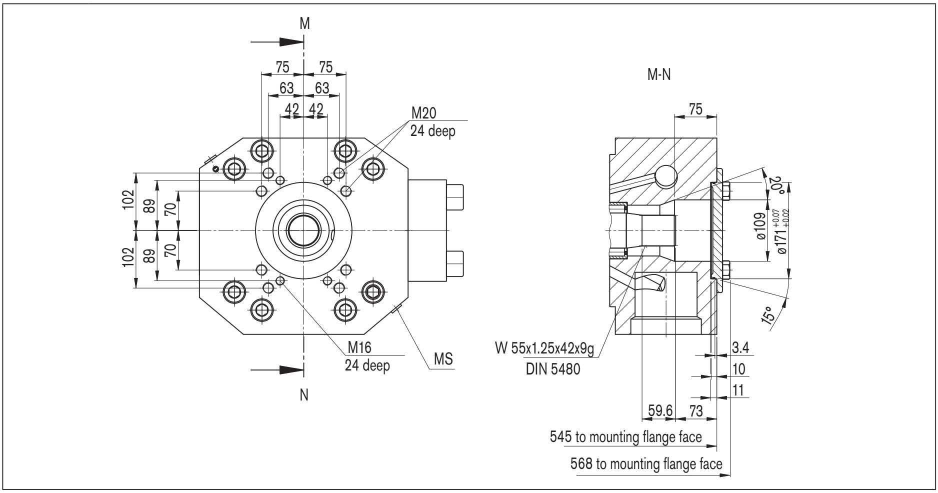
K99 Size 125

with through drive shaft, without shaft coupler, without adaptor flange, **closed with pressure tight cover (shown without cover)**



K99 Size 450

with through drive shaft, without shaft coupler, without adaptor flange, **closed with pressure tight cover**



1) Thread according to DIN 13, observe the general instructions on page 28 for the maximum tightening torques

Installation instructions

Mounting position:

Optional. The pump case must be filled with fluid during commissioning and remain full when operating.
In order to reduce the operating noise level, all connecting lines (suction, pressure and case drain lines) must be de-coupled from the tank, using flexible elements.
The use of check valves in the case drain line must be avoided. The case drain line must be returned directly to tank without a reduction in cross section.
Exceptions maybe possible, please consult us first.

1. **Vertical installation** (shaft end pointing upwards)
   With a vertical installation, bearing flushing is recommended to provide lubrication for the front bearing, see page 5.

   The following installation conditions must be taken into account:

1.1 Installation into the reservoir

a) When the minimum fluid level is equal to or above the pump mounting flange area **(only possible for the sizes 71 and 125)**: ports »R/L«, »T« and »S« open (see fig. 1).

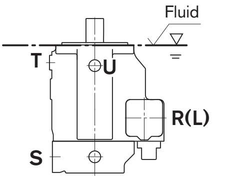


Fig. 1

b) When the minimum fluid level is below the mounting flange area: ports»R/L«,»T« and possibly »S« must be piped as shown in fig. 2. Also observe the conditions as shown in point 1.2.

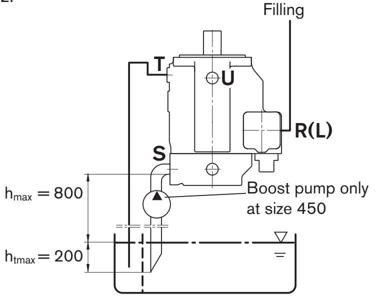


Fig.2

1.2 Installation outside the reservoir

Before installation, fill the pump housing with the pump in a horizontal position. Pipe port »T« to tank, »R/L« plugged.
Filling in mounted condition: fill via »R« and bleed via»T«, afterwards plug port»R«.
Conditions: A minimum pump inlet pressure (suction pressure) of 0.8 bar absolute for size 71/125 is necessary (of 5 bar absolute for size 450). Avoid mounting above the reservoir in order to reduce the noise level.

2. **Horizontal installation**
   The highest situated of the ports»T«,»K_1«, »K_2« or »R/L« must be used for filling/bleeding and subsequently to connect the case drain line.

2.1 Installation inside the reservoir

a) When the minimum fluid level is equal to or lies above the upper edge of the pump (only possible for sizes 71 and 125): case drain port and suction port »S« open (see fig. 3).

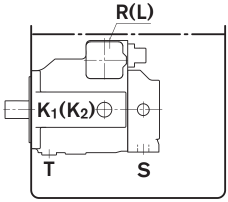


Fig. 3

b) When the minimum fluid level lies below the upper edge of the pump: case drain port and possibly port »S« must be piped, see fig. 4. Observe conditions as shown in point 1.2.

Fill pump housing prior to commissioning.

2.2 Installation outside the reservoir

Fill the pump housing before commissioning.
a) Mounting above the reservoir see fig. 4.
Observe conditions as shown in point 1.2.
b) Mounting below the reservoir
Case drain port and port »S« must be piped (see fig. 5).

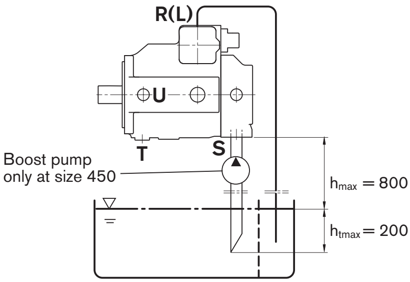


Fig. 4

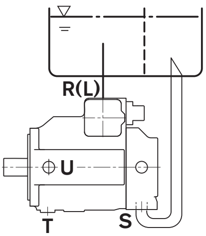


Fig. 5

Notes

General instructions

– The A4VBO pump is designed to be used in open circuit.

– Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel.

– Before operating the axial piston unit, read the appropriate operating instructions thoroughly and completely. If needed, request these from Rexroth.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Pressure ports:
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

– The data and notes contained herein must be adhered to.

– The following tightening torques apply:

- Female threads in axial piston unit:
The maximum permissible tightening torques $M_{G\,max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

- Fittings:
Observe the manufacturer's instructions regarding the tightening torques of the used fittings.

- Fixing screws:
For fixing screws according to DIN 13, we recommend checking the tightening torque individually according to VDI 2230.

- Locking screws:
For the metal locking screws, supplied with the axial piston unit, the required tightening torques of locking screws M_V apply. For values, see the following table.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

Ports Standard	 Thread size	Maximum permissible tightening torque of the threaded holes $M_{G\,max}$	Required tightening torque of the locking screws M_V	WAF hexagon socket of the locking screws
ISO 6149	M14 x 1.5	80 Nm	45 Nm	6 mm
	M18 x 1.5	140 Nm	70 Nm	8 mm
	M27 x 2	330 Nm	170 Nm	12 mm
	M33 x 2	540 Nm	310 Nm	17 mm
DIN 3852	M10 x 1	30 Nm	15 Nm[1)2)]	5 mm
	M14 x 1.5	80 Nm	35 Nm[1)]	6 mm
	M22 x 1.5	210 Nm	80 Nm[1)]	10 mm
	M27 x 2	330 Nm	135 Nm[1)]	12 mm
	M48 x 2	900 Nm	400 Nm[1)]	24 mm

1) The tightening torques apply for screws in the „dry“ state as received on delivery and the „lightly oiled“ state for installation.
2) In the “lightly oiled” state, the MV is reduced to 10 Nm for M10 x 1.

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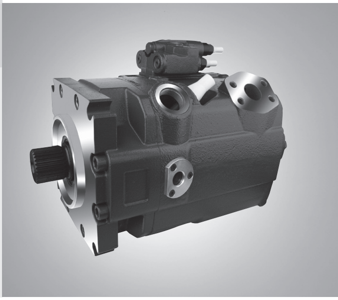
Rexroth
Bosch Group

Axial Piston Variable Pump A15VSO

RE 92800/05.12 **1**/40
Replaces: 03.10

Data sheet



Series 10
Sizes 175 to 280
Nominal pressure 350 bar
Maximum pressure 420 bar
Open circuit

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Features

- Variable axial piston pump of swashplate design for hydrostatic drives in open circuit
- Employment preferably in stationary applications
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- 100 % mooring function possible depending on specific controller (swivel mode, motor mode).
- A wide range of highly adaptable control devices with different control and regulating functions, for all important applications.
- The universal through drive is suitable for mounting gear pumps and axial piston pumps up to the same size, i.e. 100 % through drive.
- Compact design
- High efficiency
- High power density
- Low noise

Ordering code for standard program

A15VS	O								V	/	10	M		V	E4		1	E		0	–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17	18	19	20		21

Axial piston unit

01	Swashplate design, variable, nominal pressure 350 bar, maximum pressure 420 bar	**A15VS**

Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, see table of values on page 8	**175**	**210**	**280**

Control device: basic controller[1)]

					175	210	280	
04	Power controller	fixed setting			●	●	●	**LR**
	Override	electric, proportional	negative	U = 24 V DC	❍	❍	❍	**L4**
		high pressure, proportional (summation hp-control)	negative	with stop	❍	❍	●	**CR**
	Stroke limiter	electric, proportional	positive	U = 24 V DC	●	●	●	**E2**
		electric, two-point	positive	U = 24 V DC	●	●	●	**E6**
		pilot pressure, proportional	negative	Δp = 35 bar	●	●	●	**H5**
			positive		❍	❍	❍	**H6**
	Pressure controller with one-sided deflection	fixed setting			●	●	●	**DR**
		hydraulic, remote controlled (external)	positive		●	●	●	**DG**
		for parallel operation	positive		❍	❍	●	**DP[2)]**
	Pressure controller with mooring function	fixed setting			❍	❍	❍	**MD[3)]**

Auxiliary controller: pressure controller[1)]

				175	210	280	
05	Without auxiliary controller (without symbol)			●	●	●	
	Pressure controller with onesided deflection	fixed setting		●	●	●	**DR[4)]**
		hydraulic, remote controlled (external)	positive	●	●	●	**DG[5)]**
		for parallel operation	positive	❍	❍	●	**DP[2)6)]**

Auxiliary controller: stroke limiter or bleed-off[1) 7)]

					175	210	280	
06	Without auxiliary controller stroke limiter (without symbol)				●	●	●	
	Stroke limiter	electric, proportional	positive	U = 24 V DC	●	●	●	**E2**
		electric, two-point	positive	U = 24 V DC	●	●	●	**E6**
		pilot pressure, proportional	negative	Δp = 35 bar	●	●	●	**H5**
			positive		❍	❍	❍	**H6**

Auxiliary controller: load sensing[1)]

			175	210	280	
07	Without auxiliary controller load sensing (without symbol)		●	●	●	
	Load sensing pump pressure, internal	fixed setting	●	●	●	**S0**

● = Available ❍ = On request – = Not available

1) The basic controller (04) can be combined with a maximum of two auxiliary controllers (05, 06, 07)
2) Cannot be combined with E2, E6 and H5, H6 from auxiliary controller stroke limiter (06A)
3) Cannot be combined with E2, E6 and H5, H6 from auxiliary controller stroke limiter (06). All combinable auxiliary controller are suitable for mooring function.
4) Cannot be combined with basic pressure controller DR, DG, DP (04)
5) Cannot be combined with basic pressure controller DG and DP (04)
6) Cannot be combined with basic pressure controller DP (04)
7) Cannot be combined with basic controllers stroke limiter and pressure controller (04)

Ordering code for standard program

A15VS	O								V	/	10	M		V	E4		1	E		0	–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17	18	19	20		21

Depressurized basic setting and external control pressure supply[8)]

			175	210	280	
08	Maximum swivel angle ($V_{g\,max}$), without external control pressure supply (standard for power and pressure control)		●	●	●	**A**
	Maximum swivel angle ($V_{g\,max}$), with external control pressure supply (integrated shuttle valve) (standard for negative stroke limiter)		●	●	●	**B**
	Minimum swivel angle ($V_{g\,min}$), with external control pressure supply (integrated shuttle valve) (standard for positive stroke limiter)		●	●	●	**C**

Connector for solenoids[9)]

		175	210	280	
09	Without (only with hydraulic controls)	●	●	●	**0**
	HIRSCHMANN connector	●	●	●	**H**

Swivel angle indicator

10	With visual swivel angle indicator	**V**

Series

11	Series 1, index 0	**10**

Configuration of ports and fastening threads

12	Metric, port threads with O-ring seal according to ISO 6149	**M**

Direction of rotation

			175	210	280	
13	Viewed on drive shaft	clockwise	●	●	●	**R**
		counter-clockwise	●	●	●	**L**

Seals

14	FKM (fluor-caoutchouc)	**V**

Mounting flange

15	SAE J744	165-4	**E4**

Drive shaft

			175	210	280	
16	Splined shaft DIN 5480	W50x2x24x9g	●	●	–	**A2**
		W60x2x28x9g	–	–	●	**A4**
	Parallel keyed shaft DIN 6885	Ø50	●	●	–	**B2**
		Ø60	–	–	●	**B4**

Service line ports

17	SAE flange port A: on side (45°)	**1**

Rotary group version

18	Noise-optimized for n = 1500 / 1800 rpm (standard)	**E**

● = Available ❍ = On request – = Not available

8) For description, see control device
9) Connectors for other electric components can deviate.

2

Ordering code for standard program

A15VS	O								V	/	10	M		V	E4		1	E		0	–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17	18	19	20		21

Through drive

	Flange SAE J744	Mounting variant		Coupling for splined shaft[10]						
	Diameter	Symbol[11]	Designation	Diameter		Designation	175	210	280	
19	Prepared for through drive, with pressure-proof plugged cover						●	●	●	**U000**
	82-2 (A)		A1	5/8 in	9T 16/32DP	S2	●	●	❍	**A1S2**
			A2	5/8 in	9T 16/32DP	S2	❍	❍	❍	**A2S2**
	101-2 (B)		B3	7/8 in	13T 16/32DP	S4	❍	❍	❍	**B3S4**
				1 in	15T 16/32DP	S5	❍	❍	❍	**B3S5**
	127-2 (C)		C3	1 1/4 in	14T 12/24DP	S7	❍	❍	❍	**C3S7**
				1 1/2 in	17T 12/24DP	S9	❍	❍	❍	**C3S9**
	152-4 (D)		D4	W45x2x21x9g		A1	❍	❍	❍	**D4A1**
				W50x2x24x9g		A2	❍	❍	❍	**D4A2**
	165-4 (E)		E4	W50x2x24x9g		A2	●	●	●	**E4A2**
				W60x2x28x9g		A4	❍	❍	●	**E4A4**
	Flange, ISO 3019-2 (metric)	Mounting variant		Coupling for splined shaft[10]						
	Diameter	Symbol[11]	Designation	Diameter		Designation	175	210	280	
	80-2		K1	3/4 in	11T 16/32DP	S3	❍	❍	❍	**K1S3**
			K2	3/4 in	11T 16/32DP	S3	●	❍	❍	**K2S3**
			K5	3/4 in	11T 16/32DP	S3	●	●	❍	**K5S3**
	100-2		L5	7/8 in	13T 16/32DP	S4	●	●	❍	**L5S4**
	160-4		P4	1 1/4 in	14T 12/24DP	S7	❍	❍	❍	**P4S7**
	180-4		R4	1 1/2 in	17T 12/24DP	S9	●	●	❍	**R4S9**
				1 3/4 in	13T 8/16 DP	T1	❍	❍	❍	**R4T1**
	125-4		M4	1 in	15T 16/32DP	S5	❍	❍	❍	**M4S5**
				W32x2x14x9g		Z7	❍	❍	❍	**M4Z7**
	140-4		N4	W40x2x18x9g		Z9	❍	❍	❍	**N4Z9**

Sensors

20	Without	**0**

Standard / special version

21	Standard version	**0**
	Special version	**S**

Note
Short designation X on a feature refers to a special version not covered by the ordering code.

● = Available ❍ = On request – = Not available

10) Coupling for splined shaft according to ANSI B92.1a (30° pressure angle, flat root, side fit, tolerance class 5) or to DIN 5480
11) Mounting drillings pattern viewed on through drive with control at top

Technical data

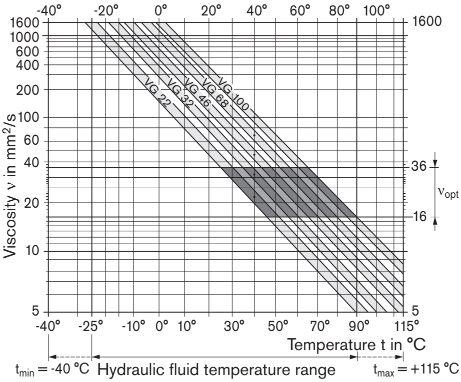
Hydraulic fluid

Before starting project planning, please refer to our data sheet RE 90220 (mineral oil) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump A15VSO is currently approved for operation with mineral oil.

Please contact us about operation with environmentally acceptable or HF hydraulic fluids.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct selection of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit, the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60° C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

2

Note
The case drain temperature, which is affected by pressure and speed, is always higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C, however. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, please contact us.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq$ -50 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up[1)]	ν_{max} = 1600	$T_{St} \geq$ -40 °C	$t \leq$ 3 min, low load (20 bar $\leq p \leq$ 50 bar), $n \leq$ 1000 rpm
Permissible temperature difference		$\Delta T \leq$ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	ν = 1600 to 400	T = -40 °C to -25 °C	at p_{nom}, 0.5 • n_{nom} and $t \leq$ 15 min
Operating phase			
Temperature difference		ΔT = approx. 5 K	between hydraulic fluid in the bearing and at port T
Maximum temperature		115 °C 110 °C	in the bearing measured at port T
Continuous operation	ν = 400 to 10 ν_{opt} = 16 to 36	T = -25 °C to + 90 °C	measured at port T, no restriction within the permissible data
Short-term operation	ν_{min} < 10 to 5	T_{max} = +110 °C	measured at port T, t < 3 min, p < 0.3 • p_{nom}
FKM shaft seal[1)]		$T \leq$ +115 °C	see page 6

1) At temperatures below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

Technical data

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Case drain pressure

The case drain pressure at ports T_1 to T_3 may be a maximum of 1.2 bar higher than the inlet pressure at port S but not higher than

$p_{L\ max}$ ______ 4 bar absolute.

A case drain line to the reservoir is required.

Shaft seal

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

Technical data

Operating pressure range
(operating with mineral oil)

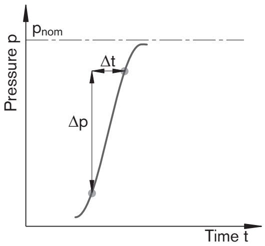
Pressure at service line port A

Nominal pressure p_{nom} ________________ 350 bar absolute

Maximum pressure p_{max} ______________ 420 bar absolute
Single operating period__________________________ 10 s
Total operating period __________________________ 300 h

Minimum pressure (high-pressure side) __________15 bar
for lower pressure, please contact us.

Rate of pressure change $R_{A\,max}$ ____________ 16000 bar/s



Pressure at suction port S (Inlet)
Minimum pressure $p_{S\,min}$ ________________≥ 0.8 bar absolute
Maximum pressure $p_{S\,max}$ _______________ ≤ 30 bar absolute

Definition

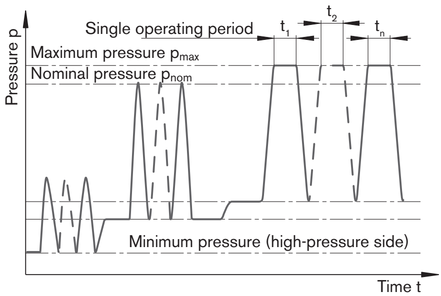
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure on the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Minimum pressure (Inlet)
Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed and displacement of the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

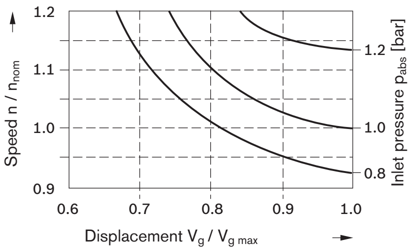
Technical data

Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size		NG		175	210	280
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	175.0	210.0	280.0
		$V_{g\,min}$	cm^3	0[1)]	0[1)]	0[1)]
Maximum speed[2)]						
at $V_{g\,max}$		n_{nom}	rpm	2150	2100	1800
at $V_g \leq V_{g\,max}$[3)]		n_{max}	rpm	2500	2500	2300
Volume flow						
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	L/min	376	441	504
Power						
at n_{nom}, $V_{g\,max}$ and $\Delta p = 350$ bar		P_{max}	kW	219	257	294
Torque						
at $V_{g\,max}$ and $\Delta p = 350$ bar		T_{max}	Nm	970	1170	1560
Rotary stiffness drive shaft	W50 A2	c	kNm/rad	357	381	–
	W60 A4	c	kNm/rad	–	–	664
	ø50 B2	c	kNm/rad	349	372	–
	ø60 B4	c	kNm/rad	–	–	620
Moment of inertia for rotary group		J_{GR}	kgm^2	0.045	0.060	0.097
Maximum angular acceleration[4)]		α	rad/s^2	5609	5014	4200
Case volume		V	L	3.6	4	6.5
Mass (approx.)		m	kg	97	111	143

1) Mooring function (swivel mode) possible up to −100% $V_{g\,max}$
2) The values are valid:
- for the optimum viscosity range from $\nu_{opt} = 16$ to $36\ mm^2/s$
- with hydraulic fluid on the basis of mineral oil
- for an absolute pressure $p_{abs} = 1$ bar at suction port S

3) Maximum speed (limiting speed) with increased inlet pressure p_{abs} at suction port S and $V_g < V_{g\,max}$, see the following diagram

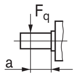
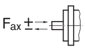


4) The data are valid for values between the minimum required and maximum permissible speed.
Valid for external excitation (e. g. engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency).
The limit value applies for a single pump only.
The load capacity of the connection parts must be considered.

Note
Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Technical data

Permissible radial and axial forces of the drive shaft

Size			NG	175	175	210	210	280	280
Drive shaft				ø50	W50	ø50	W50	ø60	W60
Maximum radial force at distance a (from shaft collar)		$F_{q\,max}$	N	14000	13500	17000	16000	20000	17500
		a	mm	41	27	41	27	52.5	29
Maximum axial force		$+F_{ax\,max}$	N	± 850		± 900		± 1000	
		$-F_{ax\,max}$	N						

Note
Special requirements apply in the case of belt drives. Please contact us.

Influence of the direction of the permissible axial force:

$+F_{ax\,max}$ = Increase in service life of bearings

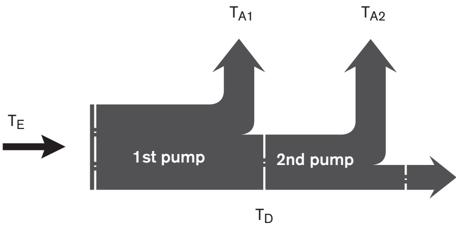
$-F_{ax\,max}$ = Reduction in service life of bearings (avoid)

Permissible input and through-drive torques

Size			NG		175	210	280
Torque at $V_{g\,max}$ and Δp = 350 bar[1)]			T_{max}	Nm	975	1170	1560
Input torque at drive shaft, maximum[2)]							
	A2	W50x2x24x9g	$T_{E\,max}$	Nm	2600	2600	–
	A4	W60x2x28x9g	$T_{E\,max}$	Nm	–	–	3500
	B2	ø50	$T_{E\,max}$	Nm	1500	1500	–
	B4	ø60	$T_{E\,max}$	Nm	–	–	2800
Maximum through-drive torque			$T_{D\,max}$	Nm	1500	1500	1950

1) Efficiency not considered
2) For drive shafts without radial force

Torque distribution



Determining the operating characteristics

Volume flow $$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{[L/min]}$$

Torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{[Nm]}$$

Power $$P = \frac{2\,\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Power controller

LR - Power controller, fixed setting

The power control regulates the displacement of the pump depending on the operating pressure so that a given drive power is not exceeded at constant drive speed.

$p_B \cdot V_g = \text{constant}$	p_B = operating pressure V_g = displacement

The precise control with a hyperbolic control characteristic, provides an optimum utilization of available power.

The operating pressure acts on a rocker via a measuring piston which moves with the control. An externally adjustable spring force counteracts this, it determines the power setting. The depressurized basic setting is $V_{g\,max}$.

If the operating pressure exceeds the set spring force, the control valve will be actuated by the rocker and the pump will swivel back from the basic setting $V_{g\,max}$ toward $V_{g\,min}$. This shortens the leverage at the rocker, allowing the operating pressure to rise at the same ratio as the displacement is reduced ($p_B \cdot V_g$ = fixed).

The hydraulic output power (characteristic LR) is influenced by the efficiency of the pump.

When ordering, state in plain text:

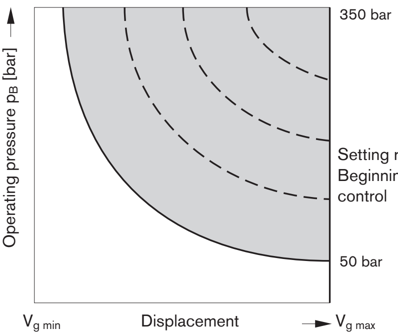
– Drive power P in kW

– Drive speed n in rpm

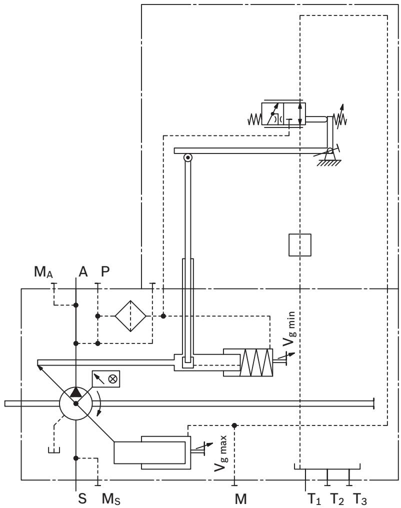
– Maximum flow $q_{V\,max}$ in L/min

After clarifying the details, we can prepare an updated power diagram.

Characteristic LR



Schematic LR



Power controller

L4 – Power controller, electric, proportional (negative control)

A control current acts against the mechanical power control adjustment spring via a proportional solenoid.

The mechanically adjusted basic power setting can be reduced by means of different control current settings.

Increase in control current = decrease in power.

The following amplifiers are available for controlling the proportional solenoids. Recommended amplifier for stationary applications:

- Analog amplifier VT-VSPA1-1 ________________ RE 30111
- Digital amplifier VT-VSPD-1 ________________ RE 30523

Further information can also be found on the internet at www.boschrexroth.com/industrial-hydraulics-catalog/

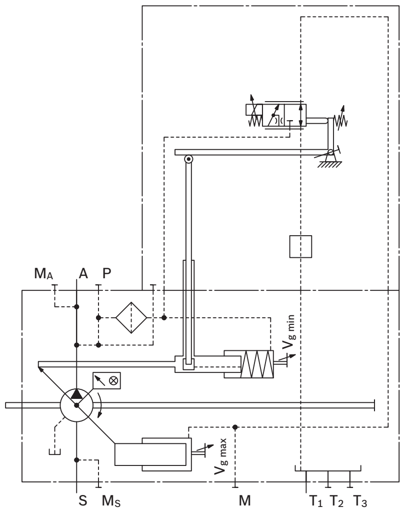
Technical data, solenoid

	L4
Voltage	24 V (±20 %)
Control current	
Beginning of control	200 mA
End of control	600 mA
Limiting current	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100 %
Type of protection see connector design page 37	

When ordering, state in plain text:

- Drive power P in kW at start of control
- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in L/min

Schematic L4

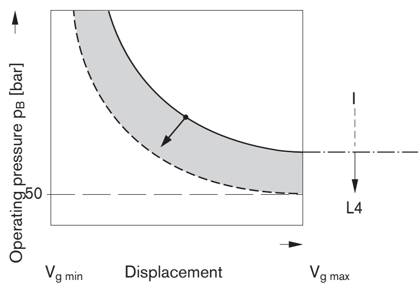


Change in beginning of control in bar when control current is changed from minimum to maximum.

Size	Δp start of control in control range from 200 to 600 mA
175	232 bar
210	218 bar
280	198 bar

Note
For de-energized operating state:
Start of control increase +50 bar

Effect of power overrides at rising current



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Power controller

CR – Summation hp-control of two power-controlled pumps, high-pressure-related override (with stop)

With two A15VSO units of the same size working in different circuits, the CR controller limits the overall power.

The CR works like the normal LR with a fixed maximum power setting along the power hyperbola. The high-pressure-related override reduces the power setpoint in dependence on the operating pressure of the other pump. That happens proportionally below the start of control and is blocked by a stop when the minimum power is reached. Here, the CR port of the one pump has to be connected to the M_A port of the other pump.

The maximum power of the first pump is reached when the second pump is working at idle when depressurized. When defining the maximum power, the idle power of the second pump has to be taken into account.

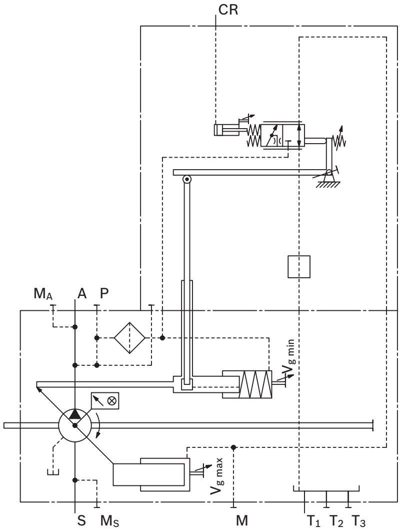
The minimum power of each pump is reached when both pumps are working at high pressure. The minimum power usually equates to 50% of the total power.

Power that in unused through activated pressure controls or other overrides remains unconsidered.

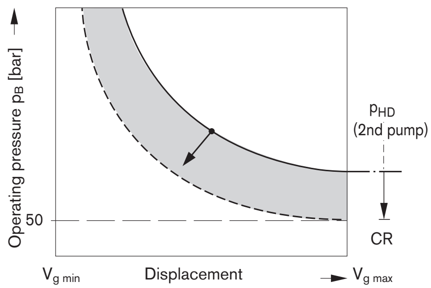
When ordering, please state separately for each pump:

- Maximum drive power P_{max} in kW
- Minimum drive power P_{min} in kW
- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in L/min

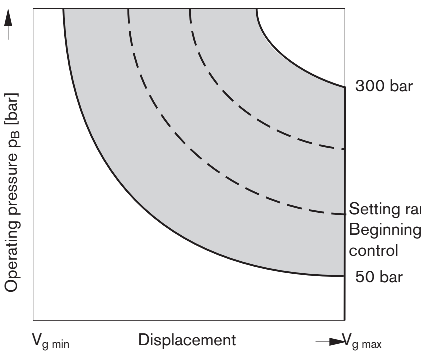
Schematic CR



Effect of power override with increasing pressure



Characteristic CR



Stroke limiter

E2 – Stroke limiter, electric, proportional (positive control)

With the electrical stroke limiter with proportional solenoid, the pump displacement is steplessly adjusted in proportion to the current by means of magnetic force.

Basic setting without pilot signal is $V_{g\ min}$. This includes the mechanically depressurized basic setting $V_{g\ min}$ (see ordering code digit 08).

With increasing control current the pump swivels to a higher displacement (from $V_{g\ min}$ to $V_{g\ max}$).

The necessary control power is taken from the operating pressure or the external control pressure applied to port P.

To enable the pump to be adjusted from the zero basic setting or from a low operating pressure, port P must be supplied with an external control pressure[1)] of at least 30 bar, maximum 50 bar.

Note
If no external control pressure is connected to P, the version "Maximum swivel angle ($V_{g\ max}$), without external control pressure supply" is to be ordered (see ordering code digit 08, A).

Technical data, solenoid

	E2
Voltage	24 V (±20 %)
Control current	
Beginning of control at $V_{g\ min}$	200 mA
End of control at $V_{g\ max}$	600 mA[2)]
Limiting current	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Duty Cycle	100 %
Type of protection see connector design page 37	

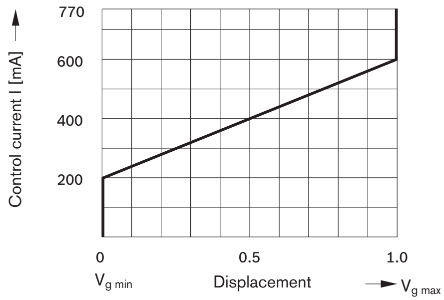
The following amplifiers are available for controlling the proportional solenoids. Recommended amplifier for stationary applications:

– Analog amplifier VT-VSPA1-1 ________________ RE 30111
– Analog amplifier module VT-MSPA1 __________ RE 59497
– Digital amplifier VT-VSPD-1 ________________ RE 30523

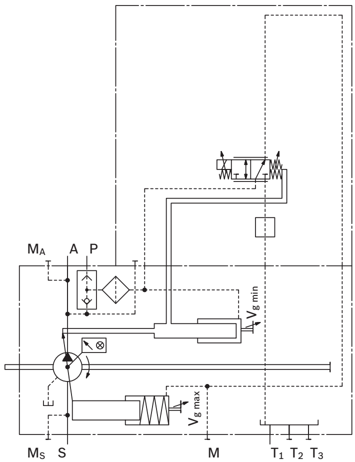
Further information can also be found on the internet at www.boschrexroth.com/industrial-hydraulics-catalog/

When ordering, state in plain text:
– Drive speed n in rpm
– Maximum flow $q_{V\ max}$ in L/min
– Minimum flow $q_{V\ min}$ in L/min

Characteristic E2



Schematic E2



Note

The spring return feature in the controller is not a safety device

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. immediate stop).

1) With an external supply of control pressure, it is possible for the pump to swivel slightly beyond the zero position (to the mechanical stop).
2) Because of the controller hysteresis, a control current of up to 650 mA may be required for the $V_{g\ max}$ position.

Stroke limiter

E6 – Stroke limiter, electric, two-point (positive control)

With the electric stroke limiter with switching solenoid, the displacement of the pump is adjusted between $V_{g\,min}$ and $V_{g\,max}$.

Basic setting without current is $V_{g\,min}$. This includes the mechanically depressurized basic setting $V_{g\,min}$ (see ordering code digit 08).

When the solenoid is energized, the pump swivels from $V_{g\,min}$ to $V_{g\,max}$.

The necessary control power is taken from the operating pressure or the external control pressure applied to port P.

To enable the pump to be adjusted from the zero basic setting or from a low operating pressure, port P must be supplied with an external control pressure[1)] of at least 30 bar, maximum 50 bar.

Note
If no external control pressure is connected to P, the version "Maximum swivel angle ($V_{g\,max}$), without external control pressure supply" is to be ordered (see ordering code digit 08, A).

Technical data, solenoid

	E6
Voltage	24 V
Nominal resistance (at 20 °C)	21.7 Ω
Nominal power	26.5 W
Test current	0.67 A
Duty Cycle	100 %
Type of protection see connector design page 37	

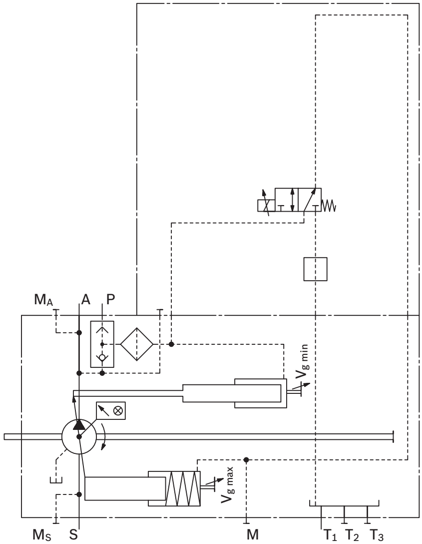
When ordering, state in plain text:

– Drive speed n in rpm

– Maximum flow $q_{V\,max}$ in L/min

– Minimum flow $q_{V\,min}$ in L/min

Schematic E6



Note

The spring return feature in the controller is not a safety device

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. immediate stop).

1) With an external supply of control pressure, it is possible for the pump to swivel slightly beyond the zero position (to the mechanical stop).

Stroke limiter

H5 – Stroke limiter, pilot pressure, proportional (negative control)

With pilot-pressure-related control, the pump displacement is adjusted in proportion to the pilot pressure applied at port H5.

Basic setting without pilot signal is $V_{g\ max}$. This includes the mechanically depressurized basic setting $V_{g\ max}$ (see ordering code digit 08).

Maximum permissible pilot pressure $p_{St\ max}$ = 100 bar

With increasing pilot pressure the pump swivels to a smaller displacement (from $V_{g\ max}$ to $V_{g\ min}$).

Beginning of control $V_{g\ max}$: 10 bar

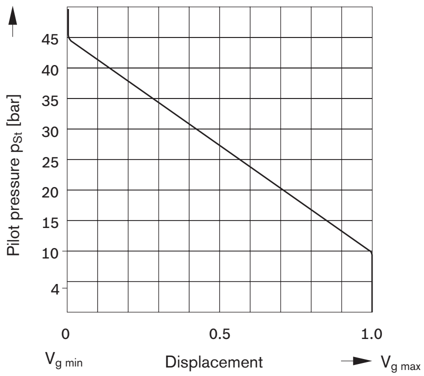
The necessary control power is taken from the operating pressure or the external control pressure applied to port P.

To enable the pump to be adjusted at low operating pressure, port P must be supplied with an external control pressure1) of at least 30 bar, maximum 50 bar.

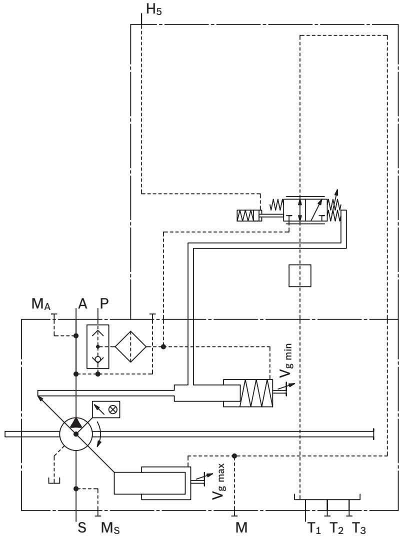
Note
If no external control pressure is connected to P, the version "Maximum swivel angle ($V_{g\ max}$), without external control pressure supply" is to be ordered (see ordering code digit 08, A).

Characteristic H5 (negative)

Control pressure characteristic $V_{g\ max}$ to $V_{g\ min}$ ____ Δp = 35 bar



Schematic H5



Note

The spring return feature in the controller is not a safety device

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. immediate stop).

When ordering, state in plain text:

– Drive speed n in rpm

– Maximum flow $q_{V\ max}$ in L/min

– Minimum flow $q_{V\ min}$ in L/min

1) With an external supply of control pressure, it is possible for the pump to swivel slightly beyond the zero position (to the mechanical stop).

Stroke limiter

H6 – Stroke limiter, pilot pressure, proportional (positive control)

With pilot-pressure-related control, the pump displacement is adjusted in proportion to the pilot pressure applied at port H6.

Basic setting without pilot signal is $V_{g\,min}$. This includes the mechanically depressurized basic setting $V_{g\,min}$ (see ordering code digit 08).

Maximum permissible pilot pressure $p_{St\,max} = 100$ bar

With increasing pilot pressure the pump swivels to a larger displacement (from $V_{g\,min}$ to $V_{g\,max}$).

Beginning of control $V_{g\,min}$: 10 bar

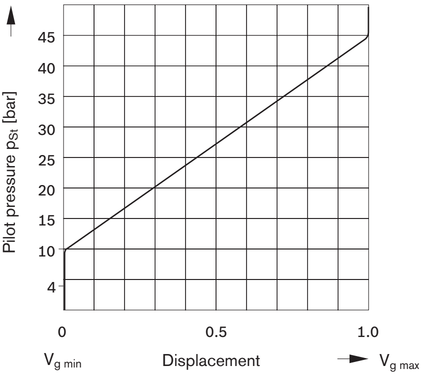
The necessary control power is taken from the operating pressure or the external control pressure applied to port P.

To enable the pump to be adjusted from the zero basic setting or from a low operating pressure, port P must be supplied with an external control pressure[1)] of at least 30 bar, maximum 50 bar.

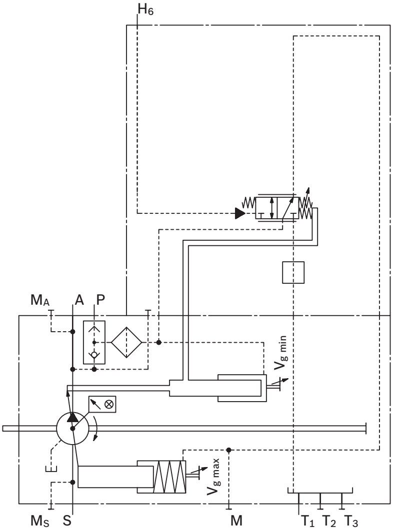
Note
If no external control pressure is connected to P, the version "Maximum swivel angle ($V_{g\,max}$), without external control pressure supply" is to be ordered (see ordering code digit 08, A).

Characteristic H6 (positive)

Control pressure increase $V_{g\,min}$ to $V_{g\,max}$ ________ $\Delta p = 35$ bar



Schematic H6



Note

The spring return feature in the controller is not a safety device

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. immediate stop).

When ordering, state in plain text:

- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in L/min
- Minimum flow $q_{V\,min}$ in L/min

1) With an external supply of control pressure, it is possible for the pump to swivel slightly beyond the zero position (to the mechanical stop).

Pressure controller

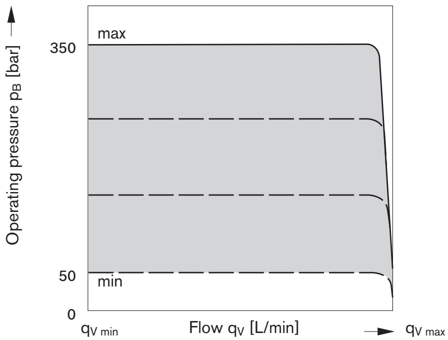
DR - Pressure controller with one-sided deflection, fixed setting

The pressure controller keeps the pressure in a hydraulic system constant within its control range even with varying volume flow. The variable pump only moves as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the setpoint value set at the integral pressure valve, the pump control will shift toward a smaller displacement and the control deviation will decrease.

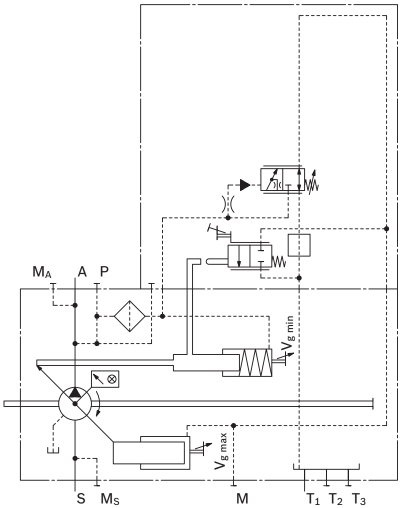
Basic position in depressurized state: $V_{g\,max}$

Setting range from 50 to 350 bar.

Characteristic DR



Schematic DR



Hydraulic $V_{g\,min}$ stop

The hydraulic $V_{g\,min}$ stop opens the valve outlet to the case drain chamber when a minimum position is reached, damping the controller and reducing overshoot. This can cause a connection from high pressure or external control pressure via the controller and the hydraulic $V_{g\,min}$ stop to the case drain chamber.

When ordering, state in plain text:

– Pressure setting p in bar

– Drive speed n in rpm

– Maximum flow $q_{V\,max}$ in L/min

2

Pressure controller

DRS0 - Pressure controller with load sensing

The load sensing control is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the actuator flow requirement.

The flow depends here on the cross section of the external sensing orifice (1) fitted between the pump outlet and the actuator. The flow is independent of the load pressure below the pressure controller setting and within the control range of the pump.

The sensing orifice is usually a separately arranged load sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the sensing orifice and thus the flow of the pump.

The load sensing control compares pressure before and after the sensing orifice and maintains the pressure drop across the orifice (differential pressure Δp), and with it the flow, constant.

If the differential pressure Δp increases at the sensing orifice, the pump is swiveled back (towards $V_{g\,min}$), and, if the differential pressure Δp decreases, the pump is swiveled out (towards $V_{g\,max}$) until equilibrium at the sensing orifice is restored.

$\Delta p_{sensing\ orifice} = p_{pump} - p_{consumer}$

Setting range for Δp ______________________ 14 to 30 bar
(please state in plain text)

Standard adjustment ___________________________ 14 bar

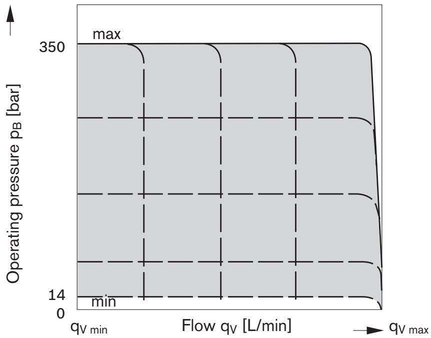
The standby pressure in zero stroke operation (sensing orifice plugged) is slightly above the Δp setting.

Hydraulic $V_{g\,min}$ stop
The hydraulic $V_{g\,min}$ stop opens the valve outlet to the case drain chamber when a minimum position is reached, damping the controller and reducing overshoot. This can cause a connection from high pressure or external control pressure via the controller and the hydraulic $V_{g\,min}$ stop to the case drain chamber.

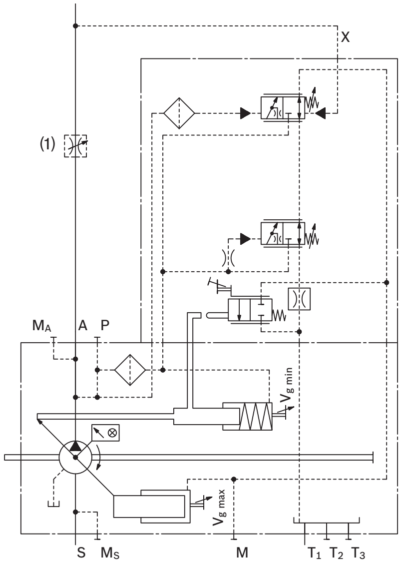
When ordering, state in plain text:

- Pressure setting DR
- Differential pressure load sensing controller Δp in bar
- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in L/min

Characteristic DRS0



Schematic DRS0



(1) The sensing orifice (control block) is not included in the delivery contents.

Pressure controller

DG – Pressure controller with one-sided deflection, hydraulic remote control (positive control)

The remote controlled pressure control has a fixed-setting Δp value. A separately connected pressure relief valve at port X (1) enables the pressure control to be remotely controlled.

Setting range Δ14 to 25 bar

Recommended value 20 bar

Control volume at X: approx 1.6 l L/min (static) at Δp 20 bar

In addition a separately configured 2/2 directional valve (2) van be operated to start the pump with low operating pressure (standby pressure).

Both functions can be used individually or in combination (see schematic).

The external valves are not included in the delivery contents.

As a separate pressure relief valve (1) we recommend:

For DBD.6, see RE 25402

Hydraulic $V_{g\,min}$ stop
The hydraulic $V_{g\,min}$ stop opens the valve outlet to the case drain chamber when a minimum position is reached, damping the controller and reducing overshoot. This can cause a connection from high pressure or external control pressure via the controller and the hydraulic $V_{g\,min}$ stop to the case drain chamber.

- Operating pressure p in bar (test pressure for DG)
- Differential pressure Δp in bar
- Drive speed n in rpm
- Maximum flow $q_{V\,max}$ in L/min

Note for setting remote controlled pressure control

The setting value for the external pressure relief valve plus the differential pressure value at the pressure control valve determines the level of pressure control.

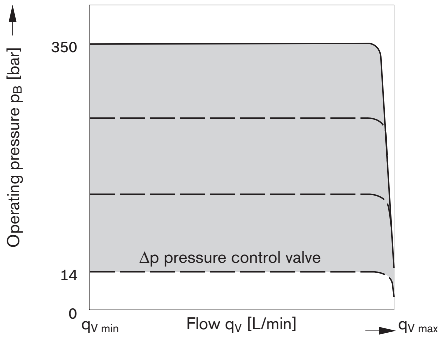
Example:

External pressure relief valve ____________________ 330 bar

Differential pressure at pressure control valve ________ 20 bar

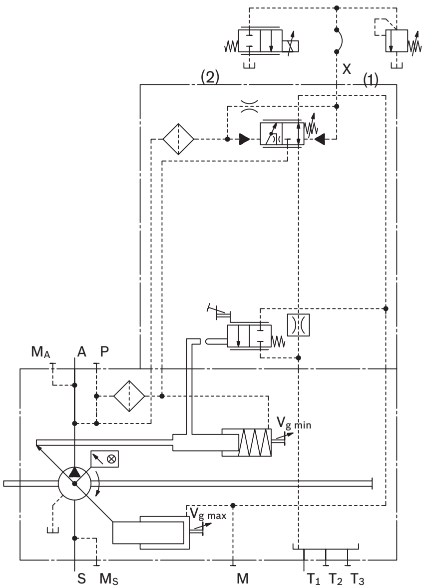
Pressure control at __________________ 330 + 20 = 350 bar

Characteristic DG



For function and description of pressure control DR, see page 17.

Schematic DG



2

Pressure controller

DP – Pressure controller with one-sided deflection for parallel operation (positive control)

The pressure control DP is suitable for pressure control of several axial piston pumps A15VSO in parallel operation pumping into a common pressure line.

The pressure control has a pressure increase of approx. 7 bar from $q_{v\,max}$ to $q_{v\,min}$. The pump regulates therefore to a pressure dependent swivel angle. This means a parallel or synchronous control behavior of several pumps.

The DP controller has a fixed Δp value which is overridden, depending on the swivel angle. Reference operating point is zero stroke.

Setting value for Δp in zero stroke 27 bar.

With the externally installed pressure relief valve (1) the nominal pressure setting of all pumps connected to the system is adjusted to the same value.

Setting range from 50 to 350 bar.

Control volume at DP: approx 1.9 L/min (static) at Δp 27 bar.

Each pump can be individually unloaded from the system by a separately installed 2/2-way directional valve (2) and set to a standby position.

The check valve in the service line (port A) is generally to be provided by the customer. The check valve in the control line (port DP) is included in the delivery contents.

The external valves are not included in the delivery contents.

As a separate pressure relief valve (1) we recommend:

DBD.6 (manual actuation), see RE 25402

Hydraulic $V_{g\,min}$ stop
The hydraulic $V_{g\,min}$ stop opens the valve outlet to the case drain chamber when a minimum position is reached, damping the controller and reducing overshoot. This can cause a connection from high pressure or external control pressure via the controller and the hydraulic $V_{g\,min}$ stop to the case drain chamber.

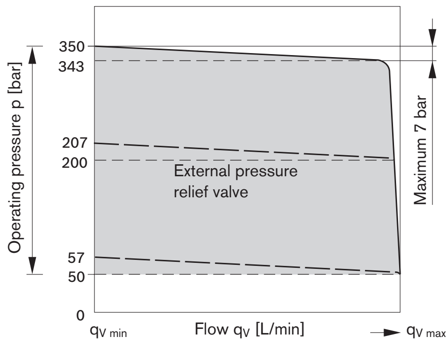
When ordering, state in plain text:

– Maximum operating pressure p in bar

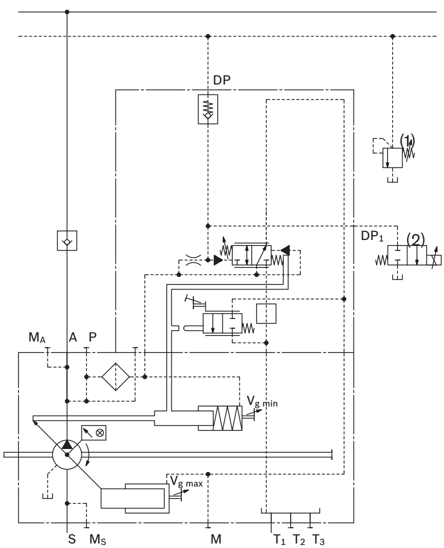
– Drive speed n in rpm

– Maximum flow $q_{V\,max}$ in L/min

Characteristic DP



Schematic DP

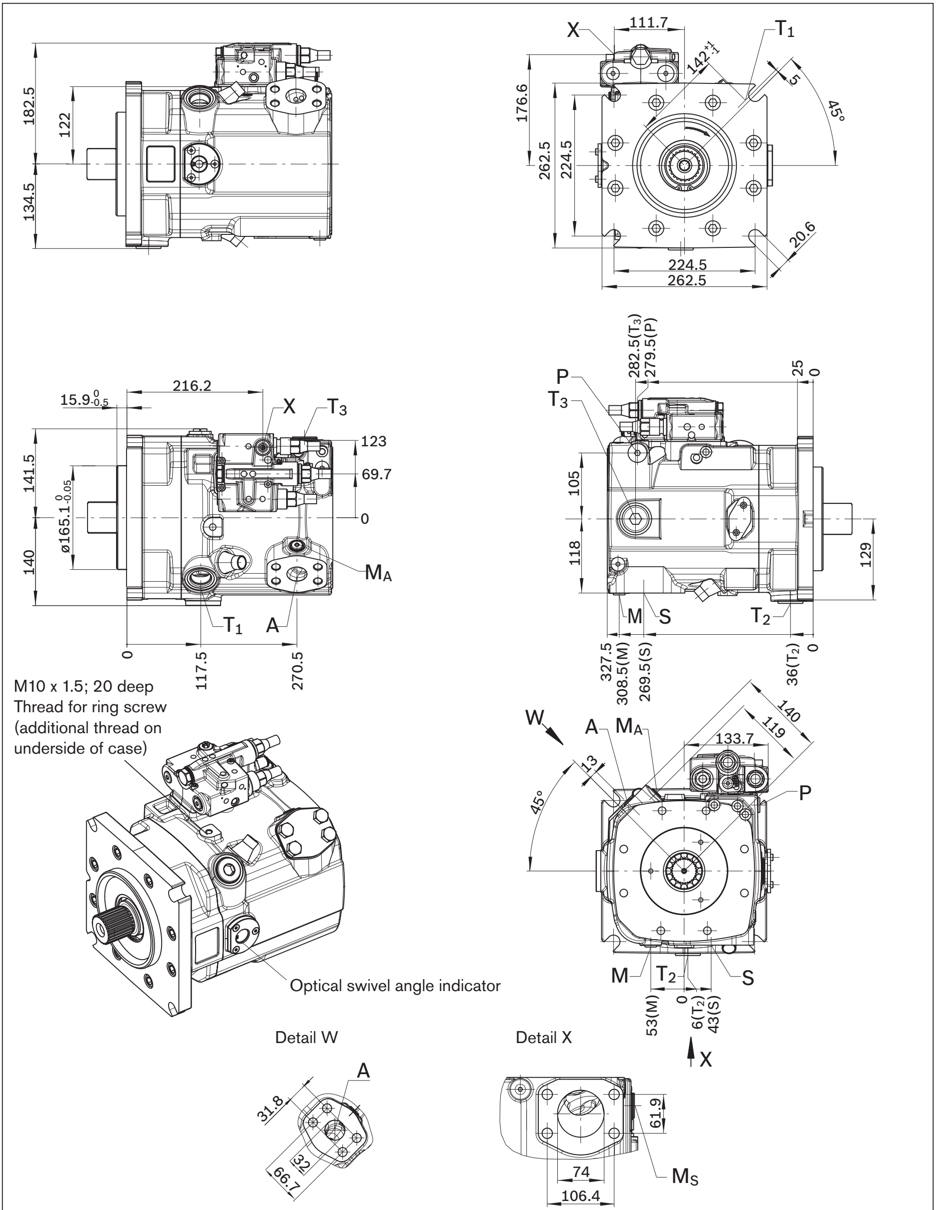


Dimensions size 175

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LRDRS0 – Power controller with pressure control and load sensing

(clockwise rotation)

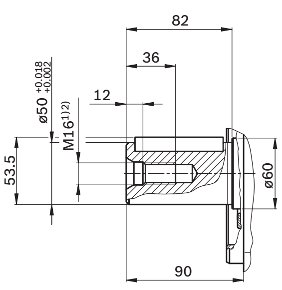


Dimensions size 175

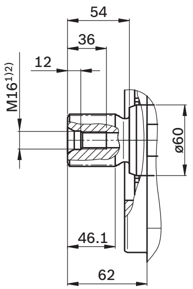
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

B2 Parallel keyed shaft DIN 6885



A2 Splined shaft, DIN 5480 W50x2x24x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A	Service line	SAE J518[4]	1 1/4 in	420	O
	Fastening threads	DIN 13	M14 x 2; 22 deep		
S	Suction line	SAE J518[4]	3 in	30	O
	Fastening threads	DIN 13	M16 x 2; 24 deep		
T_1	Drain line	ISO 6149[5]	M33 x 2; 19 deep	10	O[6]
T_2	Drain line	ISO 6149[5]	M33 x 2; 19 deep	10	X[6]
T_3	Drain line	ISO 6149[5]	M33 x 2; 19 deep	10	X[6]
M	Measuring control pressure	ISO 6149[5]	M14 x 1.5; 12 deep	420	X
M_A	Measuring pressure A	ISO 6149[5]	M14 x 1.5; 12 deep	420	X
M_S	Measuring suction pressure	ISO 6149[5]	M14 x 1.5; 12 deep	30	X
P	Control pressure (ordering code B, C with external control pressure supply)	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O
	Control pressure (ordering code A without external control pressure supply)	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	X
CR	Pilot signal (only on CR)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
DP, DP_1	Pilot pressure (only on DP)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
H_5, H_6	Pilot pressure (only on H5, H6)	ISO 6149	M14 x 1.5; 11.5 deep	100	O
X	Pilot signal	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 40 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) Depending on installation position, T_1, T_2 or T_3 must be connected (see also installation instructions on pages 38 and 89).
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

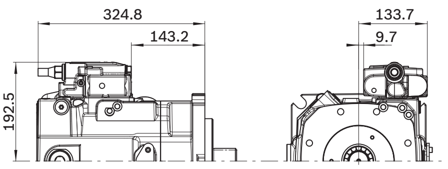
Dimensions size 175

(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

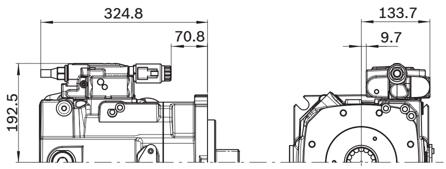
LR

Power controller, fixed setting



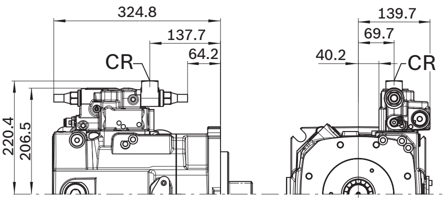
L4

Power controller, override electric, proportional



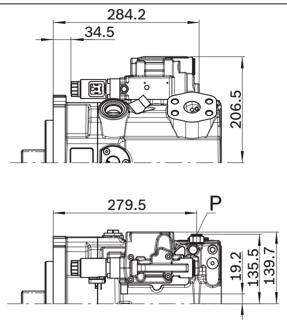
CR

Summation hp-control, override high-pressure-related (with stop)



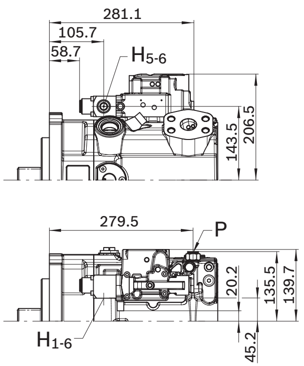
E2, E6

Stroke limiter, override electric, proportional (E2), two-point (E6)



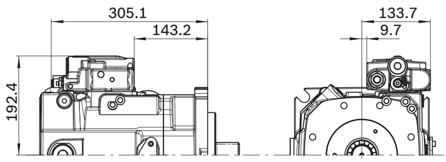
H5, H6

Stroke limiter, override pilot pressure, proportional



DR

Pressure controller with one-sided deflection, fixed setting



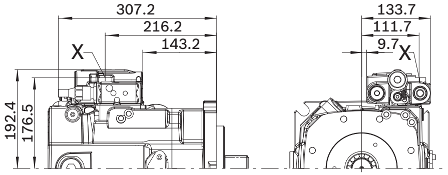
Dimensions size 175

(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

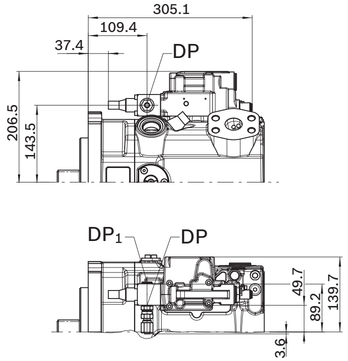
DG

Pressure controller with one-sided deflection, hydraulic remote control



DP

Pressure controller with one-sided deflection, for parallel operation

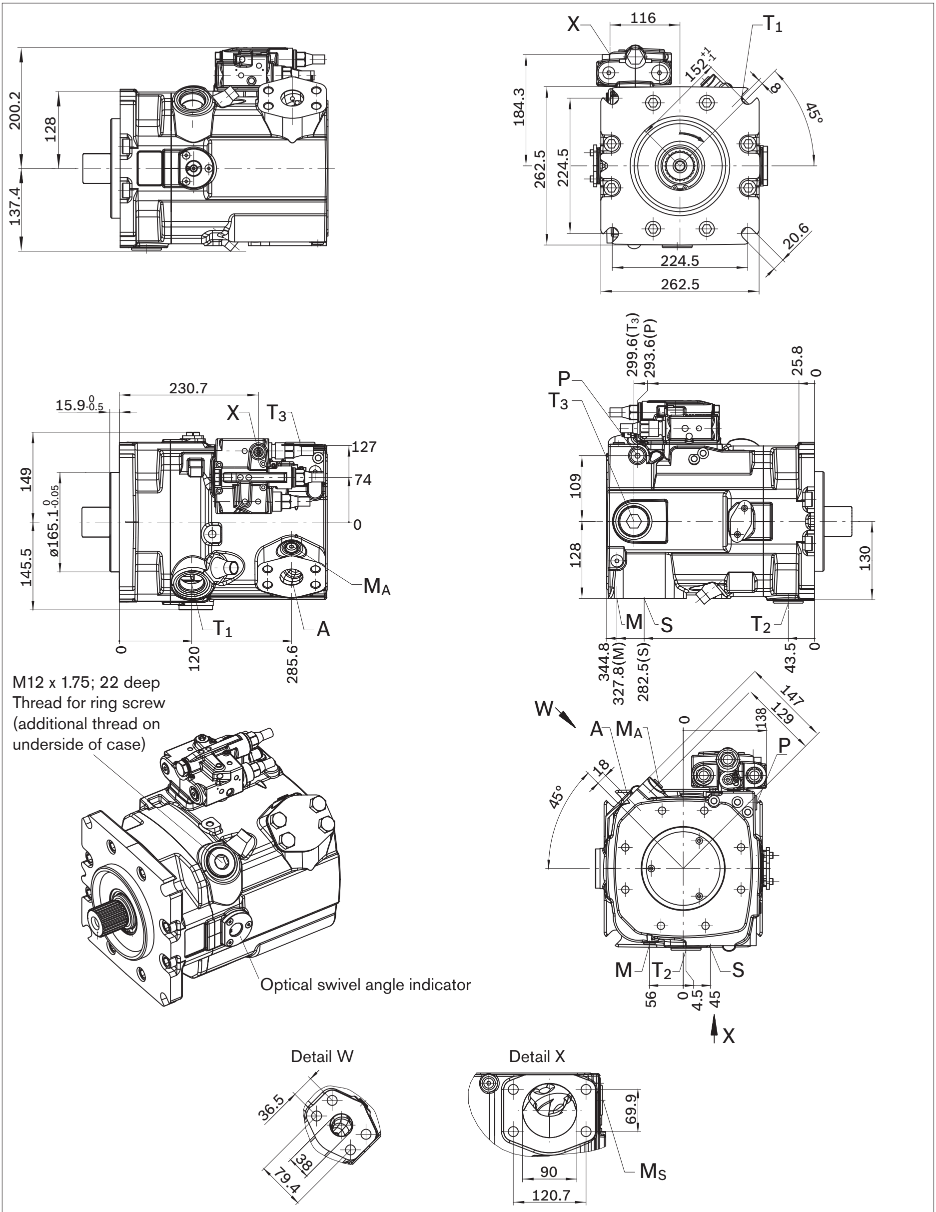


Dimensions size 210

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LRDRS0 - Power controller with pressure control and load sensing

(clockwise rotation)

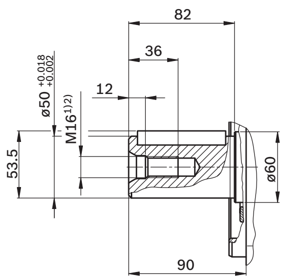


Dimensions size 210

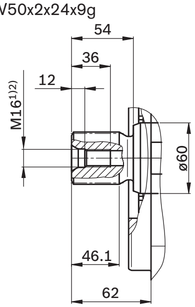
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

B2 Parallel keyed shaft
DIN 6885



A2 Splined shaft,
DIN 5480
W50x2x24x9g



2

Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A	Service line	SAE J518[4]	1 1/2 in	420	O
	Fastening threads	DIN 13	M16 x 2; 21 deep		
S	Suction line	SAE J518[4]	3 1/2 in	30	O
	Fastening threads	DIN 13	M16 x 2; 24 deep		
T_1	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	O[6]
T_2	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	X[6]
T_3	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	X[6]
M	Measuring control pressure	ISO 6149[5]	M14 x 1.5; 12 deep	420	X
M_A	Measuring pressure A	ISO 6149[5]	M14 x 1.5; 12 deep	420	X
M_S	Measuring suction pressure	ISO 6149[5]	M14 x 1.5; 12 deep	30	X
P	Control pressure (ordering code B, C with external control pressure supply)	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O
	Control pressure (ordering code A without external control pressure supply)	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	X
CR	Pilot signal (only on CR)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
DP, DP_1	Pilot pressure (only on DP)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
H_5, H_6	Pilot pressure (only on H5, H6)	ISO 6149	M14 x 1.5; 11.5 deep	100	O
X	Pilot signal	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 40 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) Depending on installation position, T_1, T_2 or T_3 must be connected (see also installation instructions on pages 38 and 39).
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

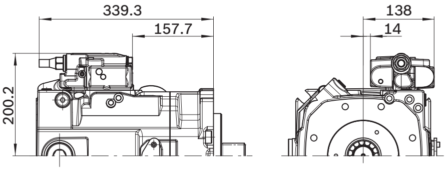
Dimensions size 210

(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

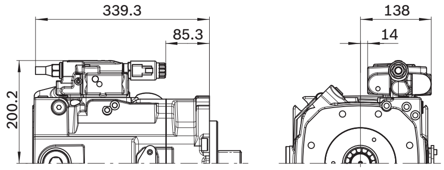
LR

Power controller, fixed setting



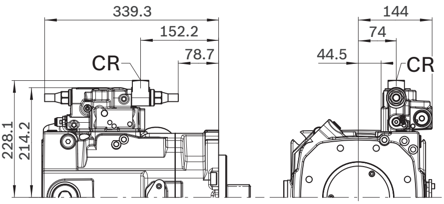
L4

Power controller, override electric, proportional



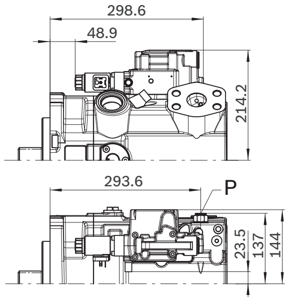
CR

Summation hp-control, override high-pressure-related (with stop)



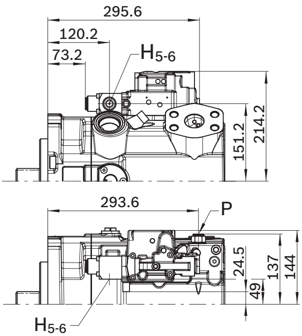
E2, E6

Stroke limiter, override electric, proportional (E2), two-point (E6)



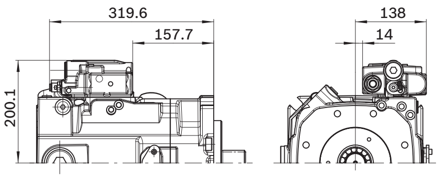
H5, H6

Stroke limiter, override pilot pressure, proportional



DR

Pressure controller with one-sided deflection, fixed setting



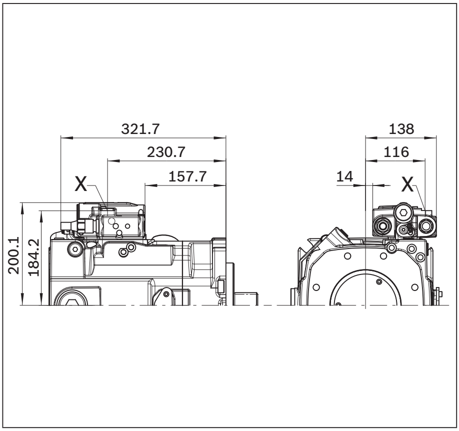
Dimensions size 210

(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

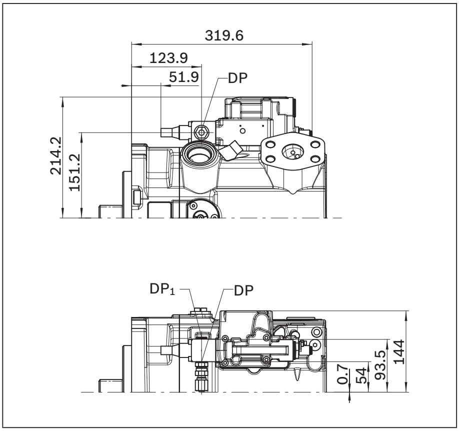
DG

Pressure controller with one-sided deflection, hydraulic remote control



DP

Pressure controller with one-sided deflection, for parallel operation

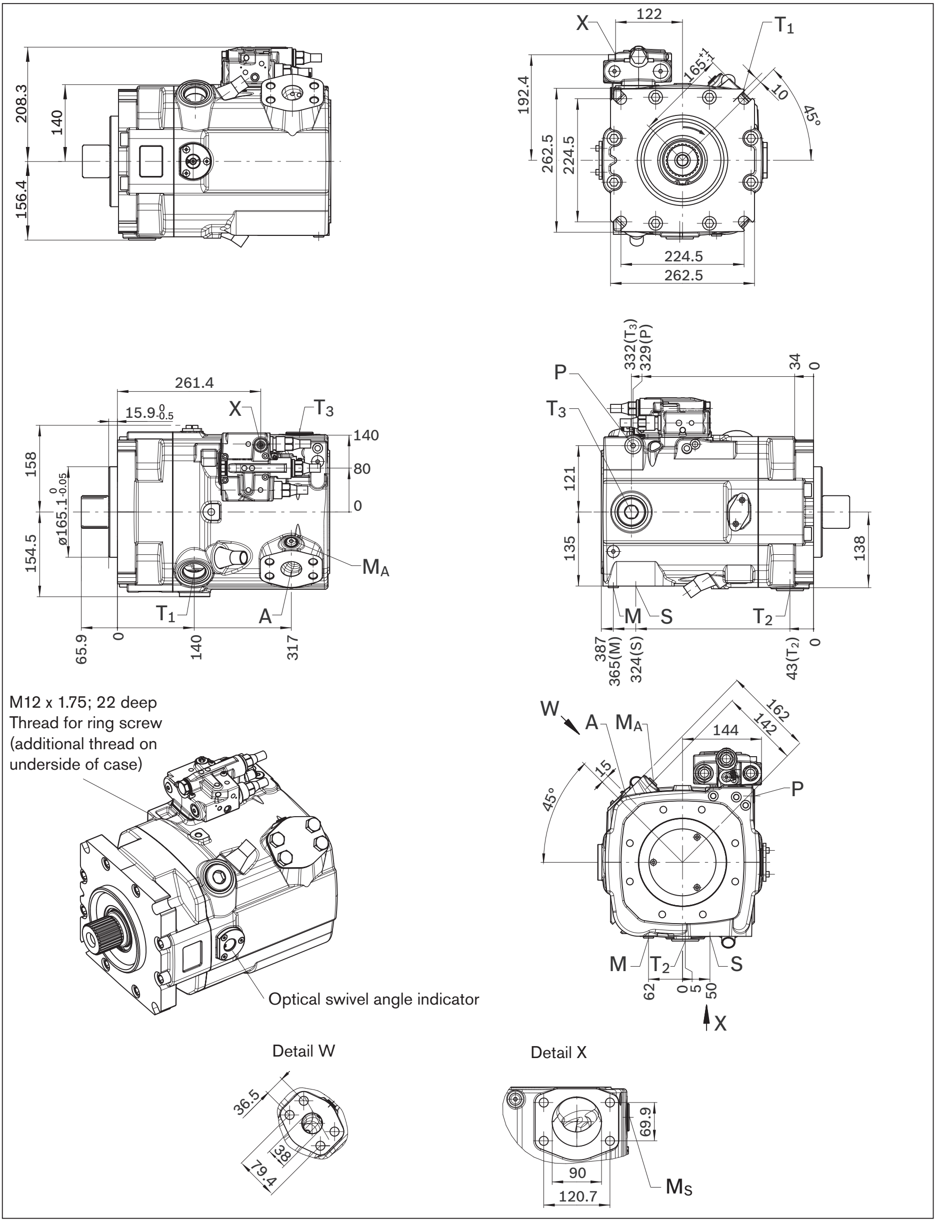


Dimensions size 280

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LRDRS0 - Power controller with pressure control and load sensing

(clockwise rotation)

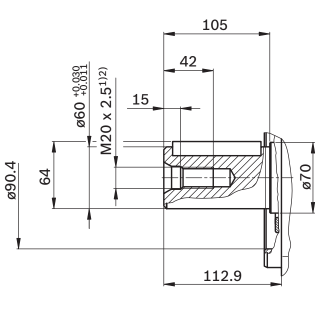


Dimensions size 280

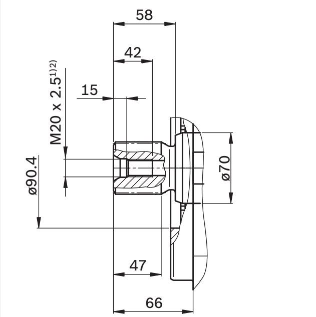
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

B4 Parallel keyed shaft DIN 6885



A4 Splined shaft, DIN 5480 W60x2x28x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A	Service line	SAE J518[4]	1 1/2 in	420	O
	Fastening threads	DIN 13	M16 x 2; 24 deep		
S	Suction line	SAE J518[4]	3 1/2 in	30	O
	Fastening threads	DIN 13	M16 x 2; 24 deep		
T_1	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	O[6]
T_2	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	X[6]
T_3	Drain line	ISO 6149[5]	M42 x 2; 19.5 deep	10	X[6]
M	Measuring control pressure	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	X
M_A	Measuring pressure A	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	X
M_S	Measuring suction pressure	ISO 6149[5]	M14 x 1.5; 12 deep	30	X
P	Control pressure (ordering code B, C with external control pressure supply)	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O
	Control pressure (ordering code A without external control pressure supply)	ISO 6149[5]	M18 x 1.5; 14.5 deep	420	X
CR	Pilot signal (only on CR)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
DP, DP_1	Pilot signal (only on DP)	ISO 6149	M14 x 1.5; 11.5 deep	420	O
H_5, H_6	Pilot signal (only on H5, H6)	ISO 6149	M14 x 1.5; 11.5 deep	100	O
X	Pilot signal	ISO 6149[5]	M14 x 1.5; 11.5 deep	420	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 40 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) Depending on installation position, T_1, T_2 or T_3 must be connected (see also installation instructions on pages 38 and 39).

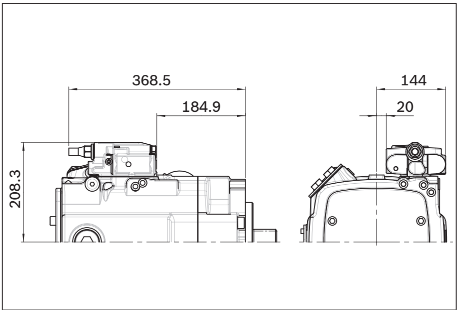
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 280

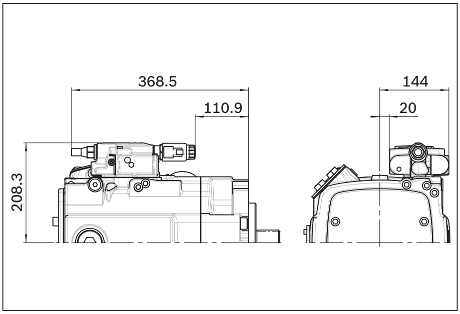
(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

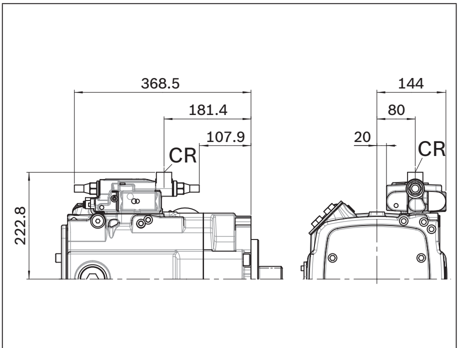
LR
Power controller, fixed setting



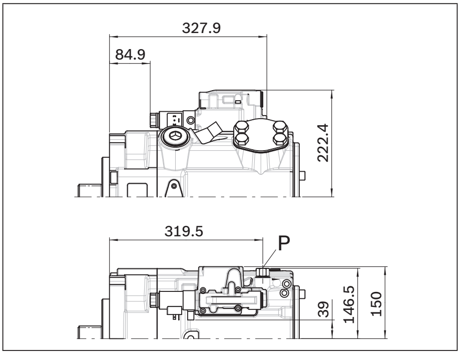
L4
Power controller, override electric, proportional



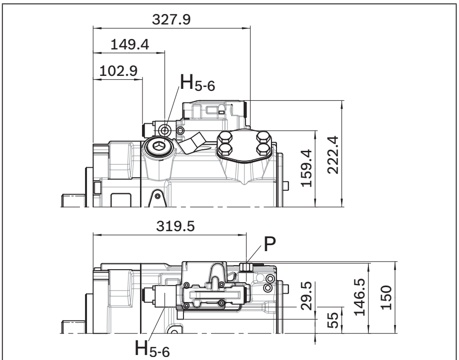
CR
Summation hp-control, override high-pressure-related (with stop)



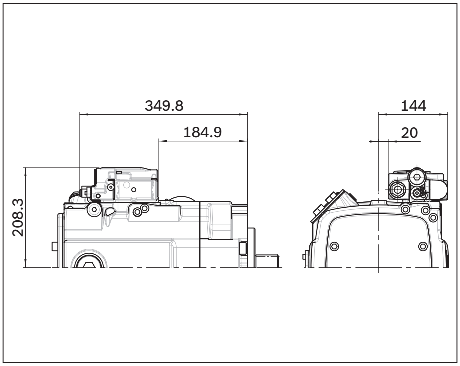
E2, E6
Stroke limiter, override electric, proportional (E2), two-point (E6)



H5, H6
Stroke limiter, override pilot pressure, proportional



DR
Pressure controller with one-sided deflection, fixed setting



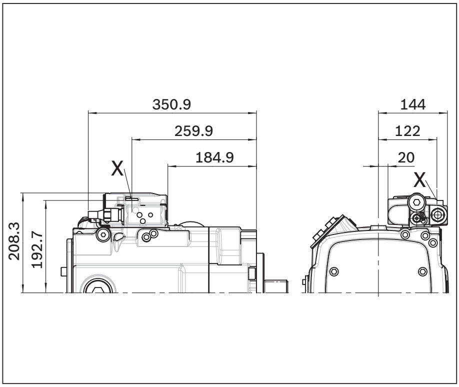
Dimensions size 280

(clockwise rotation)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

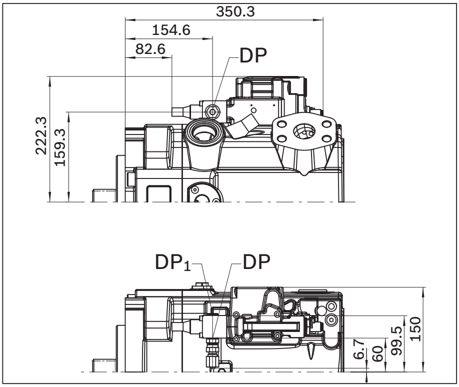
DG

Pressure controller with one-sided deflection, hydraulic remote control



DP

Pressure controller with one-sided deflection, for parallel operation



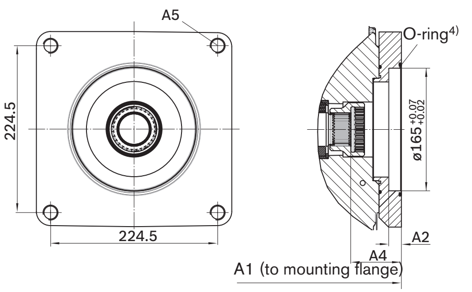
Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Flange SAE J744	Mounting variant		Coupling for splined shaft[1]						
Diameter	Symbol[2]	Designation	Diameter		Designation	175	210	280	
Prepared for through drive, with pressure-proof plugged cover						●	●	●	**U000**
82-2 (A)		A1	5/8 in	9T 16/32DP	S2	●	●	○	**A1S2**
		A2	5/8 in	9T 16/32DP	S2	○	○	○	**A2S2**
101-2 (B)		B3	7/8 in	13T 16/32DP	S4	○	○	○	**B3S4**
			1 in	15T 16/32DP	S5	○	○	○	**B3S5**
127-2 (C)		C3	1 1/4 in	14T 12/24DP	S7	○	○	○	**C3S7**
			1 1/2 in	17T 12/24DP	S9	○	○	○	**C3S9**
152-4 (D)		D4	W45x2x21x9g		A1	○	○	○	**D4A1**
			W50x2x24x9g		A2	○	○	○	**D4A2**
165-4 (E)		E4	W50x2x24x9g		A2	●	●	●	**E4A2**
			W60x2x28x9g		A4	○	○	●	**E4A4**

Flange, ISO 3019-2 (metric)	Mounting variant		Coupling for splined shaft[1]						
Diameter	Symbol[2]	Designation	Diameter		Designation	175	210	280	
80-2		K1	3/4 in	11T 16/32DP	S3	○	○	○	**K1S3**
		K2	3/4 in	11T 16/32DP	S3	●	○	○	**K2S3**
		K5	3/4 in	11T 16/32DP	S3	●	●	○	**K5S3**
100-2		L5	7/8 in	13T 16/32DP	S4	●	●	○	**L5S4**
160-4		P4	1 1/4 in	14T 12/24DP	S7	○	○	○	**P4S7**
180-4		R4	1 1/2 in	17T 12/24DP	S9	●	●	○	**R4S9**
			1 3/4 in	13T 8/16 DP	T1	○	○	○	**R4T1**
125-4		M4	1 in	15T 16/32DP	S5	○	○	○	**M4S5**
			W32x2x14x9g		Z7	○	○	○	**M4Z7**
140-4		N4	W40x2x18x9g		Z9	○	○	○	**N4Z9**

165-4 (E) E4A4



NG	A1	A2	A4	A5[3]
175	363.5	17	68	M20 x 2.5; 30 tief
210	380.8	17	68	M20 x 2.5; 30 tief
280	423	17	74.1	M20 x 2.5; 30 tief

1) Coupling for splined shaft according to ANSI B92.1a (30° pressure angle, flat root, side fit, tolerance class 5) or to DIN 5480
2) Mounting drillings pattern viewed on through drive with control at top.
3) Thread according to DIN 13, observe the general instructions on page 40 for the maximum tightening torques.
4) O-ring included in the delivery contents.

Overview of mounting options

Through drive[1]			Mounting option for 2nd pump				
Flange SAE J744	Coupling for splined shaft	Short code	A15VSO NG (shaft)	A10VSO/31 NG (shaft)	A10VSO/32 NG (shaft)	A10VO/53 NG (shaft)	Gear pump
82-2 (A)	5/8 in	**A_S2**	–	–	–	10, 18 (U)	Series F NG4 to 22[2]
101-2 (B)	7/8 in	**B_S4**	–	–	–	28 (S, R) 45 (U, W)	Series N NG20 to 32[2]
	1 in	**B3S5**	–	–	–	45 (S, R) 60, 63 (U, W)	–
127-2 (C)	1 1/4 in	**C_S7**	–	–	–	85 (U, W)	–
	1 1/2 in	**C_S9**	–	–	–	85 (S)	PGH5
165-4 (E)	W50	**E4A2**	175, 210 (A2)	–	–	–	–
	W60	**E4A4**	280 (A4)	–	–	–	–
Flange ISO 3019-2 (metric)							
80-2	3/4 in	**K_S3**	–	18 (S, R)	–	10 (S)	–
100-2	7/8 in	**L5S4**	–	28 (S, R)	–	–	–
160-4	1 1/4 in	**P4S7**	–	–	71 (S, R)	–	–
180-4	1 1/2 in	**R4S9**	–	–	100 (S)	–	–
	1 3/4 in	**R4T1**	–	140 (S)	140, 180 (S)	–	–
125-4	1 in	**M4S5**	–	–	45 (S, R)	–	–

1) Further through drives on request
2) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.

2

Combination pumps A15VSO + A15VSO

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Total length A

A15VSO	A15VSO (2nd pump)		
(1st pump)	**Size 175**	**Size 210**	**Size 280**
Size 175	691	–	–
Size 210	708	726	–
Size 280	752.45	770	810

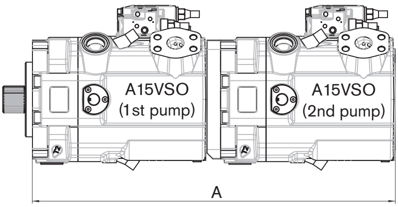
By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes.

When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "**+**".

Ordering example:
A15VSO280LRDRA0V/10MRVE4A41EE4A40-0+
A15VSO280LRDRA0V/10MRVE4A41EU0000-0

A tandem pump consisting of two equal sizes is permissible without additional supports assuming that the dynamic acceleration does not exceed maximum 10 *g* (= 98.1 m/s²).

For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque.



Connector for solenoids

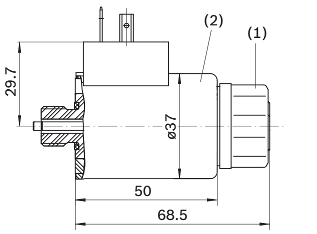
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

Without bidirectional suppressor diode________________H

There is the following type of protection with mounted mating connector:

IP65 ______________________________DIN/EN 60529



Changing connector orientation

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (WAF26, 12-sided DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (T_1, T_2, T_3).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction and drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\,max} = 800$ mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation and with cold start.

Installation Position

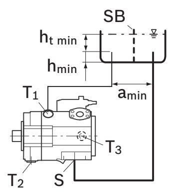
See the following examples 1 to 9.
Further installation positions are possible upon request.

Recommended installation position: 1 and 2.

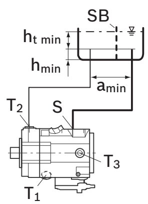
Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

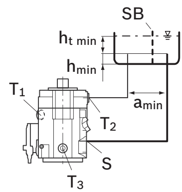
1



2



3



Installation position	Air bleed	Filling
1	T_1	S + T1
2	T_2	S + T_2
3	T_2	S + T_2

Key, see page 39

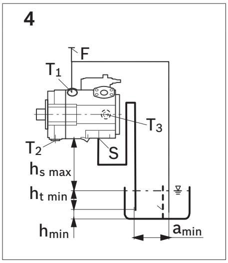
Installation instructions

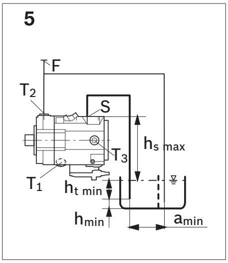
Above-reservoir installation

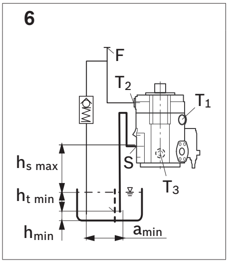
Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Observe the maximum permissible suction height $h_{S\,max} = 800$ mm.

Recommendation for installation position 6 (drive shaft upward): A check valve in the drain line (cracking pressure 0.5 bar) can prevent from draining of the pump housing.







Installation position	Air bleed	Filling
4	F	T_1 (F)
5	F	T_2 (F)
6	F	T_2 (F)

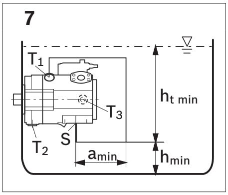
Inside-reservoir installation

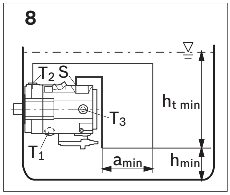
Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

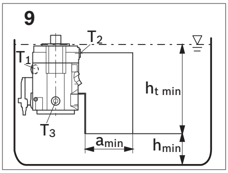
If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.

Exception
Installation of the pump with E2-/E6 control, only with HIRSCHMANN connector and mineral hydraulic fluids can be used and the fluid temperature is limited to maximum 80 °C.







Installation position	Air bleed	Filling
7	Via the highest port T_1	Automatically via the open port T_1, by position below hydraulic fluid level
8	Via the highest port T2	Automatically via the open port T_2, by position below hydraulic fluid level
9		

L	Filling / air bleed
S	Suction port
T	Drain port
SB	Baffle (baffle plate)
$h_{t\,min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacingt to reservoir bottom (100 mm)
$h_{S\,max}$	Maximum permissible suction height (800 mm)
a_{min}	When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

General instructions

– The pump A15VSO is designed to be used in open circuits.

– The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.

– Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.

– Service line ports:

- The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service line ports and function ports can only be used to accommodate hydraulic lines.

– Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to ISO 13849.

– The following tightening torques apply:

- Fittings:
  Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
- Mounting bolts:
  For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
- Female threads in the axial piston unit:
  The maximum permissible tightening torques $M_{G\,max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
- Threaded plugs:
  For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports Standard	Size of thread	Maximum permissible tightening torque of the female threads $M_{G\,max}$	Required tightening torque of the threaded plugs M_V	WAF hexagon socket of the locking screws
ISO 6149	M14 x 1.5	80 Nm	45 Nm	6 mm
	M18 x 1.5	140 Nm	70 Nm	8 mm
	M33 x 2	435 Nm	310 Nm	17 mm
	M42 x 2	580 Nm	330 Nm	22 mm

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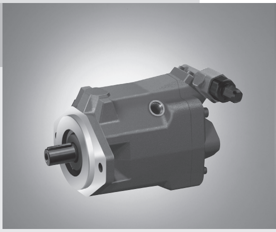
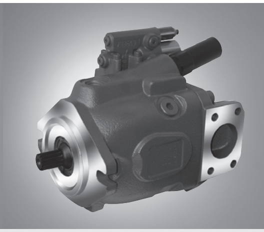
Axial Piston Variable Pump A10VO

RE 92703/08.11 **1/56**
Replaces: 10.07
RE 92708/03.08
and RE 92707/11.10

Data sheet


Series 52


Series 53

Series 52/53
Size 10 to 100
Nominal pressure 250 bar
Maximum pressure 315 bar
Open circuit

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Features

- Variable pump in axial piston swashplate design for hydrostatic drives in an open circuit
- The flow is proportional to the drive speed and the displacement. The flow can be steplessly varied by adjusting the swash-plate angle.
- Stable storage for long service life
- High permissible drive speed
- Favorable power-to-weight ratio - compact dimensions
- Low noise
- Excellent suction characteristics
- Axial and radial load capacity of drive shaft
- Pressure and flow control
- Electro-hydraulic pressure control
- Power control
- Electro-proportional swivel angle control
- Short response times

Type code for standard program

A10V(S)	O			/	5			–	V				
01	02	03	04		05	06	07		08	09	10	11	12

Axial piston unit

		10	18	28	45	60[1]	63	85	100	
01	Swashplate design, variable, nominal pressure 250 bar, maximum pressure 315 bar	●	–	–	–	–	–	–	–	**A10VS**
		–	●	●	●	●	●	●	●	**A10V**

Operation mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, see table of values on page 7	**10**	**18**	**28**	**45**	**60[1]**	**63**	**85**	**100**

Control device

						10	18	28	45	60[1]	63	85	100	
04	Pressure control					●	●	●	●	●	●	●	●	**DR**
	with flow control, hydraulic													
		X-T open				●	–	●	●	●	–	●[3]	–	**DFR**
						–	●	–	–	–	●	●[2]	●	**DRF**
		X-T plugged				●	–	●	●	●	–	●[3]	–	**DFR1**
						–	●	–	–	–	●	●[2]	●	**DRS**
		Electrically overridable (negative characteristic)				–	❍	❍	❍	–	●	●	❍	**EF.D.**[4]
	with pressure cut-off, remotely operated													
	hydraulic					●	●	●	●	●	●	●	●	**DRG**
	electrical	negative characteristic		U = 12 V		–	●	●	●	●	●	●	●	**ED71**
				U = 24 V		–	●	●	●	●	●	●	●	**ED72**
		positive characteristic		U = 12 V		–	●	●	●	●	●	●	●	**ER71**[5]
				U = 24 V		–	●	●	●	●	●	●	●	**ER72**[5]
	Power control with pressure cut-off													
			Start of control	10 to 35 bar		–	●	●	●	–	●	●	●	**LA5D**
				36 to 70 bar		–	●	●	●	–	●	●	●	**LA6D**
				71 to 105 bar		–	●	●	●	–	●	●	●	**LA7D**
				106 to 140 bar		–	●	●	●	–	●	●	●	**LA8D**
				141 to 230 bar		–	●	●	●	–	●	●	●	**LA9D**
	remotely operated		Start of control	see LA.D		–	●	●	●	–	●	●	●	**LA.DG**
	Flow control, X-T plugged		Start of control	see LA.D		–	●	●	●	–	●	●	●	**LA.DS**
	Flow control, electrically overridable (negative characteristic), X-T plugged		Start of control	see LA.D		–	●	●	●	–	●	●	●	**LA.S**

1) Series 52 units are delivered as standard with 60 cm^3. Higher values on request.
2) Series 53 only with D flange
3) Series 52 only with C flange
4) See RE 92709
5) The following must be taken into account during project planning:
Excessive current levels ($I > 1200$ mA with 12 V or $I > 600$ mA with 24 V) to the ER solenoid can result in undesired increase of pressure which can lead to pump or system damage:
- Use I_{max} current limiter solenoids.
- An intermediate plate pressure controller can be used to protect the pump in the event of overflow.
An accessory kit with intermediate plate pressure controller can be ordered from Bosch Rexroth under part number R902490825.

● = available ❍ = on request – = not available

Type code for standard program

A10V(S)	O			/	5			–	V				
01	02	03	04		05	06	07		08	09	10	11	12

			10	18	28	45	60[1]	63	85	100	
04	Electro-proportional control (positive characteristic) with										
	pressure control	U = 12 V	–	●	●	●	–	●	●	❍	**EP1D**
		U = 24 V	–	●	●	●	–	●	●	❍	**EP2D**
	Pressure and flow control, X-T open (load sensing)	U = 12 V	–	●	●	●	–	●	●	❍	**EP1DF**
		U = 24 V	–	●	●	●	–	●	●	❍	**EP2DF**
	Pressure and flow control, X-T plugged (load sensing)	U = 12 V	–	●	●	●	–	●	●	❍	**EP1DS**
		U = 24 V	–	●	●	●	–	●	●	❍	**EP2DS**
	Electrohydraulic pressure control	U = 12 V	–	●	●	●	–	●	●	❍	**EP1ED**
		U = 24 V	–	●	●	●	–	●	●	❍	**EP2ED**
	Pressure and flow control with controller cut-off, X-T open (load sensing)	U = 12 V	–	●	●	●	–	●	●	❍	**EK1DF**
		U = 24 V	–	●	●	●	–	●	●	❍	**EK2DF**
	Pressure and flow control with controller cut-off, X-T plugged (load sensing)	U = 12 V	–	●	●	●	–	●	●	❍	**EK1DS**
		U = 24 V	–	●	●	●	–	●	●	❍	**EK2DS**
	Electrohydraulic pressure control with controller cut-off	U = 12 V	–	●	●	●	–	●	●	❍	**EK1ED**
		U = 24 V	–	●	●	●	–	●	●	❍	**EK2ED**

Series

		10	18	28	45	60	63	85	100	
05	Series 5, index 2	●	–	●	●	●	–	●	–	**52**[2]
	Series 5, index 3	–	●	●	●	–	●	●	●	**53**[3,4]

Direction of rotation

06	With view on drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals

07	FKM (fluor-caoutchouc)	**V**

Drive shaft

			10	18	28	45	60[1]	63	85	100	
08	Splined shaft ANSI B92.1a	standard shaft	●	●	●	●	●	●	●	●	**S**
		similar to shaft „S“ however for higher input torque	–	●	●	●	●	●	–	–	**R**
		reduced diameter, not for through drive	●	●	–	●	●	●	●	●	**U**
		similar to shaft "U", however for higher torque	–	–	–	●	●	●	●	●	**W**
	Parallel shaft key to DIN 6885, not for through drive		●	●	–	–	–	–	–	–	**P**

1) Series 52 units are delivered as standard with 60 cm^3. Higher values on request.
2) Control DR, DFR, DFR1, DRG, ED and ER: delivery with size 10, 28, 45, 60 and 85[6] only in series 52
3) Control DR, DRF, DRS, DRG, ED and ER: delivery with size 18, 63, 85[5] and 100 only in series 53
4) Control EF., LA.., EP.. and EK.. Delivery with size 18 to 100 only in series 53
5) Control DRF and DRS: delivery with size 85 only with D flange in series 53
6) Control DFR, DFR1: delivery with size 85 only with C flange in series 52

● = available ❍ = on request – = not available

Type code for standard program

A10V(S)	O			/	5			–	V				
01	02	03	04		05	06	07		08	09	10	11	12

	Mounting flange		10	18	28	45	60[1]	63	85	100	
09	ISO 3019-2 (DIN)	2-hole	●	–	–	–	–	–	–	–	A
	ISO 3019-1 (SAE)	2-hole	●	●	●	●	●	●	●	●	C
		4-hole	–	–	–	–	●	●	●[2]	●	D

	Service line port	10	18	28	45	60[1]	63	85	100	
10	SAE flange port at rear, metric fixing thread (not for through drive)	–	●	●	●	●	●	●	●	11
	SAE flange port on opposite side, metric fixing thread (for through drive)	–	●	●	●	●	●	●	●	12
	SAE flange port at side, 90° offset, metric fixing thread (not for through drive and only available for counter-clockwise rotation)	–	–	–	●	–	–	–	–	13[3]
	Metric threaded ports, rear (not for through drive)	●	–	–	–	–	–	–	–	14

	Through drive			10	18	28	45	60[1]	63	85	100	
11	Without through drive, standard for versions 11, 13 and 14			●	●	●	●	●	●	●	●	N00
	SAE J744 flange Diameter	coupling for splined shaft[4] diameter										
	82-2 (A)	5/8 in	9T 16/32DP	–	●	●	●	●	●	●	●	K01
		3/4 in	11T 16/32DP	–	●	●	●	●	●	●	●	K52
	101-2 (B)	7/8 in	13T 16/32DP	–	–	●	●	●	●	●	●	K68
		1 in	15T 16/32DP	–	–	–	●	●	●	●	●	K04
	127-4 (C)	1 1/4 in	14T 12/24DP	–	–	–	–	●	●	●	●	K15
		1 1/2 in	17T 12/24DP	–	–	–	–	–	–	●	●	K16
	127-2 (C)	1 1/4 in	14T 12/24DP	–	–	–	–	–	–	●	●	K07
		1 1/2 in	17T 12/24DP	–	–	–	–	–	–	●	●	K24

	Connector for solenoids	10	18	28	45	60[1]	63	85	100	
12	DEUTSCH molded connector, 2-pin – without suppressor diode	–	●	●	●	●	●	●	●	P

1) Series 52 units are delivered as standard with 60 cm^3. Higher values on request.
2) Only available in series 53. For controller designation and series assignment, please refer to positions 04, 05, including footnotes.
3) Port plate 13 only available with counter-clockwise rotation.
4) Coupling for splined shaft as per ANSI B92.1a

● = available ❍ = on request – = not available

Technical data

Hydraulic fluid

Prior to project design, please see our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

When using environmentally acceptable hydraulic fluids, the limitations regarding technical data and seals must be observed. Please contact us. When ordering, indicate the hydraulic fluid that is to be used.

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected the range

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

referred to reservoir temperature (open circuit).

Limits of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods ($t \leq 1$ min)
at max. perm. case drain temperature of 115 °C.

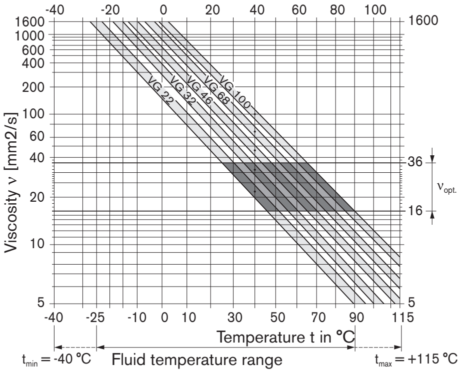
Please note that the max. case drain temperature of 115 °C is also not exceeded in certain areas (for instance bearing area). The fluid temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

ν_{max} = 1600 mm²/s
for short periods ($t \leq 1$ min)
on cold start
($p \leq 30$ bar, $n \leq 1000$ rpm, t_{min} -25 °C)

Depending on the installation situation, special measures are necessary at temperatures between -40°C and -25°C. Please contact us.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

Selection diagram



Notes on the selection of the hydraulic fluid

In order to select the correct hydraulic fluid, it is necessary to know the operating temperature in relation to the ambient temperature. In an open circuit this is the reservoir temperature.

The fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.

Example: at an ambient temperature of X °C the operating temperature in the reservoir is 60 °C . In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

Important

The case drain temperature is influenced by pressure and input speed and is always higher than the reservoir temperature. However, at no point in the component may the temperature exceed 115 °C. The temperature difference specified on the left is to be taken into account when determining the viscosity in the bearing.

Please contact us if the above conditions cannot be met due to extreme operating parameters.

Filtration of the fluid

The finer the filtration the better the fluid cleanliness class and the longer the service life of the axial piston unit.

In order to guarantee the functional reliability of the axial piston unit it is necessary to carry out a gravimetric evaluation of the fluid to determine the particle contamination and the cleanliness class according to ISO 4406. A cleanliness class of at least 20/18/15 must be achieved.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness class of at least 19/17/14 according to ISO 4406 is necessary.

Please contact us if the above classes cannot be observed.

2

Technical data

Operating pressure range

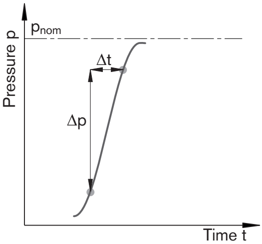
Pressure at service line port B

Nominal pressure p_{nom} ________________ 250 bar absolute

Maximum pressure p_{max} ________________ 315 bar absolute
Single operating period ________________ 2.5 ms
Total operating period ________________ 300 h

Minimum pressure (high-pressure side) __________ 10 bar

Rate of pressure change $R_{A\ max}$ ______________ 16000 bar/s



Pressure at suction port S (inlet)

Minimum pressure $p_{S\ min}$ ________________ 0.8 bar absolute
Maximum pressure $p_{S\ max}$ ________________ 5 bar absolute

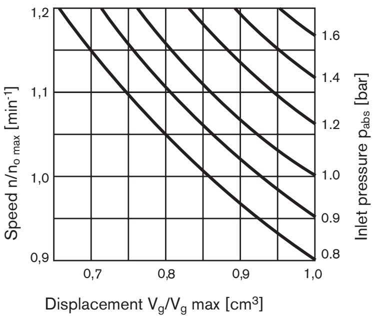
Case drain pressure

Maximum permissible case drain pressure
(at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ________________________________ 2 bar

Maximum permissible speed (limit speed)

Permissible speed by increasing inlet pressure p_{abs} at suction opening S or at $V_g \leq V_{g\ max}$.



Definition

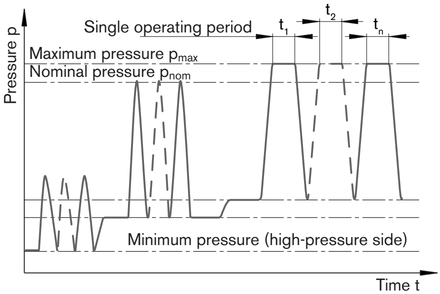
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the operating pressure within the single operating period. The total of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.

Minimum pressure (inlet) open circuit
Minimum pressure at suction port S (inlet) that is required to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

2

Technical data

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		10	18	28	45	60[1]	63[2]	85	100
Geometrical displacement per revolution		$V_{g\,max}$	cm^3	10.5	18	28	45	60	63	85	100
Speed[3]											
maximum at $V_{g\,max}$		n_{nom}	rpm	3600	3300	3000	2600[4]	2600	2600	2500	2300
maximum at $V_g < V_{g\,max}$		$n_{max\,perm}$	rpm	4320	3960	3600	3120	3140	3140	3000	2500
Flow											
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	37	59	84	117	156	163	212	230
at $n_E = 1500$ rpm and $V_{g\,max}$		$q_{vE\,max}$	l/min	15	27	42	68	90	95	128	150
Power at $\Delta p = 250$ bar											
at n_{nom}, $V_{g\,max}$		P_{max}	kW	16	25	35	49	65	68	89	96
at $n_E = 1500$ rpm and $V_{g\,max}$		$P_{E\,max}$	kW	7	11	18	28	37	39	53	62
Torque											
at $V_{g\,max}$ and	$\Delta p = 250$ bar	T_{max}	Nm	42	71	111	179	238	250	338	398
	$\Delta p = 100$ bar	T	Nm	17	29	45	72	95	100	135	159
Rotary stiffness, drive shaft	S	c	Nm/rad	9200	11000	22300	37500	65500	65500	143000	143000
	R	c	Nm/rad	–	14800	26300	41000	69400	69400	–	–
	U	c	Nm/rad	6800	8000	–	30000	49200	49200	102900	102900
	W	c	Nm/rad	–	–	–	34400	54000	54000	117900	117900
	P	c	Nm/rad	10700	13100	–	–	–	–	–	–
Moment of inertia rotary group		J_{TW}	kgm^2	0.0006	0.00093	0.0017	0.0033	0.0056	0.0056	0.012	0.012
Angular acceleration, maximum[5]		α	rad/s^2	8000	6800	5500	4000	3300	3300	2700	2700
Filling capacity		V	L	0.2	0.25	0.3	0.5	0.8	0.8	1	1
Weight (without through drive) approx.		m	kg	8	11.5	14	18	22	22	34	34

1) Only series 52
2) Only series 53
3) The values are applicable:
 - for absolute pressure $p_{abs} = 1$ bar at the suction port S
 - for the optimum viscosity range of $\nu_{opt} = 16$ to 36 mm^2/s
 - for mineral-based operating materials with a specific mass of 0.88 kg/l.
4) Please contact us regarding higher speeds
5) The scope of application lies between the minimum necessary and the maximum permissible drive speeds. Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency). The limiting value is only valid for a single pump. The loading capacity of the connecting parts must be taken into account.

Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend checking the loading with tests or calculations / simulations and comparison with the permissible values.

Determination of size

Flow $q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

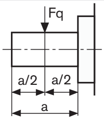
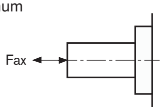
Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot p \cdot h_{mh}}$ [Nm]

Power $P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Geometric displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($h_t = h_V \cdot h_{mh}$)

Technical data

Permissible radial and axial forces on the drive shaft

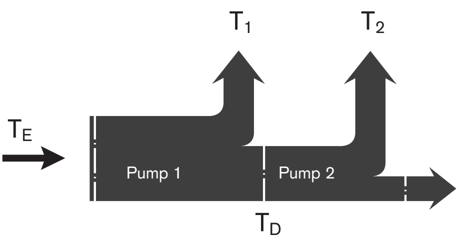
Size		NG		10	18	28	45	60/63	85	100
Radial force maximum at a/2		$F_{q\ max}$	N	250	350	1200	1500	1700	2000	2000
Axial force maximum		$\pm F_{ax\ max}$	N	400	700	1000	1500	2000	3000	3000

Permissible input and through-drive torques

Size		NG		10	18	28	45	60/63	85	100
Torque at $V_{g\ max}$ and $\Delta p = 250$ bar[1]		T_{max}	Nm	42	71	111	179	250	338	398
Input torque for drive shaft, maximum[2]										
	S	$T_{E\ max}$	Nm	126	124	198	319	630	1157	1157
		Ø	in	3/4	3/4	7/8	1	1 1/4	1 1/2	1 1/2
	R	$T_{E\ max}$	Nm	–	150	225	400	650	–	–
		Ø	in	–	3/4	7/8	1	1 1/4	–	–
	U	$T_{E\ max}$	Nm	60	59	–	188	306	628	628
		Ø	in	5/8	5/8	–	7/8	1	1 1/4	1 1/4
	W	$T_{E\ max}$	Nm	–	–	–	200	396	650	650
		Ø	in	–	–	–	7/8	1	1 1/4	1 1/4
	P	$T_{E\ max}$	Nm	90	88	–	–	–	–	–
		Ø	mm	18	18	–	–	–	–	–
Maximum through-drive torque for drive shaft										
	S	$T_{D\ max}$	Nm	–	108	160	319	484	698	698
	R	$T_{D\ max}$	Nm	–	120	176	365	484	–	–

1) Without considering efficiency
2) For drive shafts free of radial load

Distribution of torques



Technical data

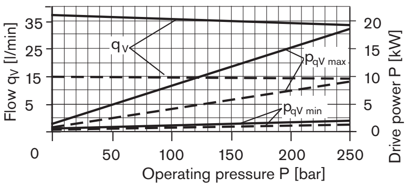
Drive power and flow

Operating material:
Hydraulic fluid ISO VG 46 DIN 51519, t = 50 °C

Size 10

_ _ _ _ n = 1500 rpm

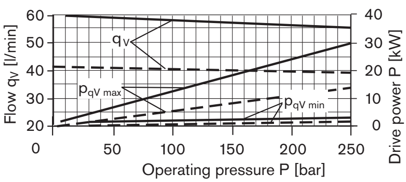
______ n = 3600 rpm



Size 18

_ _ _ _ n = 1500 rpm

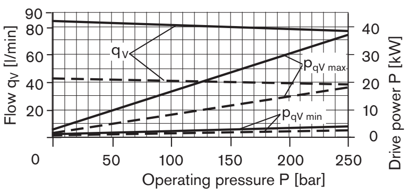
______ n = 3300 rpm



Size 28

_ _ _ _ n = 1500 rpm

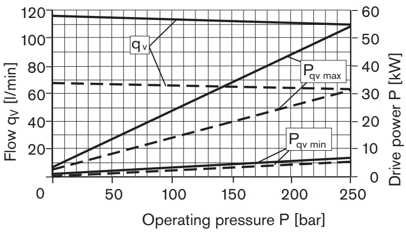
______ n = 3000 rpm



Size 45

_ _ _ _ n = 1500 rpm

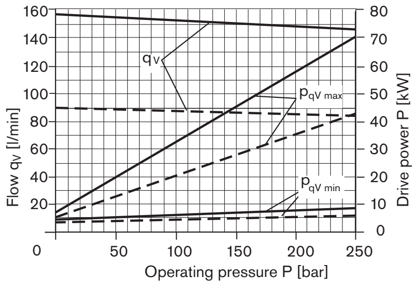
______ n = 2600 rpm



Size 60/63

_ _ _ _ n = 1500 rpm

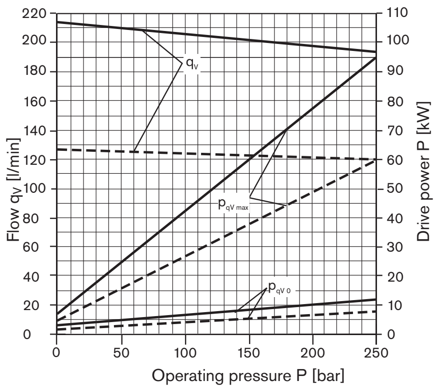
______ n = 2600 rpm



Size 85

_ _ _ _ n = 1500 rpm

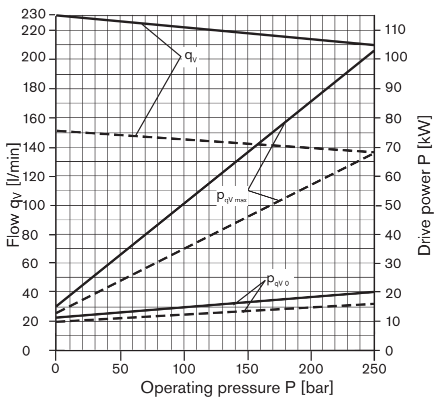
______ n = 2500 rpm



Size 100

_ _ _ _ n = 1500 rpm

______ n = 2300 rpm

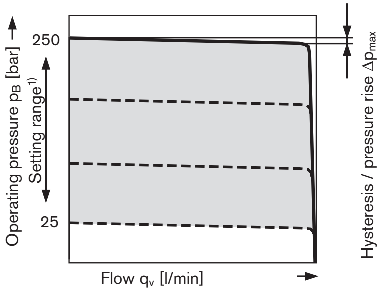


DR – Pressure control

The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the target pressure set at the pressure valve, the pump will regulate towards a smaller displacement. The pressure can be set steplessly at the control valve.

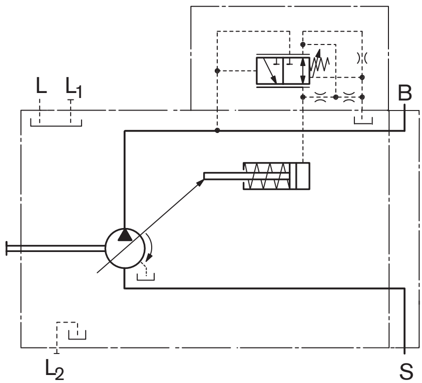
Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)



1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve are greater.

Circuit diagram



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)

Controller data

Hysteresis and repeatability Δp ____________ maximum 3 bar

Pressure rise, maximum

NG		10	18	28	45	60/63	85	100
Δp	bar	6	6	6	6	8	12	14

Control fluid consumption__________ maximum approx. 3 l/min

Flow losses at q_{Vmax} see page 9.

DRG – Pressure control remotely operated

The DRG control valve overrides the function of the DR pressure controller (see page 10).

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the delivery contents of the pump.

The differential pressure at the control valve is set as standard to 20 bar. The control fluid volume at port X is approx. 1.5 l/min. If another setting is required (range from 10 to 22 bar) please state this in clear text.

As a separate pressure relief valve we can recommend:

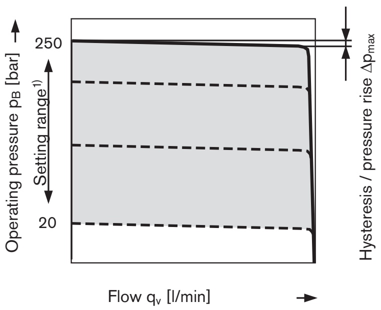
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice dia. 0.8 mm in P (electric) to RE 29166.

The max. length of piping should not exceed 2 m.

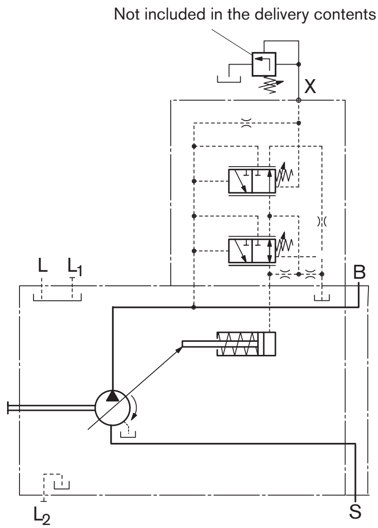
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50 °C)



1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve is higher.

Circuit diagram



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Pilot pressure

Controller data

Hysteresis and repeatability Δp ____________ maximum 3 bar

Pressure rise, maximum

NG		10	18	28	45	60/63	85	100
Δp	bar	6	6	6	6	8	12	14

Control fluid consumption_______ maximum approx. 4.5 l/min

Flow losses at q_{Vmax} see page 9.

DRF (DFR) DRS (DFR1) – Pressure and flow control

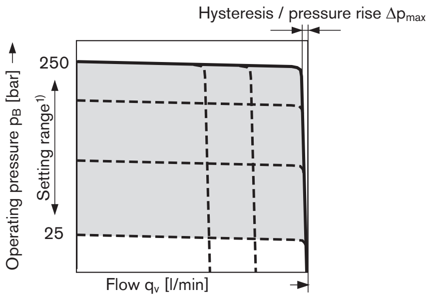
In addition to the pressure control function (see page 10), a variable orifice (e.g. directional valve) is used to adjust the differential pressure upstream and downstream of the orifice. This is used to control the pump flow. The pump flow is equal to the actual required flow by the consumer, regardless of changing pressure levels.

The pressure control overrides the flow control function.

Note
The DRS (DFR1) valve version has no connection between X and the reservoir. Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

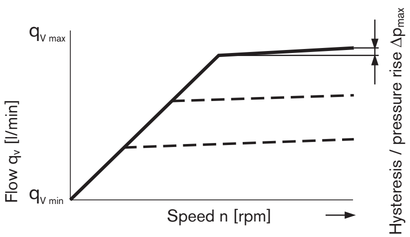
Static characteristic

Flow control at n_1 = 1500 rpm; t_{fluid} = 50 °C)



1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve is higher.

Static characteristic at variable speed



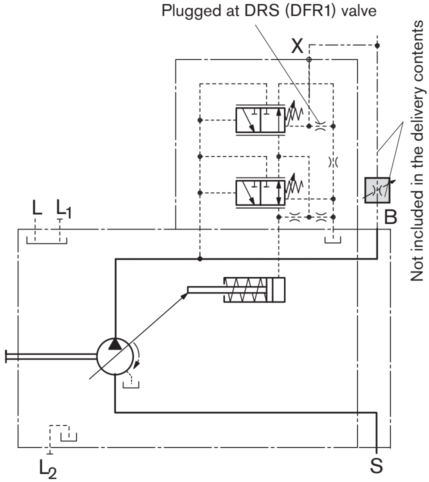
Possible connections at port B

(not included in the delivery contents)

LS mobile control blocks
Mobile control blocks M4 - 12 (RE 64276)
Mobile control blocks M4 - 15 (RE 64283)

LUDV mobile control blocks
Mobile control blocks M6 - 15 (RE 64284)
Mobile control blocks M7 - 22 (RE 64295)

Circuit diagram



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Pilot pressure

Differential pressure Δp

Standard setting: 14 to 22 bar.
If another setting is required, please state in clear text.
Relieving the load on port X to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar higher than the differential pressure Δp). No account is taken of system influences.

Controller data

Data pressure control DR, see page 10.
Maximum flow deviation measured with drive speed n = 1500 rpm.

NG		10	18	28	45	60/63	85	100
$\Delta q_{v\ max}$	l/min	0.5	0.9	1.0	1.8	2.5	3.1	3.1

Control fluid consumption
DRF (DFR) ________________maximum approx. 3 to 4.5 l/min
DRS (DFR1) ___________________ maximum approx. 3 l/min
Volume flow loss at q_{Vmax}, see page 9.

LA... – Pressure, flow and power control

Pressure control equipped as DR(G), see page 10 (11).
Flow control equipped as DRF, DRS, see page 12.

In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant.

Flow control is possible below the power control curve.

When ordering please state the power characteristics to be set ex works in clear text, e.g. 20 kW at 1500 rpm.

Controller data

For pressure controller DR data, see page 10.
For flow control FR data, see page 12.

Controller data
Maximum control fluid consumption, see page 12
Volume flow loss at q_{Vmax}, see page 9.

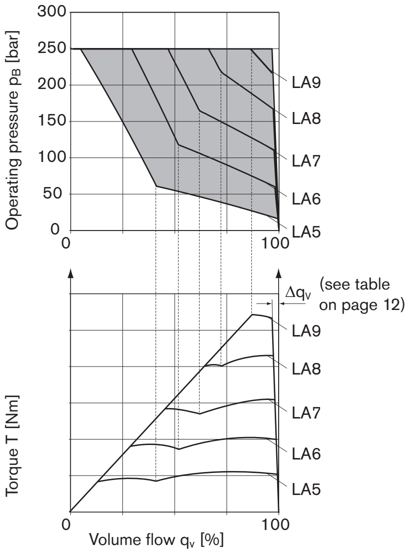
Start of control [bar]	Torque T [Nm] for size 18	28	45	63	85	100	Order code
10 to 35	3.8 - 12.1	6 - 19	10 - 30	15 - 43	20 - 57	24 - 68	**LA5**
36 to 70	12.2 - 23.3	19.1 - 36	30.1 - 59	43.1 - 83	57.1 - 112	68.1 - 132	**LA6**
71 to 105	23.4 - 33.7	36.1 - 52	59.1 - 84	83.1 - 119	112.1 - 160	132.1 - 189	**LA7**
106 to 140	33.8 - 45	52.1 - 70	84.1 - 112	119.1 - 157	160.1 - 212	189.1 - 249	**LA8**
141 to 230	45.1 - 74.8	70.1 - 117	112.1 - 189	157.1 - 264	212.1 - 357	249.1 - 419	**LA9**

2

Conversion of the torque values in power [kW]:

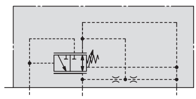
$$P = \frac{T}{6.4} \text{ [kW] (at 1500 rpm)} \quad \text{or} \quad P = \frac{2\pi \cdot T \cdot n}{60000} \text{ [kW] (for speeds, see table on page 7)}$$

Static curves and torque characteristic

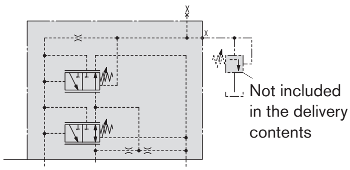


	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

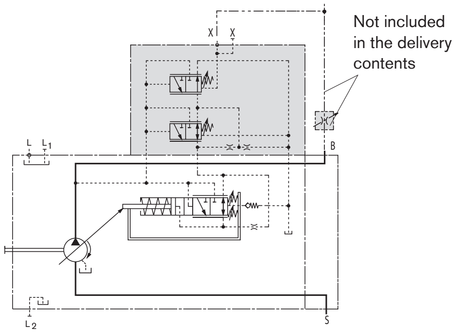
Circuit diagram (LAXD) with pressure cut-off



Circuit diagram (LAXDG) with pressure cut-off, remotely operated



Circuit diagram (LAXDS) with pressure and flow control



EP – Electro-proportional control

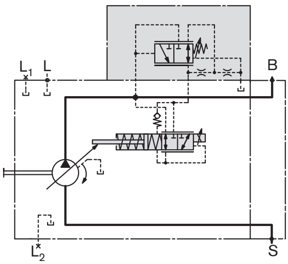
Electro-proportional control makes a stepless and reproducible setting of the pump displacement possible directly via the swashplate. The control force of the control piston is applied by a proportional solenoid. The control is proportional to the current (for start of control, see table right).

In a depressurized state, the pump is swiveled to its initial position ($V_{g\ max}$) by an adjusting spring. If the operating pressure exceeds 14 bar, the pump will swivel from $V_{g\ max}$ to $V_{g\ min}$ without control by the solenoid (control current < start of control). A PWM signal is used to control the solenoid.

EP.D: The pressure control regulates the pump displacement back to $V_{g\ min}$ after the set target pressure has been reached.

A minimum operating pressure of 14 bar is needed for control. The necessary control fluid is taken from the high pressure.

Circuit diagram EP.D



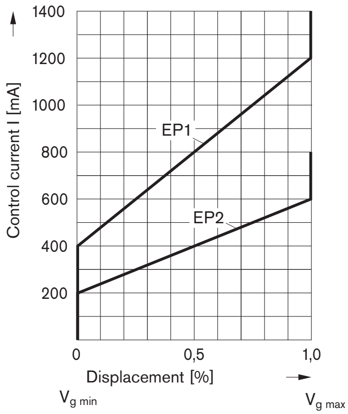
	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

Technical data, solenoid	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\ min}$	400 mA	200 mA
End of control at $V_{g\ max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For protection rating, please refer to "Socket version" on page 49		

Operating temperature range at valve -20 °C to +115 °C

Characteristic EP1/2

Hysteresis < 5 %



Note

The spring return at the controller is not a safety device

Dirt contamination (contaminated hydraulic fluid, wear or residual dirt from system components) could cause the controller to block in an undefined position. The volume flow of the axial piston unit will then no longer follow the commands of the operator.

Check whether remedial measures for your application are needed on your machine in order to put the driven consumer in a safe state (e.g. immediate stop).

EK – Electro-proportional control with controller cut-off

The variant EK... is based completely on the variant EP... (see page 14).

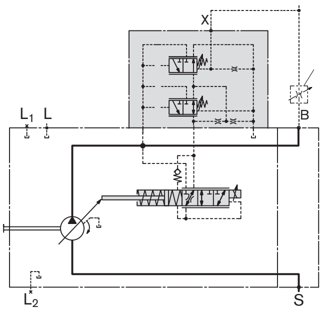
In addition to the electro-proportional control function, a controller cut-off is integrated in the electric characteristic.
The pump then swivels to $V_{g\ max}$ if the control signal is lost (e.g. cable break) and then works with the DRF settings (see page 12). The controller cut-off is only intended for short-term use and not for permanent use if the control signal is lost. If the control signal is lost, the pump swivel times will be reduced by the EK valve.
A PWM signal is used to control the solenoid.

A minimum operating pressure of 14 bar is needed for control. The necessary control fluid is taken from the high pressure.

The $V_{g\ max}$ position is maintained by the force of the adjusting spring. To overcome the force of this spring, the solenoid must be subjected to excessive current (I_{res}).

Observe the instructions regarding the project design on page 2

Circuit diagram EK.DF



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

Note

The spring return at the controller is not a safety device

Dirt contamination (contaminated hydraulic fluid, wear or residual dirt from system components) could cause the controller to block in an undefined position. The volume flow of the axial piston unit will then no longer follow the commands of the operator.

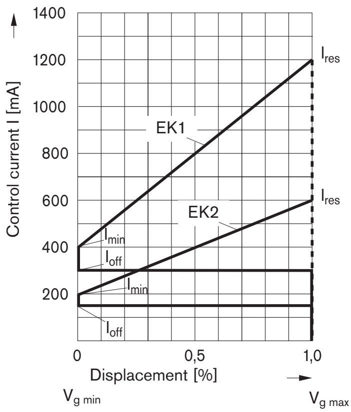
Check whether remedial measures for your application are needed on your machine in order to put the driven consumer in a safe state (e.g. immediate stop).

Technical data, solenoid	EK1	EK2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\ min}$	400 mA	200 mA
End of control at $V_{g\ max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For protection rating, please refer to "Socket version" on page 49		

Operating temperature range at valve -20 °C to +115 °C

Characteristic EK

Hysteresis < 5 %



	EK1.	EK2.
I_{min} [mA]	400	200
I_{max} [mA]	1200	600
I_{off} [mA]	< 300	< 150
I_{res} [mA]	> 1200	> 600

For changes in current, ramp times of > 200 ms must be observed.

EP(K).DF / EP(K).DS – EP(K) with pressure and flow control

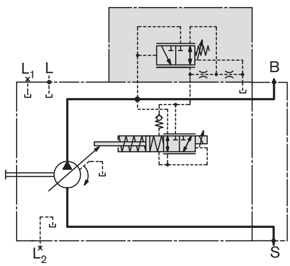
A hydraulic pressure flow control is superimposed on the electro-proportional control.
The pressure control regulates the pump displacement back to $V_{g\ min}$ after the set target pressure has been reached.
This function is super-imposed on the EP or EK control, i.e. the control-current dependent function is executed below the target pressure.
Setting range from 20 to 250 bar. For the pressure flow control, see page 12.

Pressure control has priority over electro-proportional control and flow control.

With flow control, the pump flow can be influenced in addition to pressure control. The pump flow is thus equal to the actual amount of hydraulic fluid required by the consumer. This is achieved using the differential pressure at the consumer (e.g. orifice).

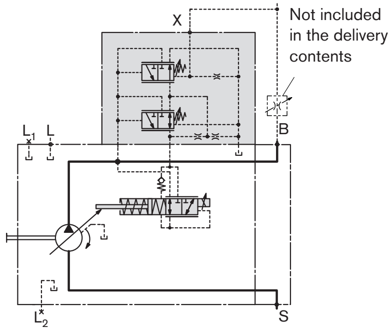
The EP.DS or EK.DS version has no connection between X and the reservoir (load sensing). Please refer to the notes on page 12.

Circuit diagram EP.D



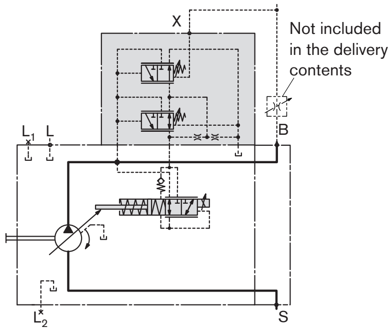
	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)

Circuit diagram EP.DF



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

Circuit diagram EP.DS



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

EP(K).ED – EP(K) with electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

When a change is made at the consumer (load pressure), the position of the control piston will shift.

This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

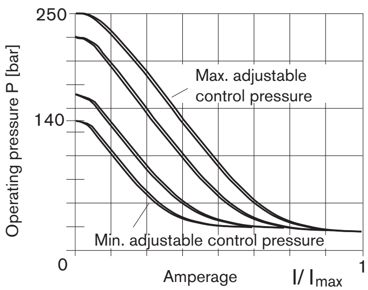
The pump thus only delivers as much hydraulic fluid as the consumers can take. The pressure can be set steplessly by the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (negative characteristic, e.g. for fan drives). A PWM signal is used to control the solenoid.

For further information and technical data of the solenoids for ED(ER) control please refer to pages 18 and 19.

Static current-pressure characteristic ED
(negative characteristic)

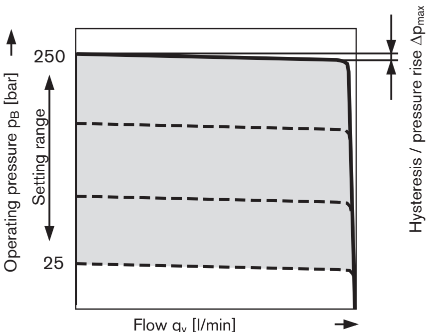
(measured with pump in zero stroke)



Hysteresis static current-pressure characteristic < 3 bar.

Static flow-pressure characteristic

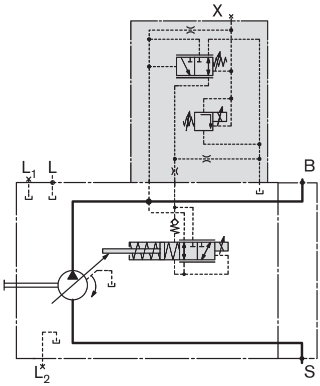
(at n= 1500 rpm; t_{fluid} = 50 °C)



Controller data

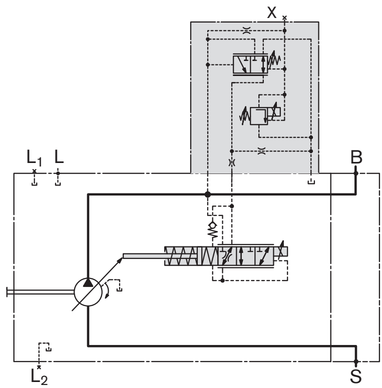
Standby standard setting: 20 bar. Other values on request.
Hysteresis / pressure rise Δp 4 bar

Circuit diagram EP.ED



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

Circuit diagram EK.ED



	Port for
B	Service line
S	Suction line
L, $L_{1,2}$	Case drain fluid ($L_{1,2}$ plugged)
X	Control pressure

ED – Electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified variable solenoid current.

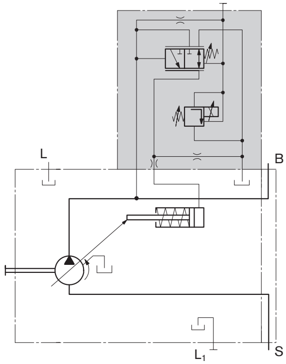
When a change is made at the consumer (load pressure), the position of the control piston will shift.

This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

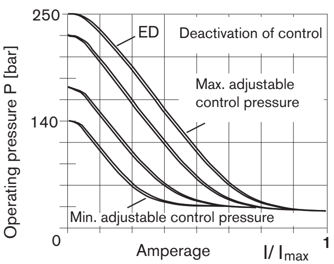
As the solenoid current signal drops towards zero, the pressure will be limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power, e.g. for fan drives).
The response time characteristic of the ED-control was optimized for the use as a fan drive system.
When ordering, state the type of application in clear text.

Circuit diagram ED..



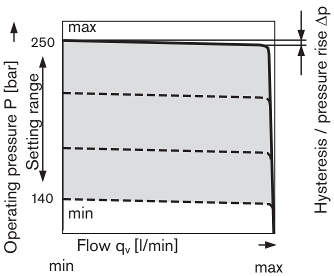
	Port for
B	Service line
S	Suction line
L, L$_1$	Case drain (L$_1$ plugged)

Static current-pressure characteristic ED
(measured at pump in zero stroke – negative characteristic)



Hysteresis static current-pressure characteristic < 3 bar

Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50 °C)



Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\,min}$	100 mA	50 mA
End of control at $q_{v\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For protection rating, please refer to "Socket version" on page 52		

Operating temperature range at valve -20 °C to +115 °C

Controller data
Standby standard setting 20 bar, other values on request.

Hysteresis and pressure rise ________________ Δp < 4 bar.
Control flow consumption________________ 3 to 4.5 l/min.

ER – Electro-hydraulic pressure control

The ER valve is set to a certain pressure by a specified variable solenoid current.

When a change is made at the consumer (load pressure), the position of the control piston will shift.

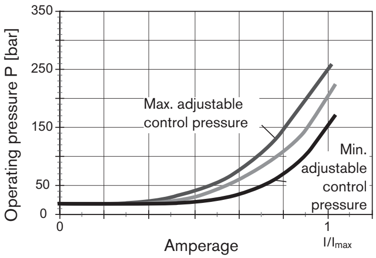
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

As the solenoid current signal drops towards zero, the pressure will be limited to p_{min} (stand by).

Observe the project planning notes on page 2.

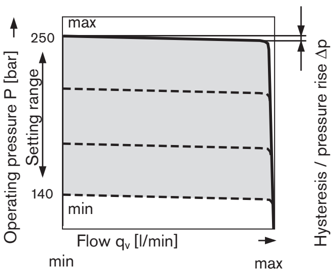
Static current-pressure characteristic ER
(measured with pump in zero stroke – positive characteristic)



Hysteresis static current-pressure characteristic < 3 bar

Influence of pressure setting on stand by ± 2 bar

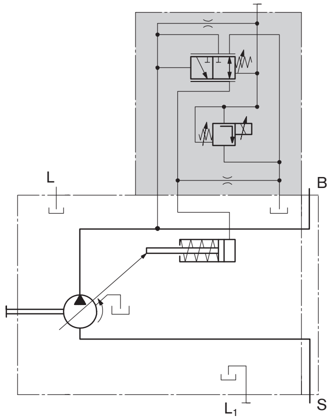
Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50°C)



Controller data
Standby standard setting 14 bar, other values on request.

Hysteresis and pressure rise ________________ Δp < 4 bar.
Control flow consumption________________ 3 to 4.5 l/min.

Circuit diagram ER..



	Port for
B	Service line
S	Suction line
L, L1	Case drain (L_1 plugged)

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\,min}$	100 mA	50 mA
End of control at $q_{v\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For protection rating, please refer to "Socket version" on page 52		

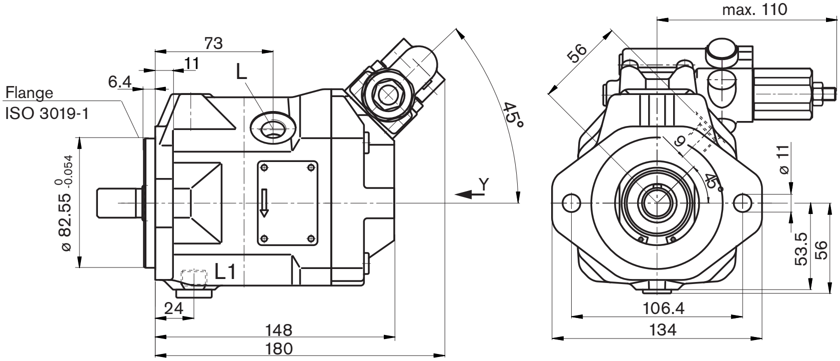
Operating temperature range at valve -20 °C to +115 °C

Dimensions, size 10

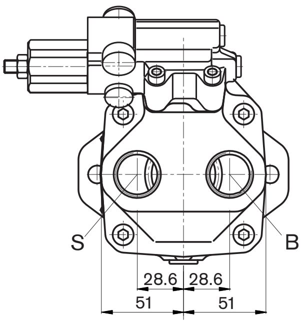
Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

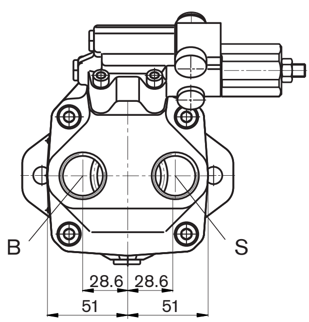
Centering flange **SAE** version



View Y clockwise rotation

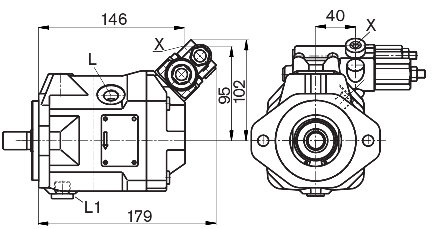


View Y counter-clockwise rotation



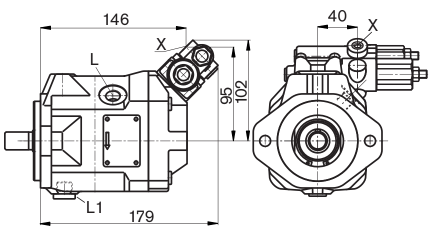
DRG

Pressure and flow control, remote controlled



DFR / DFR1

Pressure and flow control



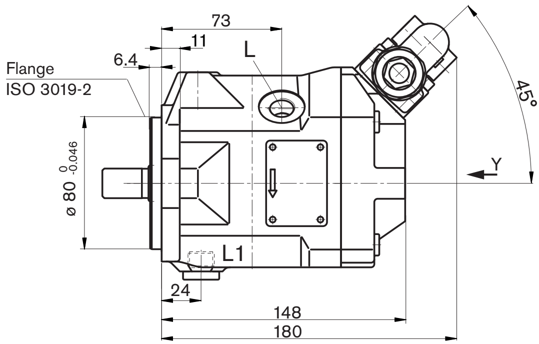
For details of connection options and drive shafts, please refer to page 22

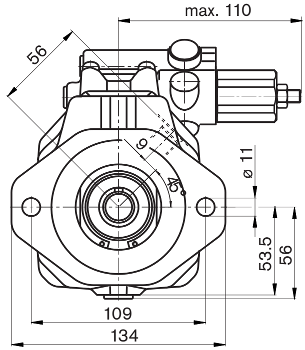
Dimensions, size 10

Before finalizing your design request a certified installation drawing. Dimensions in mm.

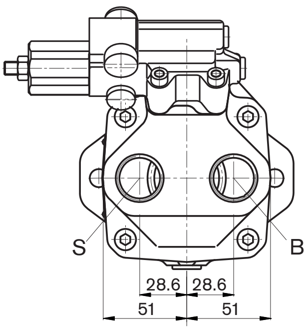
DR – Hydraulic pressure controller

Centering flange **metric** version

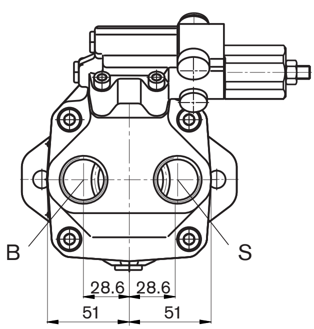




View Y clockwise rotation

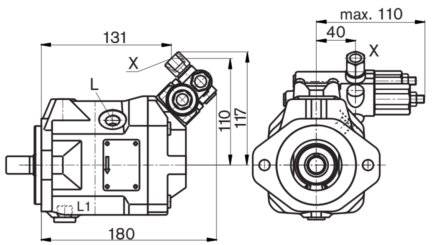


View Y counter-clockwise rotation



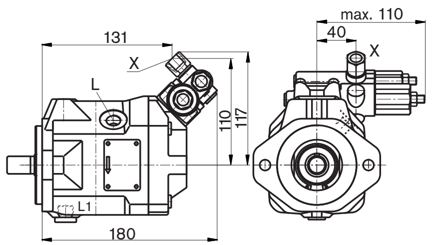
DRG

Pressure control, remotely operated



DFR / DFR1

Pressure and flow control



For details of connection options and drive shafts, please refer to page 22

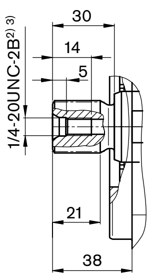
2

Dimensions, size 10

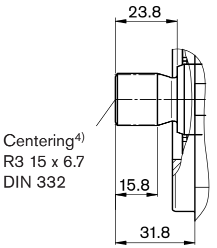
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

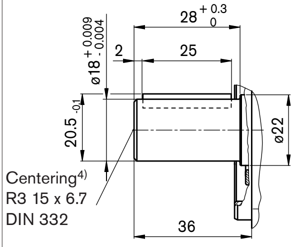
S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



U Splined shaft 5/8 in
9T 16/32DP[1] (SAE J744)



P Parallel shaft key
DIN 6885, A6x6x25



Ports

Designation	Port for	Standard	Size[3]	Maximum pressure [bar][5]	State
B	Service line	DIN 3852	M27 x 2; 16 deep	315	O
S	Suction line	DIN 3852	M27 x 2; 16 deep	5	O
L (metric)	Case drain fluid	DIN 3852[6]	M16 x 1.5; 12 deep	2	O[7]
L_1 (metric)	Case drain fluid	DIN 3852[6]	M16 x 1.5; 12 deep	2	X[7]
L (SAE)	Case drain fluid	ISO 11926[6]	9/16-18UNF-2B; 10 deep	2	O[7]
L_1 (SAE)	Case drain fluid	ISO 11926[6]	9/16-18UNF-2B; 10 deep	2	X[7]
X with adapter	Pilot pressure	DIN 3852	M14 x 1.5; 11.5 deep	315	O
X without adapter	Pilot pressure	ISO 11926[5]	7/16-20UNF-2B; 11.5 deep	315	O

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) For the maximum tightening torques the general instructions on page 56 must be observed.
4) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) The spot face can be deeper than as specified in the standard.
7) Depending on the installation position, L or L_1 must be connected (please refer to pages 54 and 55)

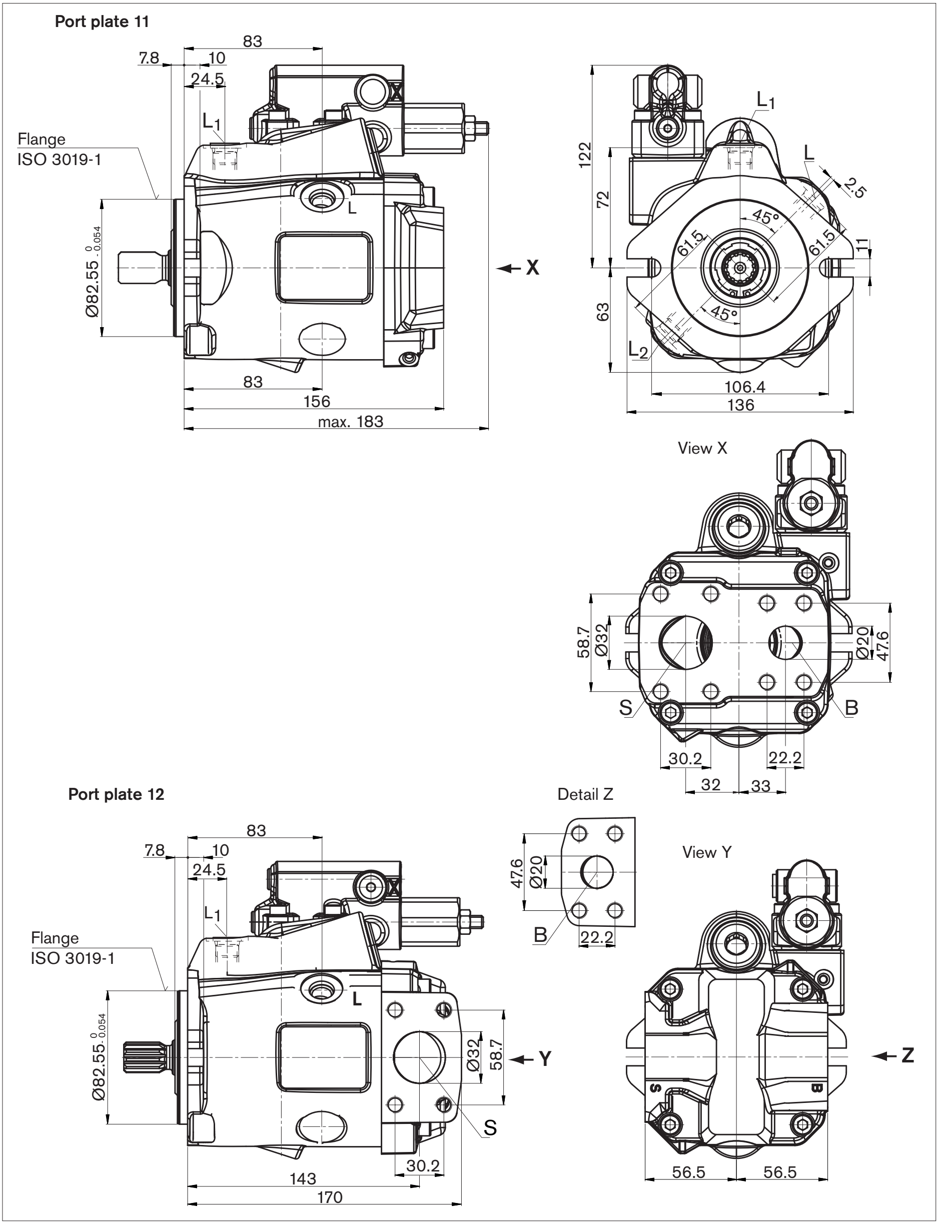
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions, size 18[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

Clockwise rotation, series 53



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

For details of connection options and drive shafts, please refer to page 24

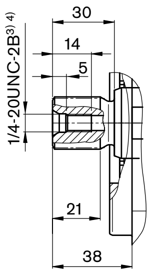
2

Dimensions, size 18

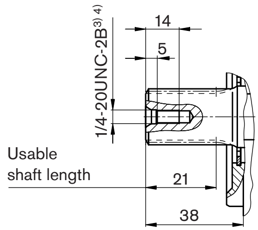
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

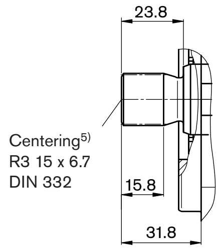
S Splined shaft 3/4 in
11T 16/32DP[1] (SAE J744)



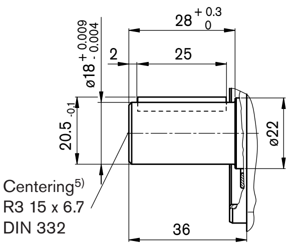
R Splined shaft 3/4 in
11T 16/32DP[1)2)] (SAE J744)



U Splined shaft 5/8 in
9T 16/32DP[1] (SAE J744)



P Parallel shaft key
DIN 6885, A6x6x25



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][6]	State
B	Service line, fixing thread	SAE J518[7] DIN 13	3/4 in M10 x 1.5; 17 deep	315	O
S	Suction line, fixing thread	SAE J518[7] DIN 13	1 1/4 in M10 x 1.5; 17 deep	5	O
L	Case drain fluid	ISO 11926[8]	3/4-16UNF-2B; 12 deep	2	O[9]
L_1, L_2	Case drain fluid	ISO 11926[8]	3/4-16UNF-2B; 12 deep	2	X[9]
X	Pilot pressure	ISO 11926[8]	7/16-20UNF-2A; 11.5 deep	315	O

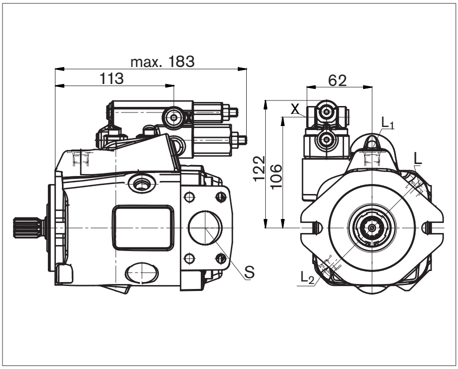
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed
5) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw
6) Depending on the application, momentary pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings
7) Metric fixing thread is a deviation from standard
8) The spot face can be deeper than as specified in the standard
9) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

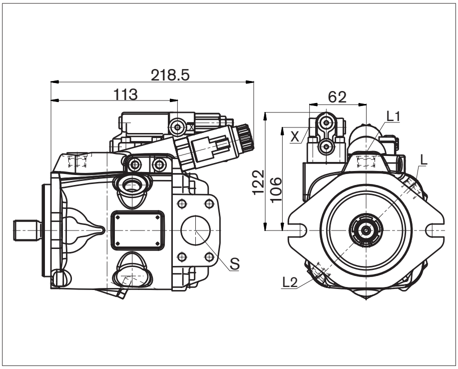
Dimensions, size 18

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

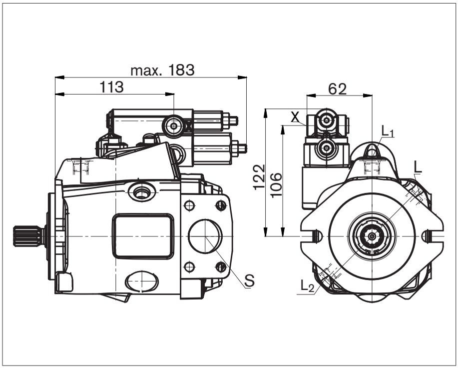
DRG
Pressure controller, remote controlled, **series 53**



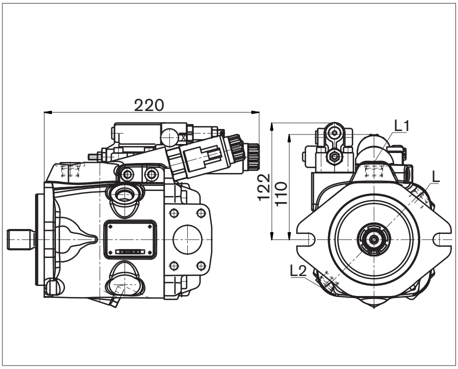
EP.D. / EK.D.
Electro-proportional control, **series 53**



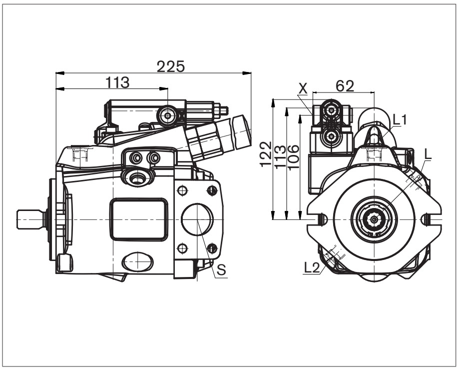
DRF/DRS
Pressure and flow control, **series 53**



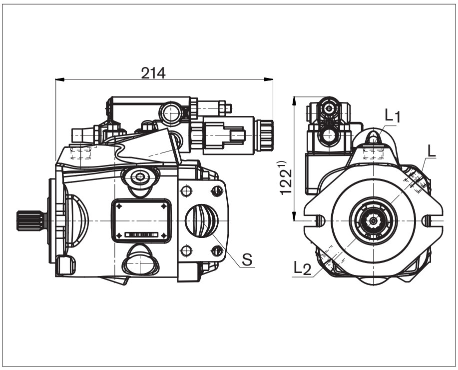
EP.ED / EK.ED
Electro-proportional control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



ED7. / ER7.
Electro-hydraulic pressure control, **series 53**



1) ER7.: 157 mm if using an intermediate plate pressure controller.

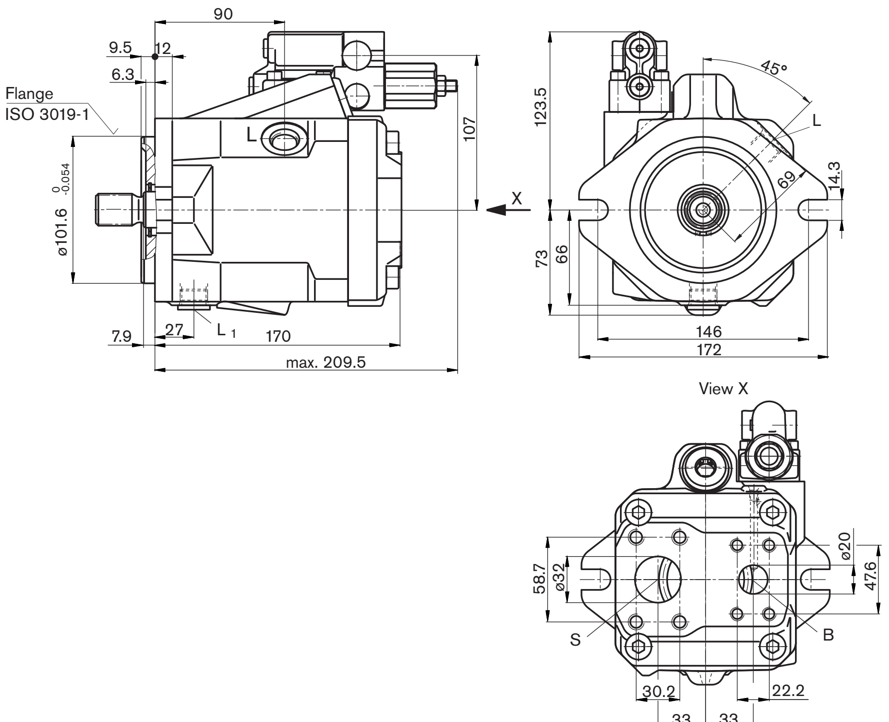
Dimensions, size 28[1)2)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

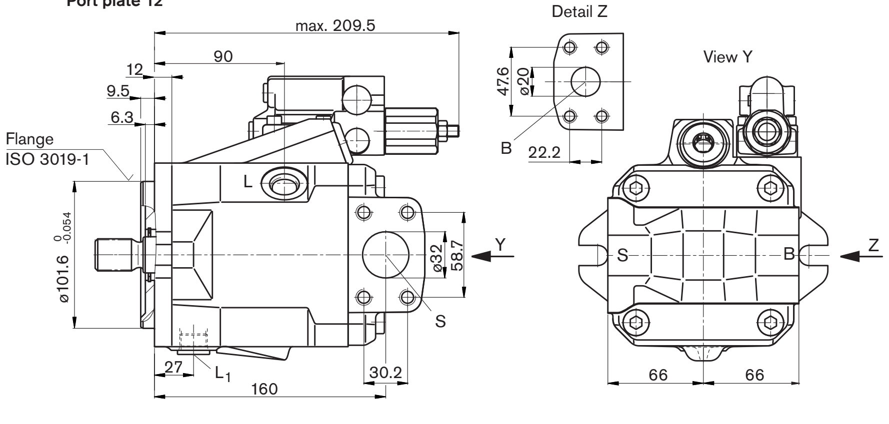
DR – Hydraulic pressure controller

Clockwise rotation, **series 52**

Port plate 11



Port plate 12



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation (please refer to page 28)

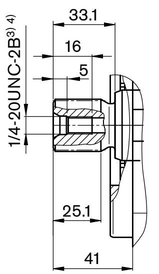
2) Primary dimensions for pump apply for series 52 and 53

Dimensions, size 28

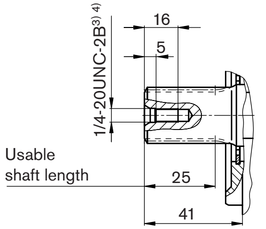
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 7/8 in
13T 16/32DP1) (SAE J744)



R Splined shaft 7/8 in
13T 16/32DP1)2) (SAE J744)



2

Ports

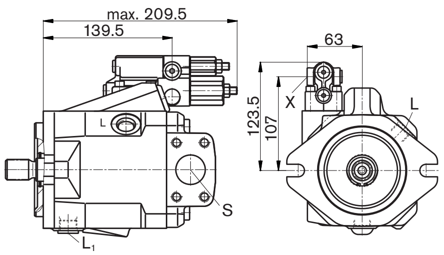
Designation	Port for	Standard	Size4)	Maximum pressure [bar]5)	State
B	Service line, fixing thread	SAE J5186) DIN 13	3/4 in M10 x 1.5; 17 deep	315	O
S	Suction line, fixing thread	SAE J5186) DIN 13	1 1/4 in M10 x 1.5; 17 deep	5	O
L	Case drain fluid	ISO 119267)	3/4-16UNF-2B; 12 deep	2	O9)
L_1, $L_2$8)	Case drain fluid	ISO 119267)	3/4-16UNF-2B; 12 deep	2	X9)
X	Control pressure	ISO 119267)	7/16-20UNF-2B; 11.5 deep	315	O

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) Metric fixing thread is a deviation from standard.
7) The spot face can be deeper than as specified in the standard.
8) Only series 53
9) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

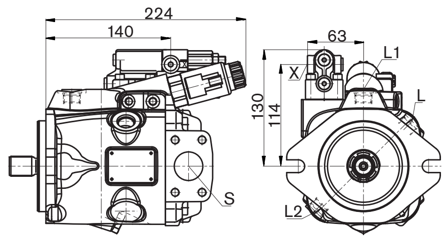
Dimensions, size 28

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

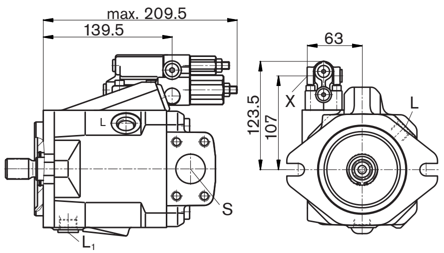
DRG
Pressure controller, remote controlled, **series 52**



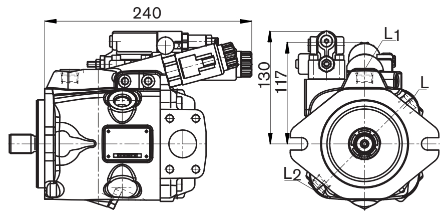
EP.D. / EK.D.
Electro-proportional control, **series 53**



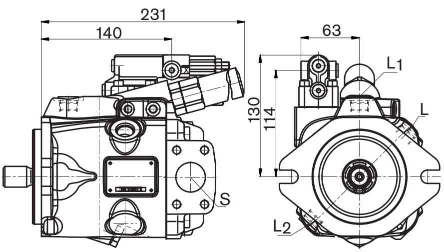
DFR / DFR1
Pressure and flow control, **series 52**



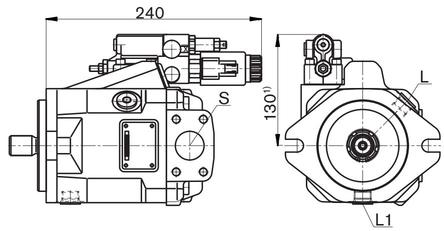
EP.ED / EK.ED
Electro-proportional control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



ED7. / ER7.
Electro-hydraulic pressure control, **series 52**



1) ER7.: 159 mm if using an intermediate plate pressure controller.

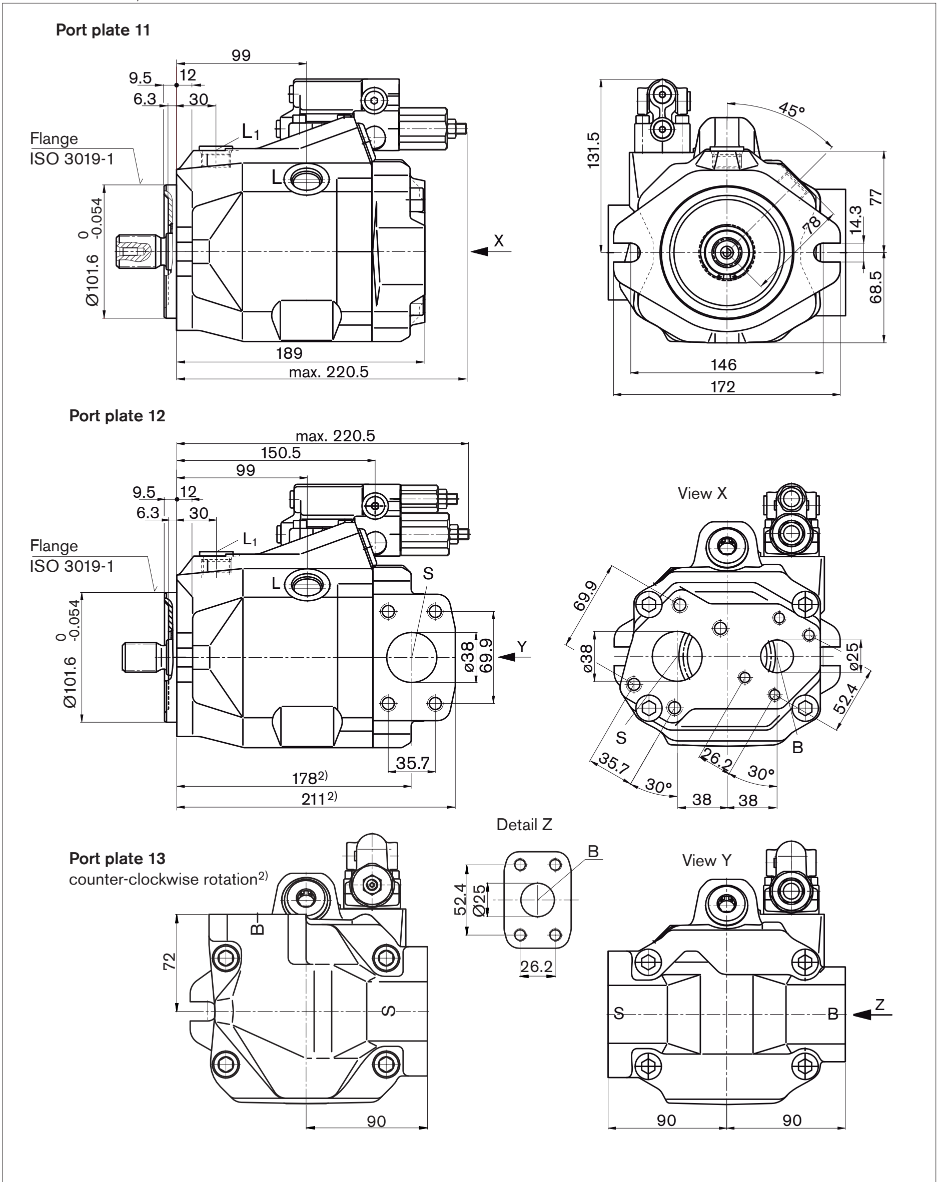
For details of connection options and drive shafts, please refer to page 27

Dimensions, size 45[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

Clockwise rotation, **series 52**



Dimensions of service line ports turned through 180° for counter-clockwise rotation

1) Primary dimensions for pump apply for series 52 and 53

2) For dimensions of service line ports S and B for port plate 13, please refer to port plate 12, footnote 2).

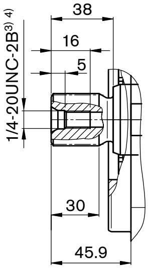
For details of connection options and drive shafts, please refer to page 30

Dimensions, size 45

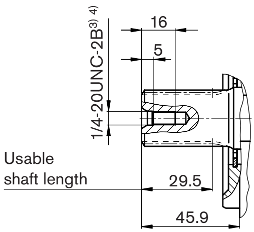
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

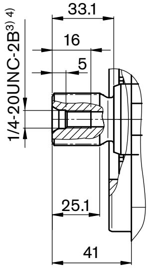
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



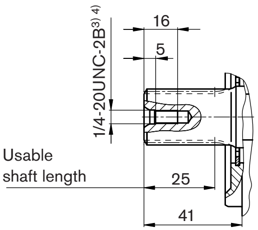
R Splined shaft 1 in
15T 16/32DP[1][2] (SAE J744)



U Splined shaft 7/8 in
13T 16/32DP[1] (SAE J744)



W Splined shaft 7/8 in
13T 16/32DP[1][2] (SAE J744)



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line, fixing thread	SAE J518[6] DIN 13	1 in M10 x 1.5; 17 deep	315	O
S	Suction line, fixing thread	SAE J518[6] DIN 13	1 1/2 in M12 x 1.75; 20 deep	5	O
L	Case drain fluid	ISO 11926[7]	7/8-14UNF-2B; 13 deep	2	O[9]
L_1, L_2[8]	Case drain fluid	ISO 11926[7]	7/8-14UNF-2B; 13 deep	2	X[9]
X	Control pressure	ISO 11926[7]	7/16-20UNF-2A; 11.5 deep	315	O

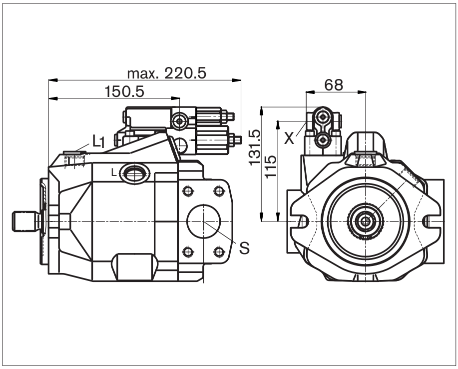
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) Metric fixing thread is a deviation from standard.
7) The spot face can be deeper than as specified in the standard.
8) Only for series 53
9) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

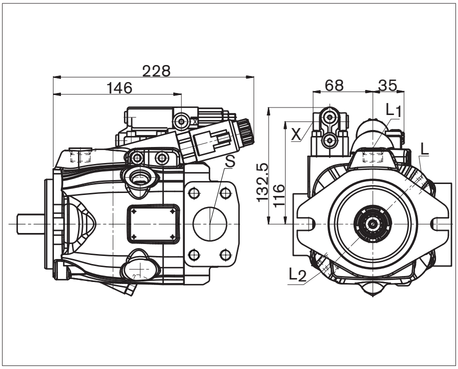
Dimensions, size 45

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

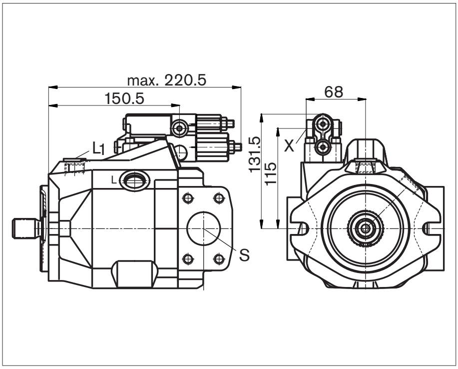
DRG
Pressure controller, remote controlled, **series 52**



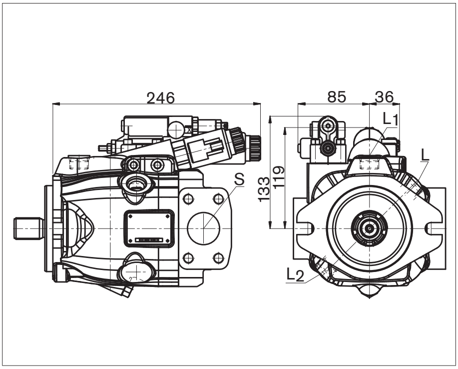
EP.D. / EK.D.
Electro-proportional control, **series 53**



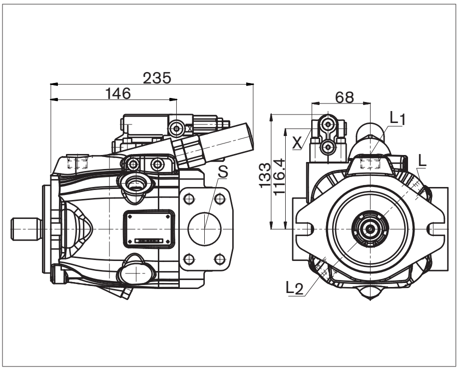
DFR / DFR1
Pressure and flow control, **series 52**



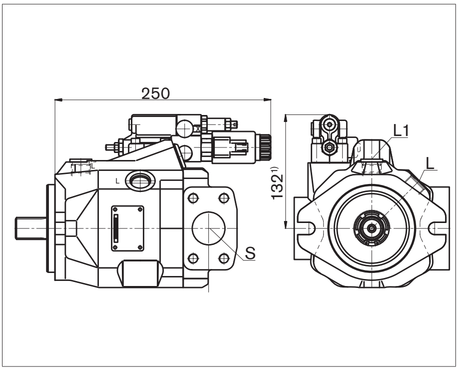
EP.ED / EK.ED
Electro-proportional control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



ED7. / ER7.
Electro-hydraulic pressure control, **series 52**



2

1) ER7.: 167 mm if using an intermediate plate pressure controller.

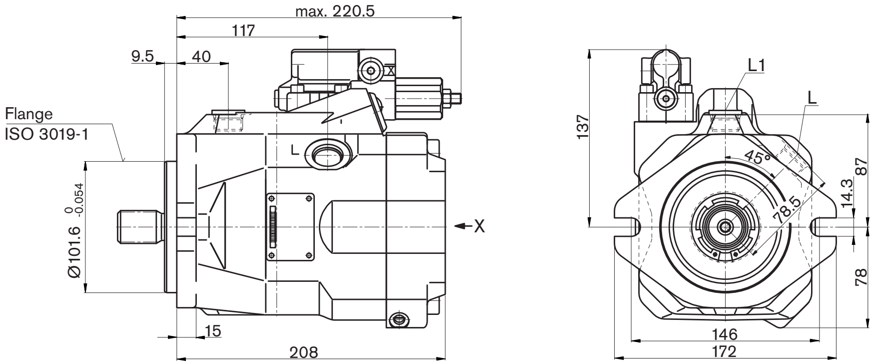
Dimensions, size 60[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

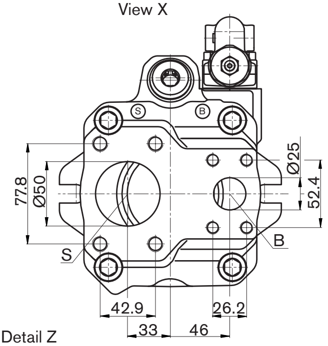
DR – Hydraulic pressure controller

Mounting flange C, clockwise rotation, **series 52**

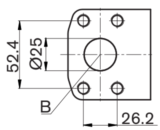
Port plate 11



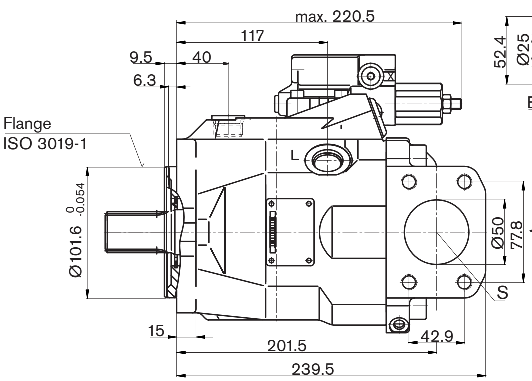
View X



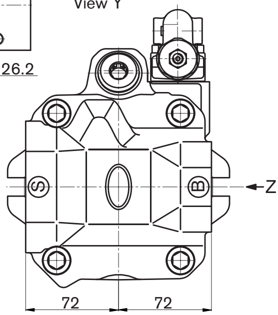
Detail Z



Port plate 12



View Y



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

For details of connection options and drive shafts, please refer to page 34

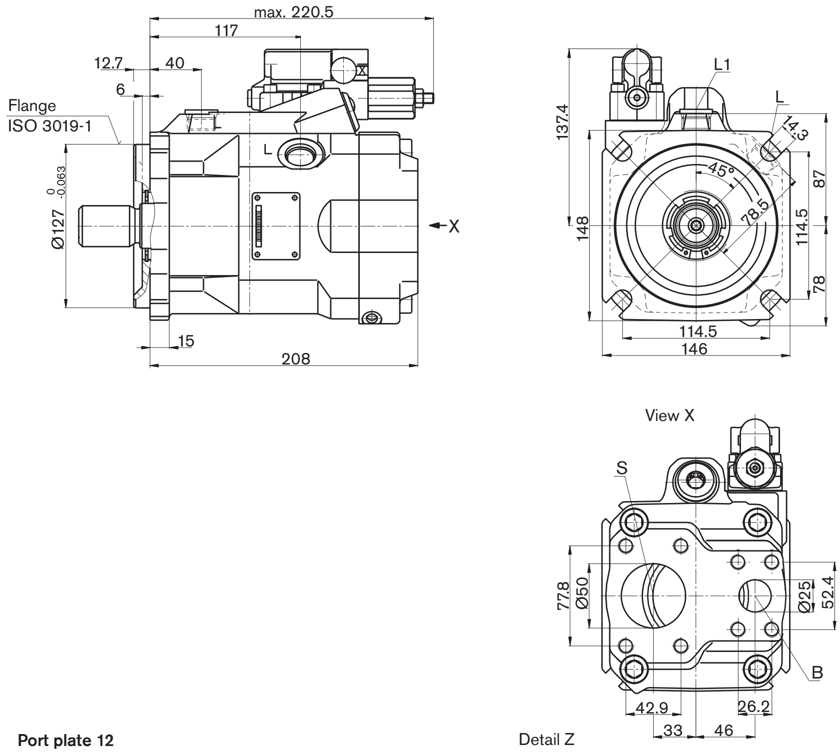
Dimensions, size 60[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

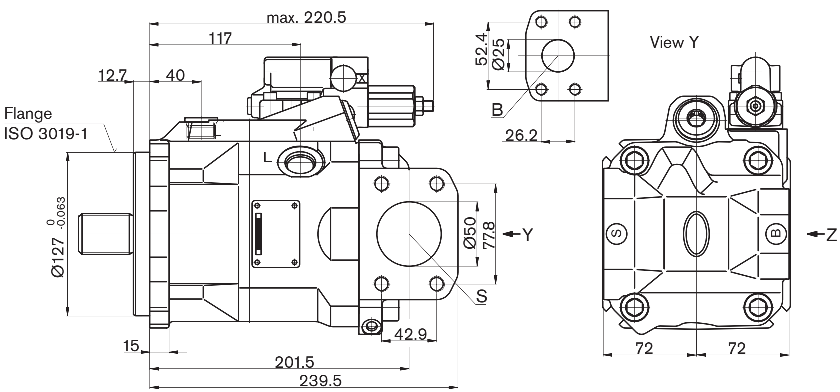
Mounting flange D, clockwise rotation, **series 52**

Port plate 11



Port plate 12

Detail Z



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

For details of connection options and drive shafts, please refer to page 34

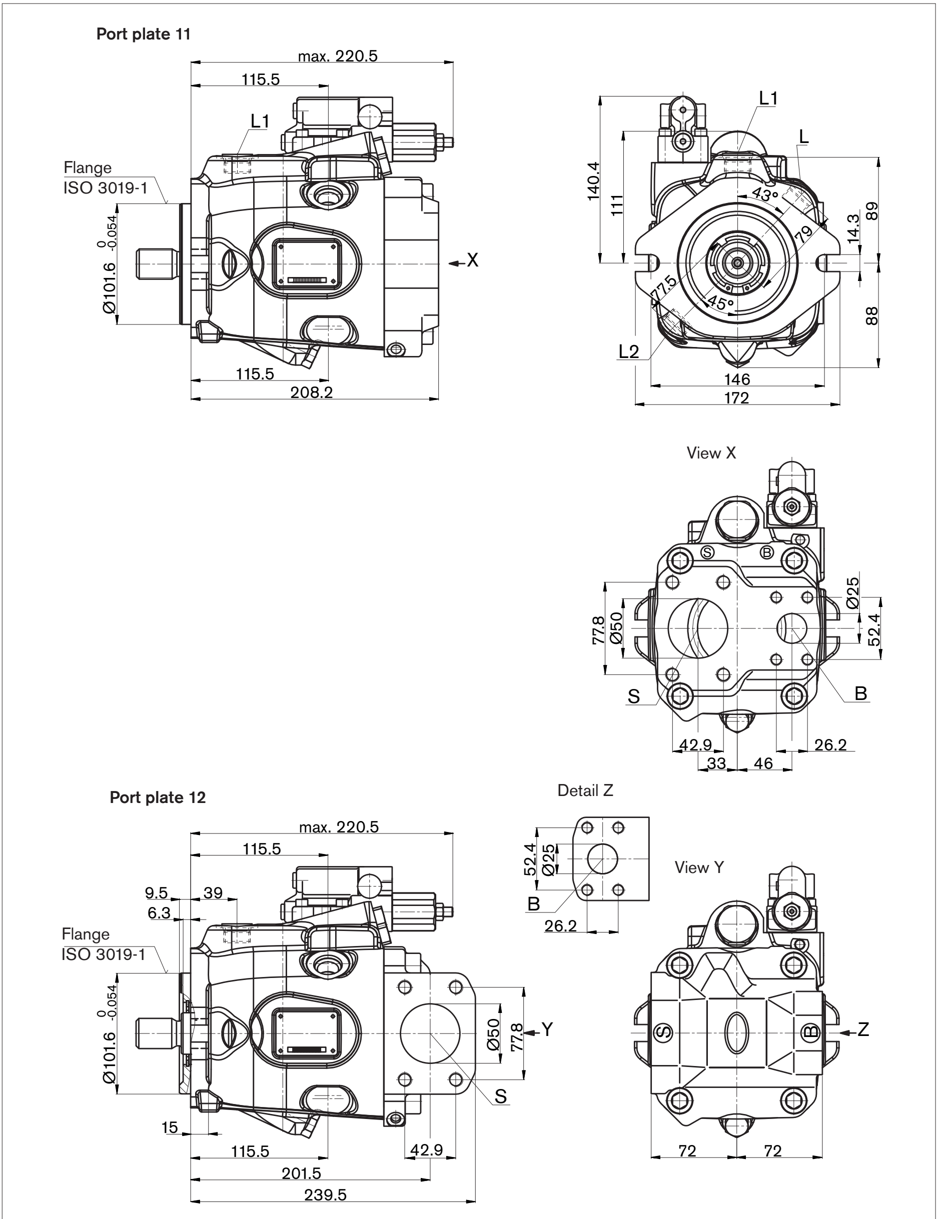
2

Dimensions, size 63[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

Mounting flange C, clockwise rotation, **series 53**



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

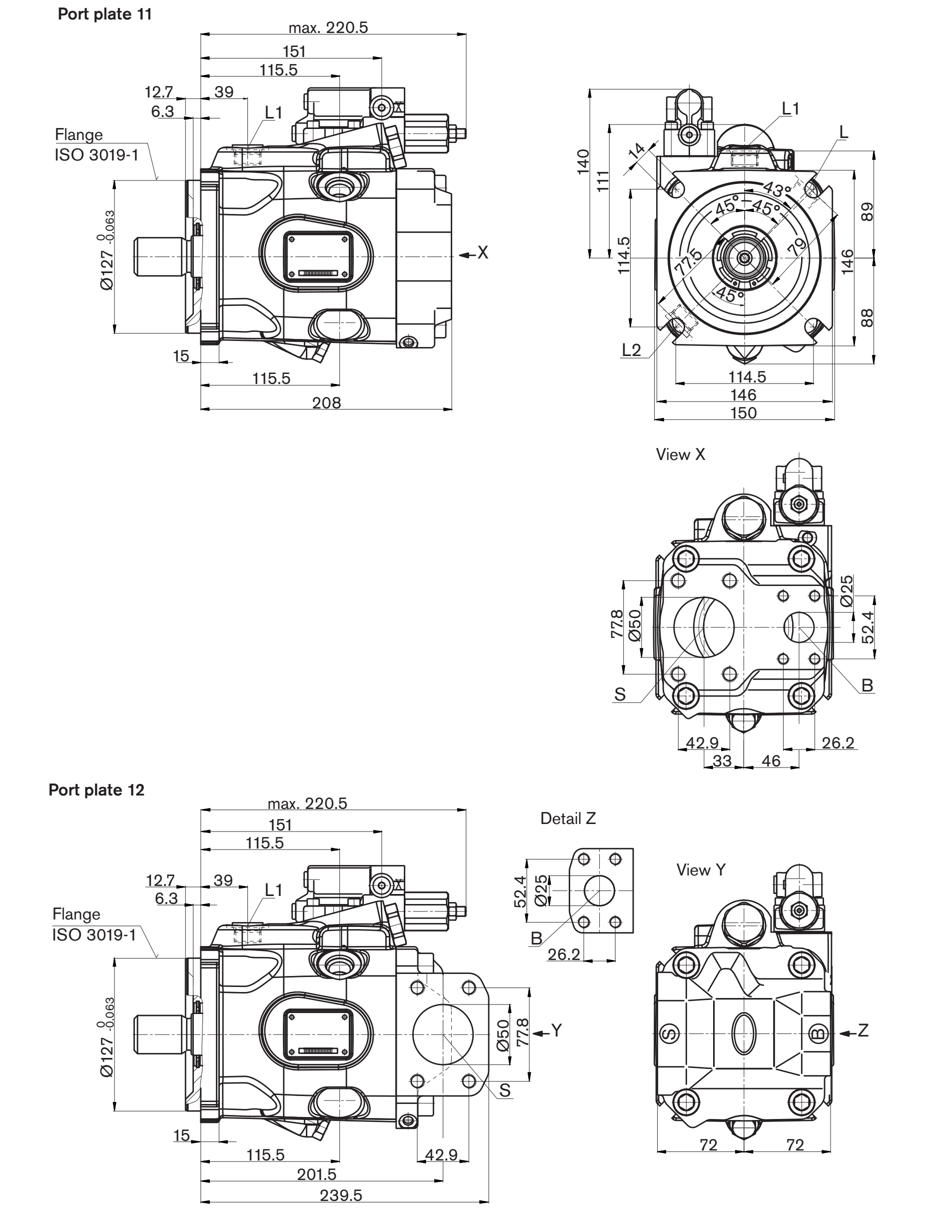
For details of connection options and drive shafts, please refer to page 34

Dimensions, size 63[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

Mounting flange D, clockwise rotation, **series 53**



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

For details of connection options and drive shafts, please refer to page 34

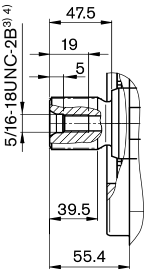
2

Dimensions, size 60 / 63

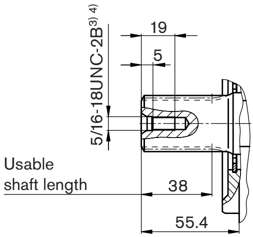
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

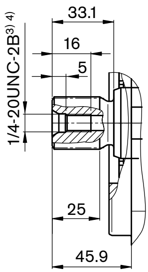
S Splined shaft 1 1/4 in
14T 12/24DP1) (SAE J744)



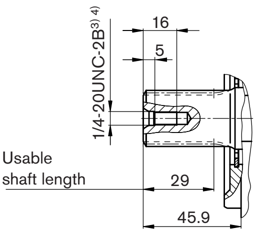
R Splined shaft 1 1/4 in
14T 12/24DP1)2) (SAE J744)



U Splined shaft 1 in
15T 16/32DP1) (SAE J744)



W Splined shaft 1 in
15 T 16/32DP1)2) (SAE J744)



Ports

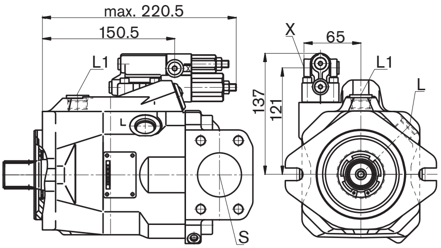
Designation	Port for	Standard	Size4)	Maximum pressure [bar]5)	State
B	Service line, fixing thread	SAE J5186) DIN 13	1 in M10 x 1.5; 17 deep	315	O
S	Suction line, fixing thread	SAE J5186) DIN 13	2 in M12 x 1.75; 20 deep	5	O
L	Case drain fluid	ISO 119267)	7/8-14UNF-2B; 13 deep	2	O9)
L_1, $L_2$8)	Case drain fluid	ISO 119267)	7/8-14UNF-2B; 13 deep	2	X9)
X	Control pressure	ISO 119267)	7/16-20UNF-2A; 11.5 deep	315	O

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) Metric fixing thread is a deviation from standard.
7) The spot face can be deeper than as specified in the standard.
8) Only for series 53
9) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

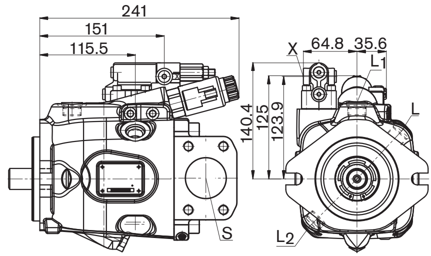
Dimensions, size 60 / 63

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

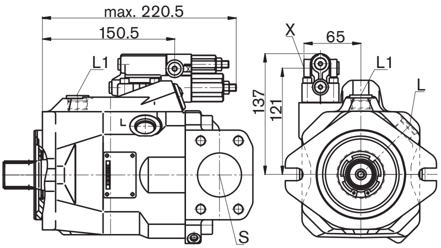
DRG
Pressure controller, remote controlled, **series 52**



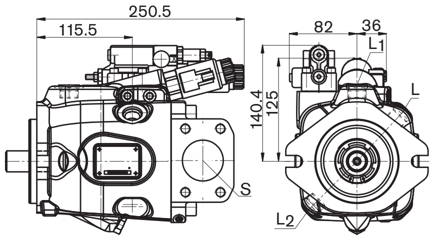
EP.D. / EK.D.
Electro-proportional control, **series 53**



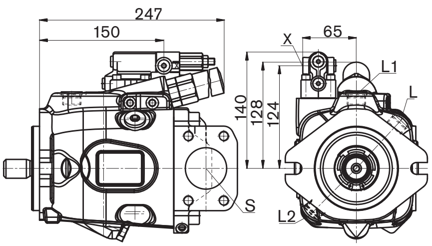
DFR / DFR1 (DRF/DRS)
Pressure and flow control, **series 52 (series 53)**



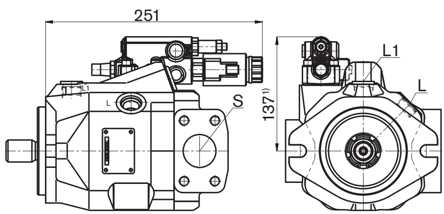
EP.ED / EK.ED
Electro-proportional control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



ED7. / ER7.
Electro-hydraulic pressure control, **series 52**



1) ER7.: 172 mm if using an intermediate plate pressure controller.

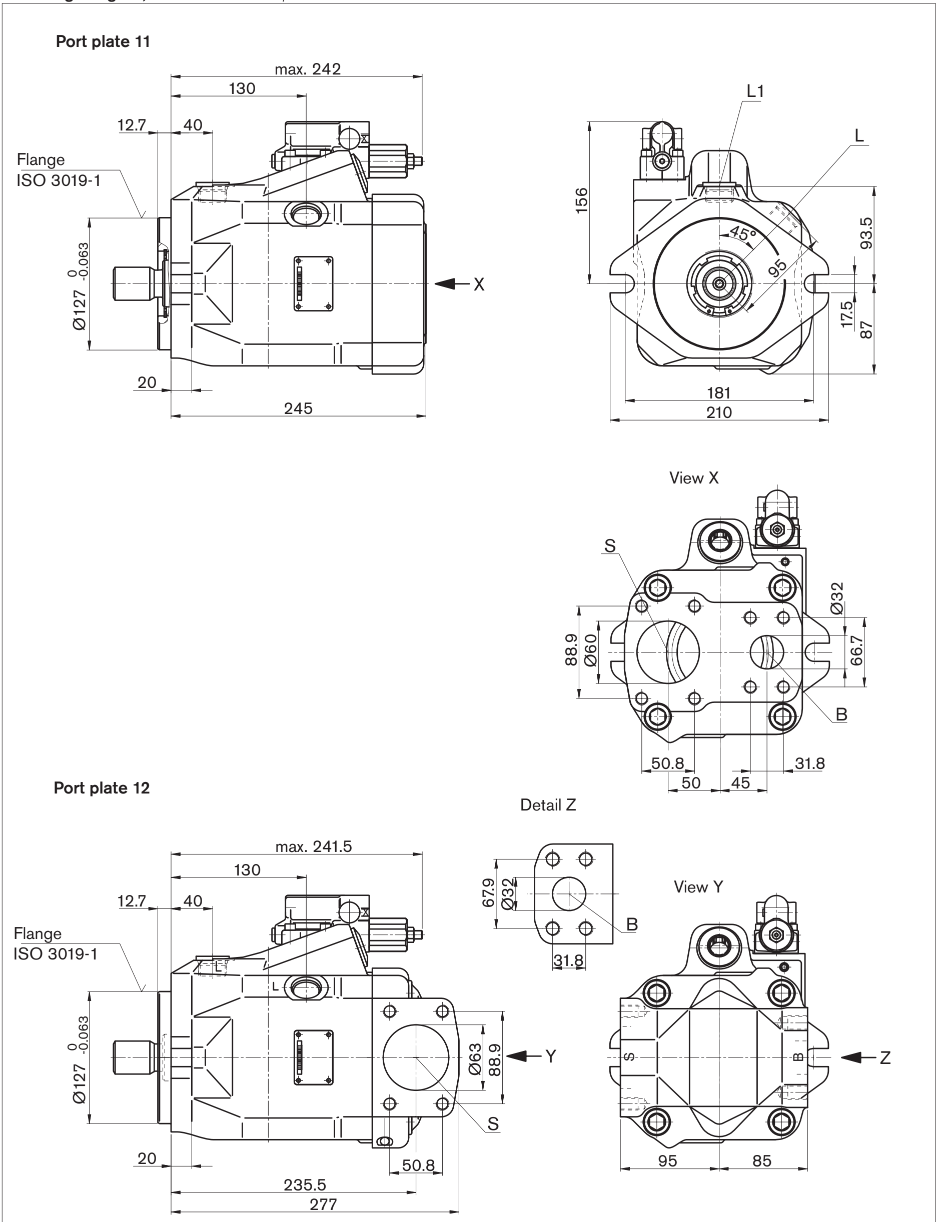
2

Dimensions, size 85[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

Mounting flange C, clockwise rotation, **series 52**



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation
For details of connection options and drive shafts, please refer to page 40

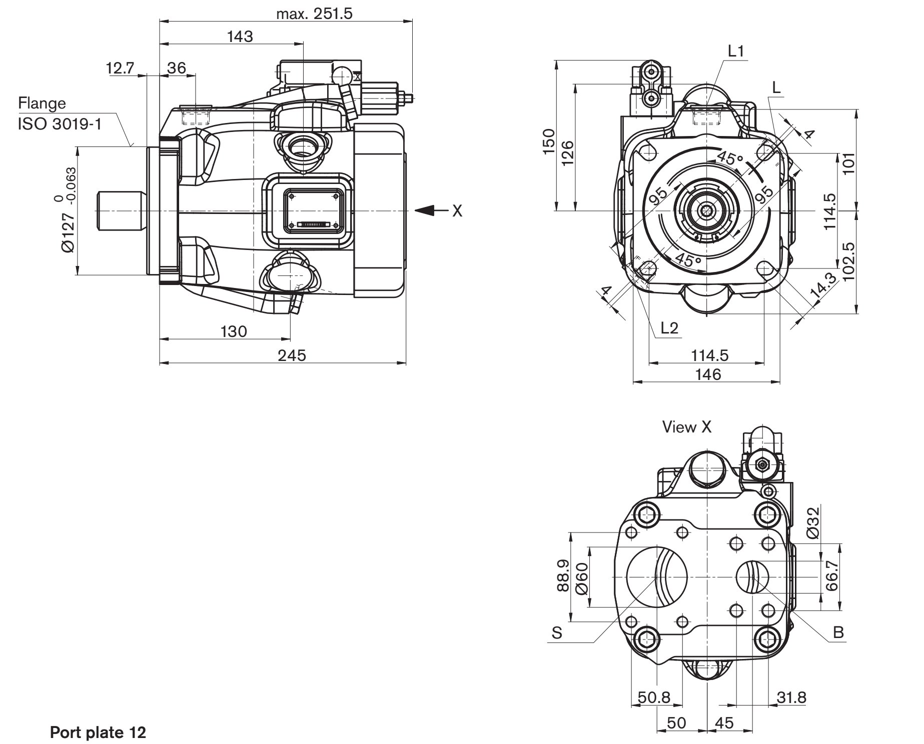
Dimensions, size 85[1)]

Before finalizing your design request a certified installation drawing. Dimensions in mm.

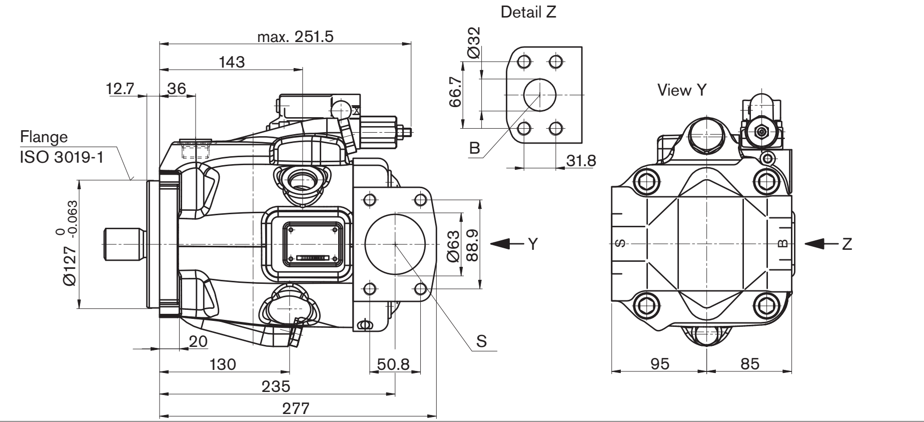
DR – Hydraulic pressure controller

Mounting flange D, clockwise rotation, **series 53**

Port plate 11



Port plate 12



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

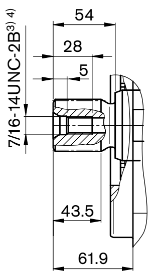
For details of connection options and drive shafts, please refer to page 40

Dimensions, size 85

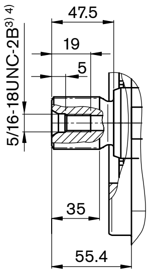
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

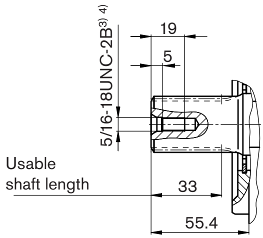
S Splined shaft 1 1/2 in
17T 12/24DP[1] (SAE J744)



U Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



W Splined shaft 1 1/4 in
14T 12/24DP[1)2)] (SAE J744)



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line, fixing thread	SAE J518[6] DIN 13	1 1/4 in M14 x 2; 19 deep	315	O
S	Suction line, fixing thread	SAE J518[6] DIN 13	2 1/2 in M12 x 1.75; 17 deep	5	O
L	Case drain fluid	ISO 11926[7]	1 1/16-12UNF-2B; 15 deep	2	O[9]
L_1, L_2[8]	Case drain fluid	ISO 11926[7]	1 1/16-12UNF-2B; 15 deep	2	X[9]
X	Control pressure	ISO 11926[7]	7/16-20UNF-2A; 11.5 deep	315	O

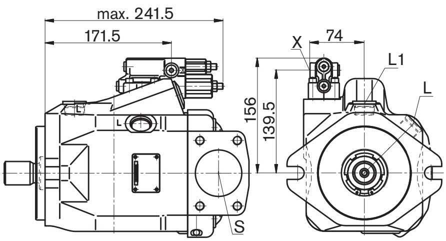
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) Metric fixing thread is a deviation from standard.
7) The spot face can be deeper than as specified in the standard.
8) Only for series 53
9) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

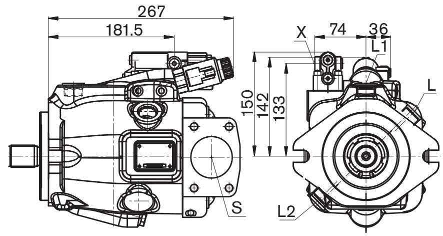
Dimensions, size 85, mounting flange C

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

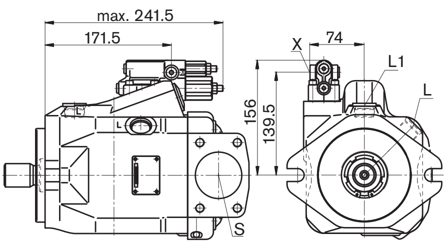
DRG
Pressure controller, remote controlled, **series 52**



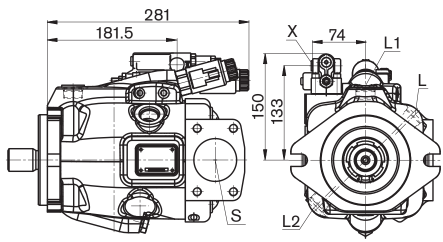
EP.D. / EK.D.
Electro-proportional control, **series 53**



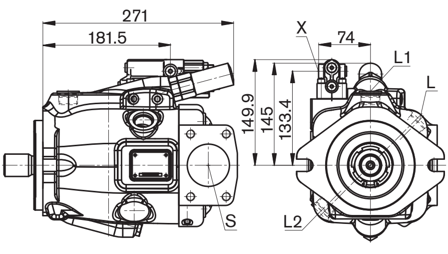
DFR / DFR1
Pressure and flow control, **series 52**



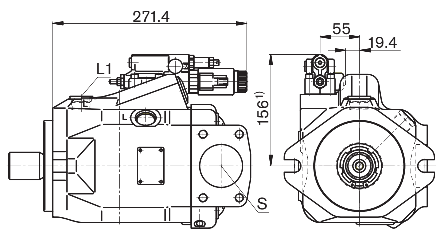
EP.ED / EK.ED
Electro-proportional control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



ED../ ER..
Electro-hydraulic pressure control, **series 52**



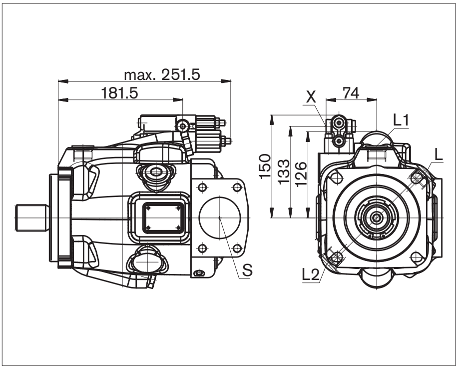
1) ER7.: 191 mm if using an intermediate plate pressure controller.

Dimensions, size 85, mounting flange D

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

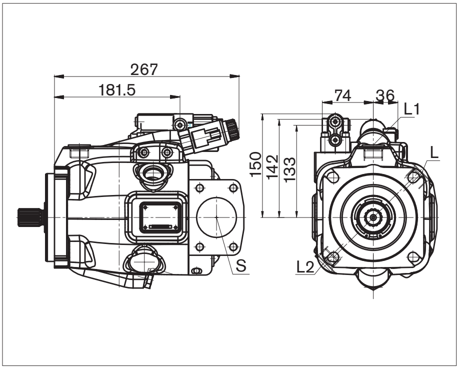
DRF/DRS

Pressure and flow control, **series 53**



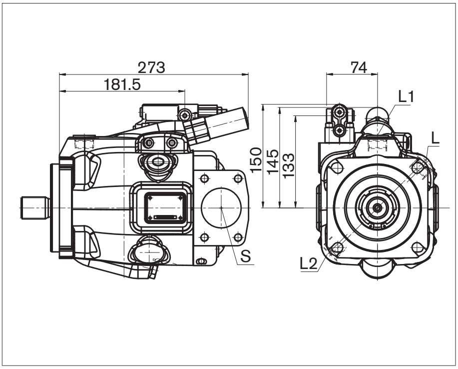
EP.D. / EK.D.

Electro-proportional control, **series 53**



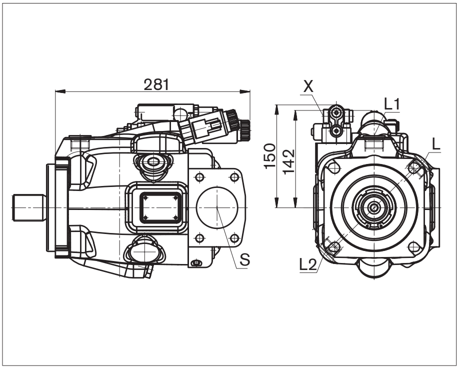
LA.D.

Pressure, flow and power control, **series 53**



EP.ED / EK.ED

Electro-proportional control, **series 53**



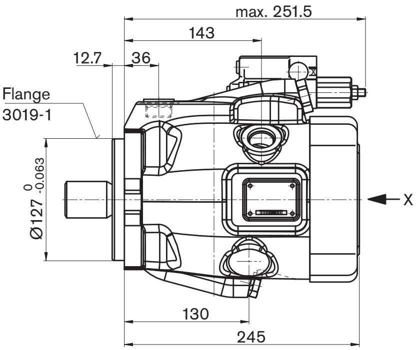
Dimensions, size 100[1)]

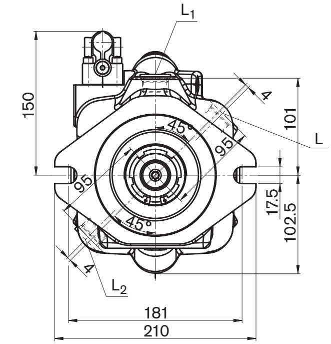
Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

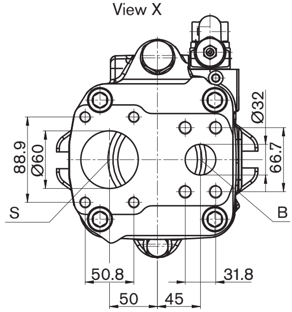
Mounting flange C, clockwise rotation, **series 53**

Port plate 11

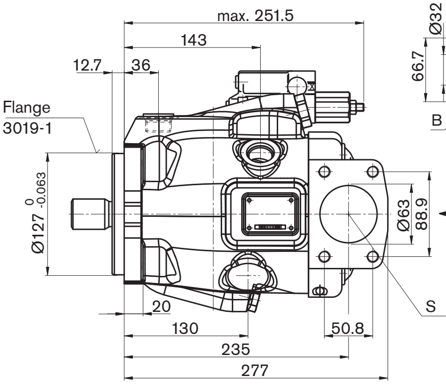




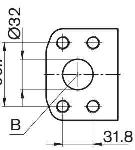
View X



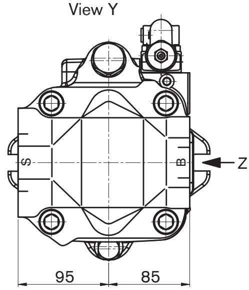
Port plate 12



Detail Z



View Y



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

For details of connection options and drive shafts, please refer to page 44

2

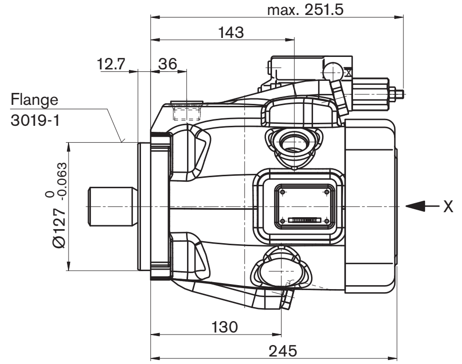
Dimensions, size 100[1)]

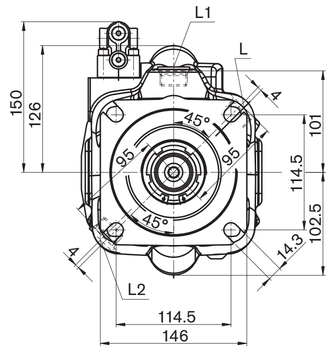
Before finalizing your design request a certified installation drawing. Dimensions in mm.

DR – Hydraulic pressure controller

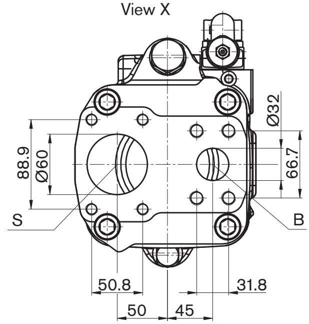
Mounting flange D, clockwise rotation, **series 53**

Port plate 11



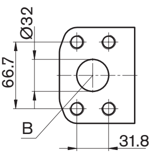


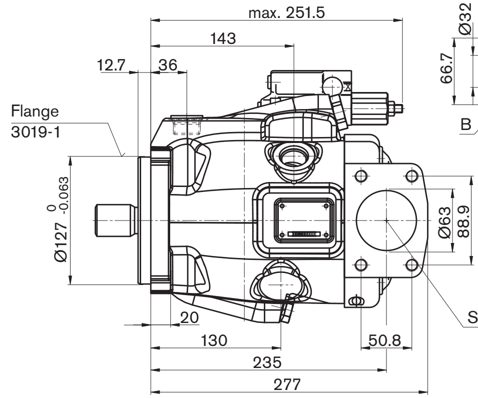
View X



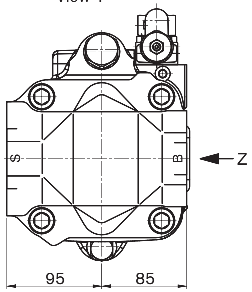
Port plate 12

Detail Z





View Y



1) Dimensions of service line ports turned through 180° for counter-clockwise rotation

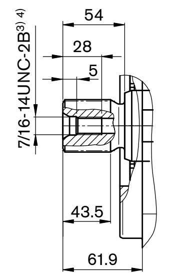
For details of connection options and drive shafts, please refer to page 44

Dimensions, size 100

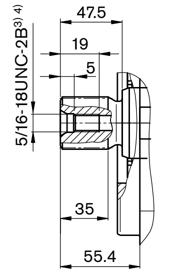
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

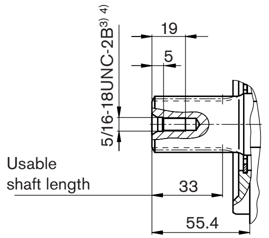
S Splined shaft 1 1/2 in
17T 12/24DP[1] (SAE J744)



U Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



W Splined shaft 1 1/4 in
14T 12/24DP[1][2] (SAE J744)



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line, fixing thread	SAE J518[6] DIN 13	1 1/4 in M14 x 2; 19 deep	315	O
S	Suction line, fixing thread	SAE J518[6] DIN 13	2 1/2 in M12 x 1.75; 17 deep	5	O
L	Case drain fluid	ISO 11926[7]	1 1/16-12UNF-2B; 15 deep	2	O[8]
L_1, L_2	Case drain fluid	ISO 11926[7]	1 1/16-12UNF-2B; 15 deep	2	X[8]
X	Control pressure	ISO 11926[7]	7/16-20UNF-2A; 11.5 deep	315	O

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 56 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring equipment and fittings.
6) Metric fixing thread is a deviation from standard.
7) The spot face can be deeper than as specified in the standard.
8) Depending on the installation position, L, L_1 or L_2 must be connected (please refer to installation instructions on pages 54, 55)

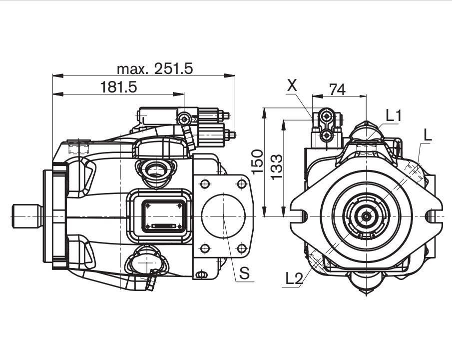
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

2

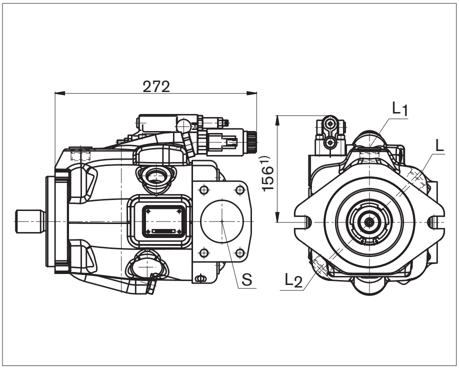
Dimensions, size 100

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

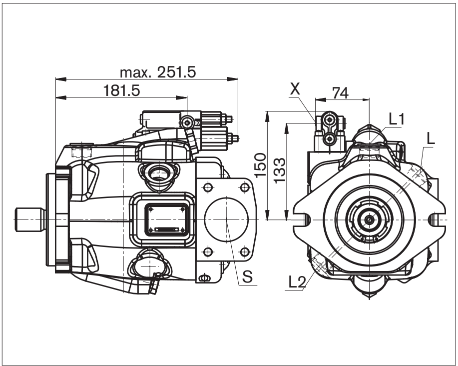
DRG
Pressure controller, remote controlled, **series 53**



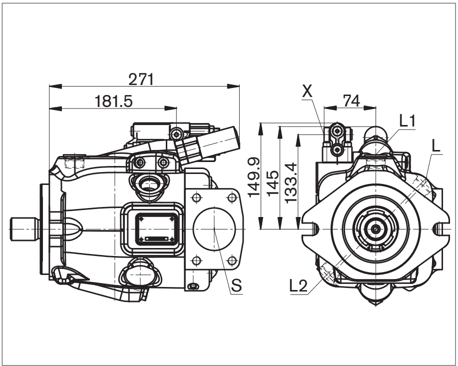
ED../ ER..
Electro-hydraulic pressure control, **series 53**



DRF/DRS
Pressure and flow control, **series 53**



LA.D.
Pressure, flow and power control, **series 53**



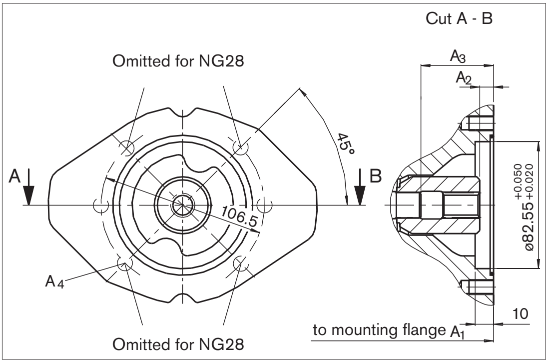
1) ER7.: 191 mm if using an intermediate plate pressure controller.

Dimensions through drive

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

K01 flange SAE J744 - 82-2 (A)

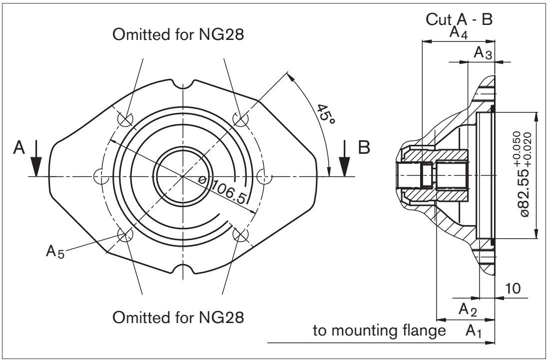
Coupling for splined shaft in accordance with ANSI B92.1a-1996 5/8 in 9T 16/32 DP[1)] (SAE J744 - 16-4 (A))



NG	A_1	A_2	A_3	A_4[2)]
18	182	9.3	43.3	M10 x 1.5, 14.5 deep
28	204	9.9	47	M10 x 1.5, 16 deep
45	229	10.7	53	M10 x 1.5, 16 deep
60/63	255	9.5	59	M10 x 1.5, 16 deep
85	302	13.4	68	M10 x 1.5, 20 deep
100	302	13.4	68	M10 x 1.5, 20 deep

K52 flange SAE J744 - 82-2 (A)

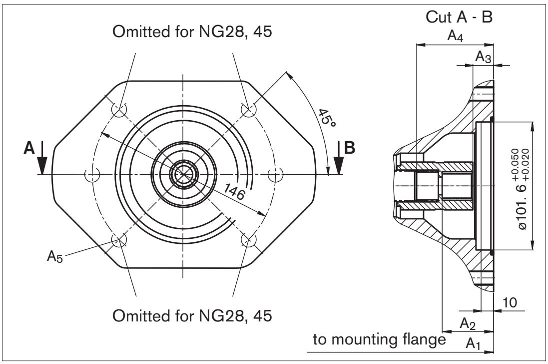
Coupling for splined shaft in accordance with ANSI B92.1a-1996 3/4 in 11T 16/32 DP[1)] (SAE J744 - 19-4 (A-B))



NG	A_1	A_2	A_3	A_4	A_5[2)]
18	182		9.3	43.3	M10 x 1.5, 14.5 deep
28	204	39.3	18.8	47	M10 x 1.5, 16 deep
45	229	39.4	18.9	53	M10 x 1.5, 16 deep
60/63	255	39.4	18.9	61	M10 x 1.5, 16 deep
85	302	44.1	23.6	65	M10 x 1.5, 20 deep
100	302	44.1	23.6	65	M10 x 1.5, 20 deep

K68 flange SAE J744 - 101-2 (B)

Coupling for splined shaft in accordance with ANSI B92.1a-1996 7/8 in 13T 16/32 DP[1)] (SAE J744 - 22-4 (B))



NG	A_1	A_2	A_3	A_4	A_5[2)]
28	204	42.3	17.8	47	M12 x 1.75, 18 deep
45	229	42.4	17.9	53	M12 x 1.75, 18 deep
60/63	255	42.4	17.9	59	M12 x 1.75, 18 deep
85	302	46.5	22	69	M12 x 1.75, 20 deep
100	302	46.5	22	69	M12 x 1.75, 20 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5

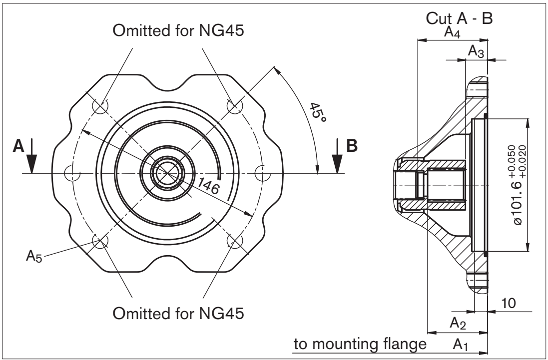
2) Thread according to DIN 13, observe the general instructions on page 56 for the maximum tightening torques.

Dimensions through drive

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

K04 flange SAE J744 - 101-2 (B)

Coupling for splined shaft in accordance with ANSI B92.1a-1996

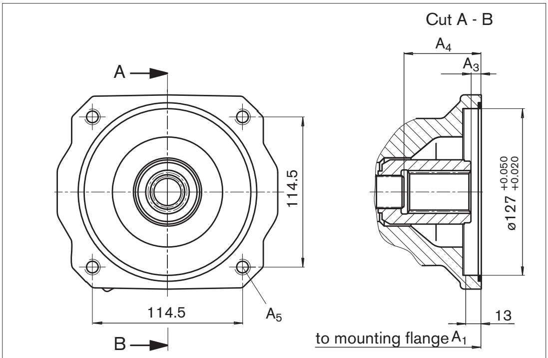


1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))

NG	A_1	A_2	A_3	A_4	A_5[2]
45	229	47.9	18.9	53.4	M12 x 1.75, 18 deep
60/63	255	47.4	18.4	58.9	M12 x 1.75, 18 deep
85	302	51.2	22.2	69	M12 x 1.75, 20 deep
100	302	51.2	22.2	69	M12 x 1.75, 20 deep

K15 flange SAE J744 - 127-4 (C)

Coupling for splined shaft in accordance with ANSI B92.1a-1996

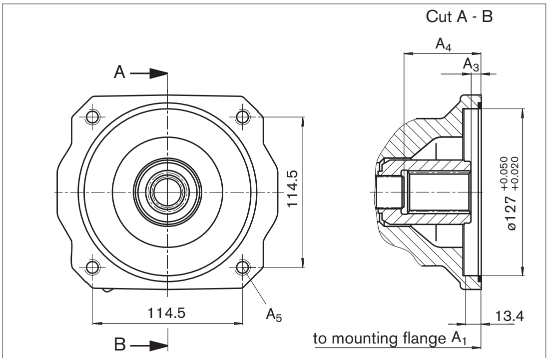


1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A_1	A_2	A_3	A_4[2]
60/63	255	8	59	M12 x 1.75, 16 deep
85	301.5	13	67.9	M12 x 1.75, through
100	301.5	13	67.9	M12 x 1.75, through

K16 flange SAE J744 - 127-4 (C)

Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A_1	A_2	A_3	A_4[2]
85	301.5	13	67.9	M12 x 1.75, through
100	301.5	13	67.9	M12 x 1.75, through

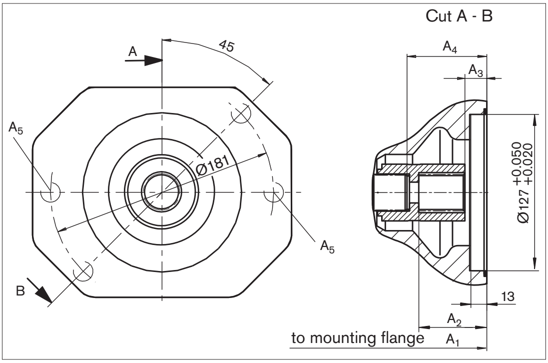
1) 30° pressure angle, flat base, flank centering, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 56 for the maximum tightening torques.

Dimensions through drive

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

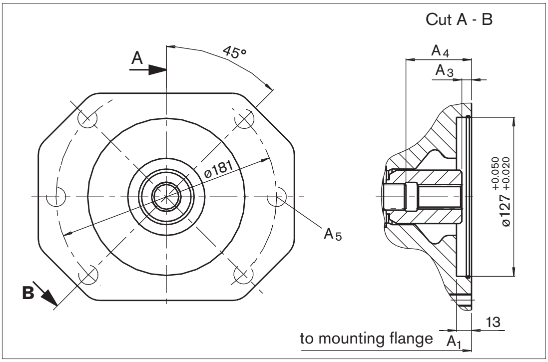
K07 flange SAE J744 - 127-2 (C)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A_1	A_2	A_3	A_4[2]
85	301.5	13	67.9	M12 x 1.75, through
100	301.5	13	67.9	M12 x 1.75, through

K24 flange SAE J744 - 127-2 (C)
Coupling for splined shaft in accordance with ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))

NG	A_1	A_2	A_3	A_4[2]
85	302	8	68	M16 x 2, 24 deep
100	302	8	68	M16 x 2, 24 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 56 for the maximum tightening torques.

2

Summary mounting options

Through-drive[1]			Mounting option – 2nd pump			
Flange	Coupling for splined shaft	Short des.	A10V(S)O/5x NG (shaft)	A10VO/31 NG (shaft)	Gear pump design (NG)	**Through drive available for NG**
82-2 (A)	5/8 in	**K01**	10 (U)	18 (U)	F (5 to 22)	18 to 100
	3/4 in	**K52**	10 (S) 18 (U) 18 (S, R)	18 (S, R)	–	18 to 100
101-2 (B)	7/8 in	**K68**	28 (S, R) 45 (U, W)[1]	28 (S, R) 45 (U, W)	N/G (26 to 49)	28 to 100
	1 in	**K04**	45 (S, R) 60, 63 (U, W) [2]	45 (S, R) –	–	45 to 100
127-4 (C)	1 1/4 in	**K15**	60, 63 (S, R)	–	–	63 to 100
	1 1/2 in	**K16**	85 (S) 100 (S)	–	–	85 to 100
127-2 (C)	1 1/4 in	**K07**	85 (U, W) 100 (U, W)	71 (S, R)	–	85 to 100
	1 1/2 in	**K24**	85 (S) 100 (S)	–	–	85 to 100

1) Not for NG28 with K68
2) Not for NG28 with K04

Combination pumps A10VO + A10VO

Before finalizing your design, please request approved installation drawing. Dimensions in mm.

When using combination pumps it is possible to have multiple, mutually independent circuits without the need for a splitter gearbox.

When ordering combination pumps the model codes for the first and the second pump must be joined by a "**+**".

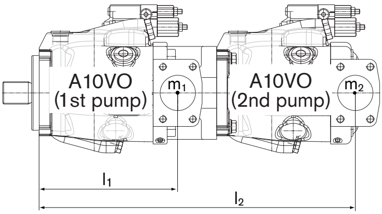
Order example:
A10VO85DRS/53R-VSC12K04+
A10VO45DRF/53R-VSC11N00

The tandem pump comprising two identical sizes is permissible without additional supports taking into account a maximum dynamic mass acceleration of 10 *g* (= 98.1 m/s²).

For combination pumps comprising more than two pumps, the mounting flange must be calculated for the permissible moment of inertia.

Permissible moment of inertia

NG			10	18	28	45	60/63	85	100
Permissible moment of inertia									
static	T_m	Nm	–	–	890	900	1370	3080	3080
dynamic at 10 *g* (98.1 m/s²)	T_m	Nm	–	–	89	90	137	308	308
Mass with through-drive plate	m	kg	–	–	17	24	28	45	45
Mass without through drive (e.g. 2nd pump)	m	kg	8	11.5	14	18	22	34	34
Distance center of gravity	l	mm	–	82	81	95	100	122	122



m_1, m_2, m_3	Mass of pumps	[kg]
l_1, l_2, l_3	Distance center of gravity	[mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ [Nm]}$$

Connector for solenoids

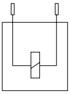
Before finalizing your design, please request approved installation drawing. Dimensions in mm.

DEUTSCH DT04-2P-EP04, 2-pin

Molded, without bidirectional suppressor diode __________ **P**
Protection according to DIN/EN 60529 ______________ IP67
Protection according to DIN 40050-9 _______________ IP69K

Circuit symbol

Without bidirectional suppressor diode



Mating connector

DEUTSCH DT06-2S-EP04
Bosch Rexroth Mat. No. R902601804

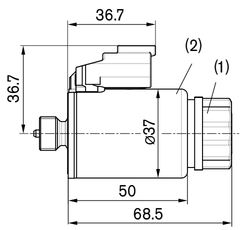
Consisting of: DT designation

– 1 case ______________________________ DT06-2S-EP04

– 1 wedge ______________________________________ W2S

– 2 sockets ___________________________ 0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.



Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one revolution counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut of the solenoid. Tightening torque: 5+1 Nm (size WAF 26, 12kt DIN 3124).

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

Electronic controls

Control	Electronics function	Electronics		Further information
Electric pressure control	Controlled power outlet	RA	analog	RE 95230
		RC2-2/21 1)	Digital	RE 95201

1) Power outlets for 2 valves, can be actuated separately
2) only 24V nominal voltage

Notes

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit empty via the hydraulic lines.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the case interior must be directed to the reservoir via the highest case drain port (L_1, L_2, L_3).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

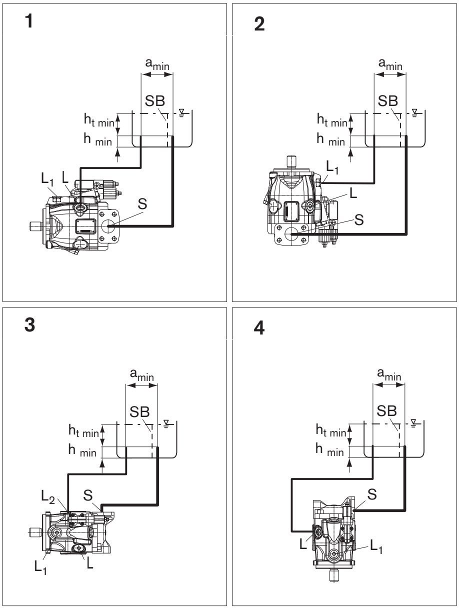
Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

Below-reservoir installation (standard)

Below-reservoir installation means the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1	L	S + L
2	L_1	S + L_1
3[1)]	L_2	S + L_2
4	L	S + L

Key, see page 53

1) Only series 53

Installation instructions

Above-reservoir installation

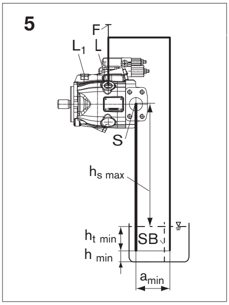
Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir.

To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm is required in installation position 6.

Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

A check valve in the case drain line is only permissible in individual cases. Consult us for approval.

5



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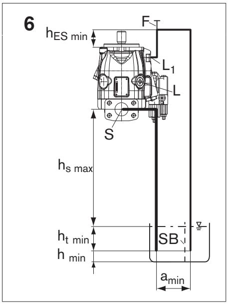

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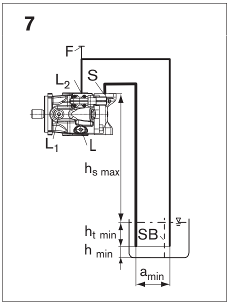

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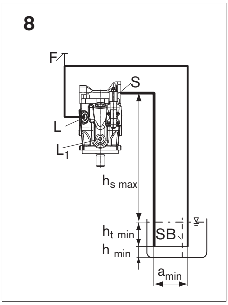


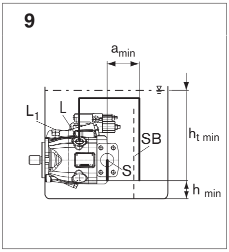
Installation position	Air bleed	Filling
5	F	L, L_1 (F)
6	F	L_1 (F)
7[1)]	F	S + L_2 (F)
8	F	S + L (F)

1) Only series 53

Inside-reservoir installation

Inside-reservoir installation means the pump is installed within the minimum reservoir fluid level.
Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.

9



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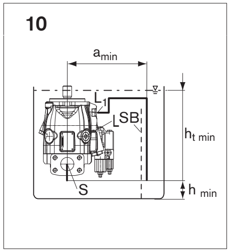

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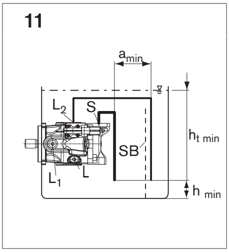
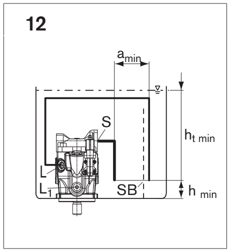


12



Installation position	Air bleed	Filling
9	L_1	L, L_1
10	L_1	L, L_1
11[1)]	L_2	S
12	L	S + L

S Suction port

F Filling / air bleeding

L, L_1 Case drain port

SB Baffle (baffle plate)

$h_{t\ min}$ Minimum necessary immersion depth (200 mm)

h_{min} Minimum necessary spacing to reservoir base (100 mm)

$h_{ES\ min}$ Minimum necessary height needed to protect the axial piston unit from draining (25 mm).

$h_{S\ max}$ Maximum permissible suction height (800 mm)

a_{min} When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

General instructions

– The A10VO pump is designed to be used in open circuit.

– Project planning, installation and commissioning of the axial piston unit require the involvement of qualified personnel.

– Before operating the axial piston unit, please read the appropriate instruction manual thoroughly and completely. If necessary, request these from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Service line ports:

  - The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

  - The service line ports and function ports are only designed to accommodate hydraulic lines.

– Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.

  - Fixing screws:
    For fixing screws with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.

  - Female threads in axial piston unit:
    The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metal threaded plugs supplied with the axial piston unit, the required tightening torques of the threaded plugs M_V apply. For values, see the following table.

Ports		**Maximum permissible tightening torque for female threads $M_{G\ max}$**	**Required tightening torque for threaded plugs M_V**	**Size of hexagon socket of threaded plugs**
Standard	**Thread size**			
DIN 3852	M14 x 1.5	80 Nm	45 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M27 x 2	330 Nm	170 Nm	12 mm
ISO 11926	7/16-20UNF-2B	40 Nm	18 Nm	3/16 in
	9/16-18UNF-2B	80 Nm	35 Nm	1/4 in
	3/4-16UNF-2B	160 Nm	70 Nm	5/16 in
	7/8-14UNF-2B	240 Nm	110 Nm	3/8 in
	1 1/16-12UN-2B	360 Nm	170 Nm	9/16 in

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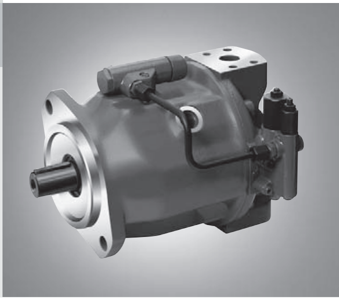
Rexroth
Bosch Group

Axial Piston Variable Pump A10VSO

RE 92711/01.12 1/48
Replaces: 06.09
and RE 92707/11.10

Data sheet



Series 31
Sizes 18 to 140
Nominal pressure 280 bar
Maximum pressure 350 bar
Open circuit

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Features

- Variable pump in axial piston swashplate design for hydrostatic drives in an open circuit
- The flow is proportional to the drive speed and the displacement
- The flow can be steplessly varied by adjustment of the swashplate angle.
- 2 case drain ports
- Excellent suction characteristics
- Low noise level
- Long service life
- Axial and radial load capacity of drive shaft
- Favorable power/weight ratio
- Versatile controller range
- Short control time
- The through drive is suitable for adding gear pumps and axial piston pumps up to the same size, i.e., 100% through drive.

Type code for standard program

	A10VS	O			/	31		–	V					
01	02	03	04	05		06	07		08	09	10	11	12	13

Version

		18	28	45	71	100	140	
01	Standard version (without symbol)	●	●	●	●	●	●	
	HFA, HFB, HFC hydraulic fluid (except for Skydrol)	–	●	●	●	●	●	**E**
	High-speed version	–	–	●	●	●	●	**H**

Axial piston unit

02	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10VS**

Operation mode

03	Pump, open circuit	**O**

Size (NG)

04	Geometric displacement, see table of values on pages 6 and 7	**18**	**28**	**45**	**71**	**100**	**140**

Control device

					18	28	45	71	100	140	
05	Two-point control, directly operated				●	●	●	●	●	●	**DG**
	Pressure control				●	●	●	●	●	●	**DR**
	with flow control, hydraulic										
		X-T open			●	●	●	●	●	●	**DFR**
		X-T closed			●	●	●	●	●	●	**DFR1**
	with swivel angle control, electric				–	●	●	●	●	●	**FE1**[1]
		pressure and swivel-angle control, electric			●	●	●	●	●	●	**DFE1**[1]
	with pressure cut-off, remotely operated										
	hydraulic				●	●	●	●	●	●	**DRG**
	electrical	negative characteristic	12V		●	●	●	●	●	●	**ED71**
			24V		●	●	●	●	●	●	**ED72**
		positive characteristic	12V		●	●	●	●	●	●	**ER71**[2]
			24V		●	●	●	●	●	●	**ER72**[2]
	Pressure, flow and power control				–	●	●	●	●	●	**DFLR**

Series

06	Series 3, Index 1	**31**

Direction of rotation

07	Viewed on drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals

08	FKM (fluor-caoutchouc)	**V**

1) See RE 30030

2) The following must be taken into account during project planning:
Excessive current levels (I > 1200 mA with 12 V or I > 600 mA with 24 V) to the ER solenoid can result in undesired increase of pressure which can lead to pump or system damage:
- Use I_{max} current limiter solenoids.
- A sandwich plate pressure reducing valve can be used to protect the pump in the event of overflow.
An accessory kit with pressure reducing sandwich plate can be ordered from Rexroth under part number R902490825.

● = available ❍ = on request – = not available

Type code for standard program

	A10VS	O			/	31		–	V					
01	02	03	04	05		06	07		08	09	10	11	12	13

	Drive shaft		18	28	45	71	100	140	
09	Splined shaft ANSI B92.1a	standard shaft	●	●	●	●	●	●	**S**
		similar to shaft "S" however for higher input torque	●	●	●	●	–	–	**R**
	Parallel keyed shaft DIN 6885	not for through drive	●	●	●	●	●	●	**P**

	Mounting flange		18	28	45	71	100	140	
10	ISO 3019-2	2-hole	●	●	●	●	●	–	**A**
		4-hole	–	–	–	–	–	●	**B**

	Service line port	18	28	45	71	100	140	
11	SAE flange ports on opposite side, metric fastening thread	●	●	●	–	●	●	**12**
		–	–	–	●	–	–	**42**

	Through drive			18	28	45	71	100	140	
12	without through drive			●	●	●	●	●	●	**N00**
	Flange ISO 3019-1 Diameter	coupling for splined shaft[1] diameter								
	82-2 (A)	5/8 in	9T 16/32DP	●	●	●	●	●	●	**K01**
		3/4 in	11T 16/32DP	●	●	●	●	●	●	**K52**
	101-2 (B)	7/8 in	13T 16/32DP	–	●	●	●	●	●	**K68**
		1 in	15T 16/32DP	–	–	●	●	●	●	**K04**
	127-2 (C)	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	**K07**
		1 1/2 in	17T 12/24DP	–	–	–	–	●	●	**K24**
	152-4 (D)	1 3/4 in	13T 8/16DP	–	–	–	–	–	●	**K17**
	Ø 63, metric 4-hole	shaft key Ø 25		–	●	●	●	●	●	**K57**
	Flange ISO 3019-2 Diameter									
	80, 2-hole	3/4 in	11T 16/32DP	●	●	●	●	●	●	**KB2**
	100, 2-hole	7/8 in	13T 16/32DP	–	●	●	●	●	●	**KB3**
		1 in	15T 16/32DP	–	–	●	●	●	●	**KB4**
	125, 2-hole	1 1/4 in	14T 12/24DP	–	–	–	●	●	●	**KB5**
		1 1/2 in	17T 12/24DP	–	–	–	–	●	●	**KB6**
	180, 4-hole	1 3/4 in	13T 8/16DP	–	–	–	–	–	●	**KB7**

	Connectors for solenoids[2]	18	28	45	71	100	140	
13	HIRSCHMANN connector – without suppressor diode	●	●	●	●	●	●	**H**

1) Coupling for splined shaft as per ANSI B92.1a
2) Connectors for other electric components can deviate.

● = available ❍ = on request – = not available

2

Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

When using environmentally acceptable hydraulic fluids, the limitations regarding technical data and seals must be observed. Please contact us. When ordering, indicate the hydraulic fluid that is to be used.

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected in the range

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

referred to reservoir temperature (open circuit).

Limits of viscosity range

For critical operating conditions the following values apply:

n_{min} = 10 mm²/s
short-term (t ≤ 1 min)
at max perm. case drain temperature of 90 °C.

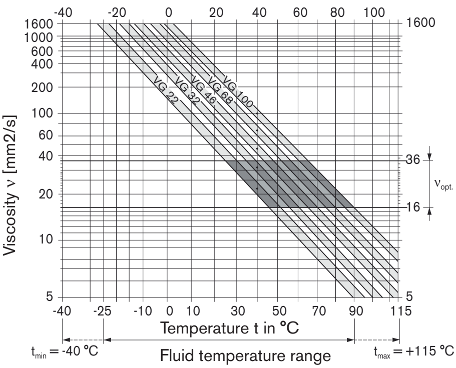
Please also ensure that the max. case drain temperature of 90 °C is not exceeded in localized areas (for instance, in the bearing area).The fluid temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

n_{max} = 1000 mm²/s
short-term (t ≤ 1 min)
on cold start
(p ≤ 30 bar, n ≤ 1000 rpm, t_{min} -25 °C)

Depending on the installation situation, special measures are necessary at temperatures between -40 °C and -25 °C. Please contact us.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

Selection diagram



Notes on the choice of hydraulic fluid

In order to select the correct hydraulic fluid, it is necessary to know the operating temperature in the reservoir (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.

Example: at an ambient temperature of X °C the operating temperature is 60 °C. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

Important:
The case drain temperature is influenced by pressure and input speed and is always higher than the reservoir temperature. However, at no point in the component may the temperature exceed 90 °C. The temperature difference specified on the left is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be met, due to extreme operating parameters please contact us.

Filtration of the hydraulic fluid

The finer the filtration the better the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

In order to guarantee the functional reliability of the axial piston unit it is necessary to carry out a gravimetric evaluation of the hydraulic fluid to determine the particle contamination and the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 must be maintained.
At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above cleanliness levels cannot be maintained, please contact us.

Technical data

Operating pressure range

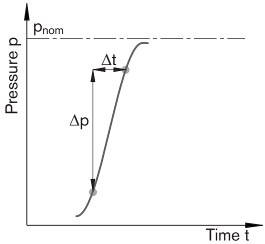
Pressure at service line port B

Nominal pressure p_{nom} ________ 280 bar absolute

Maximum pressure p_{max} ________ 350 bar absolute
Single operating period ________ 2.5 ms
Total operating period ________ 300 h

Minimum pressure (high-pressure side) ________ 10 bar absolute[1)]

Rate of pressure change $R_{A\ max}$ ________ 16000 bar/s



Pressure at suction port S (inlet)
Minimum pressure $p_{S\ min}$ ________ 0.8 bar absolute
Maximum pressure $p_{S\ max}$ ________ 10 bar[1)] absolute

Note
Please contact us for values for other hydraulic fluids.

Case drain pressure

Maximum permissible case drain pressure (at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ________ 2 bar absolute[1)]

1) Other values on request

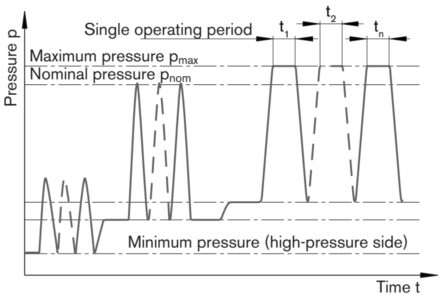
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The total of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure in the high-pressure side (port B) that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period $= t_1 + t_2 + ... + t_n$

Technical data, standard unit

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		18	28	45	71	100	140
Geometrical displacement per revolution		$V_{g\ max}$	cm^3	18	28	45	71	100	140
Speed[1)]									
maximum at $V_{g\ max}$		n_{nom}	rpm	3300	3000	2600	2200	2000	1800
maximum at $V_g < V_{g\ max}$		$n_{max\ perm}$	rpm	3900	3600	3100	2600	2400	2100
Flow									
at n_{nom} and $V_{g\ max}$		$q_{v\ max}$	l/min	59	84	117	156	200	252
at $n_E = 1500$ rpm and $V_{g\ max}$		$q_{vE\ max}$	l/min	27	42	68	107	150	210
Power at $\Delta p = 280$ bar									
at n_{nom}, $V_{g\ max}$		P_{max}	kW	30	39	55	73	93	118
at $n_E = 1500$ rpm and $V_{g\ max}$		$P_{E\ max}$	kW	12.6	20	32	50	70	98
Torque									
at $V_{g\ max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	80	125	200	316	445	623
	$\Delta p = 100$ bar	T	Nm	30	45	72	113	159	223
Rotary stiffness, drive shaft	S	c	Nm/rad	11087	22317	37500	71884	121142	169537
	R	c	Nm/rad	14850	26360	41025	76545	–	–
	P	c	Nm/rad	13158	25656	41232	80627	132335	188406
Moment of inertial rotary group		J_{TW}	kgm^2	0.00093	0.0017	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum[2)]		α	rad/s^2	6800	5500	4000	3300	2700	2700
Filling capacity		V	L	0.4	0.7	1.0	1.6	2.2	3.0
Weight (without through drive) approx.		m	kg	12	15	21	33	45	60

1) The values are applicable:
- for an absolute pressure $p_{abs} = 1$ bar at suction port S
- within the optimum viscosity range from $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-oil based hydraulic fluid.

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.
Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
The limiting value is only valid for a single pump.
The loading capacity of the connecting parts must be taken into account.

Note

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

Determination of size

Flow $\quad q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [l/min]

Torque $\quad T = \dfrac{V_g \cdot \Delta p}{20 \cdot p \cdot h_{mh}}$ [Nm]

Power $\quad P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3

Δp = Differential pressure in bar

n = Speed in rpm

η_V = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Total efficiency($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data, high-speed version

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		45	71	100	140
Geometrical displacement per revolution		$V_{g\ max}$	cm^3	45	71	100	140
Speed[1)]							
maximum at $V_{g\ max}$		n_{nom}	rpm	3000	2550	2300	2050
maximum at $V_g < V_{g\ max}$		$n_{max\ perm}$	rpm	3300	2800	2500	2200
Flow at n_{nom} and $V_{g\ max}$		$q_{v\ max}$	l/min	135	178	230	287
Power at $\Delta p = 280$ bar at n_{nom}, $V_{g\ max}$		P_{max}	kW	63	83	107	134
Torque at $V_{g\ max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	200	316	445	623
	$\Delta p = 100$ bar	T	Nm	72	113	159	223
Rotary stiffness, drive shaft	S	c	Nm/rad	37500	71884	121142	169537
	R	c	Nm/rad	41025	76545	–	–
	P	c	Nm/rad	41232	80627	132335	188406
Moment of inertial rotary group		J_{TW}	kgm^2	0.0033	0.0083	0.0167	0.0242
Angular acceleration, maximum[2)]		α	rad/s^2	4000	3300	2700	2700
Filling capacity		V	L	1.0	1.6	2.2	3.0
Weight (without through drive) approx.		m	kg	21	33	45	60

1) The values are applicable:
- for an absolute pressure $p_{abs} = 1$ bar at suction port S
- within the optimum viscosity range from $\nu_{opt} = 16$ to $36\ mm^2/s$
- for mineral-oil based hydraulic fluid.

2) The scope of application lies between the minimum necessary and the maximum permissible drive speeds.
Valid for external excitation (e.g. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
The limiting value is only valid for a single pump.
The loading capacity of the connecting parts must be taken into account.

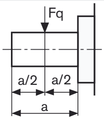
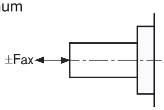
Note
Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible values.

Sizes 45, 71, 100 and 140 are optionally available in high-speed version.
External dimensions are not affected by this option.

2

Technical data

Permissible radial and axial loading on the drive shaft

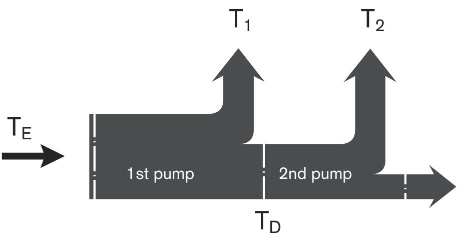
Size		NG		18	28	45	71	100	140
Radial force maximum at a/2		$F_{q\,max}$	N	350	1200	1500	1900	2300	2800
Axial force maximum		$+F_{ax\,max}$	N	700	1000	1500	2400	4000	4800

Permissible input and through-drive torques

Size	NG		18	28	45	71	100	140
Torque at $V_{g\,max}$ and $\Delta p = 280$ bar[1]	T_{max}	Nm	80	125	200	316	445	623
Input torque for drive shaft, maximum[2]								
S	$T_{E\,max}$	Nm	124	198	319	626	1104	1620
	Ø	in	3/4	7/8	1	1 1/4	1 1/2	1 3/4
R	$T_{E\,max}$	Nm	160	250	400	644	–	–
	Ø	in	3/4	7/8	1	1 1/4	–	–
P	$T_{E\,max}$	Nm	88	137	200	439	857	1206
	Ø	mm	18	22	25	32	40	45
Maximum through-drive torque for drive shaft								
S	$T_{D\,max}$	Nm	108	160	319	492	778	1266
R	$T_{D\,max}$	Nm	120	176	365	548	–	–
P	$T_{D\,max}$	Nm	88	137	200	439	778	1206

1) Without considering efficiency
2) For drive shafts free of radial load

Distribution of torques



Technical data

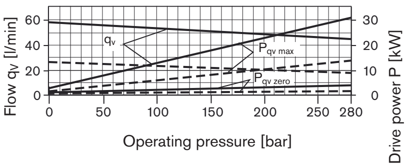
Drive power and flow

Operating material:
Hydraulic fluid ISO VG 46 DIN 51519, t = 50 °C

Size 18

_ _ _ _ n = 1500 rpm

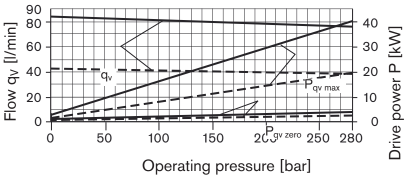
______n = 3300 rpm



Size 28

_ _ _ _ n = 1500 rpm

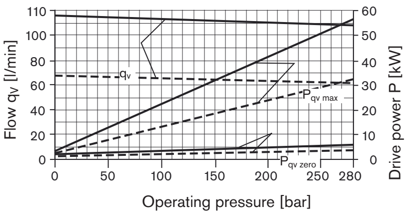
______n = 3000 rpm



Size 45

_ _ _ _ n = 1500 rpm

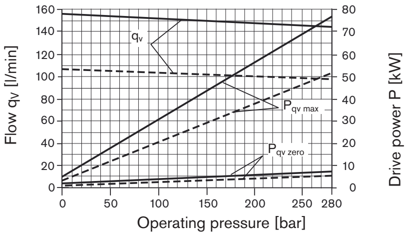
______n = 2600 rpm



Size 71

_ _ _ _ n = 1500 rpm

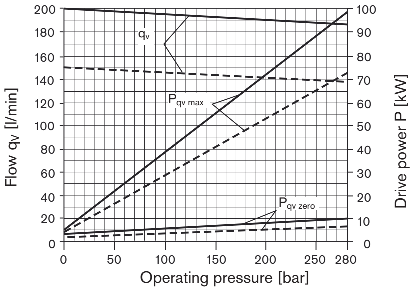
______n = 2200 rpm



Size 100

_ _ _ _ n = 1500 rpm

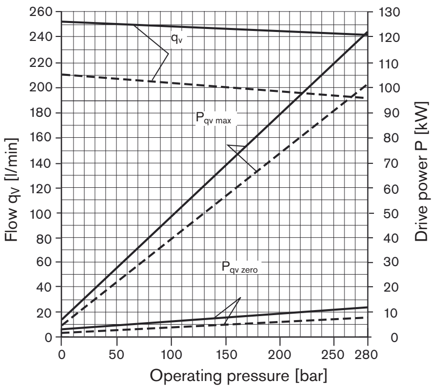
______n = 2000 rpm



Size 140

_ _ _ _ n = 1500 rpm

______n = 1800 rpm



2

DG – Two-point control, directly operated

The variable pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroke piston; a minimum control pressure of $p_{st} \geq 50$ bar is required.

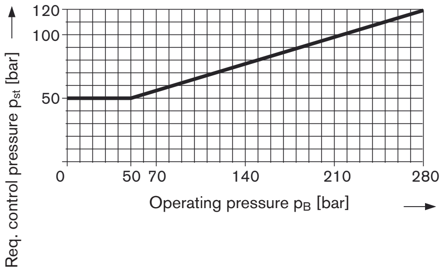
The variable pump can only be switched between $V_{g\,max}$ or $V_{g\,min}$.

Please note, that the required control pressure at port X is directly dependent on the actual operating pressure p_B in port B. (See control pressure characteristic).

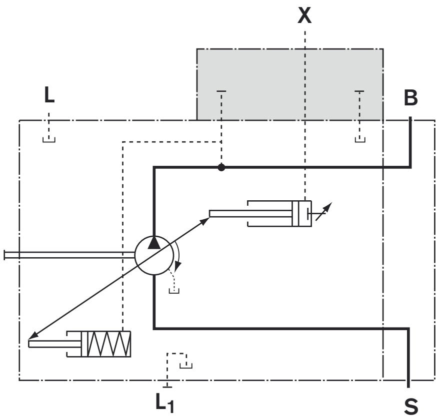
Control pressure p_{st} in X = 0 bar ≙ $V_{g\,max}$

Control pressure p_{st} in X ≥ 50 bar ≙ $V_{g\,min}$

Control pressure characteristic



Circuit diagram



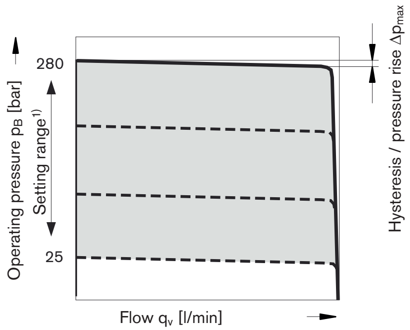
	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

DR – Pressure control

The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will adjust towards a smaller displacement and the control deviation will be reduced. The pressure can be set steplessly at the control valve.

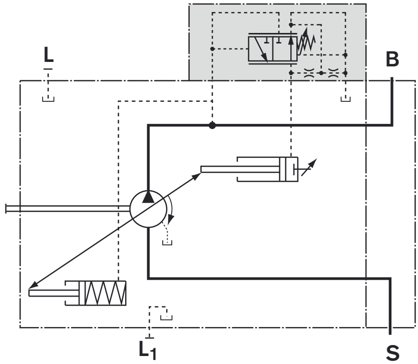
Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)

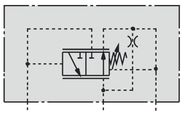


1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve are greater.

Circuit diagram, sizes 18 to 100



Circuit diagram, size 140



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)

Control data

Hysteresis and repeatability Δp ____________ maximum 3 bar

Pressure rise, maximum

NG		18	28	45	71	100	140
Δp	bar	4	4	6	8	10	12

Control fluid consumption__________ maximum approx. 3 l/min

Flow losses at q_{Vmax} see page 9.

DRG – Pressure control, remotely operated

The DR-control valve (see page 11) is overriding this DRG-remote setting of max. outlet pressure.

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the delivery contents of the DRG control.

The differential pressure at the DRG control valve is set as standard to 20 bar. This results in a pilot oil flow to the relief valve of approx. 1.5 l/min at port X. If another setting is required (range from 10-22 bar) please state in clear text.

As a separate pressure relief valve we can recommend:

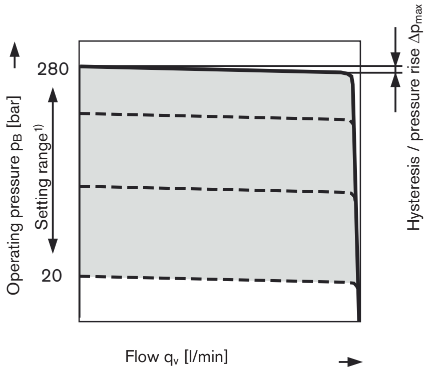
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice Ø 0.8 mm in P (electric) to RE 29166.

The max. length of piping should not exceed 2 m.

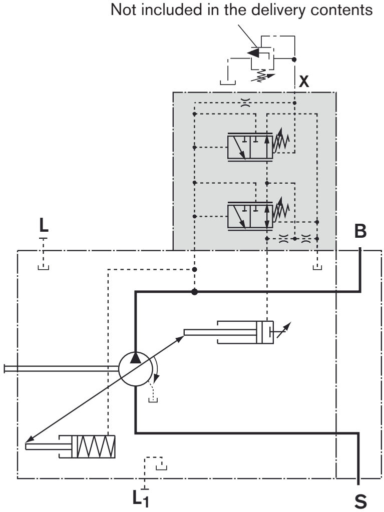
Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)

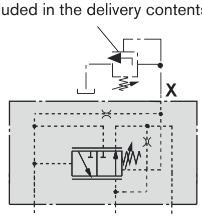


1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve are greater.

Circuit diagram, sizes 18 to 100



Circuit diagram, size 140



		Port for
B		Service line
S		Suction line
L, L_1		Case drain (L_1 plugged)
X	NG 18 to 100 **with** adapter	Pilot pressure
X	NG 140 **without** adapter	Pilot pressure

Control data

Hysteresis and repeatability Δp ____________ maximum 3 bar

Pressure rise, maximum

NG		18	28	45	71	100	140
Δp	bar	4	4	6	8	10	12

Control fluid consumption________ maximum approx. 4.5 l/min

Flow losses at q_{Vmax} see page 9.

DFR/DFR1 – Pressure and flow control

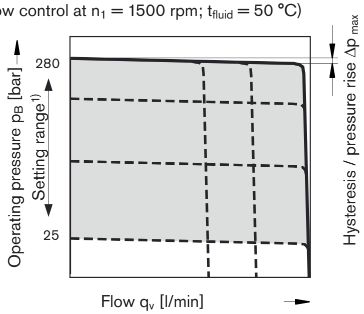
In addition to the pressure control function (see page 11), the pump flow may be varied by means of a differential pressure over an adjustable orifice (e.g. directional valve) installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

The pressure control overrides the flow control function.

Note
The DFR1 version has no connection between X and the reservoir. Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

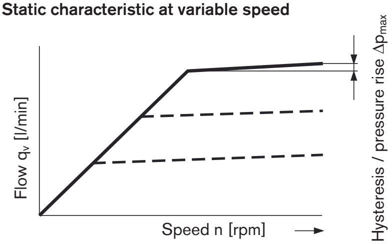
Static characteristic

Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50$ °C)



1) In order to prevent damage to the pump and the system, this setting range is the permissible setting range and must not be exceeded.
The range of possible settings at the valve are greater.

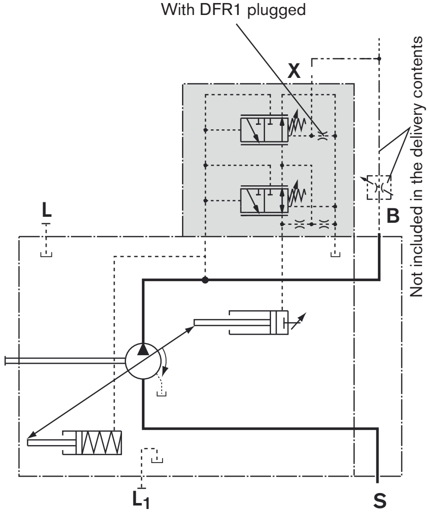
Static characteristic at variable speed



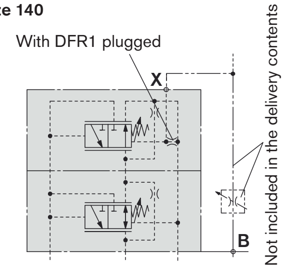
Differential pressure Δp

Standard setting: 14 to 22 bar.
If another setting is required, please state in clear text.
Relieving the load on port X to the reservoir results in a zero stroke ("standby") pressure which lies about 1 to 2 bar higher than the differential pressure Δp. System influences are not taken into account.

Circuit diagram, sizes 18 to 100



Circuit diagram, size 140



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

Control data

Data for pressure control DR, see page 11.
Maximum flow deviation measured at drive speed n = 1500 rpm.

NG		18	28	45	71	100	140
$\Delta q_{v\,max}$	l/min	0.9	1.0	1.8	2.8	4.0	6.0

Control fluid consumption DFR maximum approx. 3 to 4.5 l/min
Control fluid consumption DFR1 ____ maximum approx. 3 l/min
Volume flow loss at q_{Vmax}, see page 9.

DFLR – Pressure, flow and power control

Execution of the pressure control like DR(G), see page 11 (12).
Execution of the flow control like DFR, DFR1, see page 13.

In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the output flow from the axial piston pump is varied so that the product of flow and pressure remains constant.

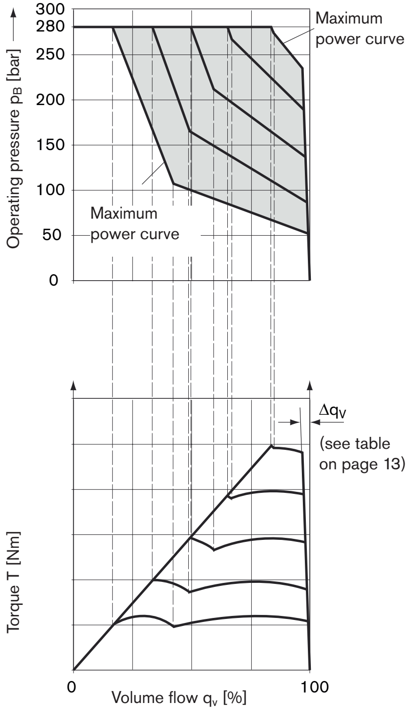
Flow control is possible below the power control curve.

The power characteristic is set in the factory; when ordering, please state in clear text, e.g. 20 kW at 1500 rpm.

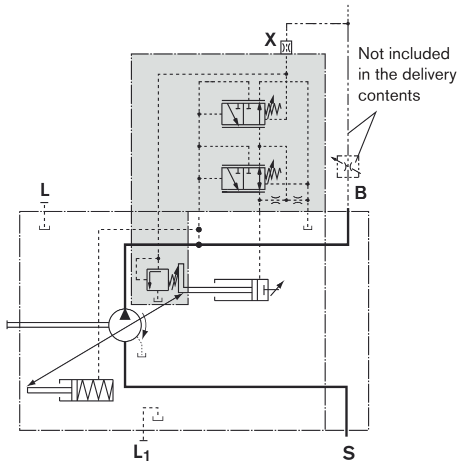
Control data

For pressure control DR data, see page 11.
For flow control FR data, see page 13.

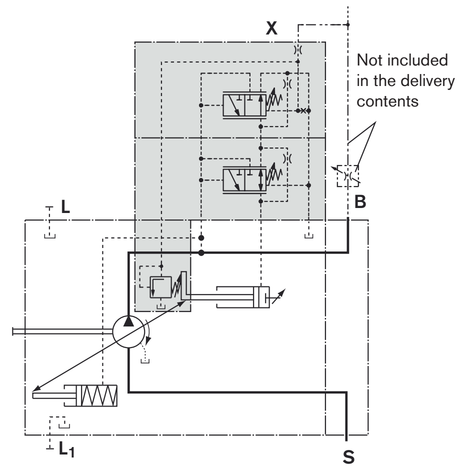
Static curves and torque characteristic



Circuit diagram, sizes 28 to 100



Circuit diagram, size 140



Control data

Beginning of control ______________________ 50 bar
Control fluid consumption______ maximum approx. 5.5 l/min

Flow loss at qv max, see page 9.

	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Pilot pressure

ED – Electro-hydraulic pressure control

The ED valve is set to a certain pressure by a specified, variable solenoid current.

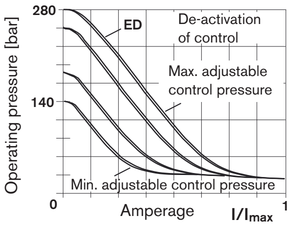
If there is a change at the consumer (load pressure), the position of the control piston changes.

This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

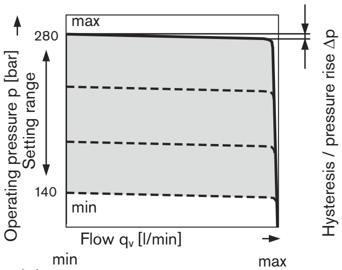
When the solenoid current signal drops towards a zero value, the maximum output pressure is limited to p_{max} by an adjustable hydraulic pressure cut-off (secure fail safe function in case of a loss of power e.g. for use as fan drives).
The response time characteristic of the ED-control was optimized for the use as a fan drive system.
When ordering, state the type of application in clear text.

Static current-pressure characteristic ED
(measured at pump in zero stroke – negative characteristic)



Hysteresis of the static current-pressure characteristic < 3 bar

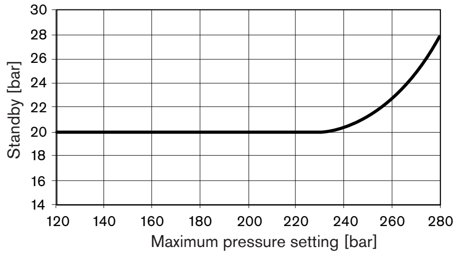
Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50 °C)



Control data
Stand-by standard setting 20 bar, other values on request.

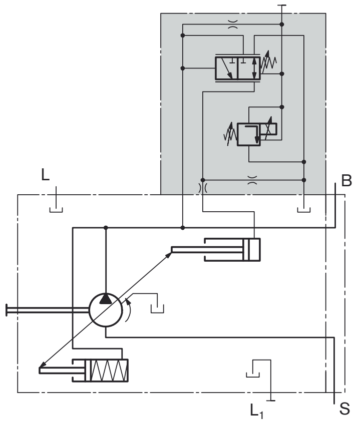
Hysteresis and pressure increase ______________ Δp < 4 bar
Control fluid consumption__________________ 3 to 4.5 l/min.

Influence of pressure setting on standby level



2

Circuit diagram ED..



	Port for
B	Service line
S	Suction line
L, L₁	Case drain (L₁ plugged)

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\ min}$	100 mA	50 mA
End of control at $q_{v\ max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For type of protection, see plug design on page 43 For details on the control electronics, see page 16		

Operating temperature range at valve -20 °C to +115 °C

ER – Electro-hydraulic pressure control

The ER valve is set to a specific pressure by a specified, variable solenoid current.

If there is a change at the consumer (load pressure), the position of the control piston changes.

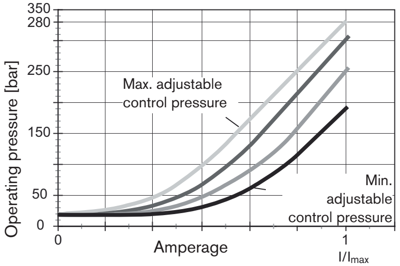
This causes an increase or decrease in the pump swivel angle (flow) in order to maintain the electrically set pressure level.

The pump thus only delivers as much hydraulic fluid as the consumers can take. The desired pressure level can be set steplessly by varying the solenoid current.

If the solenoid current drops to zero, the pressure is limited to p_{min} (stand-by).

Observe the project planning note on page 2.

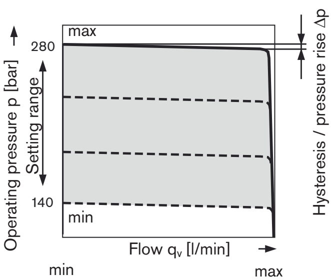
Static current-pressure characteristic ER
(measured at pump in zero stroke – positive characteristic)



Hysteresis of the static current-pressure characteristic < 3 bar

Influence of pressure setting on stand-by ±2 bar

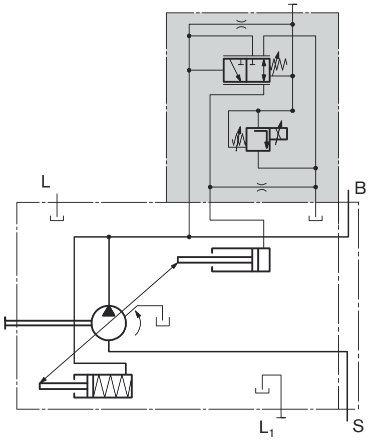
Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50 °C)



Control data
Standby standard setting 20 bar, other values on request.

Hysteresis and pressure increase ______________ Δp < 4 bar
Control fluid consumption__________________ 3 to 4.5 l/min.

Circuit diagram ER..



	Port for
B	Service line
S	Suction line
L, L₁	Case drain (L_1 plugged)

Technical data, solenoid	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\ min}$	100 mA	50 mA
End of control at $q_{v\ max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Actuated time	100 %	100 %
For type of protection, see plug design on page 43		

Operating temperature range at valve -20 °C to +115 °C

The following electric controllers and amplifiers are available for controlling the proportional solenoids:

Analog amplifier RA	RE 95230
Digital controller RC2-2/21[1]	RE 95201
Analog amplifier VT2000[2]	RE 29904
Analog amplifier VT 11029/11030[2]	RE 29741

1) Power outlets for 2 valves, can be actuated separately
2) Only 24V nominal voltage

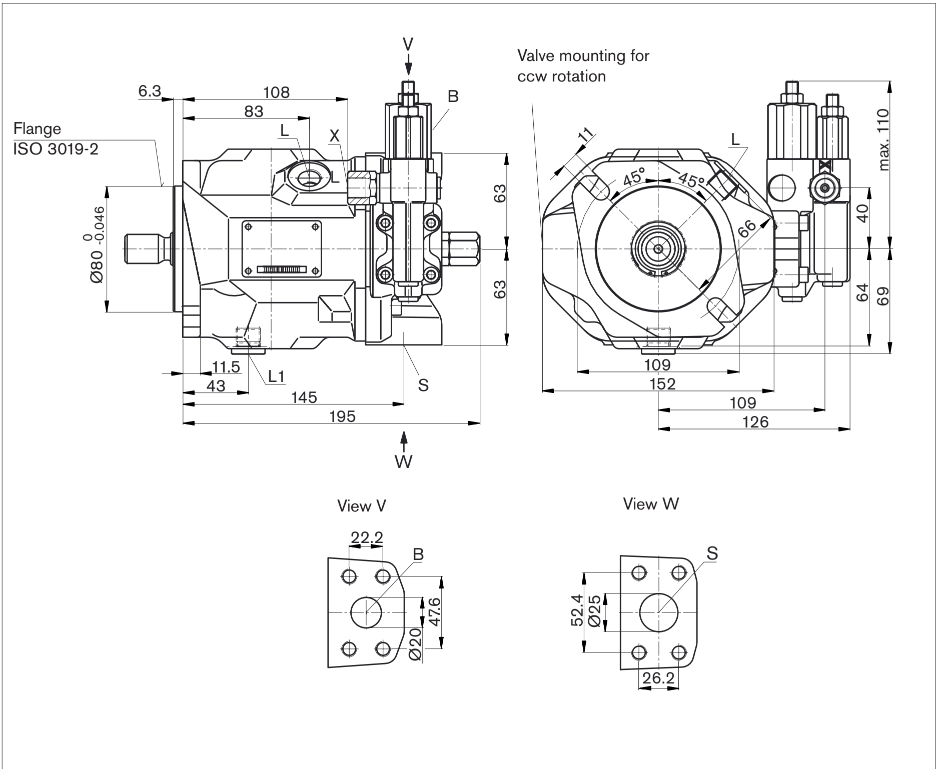
Notes

Dimensions size 18

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR, DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1)]	Maximum pressure [bar][2)]	State
B	Service line, fastening thread	SAE J518[3)] DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518[3)] DIN 13	1 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	DIN 3852[4)]	M16 x 1.5; 12 deep	2	O[5)]
L_1	Case drain fluid	DIN 3852[4)]	M16 x 1.5; 12 deep	2	X[5)]
X	Pilot pressure	DIN 3852[4)]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4)]	G 1/4 in	350	O

1) For the maximum tightening torques the general instructions on page 48 must be observed
2) Depending on the application, short-term pressure spikes can occur. Keep this in mind when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard
4) The spot face can be deeper than as specified in the standard
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 45)

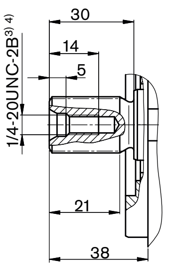
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 18

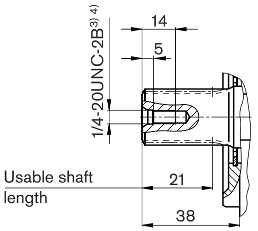
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

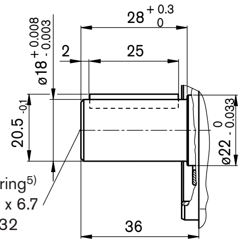
S Splined shaft 3/4 in
11T 16/32DP1) (SAE J744)



R Splined shaft 3/4 in
11T 16/32DP1)2) (SAE J744)



P Parallel shaft key
DIN 6885, A6x6x25



2

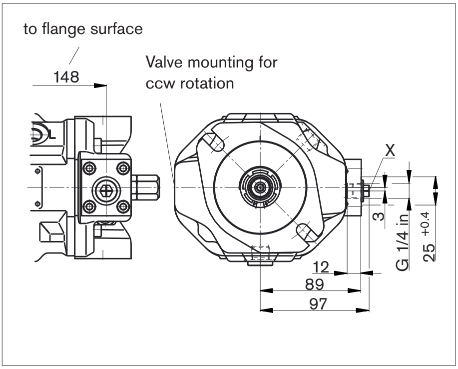
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Splines according to ANSI B92.1a, run out of spline is a deviation from standard
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general instructions on page 48 must be observed
5) Coupling axially secured, e.g. with a clamp coupling or radially mounted clamping screw

Dimensions size 18

Before finalizing your design request a certified installation drawing. Dimensions in mm.

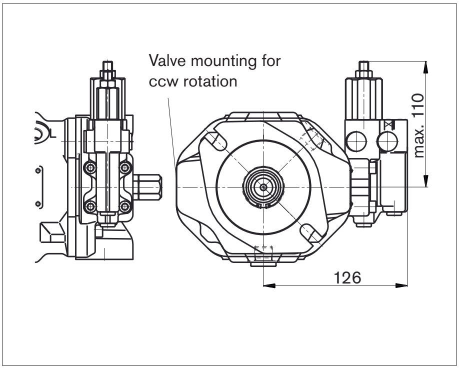
DG

Two-point control, directly operated



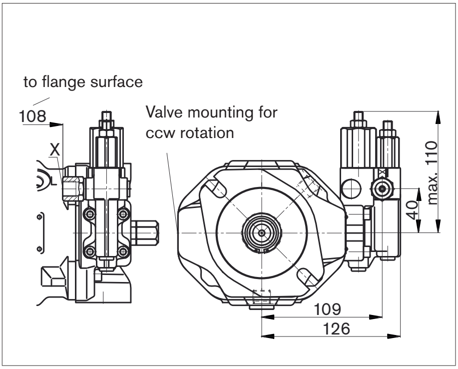
DR

Pressure control



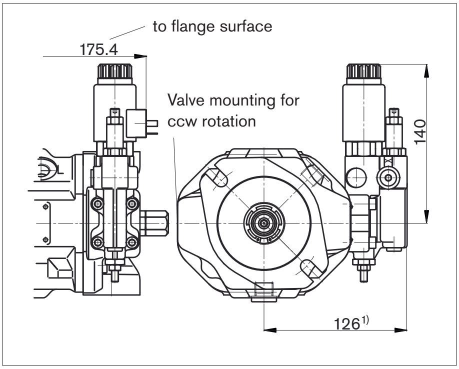
DRG

Pressure control, remotely operated



ED7., ER7.

Electro-hydraulic pressure control



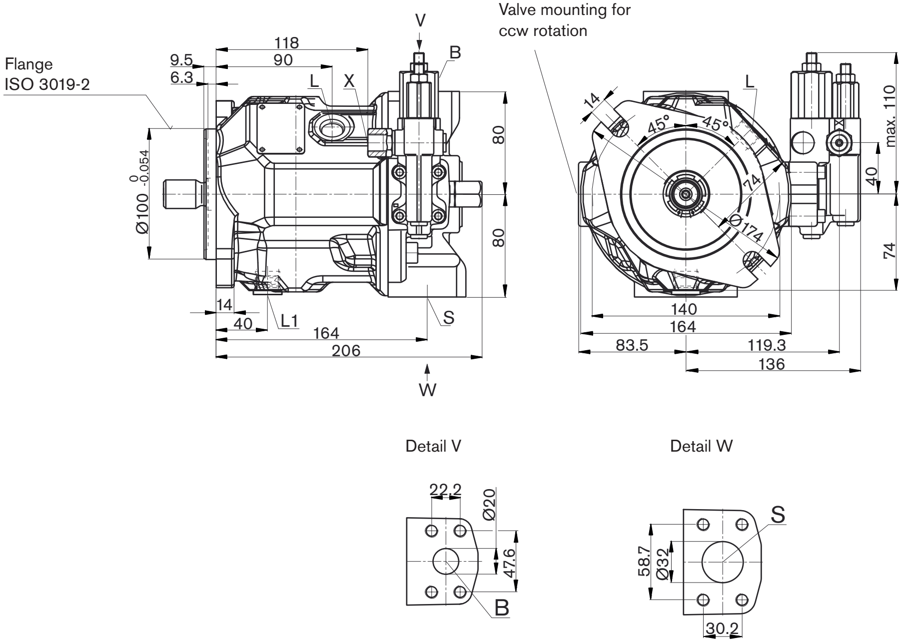
1) ER7.: 161 mm if using a sandwich plate pressure reducing valve.

Dimensions size 28

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



2

Ports

Designation	Port for	Standard	Size[1]	Maximum pressure [bar][2]	State
B	Service line, fastening thread	SAE J518[3] DIN 13	3/4 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518[3] DIN 13	1 1/4 in M10 x 1.5; 17 deep	10	O
L	Case drain fluid	DIN 3852[4]	M18 x 1.5; 12 deep	2	O[5]
L_1	Case drain fluid	DIN 3852[4]	M18 x 1.5; 12 deep	2	X[5]
X	Pilot pressure	DIN 3852[4]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4]	G 1/4in; 12 deep	350	O

1) For the maximum tightening torques the general instructions on page 48 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 45)

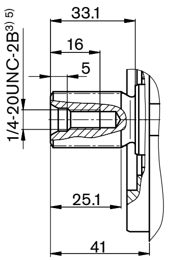
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 28

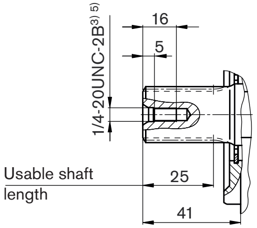
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

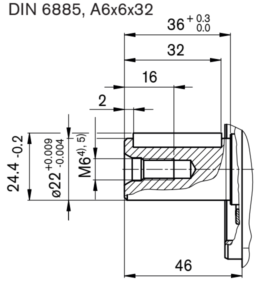
S Splined shaft 7/8 in
13T 16/32DP1) (SAE J744)



R Splined shaft 7/8 in
13T 16/32DP1)2) (SAE J744)



P Parallel shaft key
DIN 6885, A6x6x32



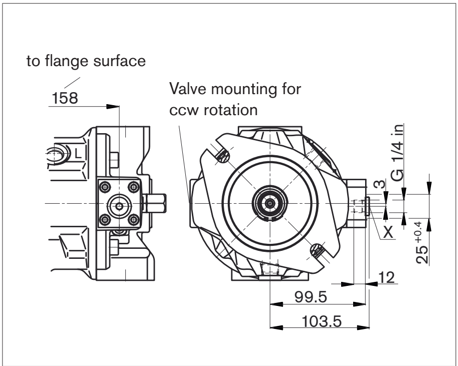
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Thread according to DIN 13
5) For the maximum tightening torques the general instructions on page 48 must be observed.

Dimensions size 28

Before finalizing your design request a certified installation drawing. Dimensions in mm.

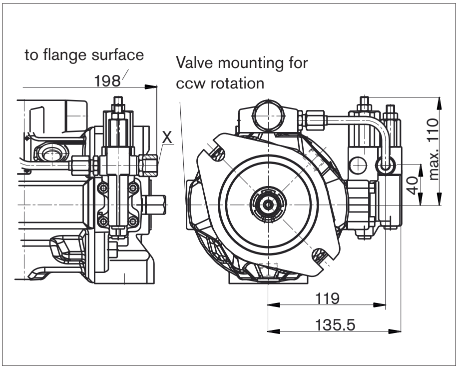
DG

Two-point control, directly operated



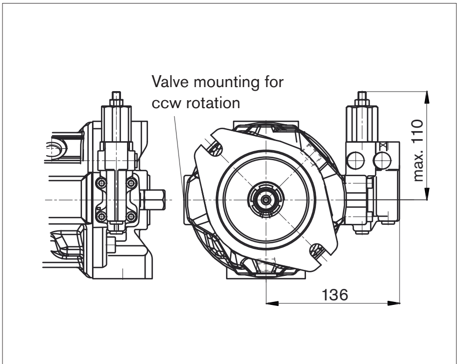
DFLR

Pressure, flow and power control



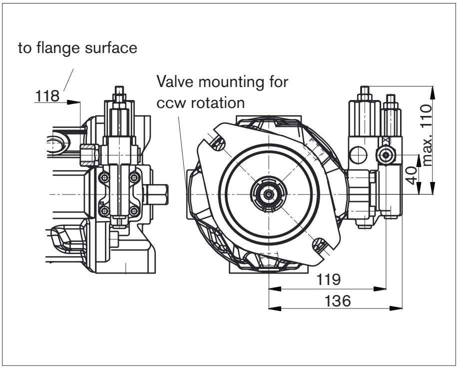
DR

Pressure control



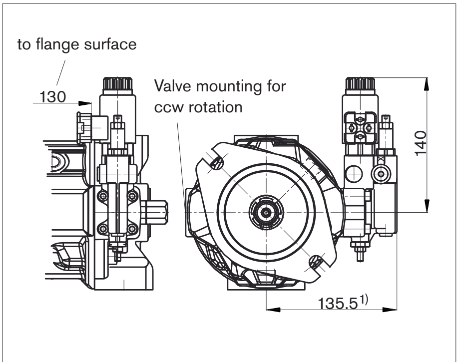
DRG

Pressure control, remotely operated



ED7. / ER7.

Electro-hydraulic pressure control



1) ER7.: 170.5 mm when using a sandwich plate pressure reducing valve.

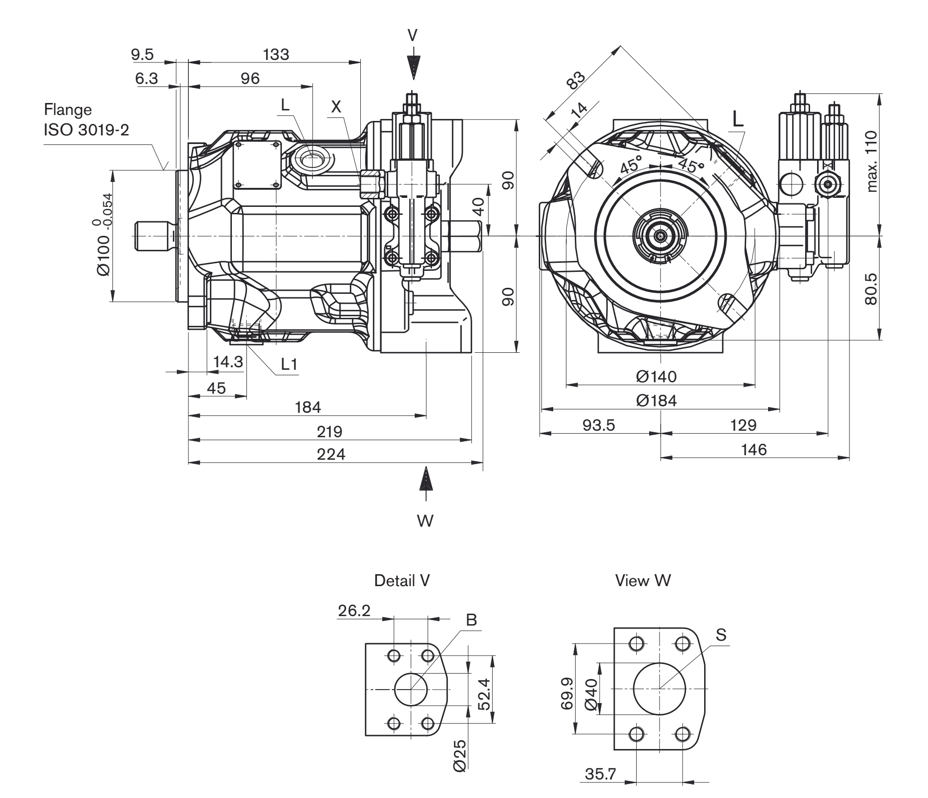
For details of connection options and drive shafts, see also pages 21 and 22

Dimensions size 45

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure [bar][2]	State
B	Service line, fastening thread	SAE J518[3] DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518[3] DIN 13	1 1/2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	DIN 3852[4]	M22 x 1.5; 14 deep	2	O[5]
L_1	Case drain fluid	DIN 3852[4]	M22 x 1.5; 14 deep	2	X[5]
X	Pilot pressure	DIN 3852[4]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4]	G 1/4 in	350	O

1) For the maximum tightening torques the general instructions on page 48 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 46)

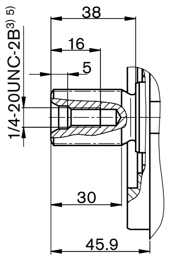
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 45

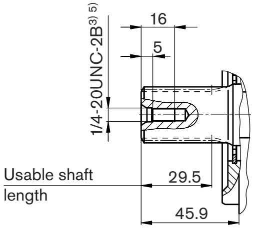
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

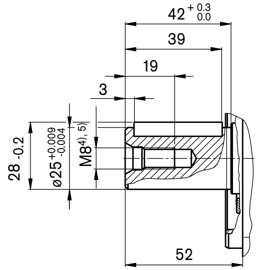
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



R Splined shaft 1 in
15T 16/32DP[1)2)] (SAE J744)



P Parallel shaft key
DIN 6885, A8x7x36

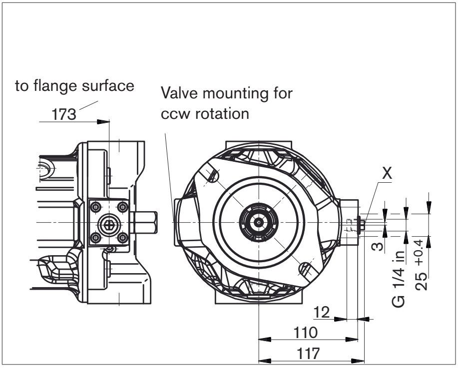


1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Thread according to DIN 13
5) For the maximum tightening torques the general instructions on page 48 must be observed.

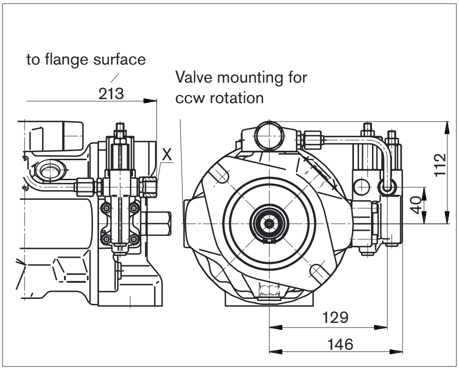
Dimensions size 45

Before finalizing your design request a certified installation drawing. Dimensions in mm.

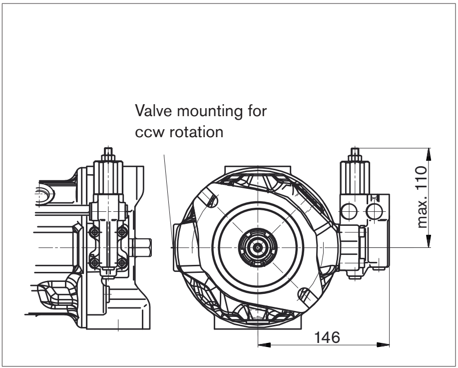
DG
Two-point control, directly operated



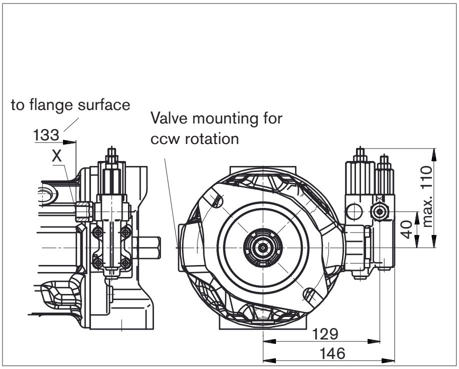
DFLR
Pressure, flow and power control



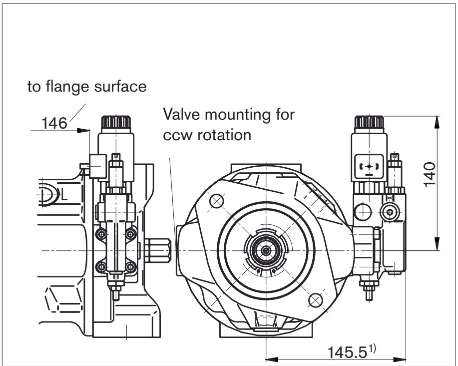
DR
Pressure control



DRG
Pressure control, remotely operated



ED7. / ER7.
Electro-hydraulic pressure control



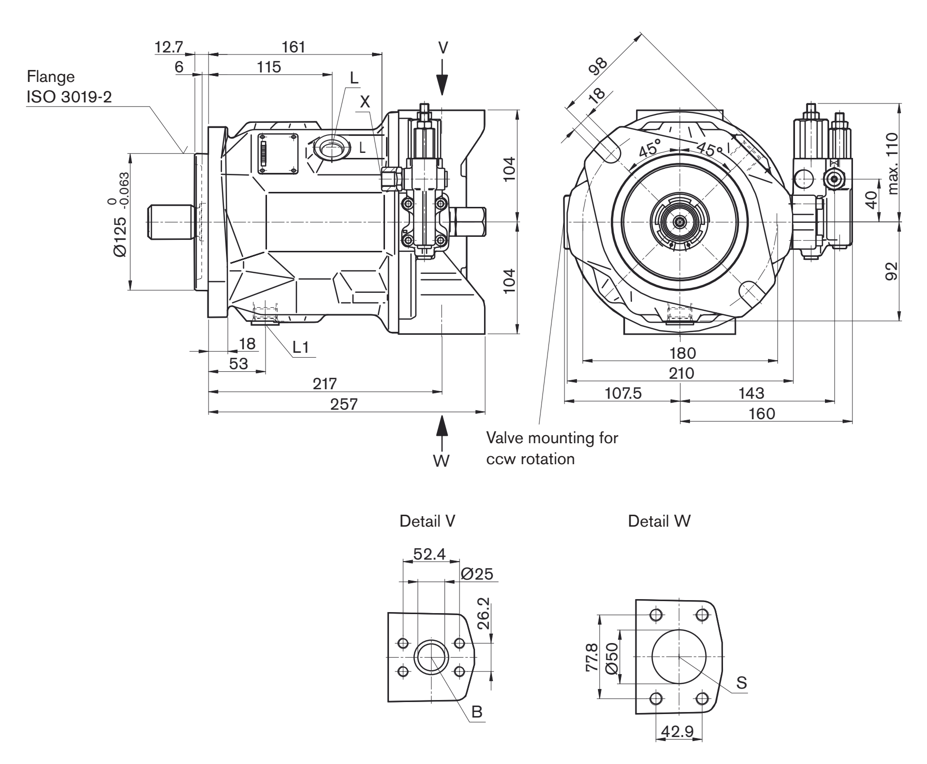
1) ER7.: 180.5 mm if using a sandwich plate pressure reducing valve.

Dimensions size 71

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure [bar][2]	State
B	Service line, fastening thread	SAE J518[3] DIN 13	1 in M10 x 1.5; 17 deep	350	O
S	Suction line, fastening thread	SAE J518[3] DIN 13	2 in M12 x 1.75; 20 deep	10	O
L	Case drain fluid	DIN 3852[4]	M22 x 1.5; 14 deep	2	O[5]
L_1	Case drain fluid	DIN 3852[4]	M22 x 1.5; 14 deep	2	X[5]
X	Pilot pressure	DIN 3852[4]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4]	G 1/4 in	350	O

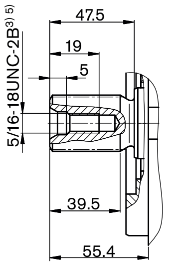
1) For the maximum tightening torques the general instructions on page 48 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 46)
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 71

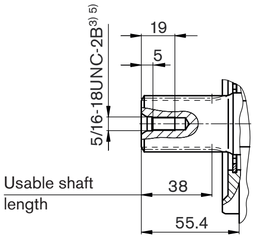
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

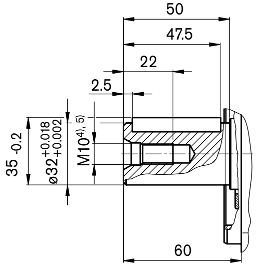
S Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



R Splined shaft 1 1/4 in
14T 12/24DP[1)2)] (SAE J744)



P Parallel shaft key
DIN 6885, A10x8x45



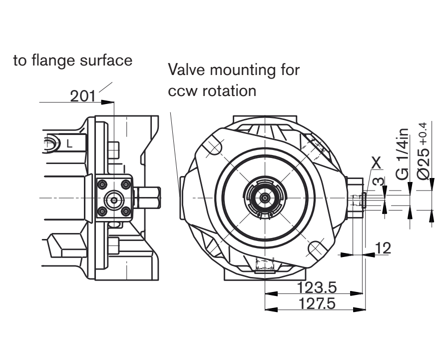
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Thread according to ASME B1.1
4) Thread according to DIN 13
5) For the maximum tightening torques the general instructions on page 48 must be observed.

Dimensions size 71

Before finalizing your design request a certified installation drawing. Dimensions in mm.

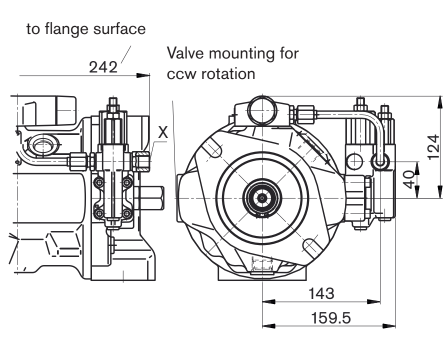
DG

Two-point control, directly operated



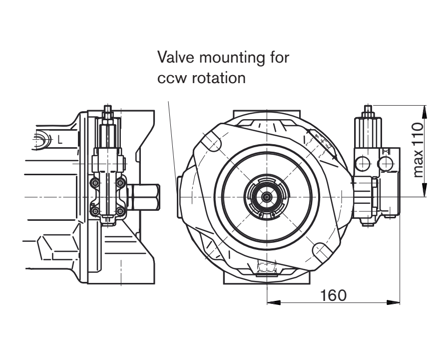
DFLR

Pressure, flow and power control



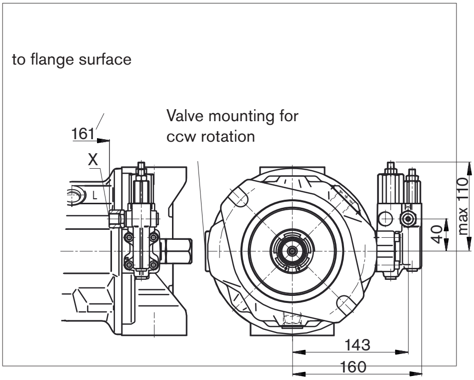
DR

Pressure control



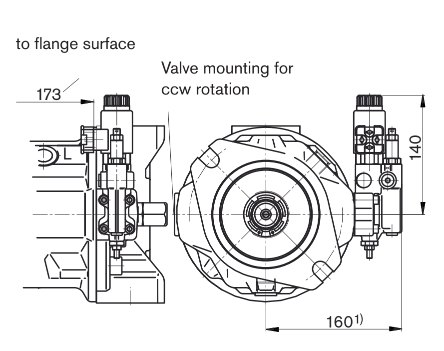
DRG

Pressure control, remotely operated



ED7. / ER7.

Electro-hydraulic pressure control



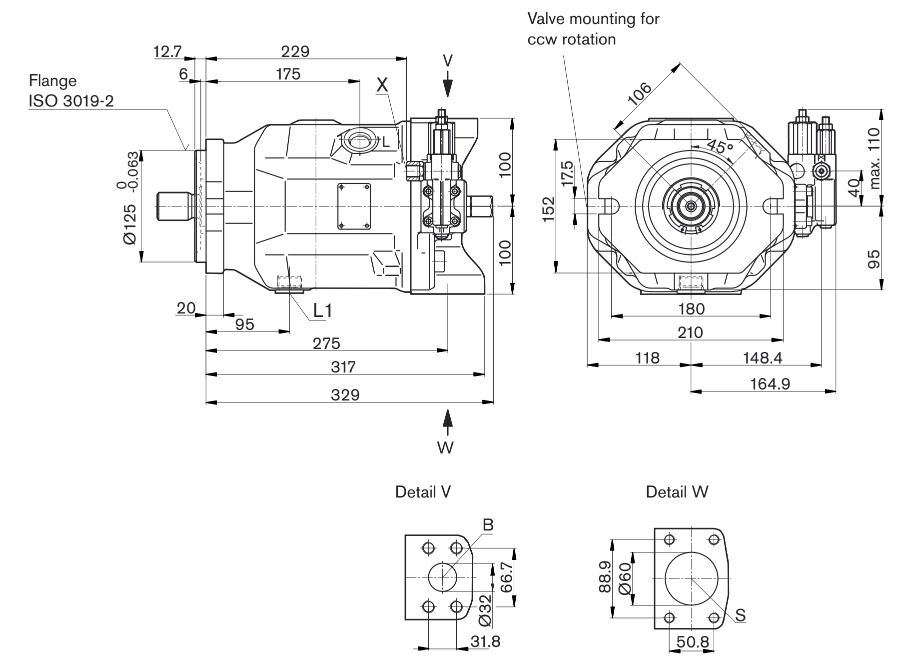
1) ER7.: 195 mm if using a sandwich plate pressure reducing valve.

Dimensions size 100

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1]	Maximum pressure [bar][2]	State
B	Service line, fastening thread	SAE J518[3] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction line, fastening thread	SAE J518[3] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	DIN 3852[4]	M27 x 2; 16 deep	2	O[5]
L_1	Case drain fluid	DIN 3852[4]	M27 x 2; 16 deep	2	X[5]
X	Pilot pressure	DIN 3852[4]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN ISO 228[4]	G 1/4 in	350	O

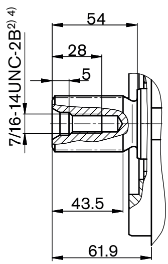
1) For the maximum tightening torques the general instructions on page 48 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 46)
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 100

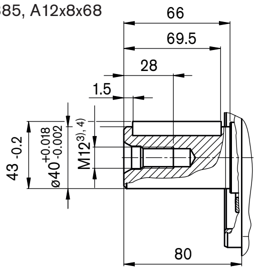
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 1/2 in
17T 12/24DP1) (SAE J744)



P Parallel shaft key
DIN 6885, A12x8x68

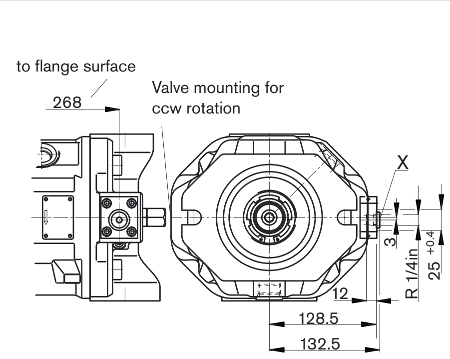


1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Thread according to DIN 13
4) For the maximum tightening torques the general instructions on page 48 must be observed.

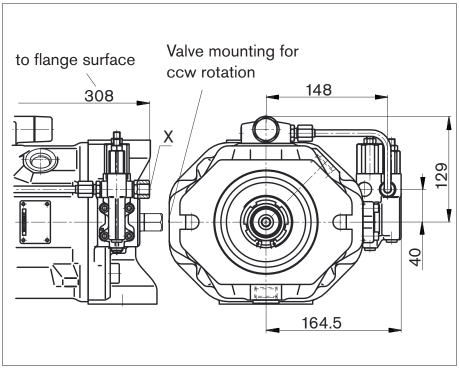
Dimensions size 100

Before finalizing your design request a certified installation drawing. Dimensions in mm.

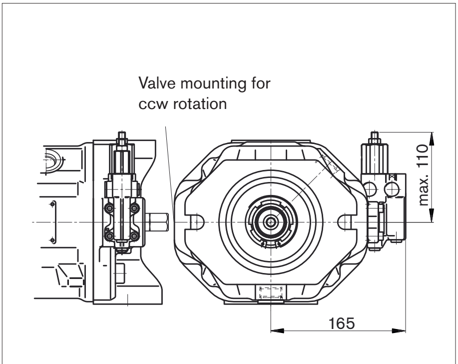
DG
Two-point control, directly operated



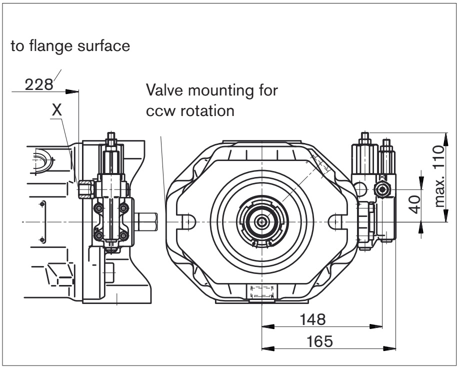
DFLR
Pressure, flow and power control



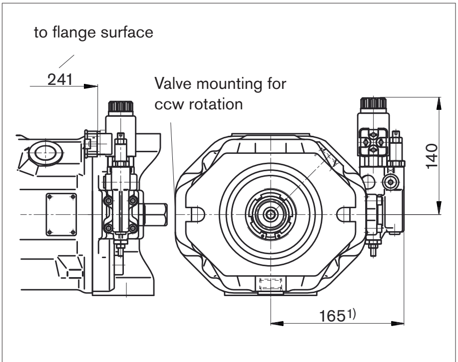
DR
Pressure control



DRG
Pressure control, remotely operated



ED7. / ER7.
Electro-hydraulic pressure control



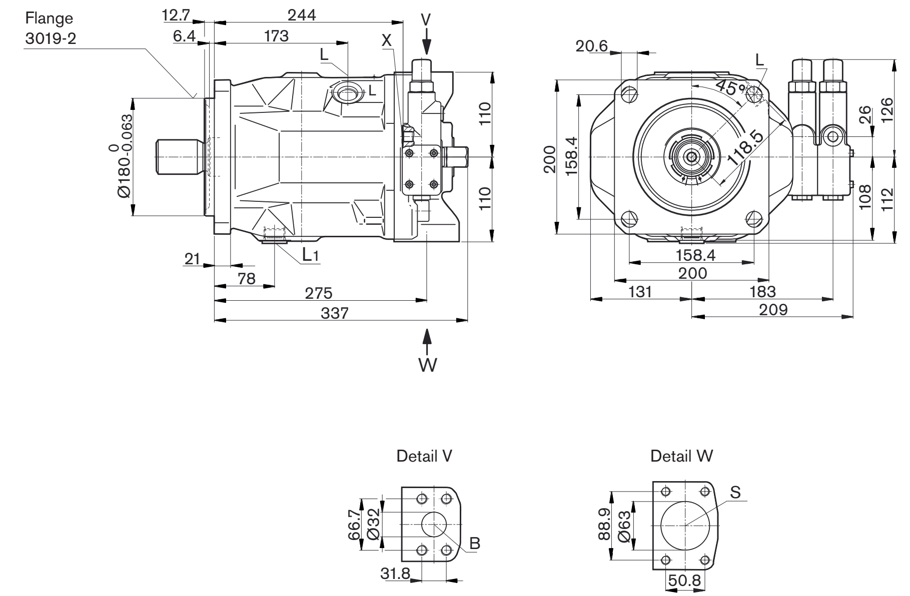
1) ER7.: 200 mm when using a sandwich plate pressure reducing valve.

Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

DFR/DFR1 – Pressure and flow control, hydraulic

Clockwise rotation



Ports

Designation	Port for	Standard	Size[1)]	Maximum pressure [bar][2)]	State
B	Service line, fastening thread	SAE J518[3)] DIN 13	1 1/4 in M14 x 2; 19 deep	350	O
S	Suction line, fastening thread	SAE J518[3)] DIN 13	2 1/2 in M12 x 1.75; 17 deep	10	O
L	Case drain fluid	DIN 3852[4)]	M27 x 2; 16 deep	2	O[5)]
L_1	Case drain fluid	DIN 3852[4)]	M27 x 2; 16 deep	2	X[5)]
X	Pilot pressure	DIN 3852[4)]	M14 x 1.5; 12 deep	350	O
X	Pilot pressure with DG-control	DIN 3852[4)]	M14 x 1.5; 12 deep	350	O
M_H	Gauge port, high pressure	DIN 3852	M14 x 1.5, 12 deep	350	X

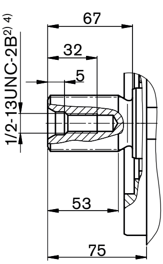
1) For the maximum tightening torques the general instructions on page 48 must be observed.
2) Depending on the application, short-term pressure spikes can occur. Consider this when selecting measuring equipment and fittings. Pressure values in bar absolute.
3) Only dimensions according to SAE J518, metric fastening thread deviating from the standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, L or L_1 must be connected (see also installation instructions on pages 44, 46)
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 140

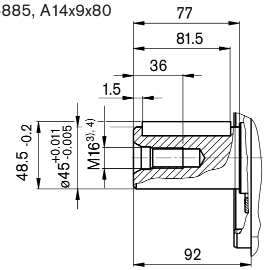
Before finalizing your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



P Parallel shaft key
DIN 6885, A14x9x80

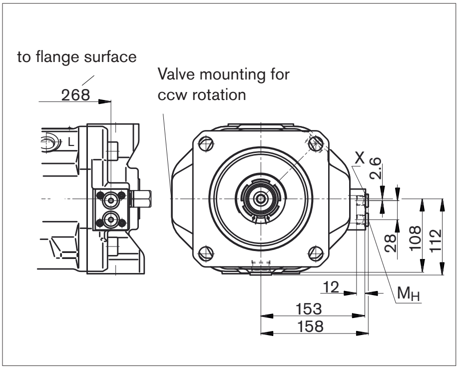


1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Thread according to DIN 13
4) For the maximum tightening torques the general instructions on page 48 must be observed.

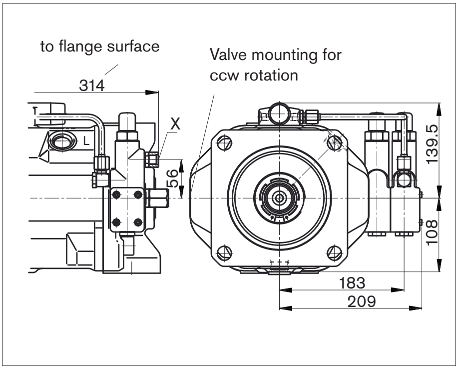
Dimensions size 140

Before finalizing your design request a certified installation drawing. Dimensions in mm.

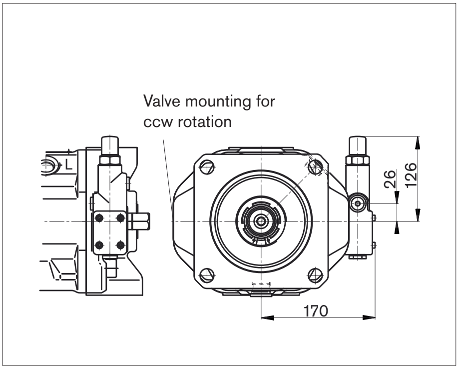
DG
Two-point control, directly operated



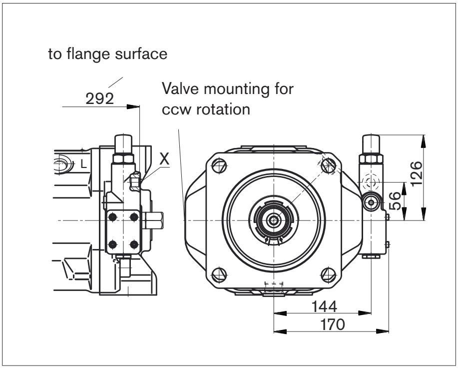
DFLR
Pressure, flow and power control



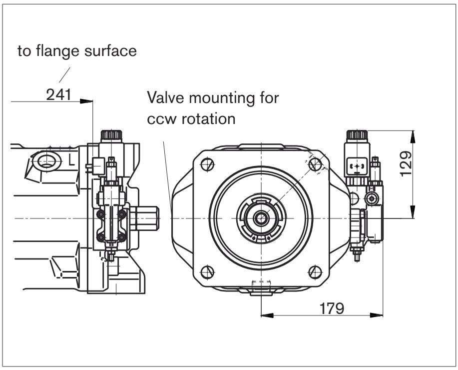
DR
Pressure control



DRG
Pressure control, remotely operated



ED7. / ER7.
Electro-hydraulic pressure control

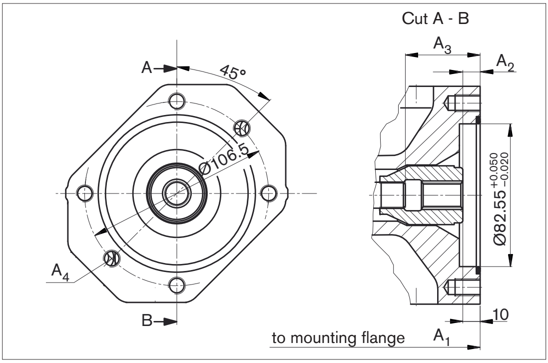


1) ER7.: 214 mm when using a sandwich plate pressure reducing valve.

Dimensions through drive

Before finalizing your design request a certified installation drawing. Dimensions in mm.

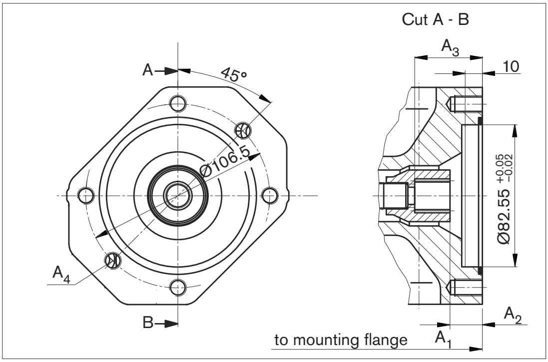
K01 flange ISO 3019-2 (SAE J744 - 82-2 (A))
Coupling for splined shaft according to ANSI B92.1a-1996



5/8 in 9T 16/32 DP[1] (SAE J744 - 16-4 (A))

NG	A_1	A_2	A_3	A_4[2]
18	182	10	43.3	M10 x 1.5, 14.5 deep
28	204	10	33.7	M10 x 1.5, 16 deep
45	229	10.7	53.4	M10 x 1.5, 16 deep
71	267	11.8	61.3	M10 x 1.5, 20 deep
100	338	10.5	65	M10 x 1.5, 16 deep
140	350	10.8	77.3	M10 x 1.5, 16 deep

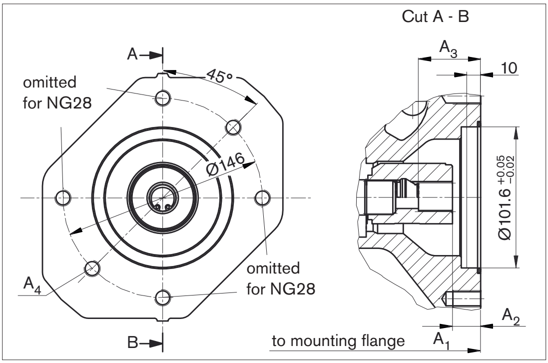
K52 flange ISO 3019-2 (SAE J744 - 82-2 (A))
Coupling for splined shaft according to ANSI B92.1a-1996



3/4 in 11T 16/32 DP[1] (SAE J744 - 19-4 (A-B))

NG	A_1	A_2	A_3	A_4[2]
18	182	18.8	38.7	M10 x 1.5, 14.5 deep
28	204	18.8	38.7	M10 x 1.5, 16 deep
45	229	18.9	38.7	M10 x 1.5, 16 deep
71	267	21.3	41.4	M10 x 1.5, 20 deep
100	338	19	38.9	M10 x 1.5, 16 deep
140	350	18.9	38.6	M10 x 1.5, 16 deep

K68 flange ISO 3019-2 (SAE J744 - 101-2 (B))
Coupling for splined shaft according to ANSI B92.1a-1996



7/8 in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))

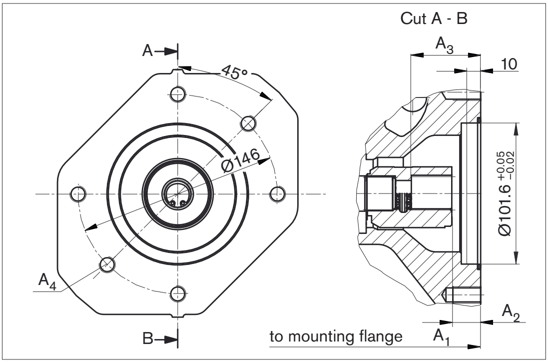
NG	A_1	A_2	A_3	A_4[2]
28	204	17.8	41.7	M12 x 1.75, continuous
45	229	17.9	41.7	M12 x 1.75, 18 deep
71	267	20.3	44.1	M12 x 1.75, 20 deep
100	338	18	41.9	M12 x 1.75, 20 deep
140	350	17.8	41.6	M12 x 1.75, 20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 48 for the maximum tightening torques.

Dimensions through drive

Before finalizing your design request a certified installation drawing. Dimensions in mm.

K04 flange ISO 3019-2 (SAE J744 - 101-2 (B))
Coupling for splined shaft according to ANSI B92.1a-1996

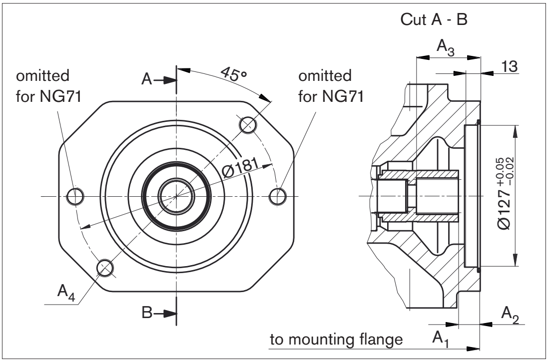


1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))

NG	A_1	A_2	A_3	A_4[2]
45	229	18.4	46.7	M12 x 1.75, 18 deep
71	267	20.8	49.1	M12 x 1.75, 20 deep
100	338	18.2	46.6	M12 x 1.75, 20 deep
140	350	18.3	45.9	M12 x 1.75, 20 deep

2

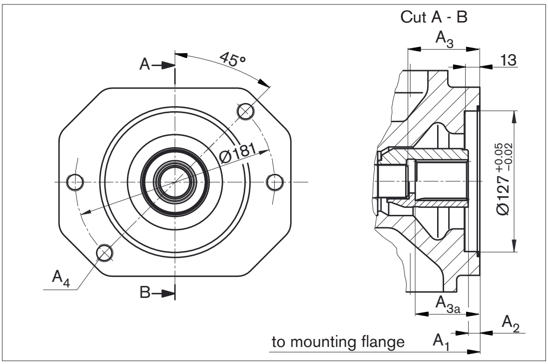
K07 flange ISO 3019-2 (SAE J744 - 127-2 (C))
Coupling for splined shaft according to ANSI B92.1a-1996



1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A_1	A_2	A_3	A_4[2]
71	267	21.8	58.6	M16 x 2, continuous
100	338	19.5	56.4	M16 x 2, continuous
140	350	19.3	56.1	M16 x 2, 24 deep

K24 flange ISO 3019-2 (SAE J744 - 127-2 (C))
Coupling for splined shaft according to ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))

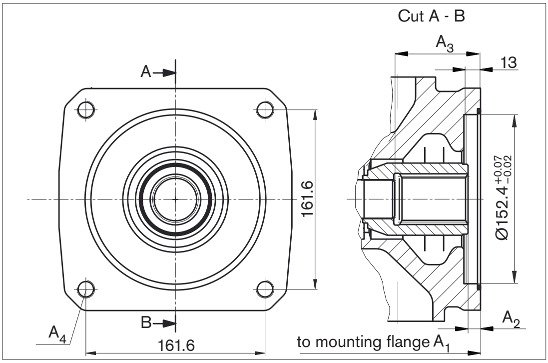
NG	A_1	A_2	A_3[3]	A_{3a}[4]	A_4[2]
100	338	10.5	65	–	M16 x 2, continuous
140	350	10.8	75	–	M16 x 2, 24 deep
	350	10.3	–	69.1	M16 x 2, 24 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 48 for the maximum tightening torques.
3) Coupling **without** stop
4) Coupling **with** stop

Dimensions through drive

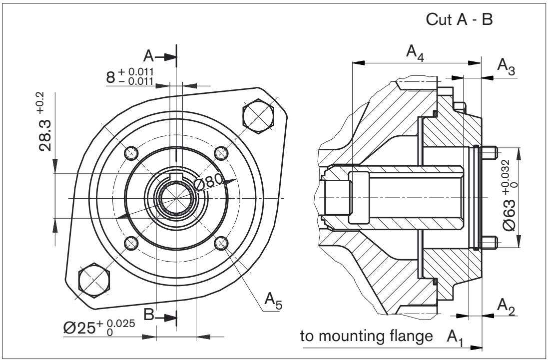
Before finalizing your design request a certified installation drawing. Dimensions in mm.

K17 flange ISO 3019-2 (SAE J744 - 152-4 (A))
Coupling for splined shaft according to ANSI B92.1a-1996 1 3/4 in 13T 8/16 DP[1] (SAE J744 - 44-4 (D))



NG	A_1	A_2	A_3	A_4[2]
140	350	11	77.3	M6 x 2, continuous

K57 Metric 4-hole flange for mounting an R4 radial piston pump (see RE 11263)
Coupling for metric shaft key



NG	A_1	A_2	A_3	A_4	A_5[3]
28	232	8	10.6	58.4	M8
45	257	8	11	81	M8
71	283	8	12.5	77	M10
100	354	8	10.5	81	M10
140	366	8	11	93	M8

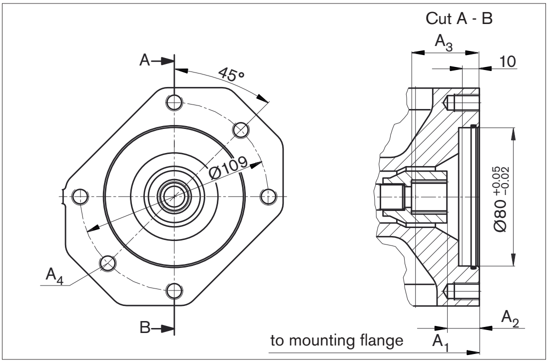
1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 48 for the maximum tightening torques.
3) Screws for mounting the radial piston motor are included in the delivery contents.

Dimensions through drive

Before finalizing your design request a certified installation drawing. Dimensions in mm.

KB2 flange ISO 3019-2 - 80A2SW

Coupling for splined shaft according to ANSI B92.1a-1996



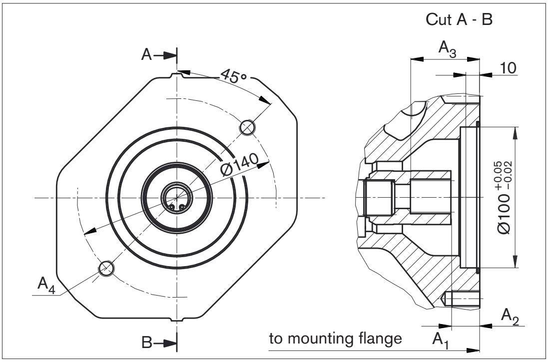
3/4 in 11T 16/32 DP[1] (SAE J744 - 19-4 (A-B))

NG	A_1	A_2	A_3	A_4[2]
18	182	18.8	38.7	M10 x 1.5, 14.5 deep
28	204	18.8	38.7	M10 x 1.5, 16 deep
45	229	18.9	38.7	M10 x 1.5, 16 deep
71	267	21.3	41.4	M10 x 1.5, 20 deep
100	338	19	38.9	M10 x 1.5, 20 deep
140	350	18.9	38.6	M10 x 1.5, 20 deep

2

KB3 flange ISO 3019-2 - 100A2SW

Coupling for splined shaft according to ANSI B92.1a-1996

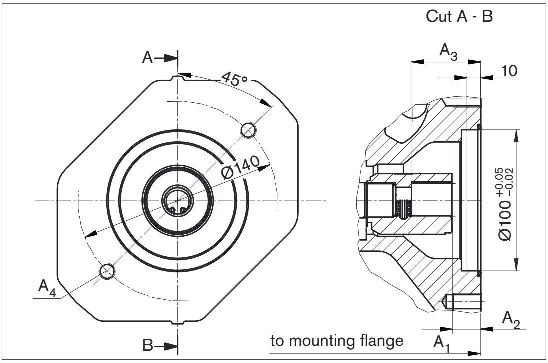


7/8 in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))

NG	A_1	A_2	A_3	A_4[2]
28	204	17.8	41.7	M12 x 1.5, continuous
45	229	17.9	41.7	M12 x 1.5, continuous
71	267	20.3	44.1	M12 x 1.5, 20 deep
100	338	18	41.9	M12 x 1.5, 20 deep
140	350	17.8	41.6	M12 x 1.5, 20 deep

KB4 flange ISO 3019-2 - 100A2SW

Coupling for splined shaft according to ANSI B92.1a-1996



1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))

NG	A_1	A_2	A_3	A_4[2]
45	229	18.4	46.7	M12 x 1.75, continuous
71	267	20.8	49.1	M12 x 1.75, 20 deep
100	338	18.2	46.6	M12 x 1.75, 20 deep
140	350	18.3	45.9	M12 x 1.75, 20 deep

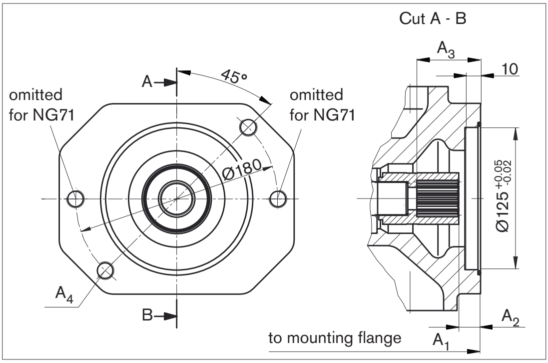
1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 48 for the maximum tightening torques.

Dimensions through drive

Before finalizing your design request a certified installation drawing. Dimensions in mm.

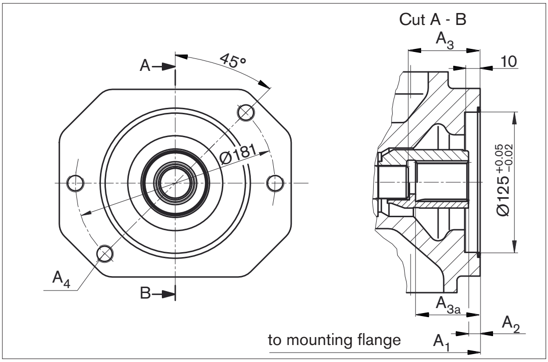
KB5 flange ISO 3019-2 - 125A2SW
Coupling for splined shaft according to ANSI B92.1a-1996



1 1/4 in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))

NG	A_1	A_2	A_3	A_4[2]
71	267	21.8	58.6	M16 x 2, continuous
100	338	19.5	56.4	M16 x 2, continuous
140	350	19.3	56.1	M16 x 2, 24 deep

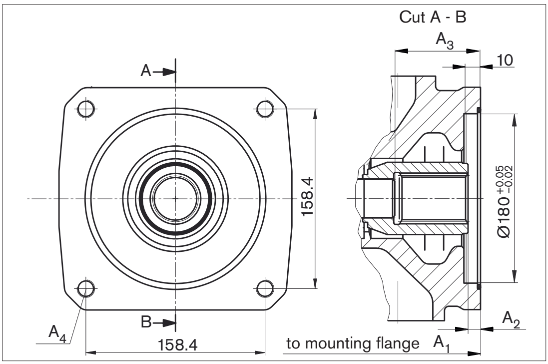
KB6 flange ISO 3019-2 - 125A2SW
Coupling for splined shaft according to ANSI B92.1a-1996



1 1/2 in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))

NG	A_1	A_2	A_3[3]	A_{3a}[4]	A_4[2]
100	338	10.5	65	–	M16 x 2, continuous
140	350	10.8	75	–	M16 x 2, 24 deep
	350	10.3	–	69.1	M16 x 2, 24 deep

KB7 flange ISO 3019-2 - 180B4HW
Coupling for splined shaft according to ANSI B92.1a-1996



1 3/4 in 13T 8/16 DP[1] (SAE J744 - 44-4 (D))

NG	A_1	A_2	A_3	A_4[2]
140	350	11.3	77.3	M16 x 2, continuous

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to DIN 13, observe the general instructions on page 48 for the maximum tightening torques.
3) Coupling **without** stop
4) Coupling **with** stop

Summary mounting options

SAE – mounting flange

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-1	Coupling for splined shaft	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Gear pump design (NG)	Through drive available for NG
82-2 (A)	5/8 in	**K01**	18 (U)	10 (U)	F (5 to 22)	18 to 140
	3/4 in	**K52**	18 (S, R)	10 (S) 18 (U) 18 (S, R)	–	18 to 140
101-2 (B)	7/8 in	**K68**	28 (S, R) 45 (U, W)[1]	28 (S, R) 45 (U, W)[1]	N/G (26 to 49)	28 to 140
	1 in	**K04**	45 (S, R) –	45 (S, R) 60, 63 (U, W) [2]	–	45 to 140
127-2 (C)	1 1/4 in	**K07**	71 (S, R) 100 (U)[3]	85 (U, W)[3] 100 (U, W)	–	71 to 140
	1 1/2 in	**K24**	100 (S)	85 (S) 100 (S)	–	100 to 140
152-4 (4-hole D)	1 3/4 in	**K17**	140 (S)	–	–	140

1) Not for main pump NG28 with K68
2) Not for main pump NG45 with K04
3) Not for main pump NG71 with K07

ISO – mounting flange

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-2	Coupling for splined shaft	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Gear pump design (NG)	Through drive available for NG
80-2	3/4 in	**KB2**	18 (S, R)	10 (S)	–	18 to 140
100-2	7/8 in	**KB3**	28 (S, R)	–	–	28 to 140
	1 in	**KB4**	45 (S, R)	–	–	45 to 140
125-2	1 1/4 in	**KB5**	71 (S, R)	–	–	71 to 140
	1 1/2 in	**KB6**	100 (S)	–	–	100 to 140
180-4 (4-hole B)	1 3/4 in	**KB7**	140 (S)	–	–	140

Shaft key

Through-drive[1]			Mounting option – 2nd pump			
Flange ISO 3019-2	Coupling for shaft key	Short des.	A10VO/31 NG (shaft)	A10V(S)O/5x NG (shaft)	Radial piston pump	Through drive available for NG
80-2	3/4 in	**K57**	–	–	R4	28 to 140

Combination pumps A10VO + A10VO

Before finalizing your design request a certified installation drawing. Dimensions in mm.

When using combination pumps it is possible to have multiple, mutually independent circuits without the need for a splitter gearbox.

When ordering combination pumps the model codes for the first and the second pump must be joined by a "**+**".

Order example:
A10VSO100DFR1/31R-VSB12K04+
A10VSO45DFR/31R-VSA12N00

If no further pumps are to be factory-mounted, the simple type code is sufficient.Included in the delivery contents of the pump with through drive are then: coupling and seal, with plastic cover to prevent penetration by dust and dirt.

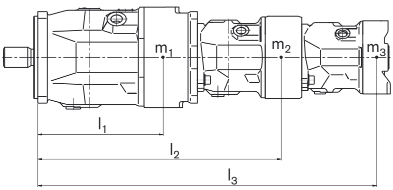
It is permissible to use a combination of two single pumps of the same size (tandem pump), considering a dynamic mass acceleration force of maximum 10 *g* (= 98.1 m/s^2) without an additional support bracket.

Each through drive is plugged with a **non-pressure-resistant** cover. Before commissioning the units, they must therefore be equipped with a pressure-resistant cover.
Through drives can also be ordered with pressure-resistant covers. Please specify in clear text.

For combination pumps comprising more than two pumps, the mounting flange must be calculated for the permissible moment of inertia.

Permissible mass moment of inertia

NG			18	28	45	71	100	140
Permissible mass moment of inertia								
static	T_m	Nm	500	880	1370	2160	3000	4500
dynamic at 10 *g* (98.1 m/s^2)	T_m	Nm	50	88	137	216	300	450
Mass with through-drive plate	m	kg	14	19	25	39	54	68
Mass without through drive (e.g. 2nd pump)	m	kg	12	15	21	33	45	60
Distance center of gravity	l	mm	90	110	130	150	160	160



m_1, m_2, m_3	Mass of pumps	[kg]
l_1, l_2, l_3	Distance center of gravity	[mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ [Nm]}$$

Connector for solenoids

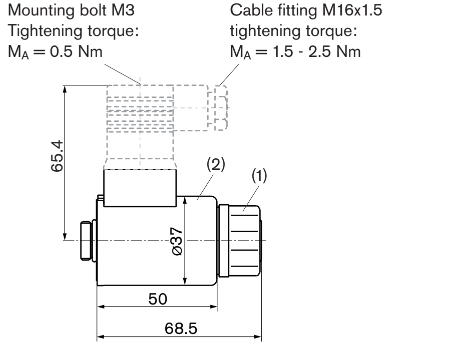
HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

without bidirectional suppressor diode ________________ **H**

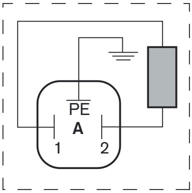
Type of protection according to DIN/EN 60529 _______ IP65

The sealing ring in the screw cable fitting is suitable for line diameters of 4.5 mm to 10 mm.

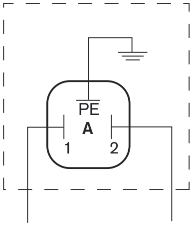
The line connector is not included in the delivery contents.
This can be supplied by Bosch Rexroth on request.
Bosch Rexroth material number: R902602623



Device plug on solenoid according to DIN 43650



line connector
DIN EN 175301-803-A
Wiring screw connector
M 16x1.5



Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one revolution counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut of the solenoid. Tightening torque: 5+1 Nm. (size WAF26, 12-pt DIN 3124)

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

2

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit empty via the hydraulic lines.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the motor housing must be directed to the reservoir via the highest case drain port (L_1, L_2, L_3).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the case drain ports of the units, the shared case drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate case drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\ max} = 800$ mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

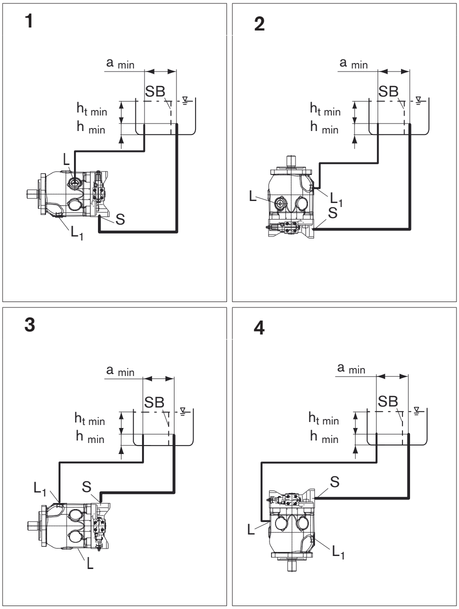
Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

Below-reservoir installation (standard)

Below-reservoir installation means the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1	L	S + L_1
2	L_1	S + L
3	L_1	S + L
4	L	S + L_1

Key, see page 45.

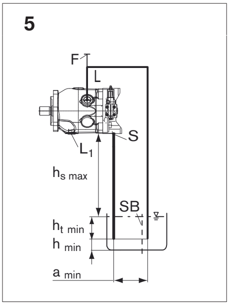
Installation instructions

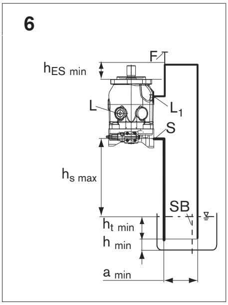
Above-reservoir installation

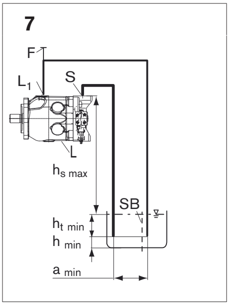
Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir.
To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm at port L_1 is required in installation position 6.

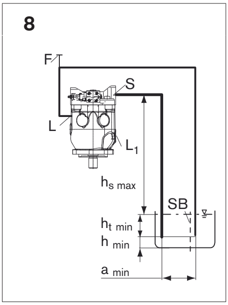
Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

A check valve in the case drain line is only permissible in individual cases. Consult us for approval.









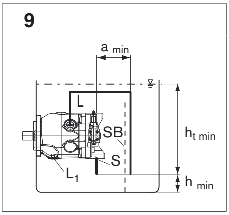
Installation position	Air bleed	Filling
5	F	L (F)
6	F	L_1 (F)
7	F	S + L_1 (F)
8	F	S + L (F)

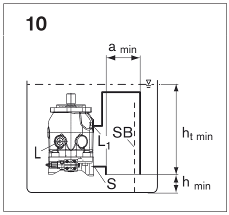
Inside-reservoir installation

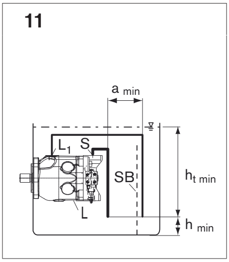
Inside-reservoir installation is when the axial piston unit is nstalled in the reservoir below the minimum fluid level.
The axial piston unit is completely below the hydraulic fluid.

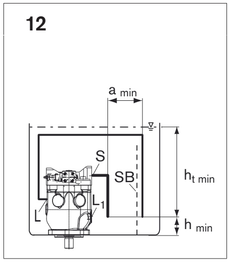
If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

Axial piston units with electrical components (e.g. electric control, sensors) may not be installed in a reservoir below the fluid level.









Installation position	Air bleed	Filling
9	L	L, L_1
10	L_1	L, L_1
11	L_1	S + L, L_1
12	L	S + L, L_1

S Suction port
F Filling / air bleeding
L, L_1 Case drain port
SB Baffle (baffle plate)
$h_{t\ min}$ Minimum necessary immersion depth (200 mm)
h_{min} Minimum necessary spacing to reservoir bottom (100 mm)
$h_{ES\ min}$ Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
$h_{S\ max}$ Maximum permissible suction height (800 mm)
a_{min} When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Notes

Notes

General instructions

– The A10VSO pump is designed to be used in open circuit.

– Project planning, installation and commissioning of the axial piston unit require the involvement of qualified personnel.

– Before operating the axial piston unit, please read the appropriate instruction manual thoroughly and completely. If necessary, request these from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Service line ports:

  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

  - The service line ports and function ports are only designed to accommodate hydraulic lines.

– Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.

  - Mounting bolts: For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.

  - Female threads in axial piston unit:
    The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metal threaded plugs supplied with the axial piston unit, the required tightening torques of the threaded plugs M_V apply. For values, see the following table.

Ports		**Maximum permissible tightening torque for female threads $M_{G\ max}$**	**Required tightening torque for threaded plugs M_V**	**Size of hexagon socket of threaded plugs**
Standard	**Thread size**			
DIN 3852	M14 x 1.5	80 Nm	45 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M27 x 2	330 Nm	135 Nm	12 mm
DIN ISO 228	G 1/4 in	70 Nm	–	–

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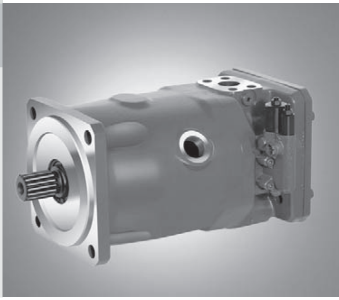
Rexroth
Bosch Group

Axial Piston Variable Pump A10VSO

RE 92714/06.11
Replaces: 07.10
and RE 92707

Data sheet



Series 32
Size 45 to 180
Nominal pressure 280 bar
Maximum pressure 350 bar
Open circuit

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Features

- Variable axial piston pump in swash plate design for hydrostatic drives in open circuit systems
- The flow is proportional to the drive speed and the displacement
- The flow can be steplessly varied by adjustment of the swash plate angle.
- Hydrostatic unloading of the cradle bearings
- Port for pressure transducer in pump outlet
- Low noise level
- Low pressure pulsation
- High efficiency
- Highly resistant against cavitation,
  sudden drop in suction pressure and housing pressure spikes
- Universal through drive

Type code for standard program

A10VS	O			/	32		–	V		B				
01	02	03	04		05	06		07	08	09	10	11	12	13

Axial piston unit

01	Swash plate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10VS**

Type of operation

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement, (see table of values page 6)	**045**	**071**	**100**	**140**	**180**

Control device

					045	071	100	140	180	
04	Two point control, directly controlled				●	●	●	●	●	**DG**
	Pressure control				●	●	●	●	●	**DR**
		with flow control, hydraulic		X-T open	●	●	●	●	●	**DRF**
				X-T closed	●	●	●	●	●	**DRS**
		with flow control, electric			❍	●	●	●	❍	**DFE1**[1]
		with pressure control, remotely operated		hydraulic	●	●	●	●	●	**DRG**
		electrical	negative characteristic		●	●	●	●	●	**ED.**[2]
			positive characteristic		●	●	●	●	●	**ER.**[2]
			nominal voltage							
			12V		●	●	●	●	●	**71**
			24V		●	●	●	●	●	**72**
	Power control	with pressure cut off								
		Control begin	to	50 bar	●	●	●	●	●	**LA5D**
			from	51 to 90 bar	●	●	●	●	●	**LA6D**
				91 to 160 bar	●	●	●	●	●	**LA7D**
				160 to 240 bar	●	●	●	●	●	**LA8D**
			over	240 bar	●	●	●	●	●	**LA9D**
		with pressure cut off	remotely operated							
		Control begin	see above		●	●	●	●	●	**LA.DG**
		with pressure cut off, flow control, X-T closed								
		Control begin	see above		●	●	●	●	●	**LA.DS**
		with separate flow control, X-T closed								
		Control begin	see above		●	●	●	●	●	**LA.S**

Series

05	Series 3, Index 2	**32**

Direction of rotation

06	With view on drive shaft	clockwise	**R**
		counter clockwise	**L**

● = available ❍ = on request – = not available

1) See RE 30630, or http://www.boschrexroth.de/sydfe

2) At project design, the following must be considered:
Excessive current levels(I > 1200 mA at 12 V or I > 600 mA at 24 V) to the ER-solenoid can result in undesired increase of pressure which can lead to pump or system damage:

- Use Imax -current limiter.
- An intermediate-plate pressure controller can be used to protect the pump in the event of overflow.
  An accessory kit with pressure reducing sandwich plate can be ordered from Rexroth under part number R902490825.

Type code for standard program

A10VS	O			/	32		–	V		B				
01	02	03	04		05	06		07	08	09	10	11	12	13

Seals

07	FKM (Fluoro-rubber)	●	●	●	●	●	V

Drive shaft

			045	071	100	140	180	
08	Parallel keyed shaft to DIN 6885, not for through drive		●	●	●	●	●	P
	Splined shaft ANSI B92.1a	standard shaft	●	●	●	●	●	S
		similar to shaft „S“ however for higher input torque	●	●	–	–	–	R

Mounting flange

09	ISO 3019-2 - 4-bolt	B

Ports for service lines[1]

10	SAE-flange on top and at the bottom , opposite sides, Metric fixing thread, with universal through drive	●	●	●	●	●	22U
	Like 22U, with pulsation damping, not for High-Speed	●	●	●	●	❍	32U

Through drive

11	Without through drive, with through drive shaft, without shaft coupler, without adapter flange, with cover properly closed		–	▲	▲	▲	–	99
	Without through drive, with through drive shaft, without shaft coupler, without adapter flange with cover properly closed (for new applications)		●	●	●	●	●	00
	Flange ISO 3019-2[2] Diameter	Coupler for splined shaft[3] Diameter						
	ISO 80, 2-bolt	3/4 in 11T 16/32DP	●	●	●	●	●	B2
	ISO 100, 2-bolt	7/8 in 13T 16/32DP	●	●	●	●	●	B3
		1 in 15T 16/32DP	●	●	●	●	●	B4
	ISO 125, 4-bolt	1 in 15T 16/32DP	●	●	●	●	●	E1
	ISO 160, 4-bolt	1 1/4 in 14T 12/24DP	–	●	●	●	●	B8
	ISO 180, 4-bolt	1 1/2 in 17T 24/24DP	–	–	●	●	●	B9
		1 3/4 in 13T 8/16DP	–	–	–	●	●	B7
	Flange ISO 3019-1[2]							
	82-2 (A)	5/8 in 9T 16/32DP	●	●	●	●	●	01
		3/4 in 11T 16/32DP	●	●	●	●	●	52
	101-2 (B)	7/8 in 13T 16/32DP	●	●	●	●	●	68
	101-2 (B)	1 in 15T 16/32DP	●	●	●	●	●	04
	127-4 (C)	1 in 15T 16/32DP	●	●	●	●	●	E2
		1 1/4 in 14T 12/24DP	–	●	●	●	●	15
	127-2 (C)	1 1/2 in 17T 12/24DP	–	–	●	●	●	24
	152-4 (D)	1 1/2 in 17T 12/24DP	–	–	●	●	●	96
		1 3/4 in 13T 8/16DP	–	–	–	●	●	17

Rotary group version

12	Standard-rotary group (noise-optimized for n = 1500/1800 rpm)	●	●	●	●	●	E
	High-Speed (only with port plate 22U)	●	●	●	●	❍	S

Solenoid connectors

13	Without	●	●	●	●	●	0
	HIRSCHMANN-plug - without suppressor diode (only for ED/ER control)	●	●	●	●	●	H

● = available ❍ = on request ▲ = not for new applications – = not available

1) See RE 95581 universal through drive
2) 2-bolt: mounting pump series 31; 4-bolt: mounting pump series 32. See page 37 Summary mouting options
3) Coupler for splined shaft to ANSI B92.1a (drive shaft allocation to SAE J744)

Technical data

Fluids

Prior to project design, please see our technical data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable fluids) for detailed information on fluids and operating conditions.

When using environmentally acceptable hydraulic fluids, the limitations regarding technical data and seals must be observed. Please contact us.

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected the range

ν_{opt} = optimum operating viscosity 16 ... 36 mm²/s

referred to tank temperature (open circuit).

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods ($t \leq 1$ min)
at max. perm. fluid temperature of 90 °C.

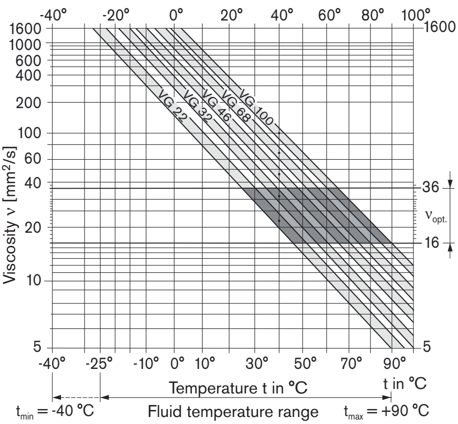
Please note that the max. leakage fluid temperature of 90 °C is also not exceeded in certain areas (for instance bearing area). The fluid temperature in the bearing area is approx. 5 K higher than the average leakage fluid temperature

ν_{max} = 1000 mm²/s
for short periods ($t \leq 1$ min)
on cold start
($p \leq 30$ bar, $n \leq 1500$ rpm, t_{min} = -25 °C)

At temperatures between -40 °C and -25 °C special measures are required, please consult us for further information.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

Selection diagram



Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The fluid should be selected so that witin the operating temperature range, the viscosity lies within the optimum range (ν_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.

Example: at an ambient temperature of X °C the operating temperature in the tank is 60 °C . in the optimum viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

Important: The leakage fluid (case drain fluid) temperature is influenced by pressure and input speed and is always higher than the tank temperature. However, at no point in the component may the temperature exceed 90 °C. The temperature difference specified on the left is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be met, due to extreme operating parameters please consult us.

Filtration of the fluid

The finer the filtration the better the fluid cleanliness class and the longer the service life of the axial piston pump.

In order to guarantee the functional reliability of the axial piston unit it is necessary to carry out a gravimetric evaluation of the fluid to determine the particle contamination and the cleanliness class acc. to ISO 4406. A cleanliness class of at least is necessary 20/18/15.
At very high fluid temperatures (90 °C to max. 115 °C) a cleanliness class of at least 19/17/14 nach ISO 4406 is necessary.

If above classes cannot be maintained, please consult us.

Technical data

Operating pressure range

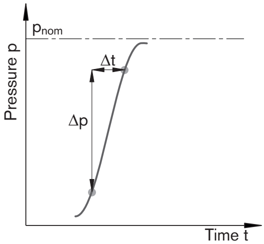
Pressure at outlet port (pressure port) B

Nominal pressure p_{nom} ________________ 280 bar absolute

Maximum pressure p_{max} ______________ 350 bar absolute
Individual operating period ______________________ 2.5 ms
Total operating period ___________________________ 300 h

Minimum pressure**(high pressure side)** _________ 10 bar[2)]

Rate of pressure change $R_{A\ max}$ ____________ 16000 bar/s



To safeguard against over pressure pump safety blocks to RE 25880 and RE 25890 for direct mounting onto the SAE flange port (B) can be ordered separately.

Pressure at suction port S (inlet)

Inlet pressure standard rotary group

Size 45 to100 at 1800 rpm
Minimum pressure $p_{abs\ min}$ ________________ 0.8 bar absolute

Size 140 to180 at 1800 min^{-1}
Minimum pressure $p_{abs\ min}$ __________________ 1 bar absolute

Maximum pressure $p_{abs\ max}$ ________________10 bar[1)] absolute

Inlet pressure high-speed-rotary group

Minimum pressure $p_{abs\ min}$ __________________ 1 bar absolute

Maximum pressure $p_{abs\ max}$ ________________10 bar[1)] absolute

Case drain pressure

Maximum permissible case drain pressure (at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ____________________________________ 2 bar[1)]

Definition

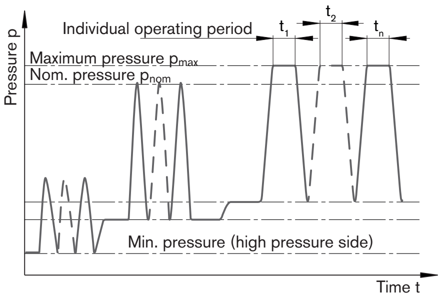
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum pressure within the individual operating period. The total of the individual operating periods must not exceed the total operating period.

Minimum pressure (in pump outlet)
Minimum pressure in the pump outlet side (port B) that is required in order to prevent damage to the axial piston unit.

Minimum pressure (inlet) open circuit
Minimum pressure at suction port S (inlet) that is required to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

1) Other values on request

2) Lower pressure, depends on timeframe, please consult us.

2

Technical data – Standard rotary group – Version E

Table of values (theoretical values, without efficiencies and tolerances: values rounded)

Size		NG		45	71	100	140	180
Displacement, geometric (per revolution)		$V_{g\,max}$	cm^3	45	71	100	140	180
Standard rotary group noise optimized								
Speed								
maximum at $V_{g\,max}$		n_{max}	rpm	1800[1]	1800[1]	1800[1]	1800[2]	1800[2]
Flow								
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	L/min	81	128	180	252	324
at $n_E = 1500$ rpm		$q_{vE\,max}$	L/min	67.5	106.7	150	210	270
Power								
at n_{nom} and $V_{g\,max}$ and $\Delta p = 280$ bar		P_{max}	kW	38	59.7	84	118	151
at $n_E = 1500$ rpm		$P_{E\,max}$	kW	31	50	70	98	125
Torque[1]								
at $V_{g\,max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	200	317	446	624	802
	$\Delta p = 100$ bar	T	Nm	72	113	159	223	286
Torsional stiffness	P	c	Nm/rad	34587	80627	132335	188406	213022
Shaft	S	c	Nm/rad	29497	71884	121142	169537	171107
	R	c	Nm/rad	41025	76545	–	–	–
Moment of inertial rotary group		J_{TW}	kgm^2	0.0035	0.0087	0.0185	0.0276	0.033
Case volume		V	L	1.0	1.6	2.2	3.0	2.7
Weight (without through drive) approx.		m	kg	30	47	69	73	78

1) The values are applicable:
- for absolute pressure $p_{abs} = 0.8$ bar at suction port S
- for the optimum viscosity range of $\nu_{opt} = 16$ to $36\ mm^2/s$
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

2) The values are applicable:
- for absolute pressure $p_{abs} = 1$ bar at suction port S
- for the optimum viscosity range of $\nu_{opt} = 16$ to $36\ mm^2/s$
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

Important

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational-service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible data.

Determination of size

Flow $\quad q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [L/min]

Torque $\quad T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $\quad P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Geometr. displacement per revolution in cm^3
Δp = Pressure differential in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data – High-Speed-rotary group – Version S

Table of values (theoreticaal values, without efficiencies and tolerances: values rounded)

Size		NG		45	71	100	140
Displacement, geometric (per revolution)		$V_{g\ max}$	cm^3	45	71	100	140
High-speed-rotary group							
Speed							
maximum at $V_{g\ max}$		n_{max}	rpm	3000[1]	2550[1]	2300[1]	2200[1]
Flow							
at n_{nom} and $V_{g\ max}$		$q_{v\ max}$	L/min	135	181	280	308
at $n_E = 1500$ rpm		$q_{vE\ max}$	L/min	67,5	106,6	150	210
Power							
at n_{nom}, $V_{g\ max}$ and $\Delta p = 280$ bar		P_{max}	kW	62.8	85	107	144
at $n_E = 1500$ rpm		$P_{E\ max}$	kW	31	50	70	98
Torque[1]							
at $V_{g\ max}$ and	$\Delta p = 280$ bar	T_{max}	Nm	200	317	446	624
	$\Delta p = 100$ bar	T	Nm	72	113	159	223
Torsional stiffness	P	c	Nm/rad	34587	80627	132335	188406
Shaft	S	c	Nm/rad	29497	71884	121142	169537
	R	c	Nm/rad	41025	76545	–	–
Moment of inertia rotary group		J_{TW}	kgm^2	0.0035	0.0087	0.0185	0.0276
Case volume		V	L	1.0	1.6	2.2	3.0
Weight (without through drive) approx.		m	kg	30	47	69	73

1) The values are applicable:
- for absolute pressure $p_{abs} = 1$ bar at suction port S
- for the optimum viscosity range of $\nu_{opt} = 16$ to 36 mm^2/s
- for mineral-based operating materials with a specific mass of 0.88 kg/l.

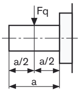
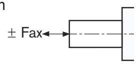
Important

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible data.

2

Technical data

Permissible radial and axial forces on the drive shaft

Size		NG		45	71	100	140	180
Radial force maximum at a/2		$F_{q\ max}$	N	1500	1900	2300	2800	2300
Axial force maximum		$\pm F_{ax\ max}$	N	1500	2400	4000	4800	800

Note

The direction of the permissible axial force:

$+ F_{ax\ max}$ = Increase of bearing service life

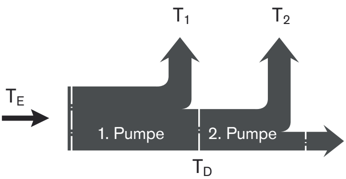
$- F_{ax\ max}$ = Reduction of bearing service life (avoid)

Permissible input and through drive torques

Size	NG		45	71	100	140	180
Torque at $V_{g\ max}$ and $\Delta p = 280$ bar[1]	T_{max}	Nm	200	317	446	624	802
Input torque for drive shaft, maximum[2]							
P	$T_{E\ max}$	Nm	200	439	857	1206	1206
DIN 6885	Ø	mm	25	32	40	45	45
S	$T_{E\ max}$	Nm	319	626	1104	1620	1620
	Ø	in	1	1 1/4	1 1/2	1 3/4	1 3/4
R	$T_{E\ max}$	Nm	400	644	–	–	–
	Ø	in	1	1 1/4	–	–	–
Through drive torque for drive shaft, maximum							
S	$T_{D\ max}$	Nm	319	492	778	1266	1266
R	$T_{D\ max}$	Nm	365	548	–	–	–

1) Without considering efficiency
2) For drive shafts free of radial load

Distribution of torques



Technical data

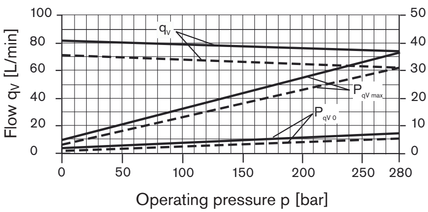
Drive power and flow

Fluid: hydraulic oil ISO VG 46 DIN 51519, t= 50°C

Size 45

_ _ _ _n = 1500 rpm

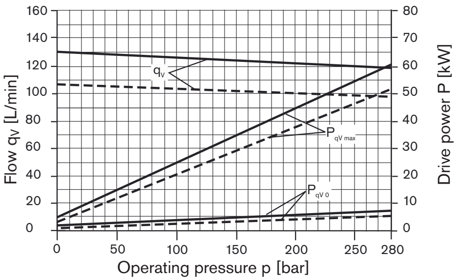
______ n = 1800 rpm



Size 71

_ _ _ _n = 1500 rpm

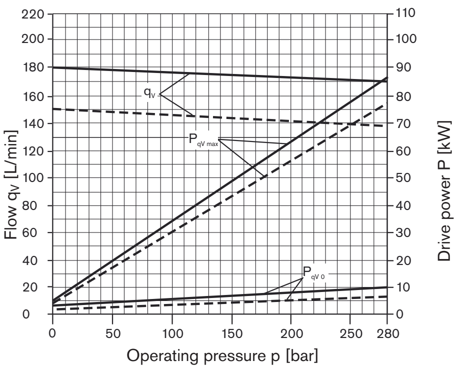
______ n = 1800 rpm



Size 100

_ _ _ _n = 1500 rpm

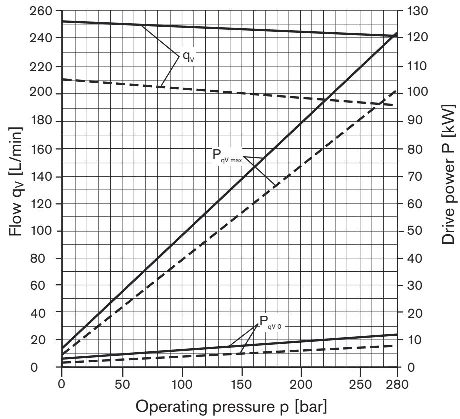
______ n = 1800 rpm



Size 140

_ _ _ _n = 1500 rpm

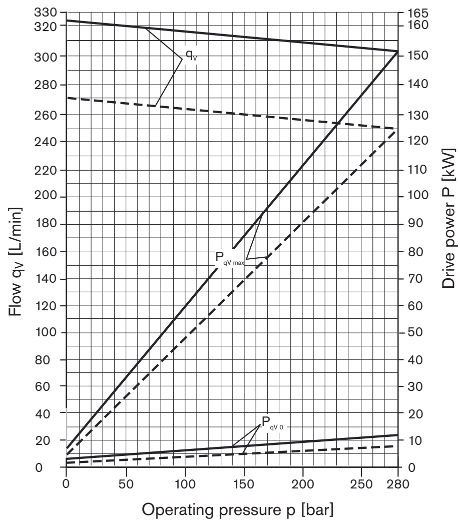
______ n = 1800 rpm



Size 180

_ _ _ _n = 1500 rpm

______ n = 1800 rpm



DG – Two point control, directly operated

The pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroking piston; a minimum pressure of $p_{st} \geq 50$ bar is required.

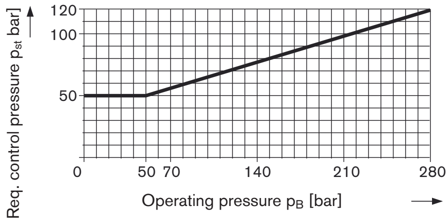
The pump can only be switched between $V_{g\ max}$ or $V_{g\ min}$.

Please note, that the required control pressure at port X is directly dependent on the actual operating pressure p_B in port B. (see control pressure diagram).

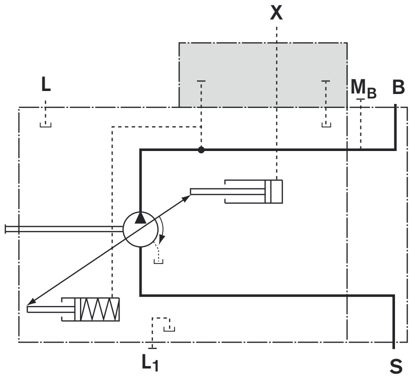
Control pressure p_{st} in X = 0 bar $\triangleq V_{g\ max}$

Control pressure p_{st} in X ≥ 50 bar $\triangleq V_{g\ min}$

Control pressure diagram



Schematic



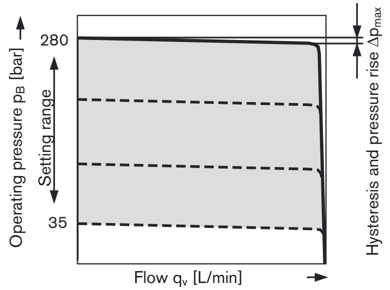
	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Control pressure
M_B	Measuring operating pressure

DR – Pressure control

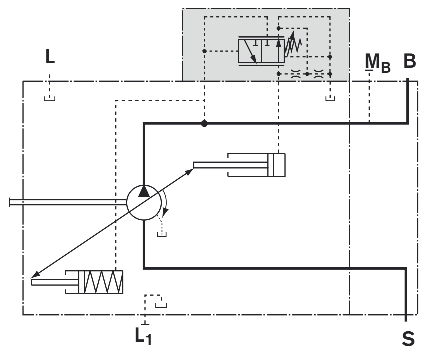
The pressure control limits the maximum pressure at the pump output within the pump control range. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure set-point set at the integrated pressure valve, the pump will adjust towards a smaller displacement and the control deviation will be reduced. The pressure can be set steplessly at the control valve.

Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50°C)



Schematic



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
M_B	Measuring operating pressure

Controller data

Hysteresis and repeatibility ________________ Δp max. 3 bar

Pressure rise, max

NG		45	71	100	140	180
Δp	bar	6	8	10	12	14

Control fluid consumption_____________ max. approx. 3 L/min

Flow losses at q_{Vmax} see page 9.

DRG – Pressure control remotely operated

The DR-pressure control (see page 11) is overriding this DRG-remote setting of max. outlet pressure.

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the pump supply.

The differential pressure at the DRG-control spool is set as standard to 20 bar. This results in a pilot oil flow to the relief valve of approx. 1,5 L/min. If another setting is required (range from 10-22 bar) please state in clear text.

As a separate relief valve we can recommend:

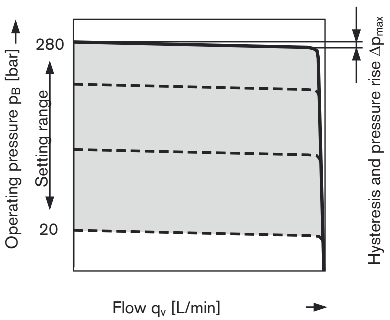
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice dia. 0,8 mm in P (electric) to RE 29166.

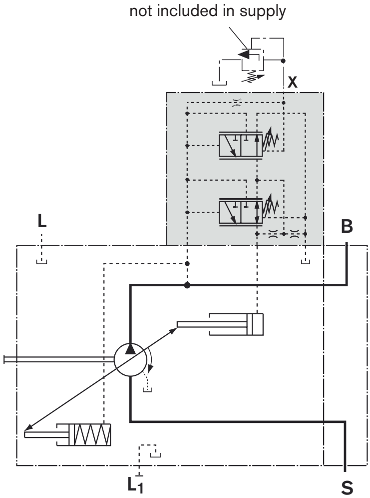
The max. lenght of piping should not exceed 2 m.

Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)



Schematic



	Port for
B	Service line
S	Suction line
L, L_1	Case drain(L_1 verschlossen)
X	Control pressure
M_B	Measuring operating pressure

Controller data

Hysteresis and repeatibility________________ Δp max. 3 bar

Pressure rise, max

NG		45	71	100	140	180
Δp	bar	6	8	10	12	14

Control fluid consumption___________ max.approx. 4.5 L/min

Flow losses at q_{Vmax} see page 9.

DRF/DRS – Pressure and flow control

In additon to the pressure control function, the pump flow may be varied by means of a differential pressure over an orifice or valve spool installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

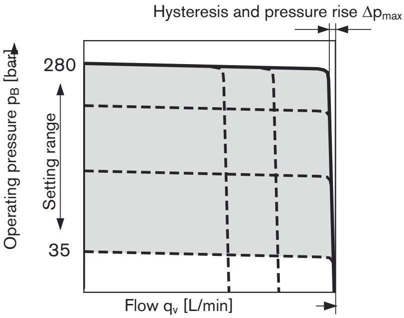
The pressure control overrides the flow control function.

Note

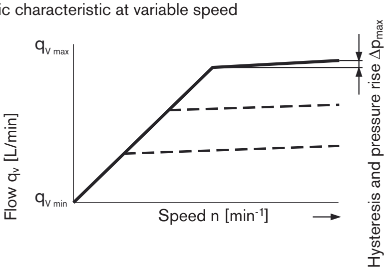
The DRS-valve version has no connection between X and the tank (pump housing).
Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

Static characteristic

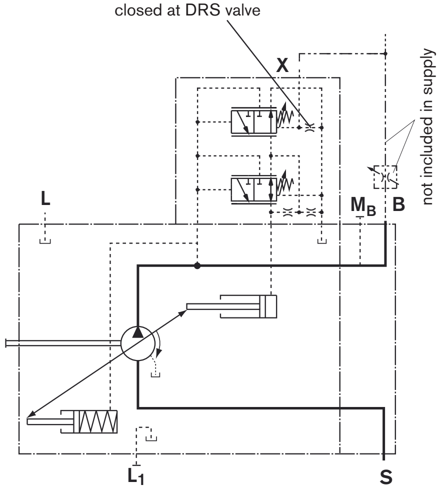
Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)



Static characteristic at variable speed



Schematic DRF



	Port for
B	Service line
S	Suction line
L, L_1	Case drain (L_1 plugged)
X	Control pressure
M_B	Measuring operating pressure

Differential pressure Δp:

Standard setting: 14 to 22 bar.

If another setting is required, please state in clear text.
Unloading port X to tank (with outlet port B closed) results in a zero stroke (standby) pressure which lies about 1 to 2 bar higher than the Δp setting).

Controller data

Data pressure control DR see page 11.
Maximum flow deviation measured with drive speed n = 1500 rpm.

Size		**45**	**71**	**100**	**140**	**180**
$\Delta q_{v\,max}$	L/min	1.8	2.8	4.0	6.0	8.0

Control fluid consumption DRF __ max. approx. 3 bis 4.5 L/min
Control fluid consumption DRS ________ max. approx. 3 L/min

LA... – Pressure, flow and power control

Execution of the pressure control like DR(G), see page 11 (12). Execution of the flow control like DRS, see page 13.

In order to achieve a constant drive torque with varying operating pressures, the swivel angle and with it the output flow from the axial piston unit is varied so that the product of flow and pressure remains constant.

Flow control is possible below the power control curve.

When ordering please state the max. input torque in clear text, e.g. 20 kW at 1500 min^{-1}.

Control data

For technical Data of pressure control DR see page 11.

For technical Data of flow control FR see page 13.

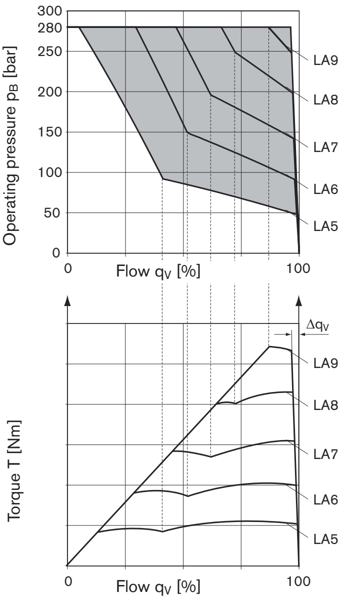
Controller data:
Control fluid consumption max. approx. 5.5 L/min

	Torque T [Nm] for size					
Control begin	**45**	**71**	**100**	**140**	**180**	**Ordering code**
to 50 bar	to 42.0	to 67.0	to 94.0	to 132.0	to 167.0	**LA5**
51 to 90 bar	42.1 - 76.0	67.1 - 121.0	94.1 - 169.0	132.1 - 237.0	167.1 - 302.0	**LA6**
91 to 160 bar	76.1 - 134.0	121.1 - 213.0	169.1 - 299.0	237.1 - 418.0	302.1 - 540.0	**LA7**
161 to 240 bar	134.1 - 202.0	213.1 - 319.0	299.1 - 449.0	418.1 - 629.0	540.1 - 810.0	**LA8**
over 240 bar	over 202.1	over 319.1	over 449.1	over 629.1	over 810.1	**LA9**

Conversion of the torque values in power [kW] :

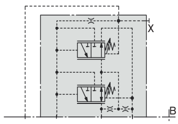
$$P = \frac{T}{6.4} \text{ [kW] (at 1500 rpm)} \qquad \text{or} \qquad P = \frac{2\pi \cdot T \cdot n}{60000} \text{ [kW] (speeds see tables on page 6 and 7)}$$

Static curves and torque characteristic

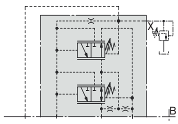


	Port for
B	Service line
S	Suction line
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure

Schematic (LAXD) with pressure cut off

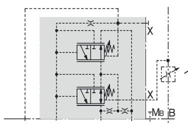


Schematic (LAXDG) with pressure cut off, remotely operated



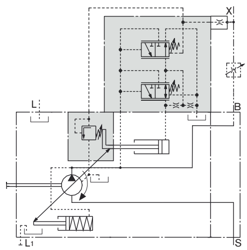
not included in supply

Schematic (LAXS) with separate flow control



not included in supply

Schematic (LAXDS) with pressure and flow control



not included in supply

ED – Electro-hydraulic pressure control

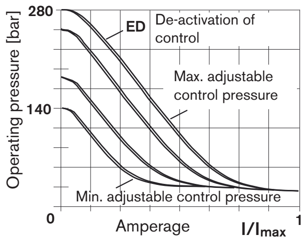
The maximum pump output pressure is set through a command current signal to the ED-valve solenoid

When system pressure (load pressure) reaches this pressure level, the pump's control valve spool shifts and causes an increase or decrease in the pump's swivel angle (flow) in order to maintain this set pressure level.

The pump output flow matches the needed input flow to the actuators. The desired pressure level can be set steplessly by varying the solenoid current.

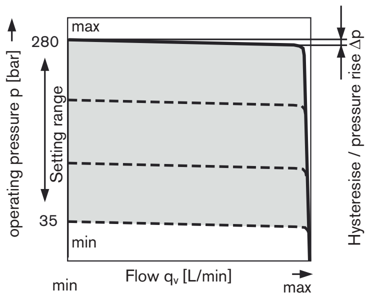
When the solenoid current signal drops towards a zero value, the maximum output pressure is limited by an adjustable mechanical pressure cut off (secure fail safe function in case of a loss of power e.g. for use as fan drives).
The response time characteristic of the ED-control was optimized for the use as a fan drive system.
When ordering, state the type of application in clear text.

Static current-pressure characteristic (negative characteristic)
(measured with pump in standby)



Hysteresis of static current-press. characteristic < 3 bar

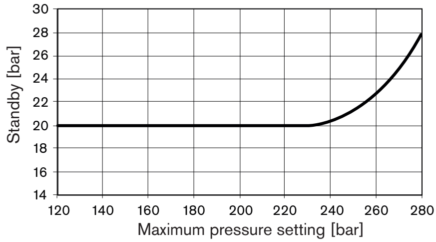
Static flow-pressure characteristic
(at n= 1500 min^{-1}; t_{fluid} = 50 °C)



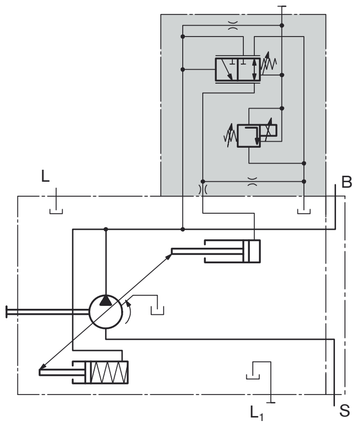
Control data
Standby standard settings (see diagramm at right), other values on request.

Hysteresis and pressure rise Δp < 4 bar.
Pilot flow consumption: 3 to 4,5 L/min.

Influence of pressure setting on stanby level



Schematic ED..



	Port for
B	Service line
S	Suction line
L, L_1	Case drain fluid (L_1 plugged)

Technical data, solenoids	**ED71**	**ED72**
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\ min}$	100 mA	50 mA
End of control at $q_{v\ max}$	1200 mA	600 mA
Limit current	1,54 A	0,77 A
Nom. resistence (at 20 °C)	5,5 Ω	22,7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100 %	100 %
Solenoide class of material see page 39		

Operating temperature range at valve -20 °C to +115 °C

2

ER – Electro-hydraulic pressure control

The maximum pump output pressure is set through a command current signal to the ED-valve solenoid

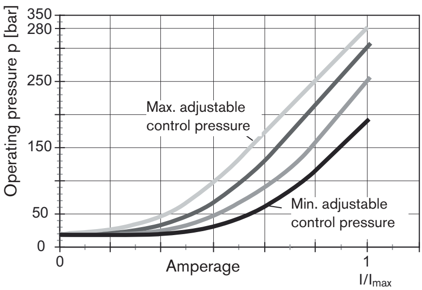
When system pressure (load pressure) reaches this pressure level, the pump's control valve spool shifts and causes an increase or decrease in the pump's swivel angle (flow) in order to maintain this set pressure level.

The pump output flow matches the needed input flow to the actuators. The desired pressure level can be set steplessly by varying the solenoid current.

When the solenoid current signal drops towards a zero value, the pump's output pressure will also drop to the standby level.

Observe the instructions regarding the project design on page 2

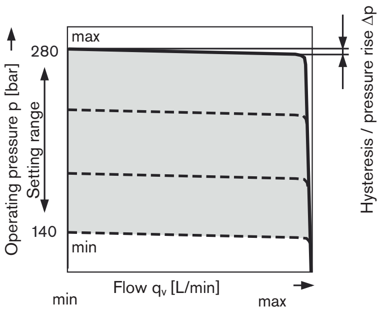
Static current-pressure characteristic (positive characteristic)
(measured with pump in standby)



Hysteresis static current-pressure characteristic < 3bar

Influence of pressure setting on stand by ± 2bar

Static flow-pressure characteristic
(at n= 1500 rpm; t_{fluid} = 50°C)

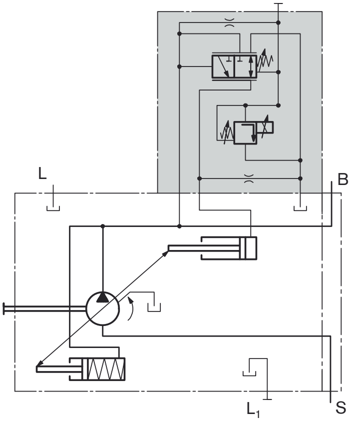


Control data
Standby standard setting 14 bar, other values on request.

Hysteresis and pressure rise Δp < 4bar.

Pilot flow consumption: 3 to 4,5 L/min.

Schematic ER..



	Port for
B	Service line
S	Suction line
L, L_1	Caise drain (L_1 plugged)

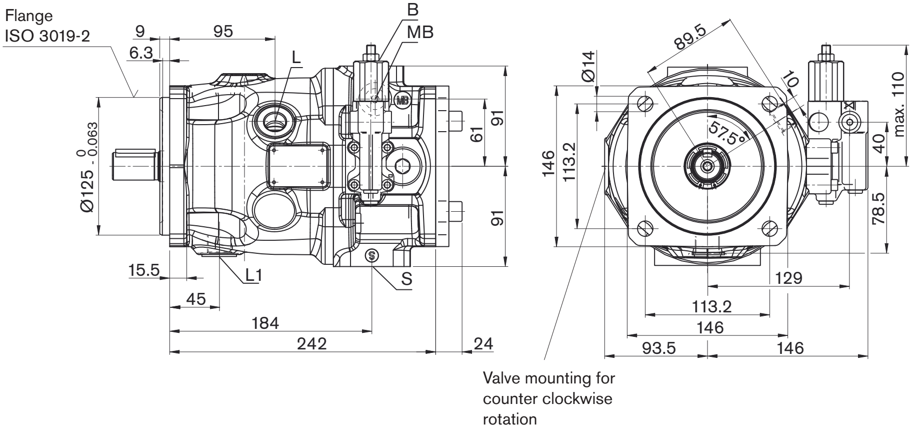
Technical data, solenoids	ED71	ED72
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Control begin at $q_{v\ min}$	100 mA	50 mA
End of control at $q_{v\ max}$	1200 mA	600 mA
Limit current	1,54 A	0,77 A
Nom. resistence (at 20 °C)	5,5 Ω	22,7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Duty cycle	100 %	100 %
Solenoide class of material see page 39		

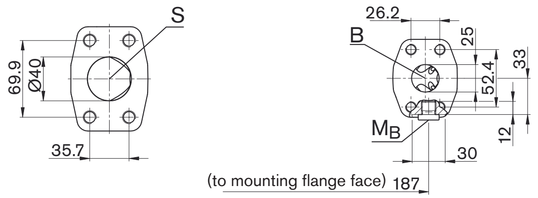
Operating temperature range at valve -20 °C to +115 °C

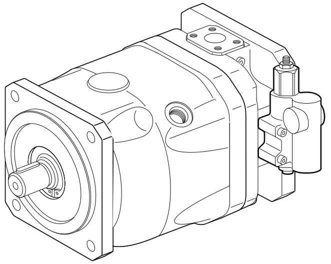
Dimensions size 45

Before finalising your design request a certified installation drawing. Dimensions in mm.

DR – Pressure control







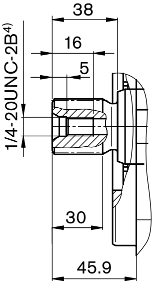
2

Dimensions size 45

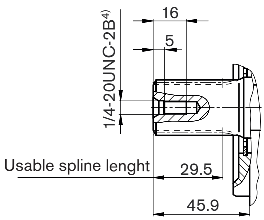
Before finalising your design request a certified installation drawing. Dimensions in mm.

Drive shaft

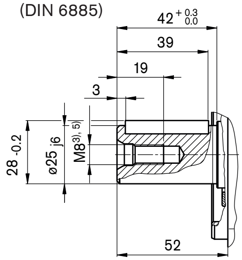
S Splined shaft 1 in
15T 16/32DP[1] (SAE J744)



R Splined shaft 1 in
15T 16/32DP[1)2)] (SAE J744)



P Parallel keyed shaft
(DIN 6885)



Ports

Designation	Port for	Standard	Size[5]	Maximum pressure [bar][6]	State
B	Service line (standard pressure range)	SAE J518[8]	1 in	350	O
	Fixing thread	DIN 13	M10 x 1.5; 17 deep		
S	Suction (standard pressure range)	SAE J518[8]	1 1/2 in	10	O
	Fixing thread	DIN 13	M12 x 1.75; 20 deep		
L	Case drain fluid	DIN 3852[9]	M22 x 1.5; 14 deep	2	O[7]
L_1	Case drain fluid	DIN 3852[9]	M22 x 1.5; 14 deep	2	X[7]
X	Load-Sensing pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Control press. DG control	DIN 3852	G 1/4 in; 12 deep	120	O
M_B	Measuring pressure in B	DIN 3852[9]	G 1/4; 12 deep	350	X

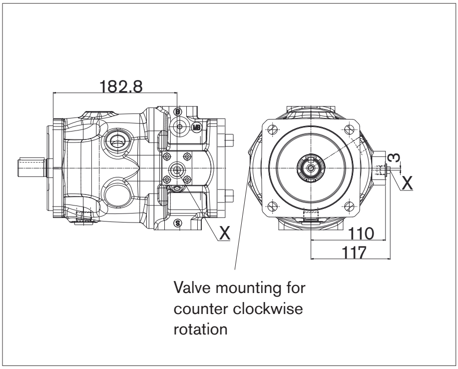
1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Center bore according to DIN 332 (thread according to DIN 13).
4) Thread according to ASME B1.1
5) For the maximum tightening torques the general information on page 44 must be observed.
6) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
7) Depending on the installation postion, L or L_1 must be connected (see also page 42, 43).
8) Metric fastening thread is a deviation from standard.
9) The spot face can be deeper than as specified in the standard.

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

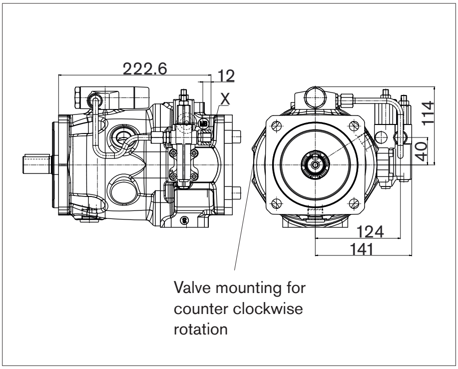
Dimensions size 45

Before finalising your design request a certified installation drawing. Dimensions in mm.

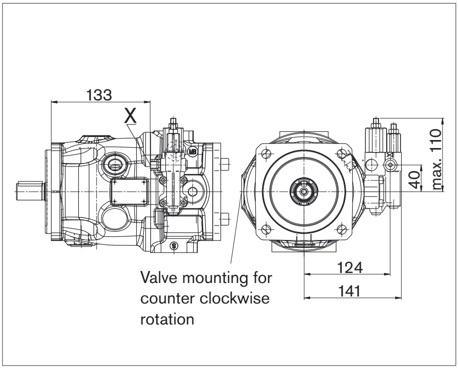
DG
Two point control, directly operated



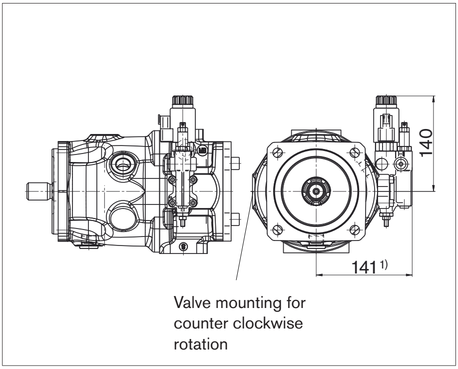
LA.D
Pressure, flow and power control



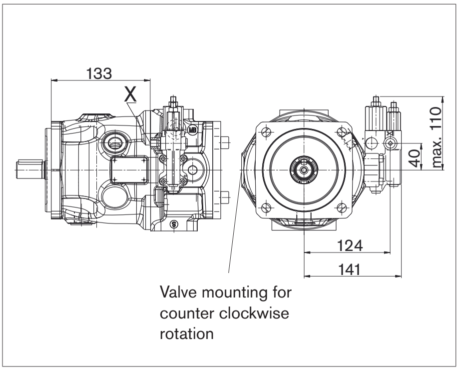
DRG
Pressure control, remotely operated



ED7./ER7.
Electro hydraulic pressure control



DRF/DRS
Pressure and flow control

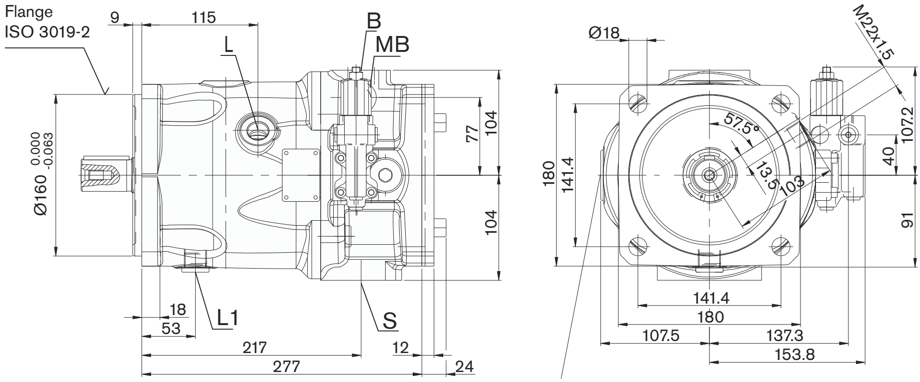


1) ER7.: 176mm when using a sandwich plate pressure reducing valve.

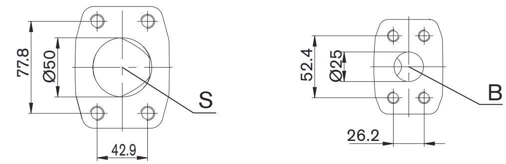
Dimensions size 71

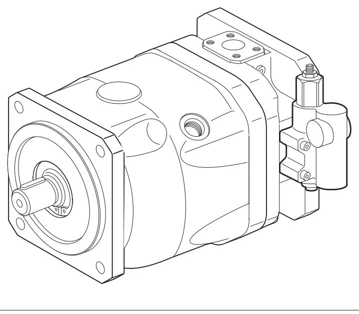
Before finalising your design request a certified installation drawing. Dimensions in mm.

DR – Pressure control



Valve mounting for counter clockwise rotation



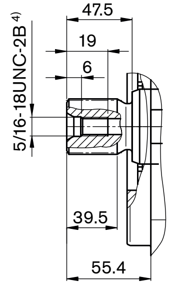


Dimensions size 71

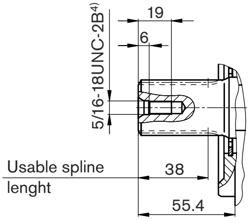
Before finalising your design request a certified installation drawing. Dimensions in mm.

Drive shaft

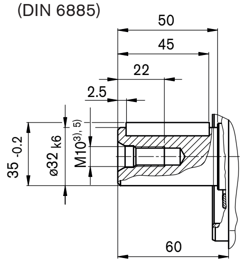
S Splined shaft 1 1/4 in
14T 12/24DP1) (SAE J744)



R Splined shaft 1 1/4 in
14T 12/24DP1)2) (SAE J744)



P Parallel keyed shaft
(DIN 6885)



2

Ports

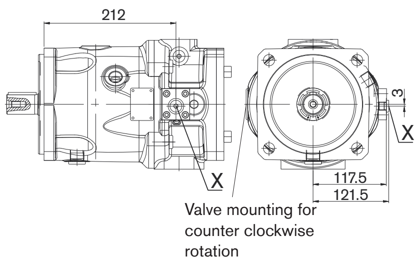
Designation	Port for	Standard	Size5)	Maximum pressure [bar]6)	State
B	Service line (standard pressure range)	SAE J5188)	1 in	350	O
	Fixing thread	DIN 13	M10 x 1.5; 17 deep		
S	Suction (standard pressure range)	SAE J5188)	2 in	10	O
	Fixing thread	DIN 13	M12 x 1.75; 20 deep		
L	Case drain fluid	DIN 38529)	M22 x 1.5; 14 deep	2	O7)
L_1	Case drain fluid	DIN 38529)	M22 x 1.5; 14 deep	2	X7)
X	Load-Sensing pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Control pressure DG-control	DIN 3852	G 1/4 in ; 12 deep	120	O
M_B	Measuring pressure in B	DIN 38529)	G 1/4; 12 deep	350	X

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline according to ANSI B92.1a, run out of spline is a deviation from standard.
3) Center bore according to DIN 332 (thread according to DIN 13).
4) Thread according to ASME B1.1
5) For the maximum tightening torques the general information on page 44 must be observed.
6) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
7) Depending on the installation postion, L or L_1 must be connected (see also page 42, 43).
8) Metric fastening thread is a deviation from standard.
9) The spot face can be deeper than as specified in the standard.
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

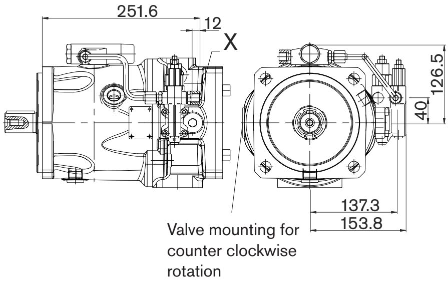
Dimensions size 71

Before finalising your design request a certified installation drawing. Dimensions in mm.

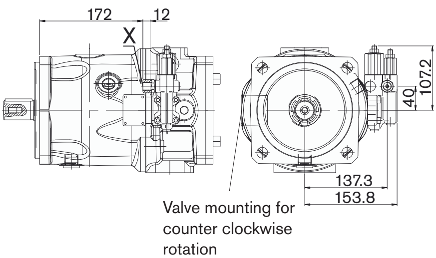
DG
Two point control, directly operated



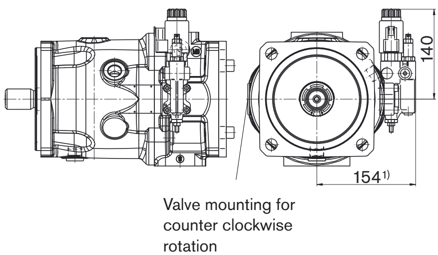
LA.D
Pressure, flow and power control



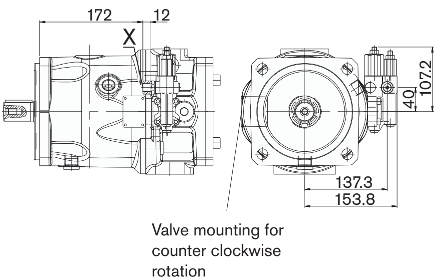
DRG
Pressure control, remotely operated



ED7./ER7.
Electro hydraulic pressure control



DRF/DRS
Pressure and flow control

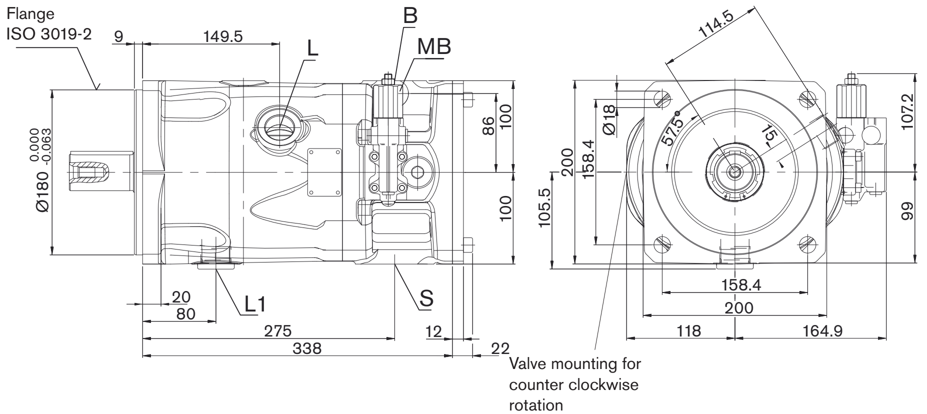


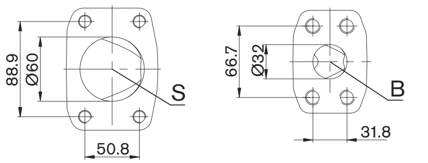
1) ER7.: 189 mm when using a sandwich plate pressure reducing valve.

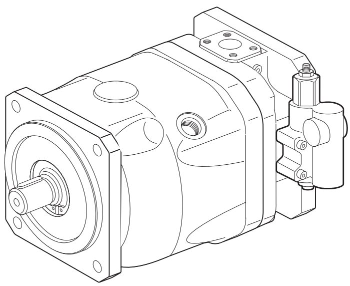
Dimensions size 100

Before finalising your design request a certified installation drawing. Dimensions in mm.

DR – Pressure control





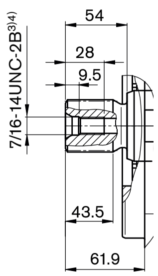


Dimensions size 100

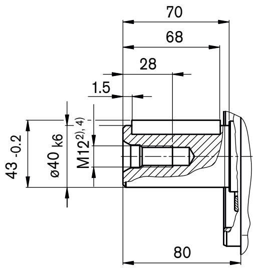
Before finalising your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 1/2 in
17T 12/24DP[1] (SAE J744)



P Parallel keyed shaft(DIN 6885)



Ports

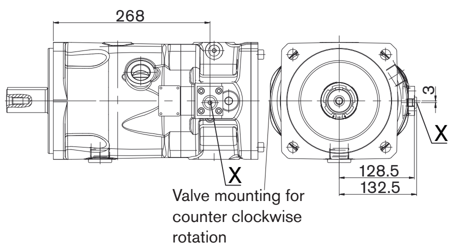
Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line (high pressure range)	SAE J518[7]	1 1/4 in	350	O
	Fixing thread	DIN 13	M14 x 2; 19 deep		
S	Suction (standard pressure range)	SAE J518[7]	2 1/2 in	10	O
	Fixing thread	DIN 13	M12 x 1.75; 17 deep		
L	Case drain fluid	DIN 3852[8]	M33 x 2; 16 deep	2	O[6]
L_1	Case drain fluid	DIN 3852[8]	M33 x 2; 16 deep	2	X[6]
X	Load-Sensing pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Control pressure DG-control	DIN 3852	G 1/4 in ; 12 deep	120	O
M_B	Measuring pressure in B	DIN 3852[8]	G 1/4; 12 deep	350	X

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Center bore according to DIN 332 (thread according to DIN 13).
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general information on page 44 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
6) Depending on the installation postion, L or L_1 must be connected (see also page 42, 43).
7) Metric fastening thread is a deviation from standard.
8) The spot face can be deeper than as specified in the standard.
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

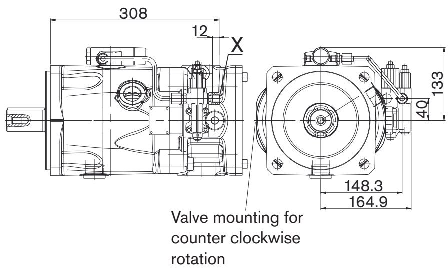
Dimensions size 100

Before finalising your design request a certified installation drawing. Dimensions in mm.

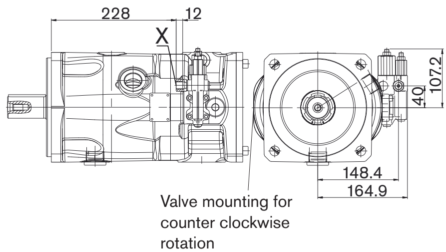
DG
Two point control, directly operated



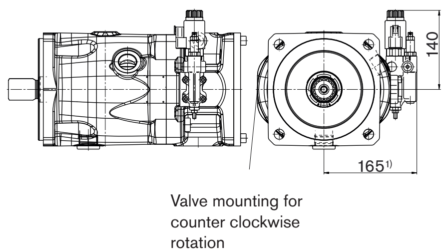
LA.D
Pressure, flow and power control



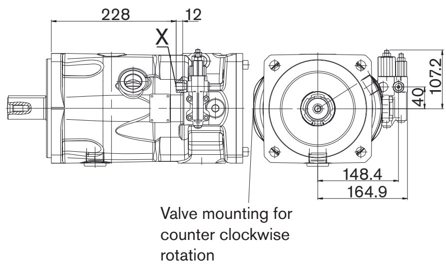
DRG
Pressure control, remotely operated



ED7./ER7.
Electro hydraulic pressure control



DRF/DRS
Pressure and flow control

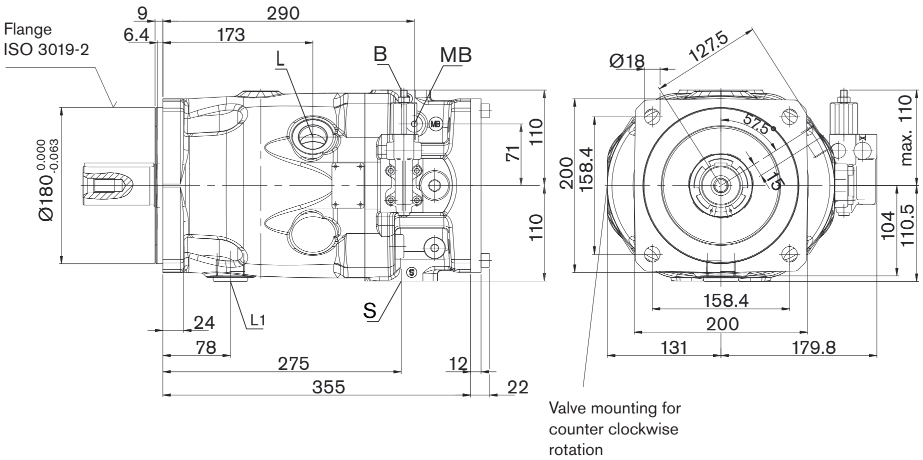


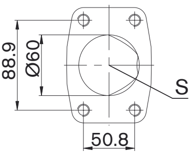
1) ER7.: 200 mm when using a sandwich plate pressure reducing valve.

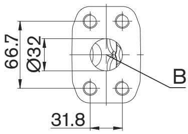
Dimensions size 140

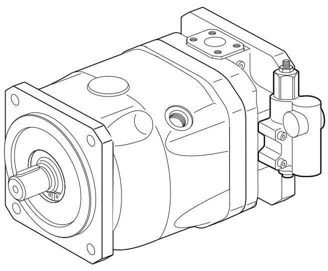
Before finalising your design request a certified installation drawing. Dimensions in mm.

DR – Pressure control







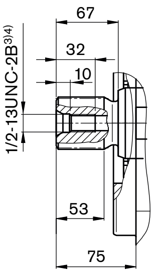


Dimensions size 140

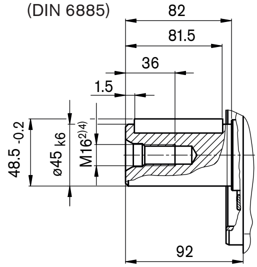
Before finalising your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



P Parallel keyed shaft
(DIN 6885)



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line (high pressure range)	SAE J518[7]	1 1/4 in	350	O
	Fixing thread	DIN 13	M14 x 2; 19 deep		
S	Suction (standard pressure range)	SAE J518[7]	2 1/2 in	10	O
	Fixing thread	DIN 13	M12 x 1.75; 17 deep		
L	Case drain fluid	DIN 3852[8]	M33 x 2; 16 deep	2	O[6]
L_1	Case drain fluid	DIN 3852[8]	M33 x 2	2	X[6]
X	Load-Sensing pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Control pressure DG-control	DIN 3852	G 1/4 in ; 12 deep	120	O
M_B	Measuring pressure in B	DIN 3852[8]	G 1/4; 12 deep	350	X

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Center bore according to DIN 332 (thread according to DIN 13).
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general information on page 44 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
6) Depending on the installation postion, L or L_1 must be connected (see also page 42, 43).
7) Metric fastening thread is a deviation from standard.
8) The spot face can be deeper than as specified in the standard.

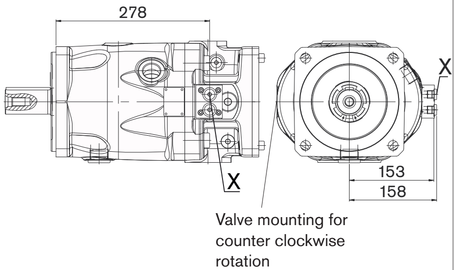
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 140

Before finalising your design request a certified installation drawing. Dimensions in mm.

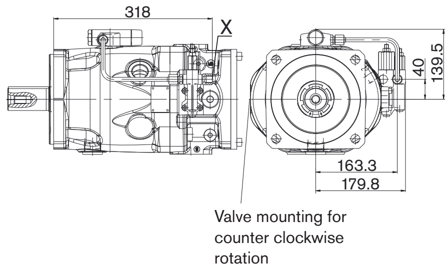
DG

Two point control, directly operated



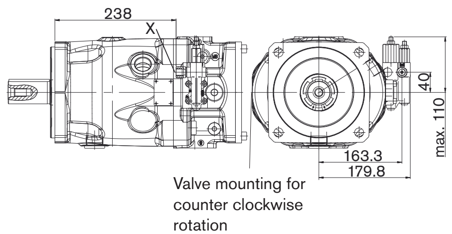
LA.D

Pressure, flow and power control



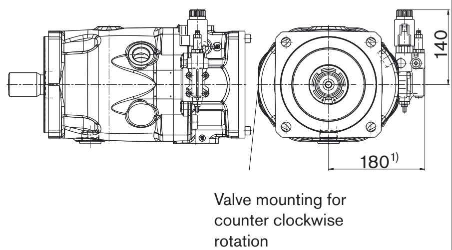
DRG

Pressure control, remotely operated



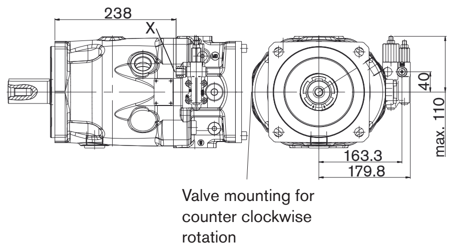
ED7./ER7.

Electro hydraulic pressure control



DRF/DRS

Pressure and flow control

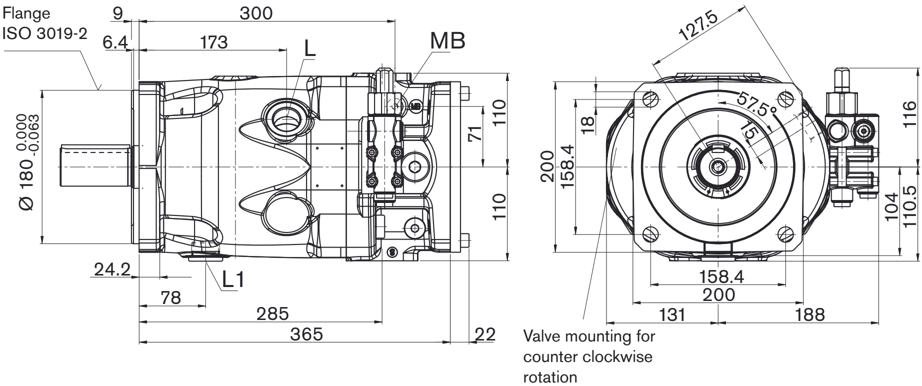


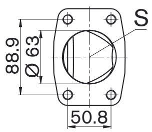
1) ER7.: 215 mm when using a sandwich plate pressure reducing valve.

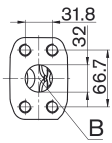
Dimensions size 180

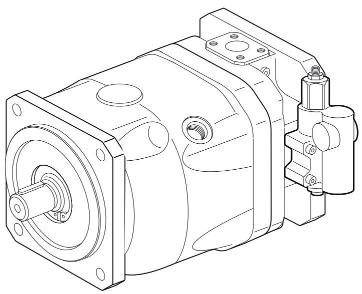
Before finalising your design request a certified installation drawing. Dimensions in mm.

DR – Pressure control







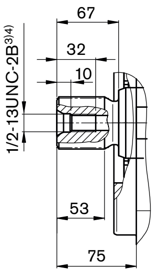


Dimensions size 180

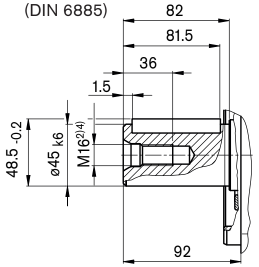
Before finalising your design request a certified installation drawing. Dimensions in mm.

Drive shaft

S Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



P Parallel keyed shaft
(DIN 6885)



Ports

Designation	Port for	Standard	Size[4]	Maximum pressure [bar][5]	State
B	Service line (high pressure range)	SAE J518[7]	1 1/4 in	350	O
	Fixing thread	DIN 13	M14 x 2; 19 deep		
S	Suction (standard pressure range)	SAE J518[7]	2 1/2 in	10	O
	Fixing thread	DIN 13	M12 x 1.75; 17 deep		
L	Case drain fluid	DIN 3852[8]	M33 x 2; 16 deep	2	O[6]
L_1	Case drain fluid	DIN 3852[8]	M33 x 2; 16 deep	2	X[6]
X	Load-Sensing pressure	DIN 3852	M14 x 1.5; 12 deep	350	O
X	Control pressure DG-control	DIN 3852	G 1/4 in ; 12 deep	120	O
M_B	Measuring pressure in B	DIN 3852[8]	G 1/4; 12 deep	350	X

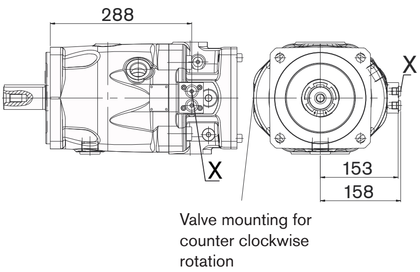
1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Center bore according to DIN 332 (thread according to DIN 13).
3) Thread according to ASME B1.1
4) For the maximum tightening torques the general information on page 44 must be observed.
5) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
6) Depending on the installation postion, L or L_1 must be connected (see also page 42, 43).
7) Metric fastening thread is a deviation from standard.
8) The spot face can be deeper than as specified in the standard.

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

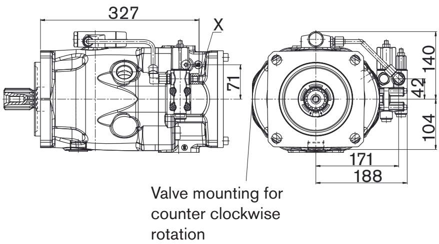
Dimensions size 180

Before finalising your design request a certified installation drawing. Dimensions in mm.

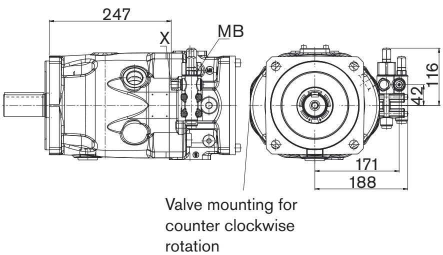
DG
Two point control, directly operated



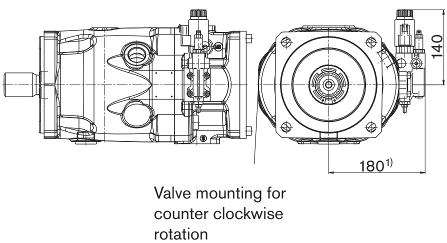
LA.D
Pressure, flow and power control



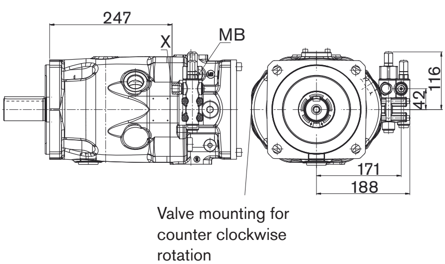
DRG
Pressure control, remotely operated



ED7./ER7.
Electro hydraulic pressure control



DRF/DRS
Pressure and flow control

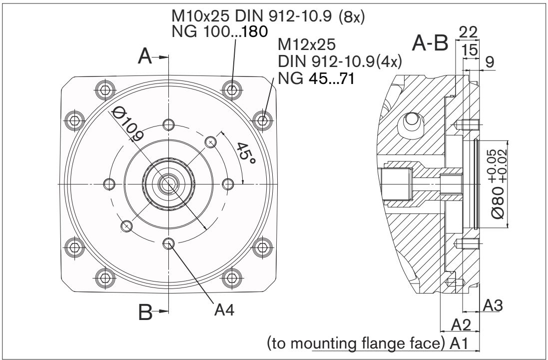


1) ER7.: 215 mm when using a sandwich plate pressure reducing valve.

Dimensions through drive

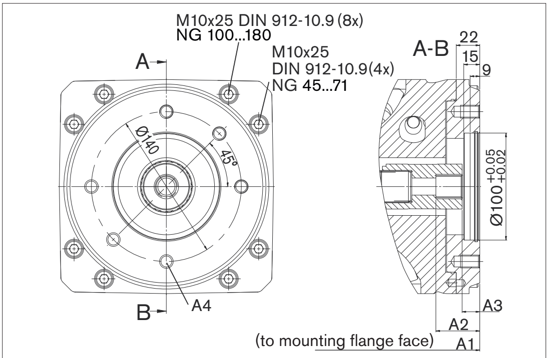
Before finalising your design request a certified installation drawing. Dimensions in mm.

B2 Flange ISO 3019-2 - 80 2-bolt
Coupler for splined shaft to ANSI B92.1a-1996 3/4in 11T 16/32 DP[1] (SAE J744 - 16-4 (A-B))



Size	A_1	A_2	A_3	A_4[2]
45	264	38	15.5	M10 x 1.5; 16 deep
71	299	38	15.5	M10 x 1.5; 16 deep
100	360	38	15.5	M10 x 1.5; 16 deep
140	377	38	15.5	M10 x 1.5; 16 deep
180	387	38	15.5	M10 x 1.5; 16 deep

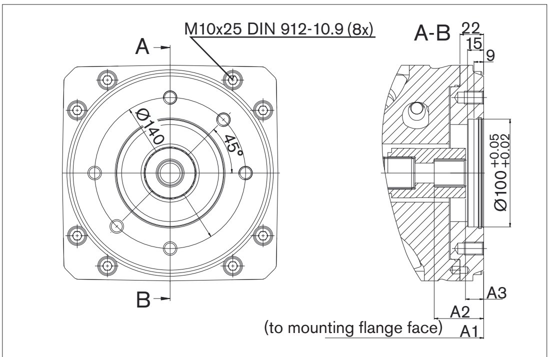
B3 Flange ISO 3019-2 - 100 2-bolt
Coupler for splined shaft to ANSI B92.1a-1996 7/8in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))



Size	A_1	A_2	A_3	A_4[2] at U99
45	264	41	16.5	M12 x 1.75; 18 deep
71	299	41	16.5	M12 x 1.75; 18 deep
100	360	41	16.5	M12 x 1.75; 18 deep
140	377	41	16.5	M12 x 1.75; 18 deep
180	387	41	16.5	M12 x 1.75; 18 deep

Thread of all NG at U00 M12 x 1.75; 22 deep

B4 Flange ISO 3019-2 - 100 2-bolt
Coupler for splined shaft to ANSI B92.1a-1996 1in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))



Size	A_1	A_2	A_3	A_4[2] at U99
45	264	45.9	16.9	M12 x 1.75; 18 deep
71	299	45.9	16.9	M12 x 1.75; 18 deep
100	360	45.9	16.9	M12 x 1.75; 18 deep
140	377	45.9	16.9	M12 x 1.75; 18 deep
180	387	45.9	16.9	M12 x 1.75; 18 deep

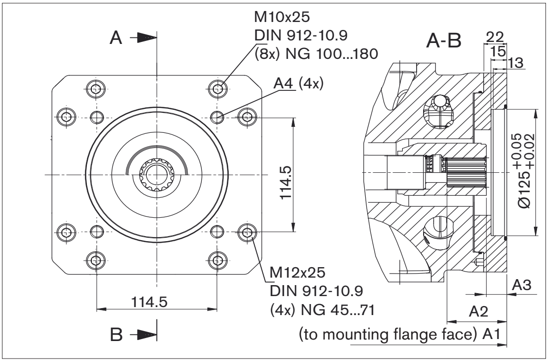
Thread of all NG at U00 M12 x 1.75; 22 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

Dimensions through drive

Before finalising your design request a certified installation drawing. Dimensions in mm.

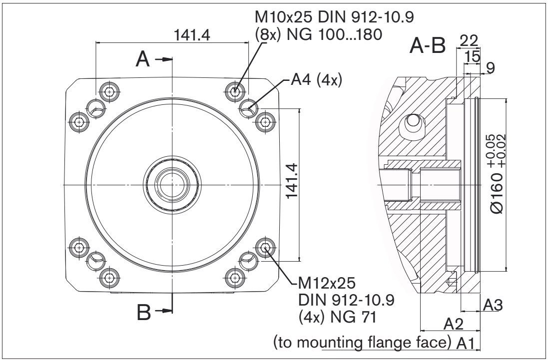
E1 Flange ISO 3019-2 - 125 4-bolt
Coupler for splined shaft to ANSI B92.1a-1996 1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))



Size	A_1	A_2	A_3	A_4[2] at U99
45	264	45.9	16.9	M12 x 1.75; 22 deep
71	299	45.9	16.9	M12 x 1.75; 15 deep
100	360	45.9	16.9	M12 x 1.75; 15 deep
140	377	45.9	16.9	M12 x 1.75; 15 deep
180	387	45.9	16.9	M12 x 1.75; 22 deep

Thread of all NG at U00 M12 x 1.75; 22 deep

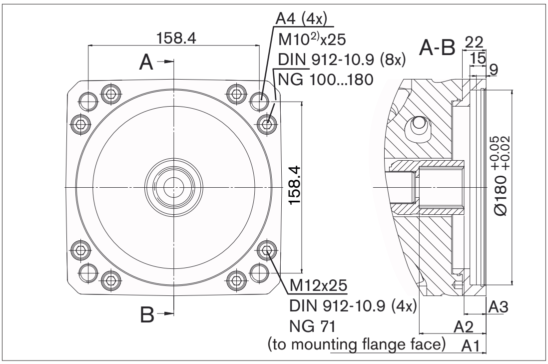
B8 Flange ISO 3019-2 - 160 4-bolt
Coupler for splined shaft to ANSI B92.1a-1996 1 1/4in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))



Size	A_1	A_2	A_3	A_4[2] at U99
71	299	55.4	17.9	M16 x 2; 20 deep
100	360	55.4	17.9	M16 x 2; 20 deep
140	377	55.4	17.9	M16 x 2; 20 deep
180	387	55.4	17.9	M16 x 2; 20 deep

Thread of all NG at U00 M16 x 2; 22 deep

B9 Flange ISO 3019-2 - 180 4-bolt
Coupler for splined shaft to ANSI B92.1a-1996 1 1/2in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))



Size	A_1	A_2	A_3	A_4[2] at U99
100	360	61.9	20.4	M16 x 2; 20 deep
140	377	61.9	20.4	M16 x 2; 20 deep
180	387	61.9	20.4	M16 x 2; 20 deep

Thread of all NG at U00 M16 x 2; 22 deep

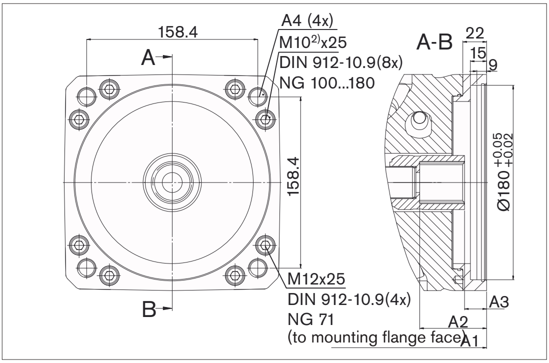
1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

2

Dimensions through drive

Before finalising your design request a certified installation drawing. Dimensions in mm.

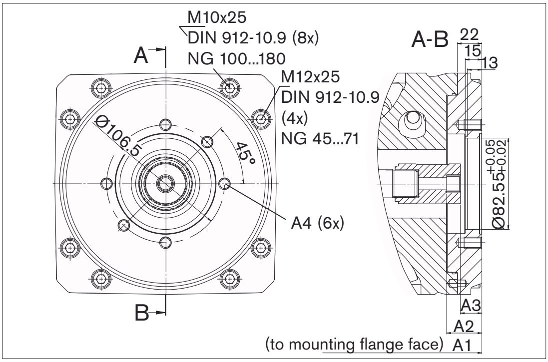
B7 Flange ISO 3019-2 - 180 4-bolt
Coupler for splined shaft to ANSI B92.1a-1996 1 3/4in 13T 8/16 DP[1] (SAE J744 - 44-4 (D))



Size	A_1	A_2	A_3	A_4[2] at U99
140	377	75	On request	M16 x 2; 20 deep
180	387	75	On request	M16 x 2; 20 deep

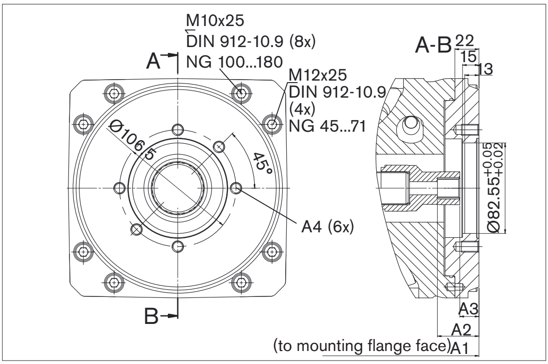
Thread of all NG at U00 M16 x 2; 22 deep

01 Flange ISO 3019-1 - 82-2 (A)
Coupler for splined shaft to ANSI B92.1a-1996 5/8in 9T 16/32 DP[1] (SAE J744 - 16-4 (A))



Size	A_1	A_2	A_3	A_4[2]
45	264	31.8	19.3	M10 x 1.5; 16 deep
71	299	31.8	19.3	M10 x 1.5; 16 deep
100	360	31.8	On request	M10 x 1.5; 16 deep
140	377	31.8	On request	M10 x 1.5; 16 deep
180	387	31.8	On request	M10 x 1.5; 16 deep

52 Flange ISO 3019-1 - 82-2 (A)
Coupler for splined shaft to ANSI B92.1a-1996 3/4in 11T 16/32 DP[1] (SAE J744 - 19-4 (A-B))



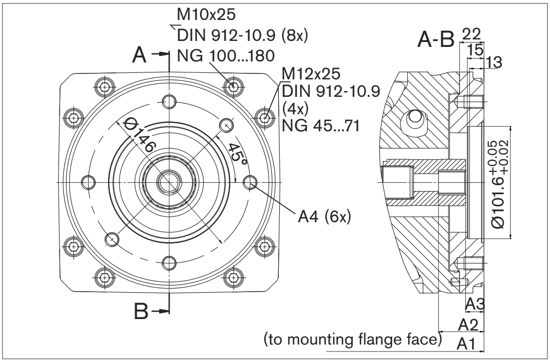
Size	A_1	A_2	A_3	A_4[2]
45	264	38	17.5	M10 x 1.5; 16 deep
71	299	38	17.5	M10 x 1.5; 16 deep
100	360	38	17.5	M10 x 1.5; 16 deep
140	377	38	17.5	M10 x 1.5; 16 deep
180	387	38	17.5	M10 x 1.5; 16 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

Dimensions through drive

Before finalising your design request a certified installation drawing. Dimensions in mm.

68 Flange ISO 3019-1 - 101-2 (B)
Coupler for splined shaft to ANSI B92.1a-1996 7/8in 13T 16/32 DP[1] (SAE J744 - 22-4 (B))

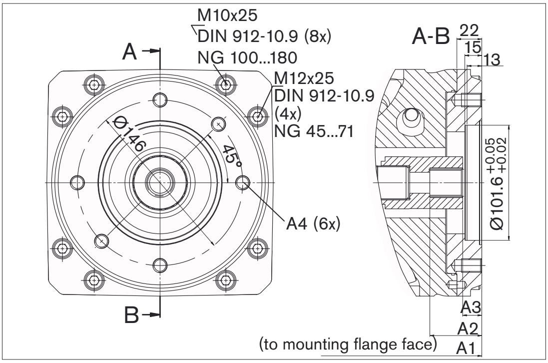


Size	A_1	A_2	A_3	A_4[2] at U99
45	264	41	16.5	M12 x 1.75; 22 deep
71	299	41	16.5	M12 x 1.75; 22 deep
100	360	41	16.5	M12 x 1.75; 18 deep
140	377	41	16.5	M12 x 1.75; 18 deep
180	387	41	16.5	M12 x 1.75; 18 deep

Thread of all NG at U00 M12 x 1.75; 22 deep

2

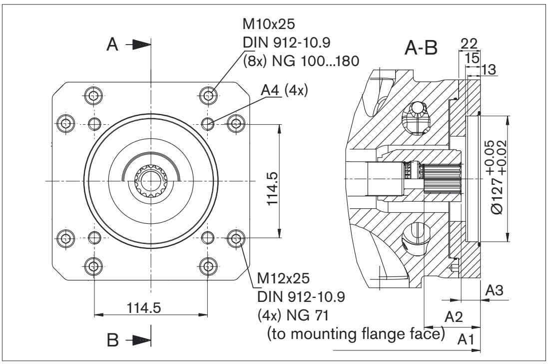
04 Flange ISO 3019-1 - 101-2 (B)
Coupler for splined shaft to ANSI B92.1a-1996 1in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))



Size	A_1	A_2	A_3	A_4[2] at U99
45	264	45.9	16.9	M12 x 1.75; 22 deep
71	299	45.9	16.9	M12 x 1.75; 22 deep
100	360	45.9	16.9	M12 x 1.75; 18 deep
140	377	45.9	16.9	M12 x 1.75; 18 deep
180	387	45.9	16.9	M12 x 1.75; 18 deep

Thread of all NG at U00 M12 x 1.75; 22 deep

E2 Flange ISO 3019-1 - 127-4 (C)
Coupler for splined shaft to ANSI B92.1a-1996 1 in 15T 16/32 DP[1] (SAE J744 - 25-4 (B-B))



Size	A_1	A_2	A_3	A_4[2] at U99
45	264	45.9	16.9	M12 x 1.75; 22 deep
71	299	45.9	16.9	M12 x 1.75; 22 deep
100	360	45.9	16.9	M12 x 1.75; 22 deep
140	377	45.9	16.9	M12 x 1.75; 15 deep
180	387	45.9	16.9	M12 x 1.75; 22 deep

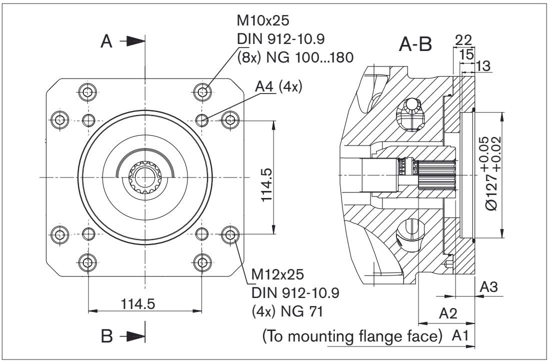
Thread of all NG at U00 M12 x 1.75; 22 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

Dimensions through drive

Before finalising your design request a certified installation drawing. Dimensions in mm.

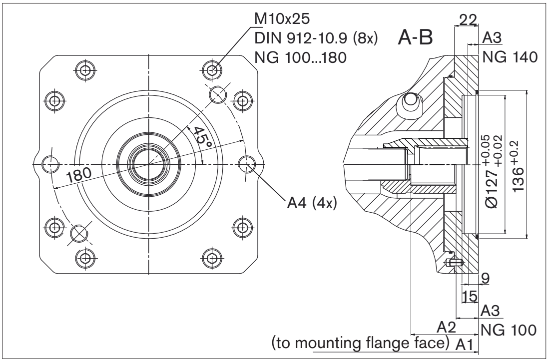
15 Flange ISO 3019-1 - 127-4 (C)
Coupler for splined shaft to ANSI B92.1a-1996 1 1/4in 14T 12/24 DP[1] (SAE J744 - 32-4 (C))



Size	A_1	A_2	A_3	A_4[2] at U99
71	299	55.4	17.9	M12 x 1.75; 22 deep
100	360	55.4	17.9	M12 x 1.75; 15 deep
140	377	55.4	17.9	M12 x 1.75; 15 deep
180	387	55.4	17.9	M12 x 1.75; 22 deep

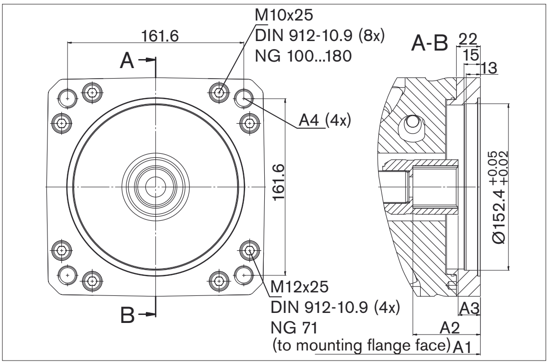
Thread of all NG at U00 M12 x 1.75; 22 deep

24 Flange ISO 3019-1 - 127-2 (C)
Coupler for splined shaft to ANSI B92.1a-1996 1 1/2in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))



Size	A_1	A_2	A_3	A_4[2]
100	360	61.9	20.4	M16 x 2; 22 deep
140	377	61.9	20.4	M16 x 2; 22 deep
180	387	61.9	20.4	M16 x 2; 22 deep

96 Flange ISO 3019-1 - 152-4 (D)
Coupler for splined shaft to ANSI B92.1a-1996 1 1/2in 17T 12/24 DP[1] (SAE J744 - 38-4 (C-C))



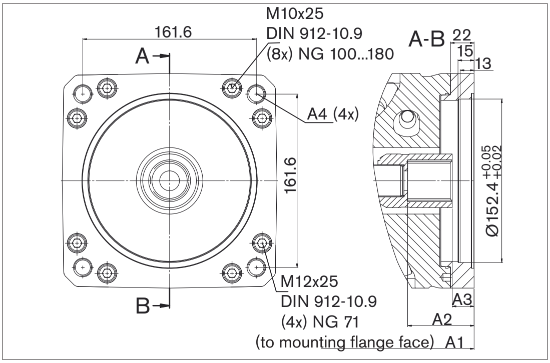
Size	A_1	A_2	A_3	A_4[2]
100	360	61.9	20.4	M16 x 2; 22 deep
140	377	61.9	20.4	M16 x 2; 22 deep
180	387	61.9	20.4	M16 x 2; 22 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

Dimensions through drive

Before finalising your design request a certified installation drawing. Dimensions in mm.

17 Flange ISO 3019-1 - 152-4 (D)
Coupler for splined shaft to ANSI B92.1a-1996 1 3/4in 13T 8/16 DP[1)] (SAE J744 - 44-4 (D))



Size	A_1	A_2	A_3	A_4[2)]
140	377	75	On request	M16 x 2; 22 deep
180	387	75	On request	M16 x 2; 22 deep

1) 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread according to DIN 13, for the maximum tightening torques the general information on page 44 must be observed.

Summary mounting options

The A10VSO is equipped with a flexible universal through drive. This enables the utilisation of various through drive options without any machining of the port plate. Details of the necessary adapter parts can be found in data sheet RE 95581.

Through drive - A10VSO			**Mounting option 2nd pump**			Through drive
Flange	Coupler for splined shaft	Code	A10VSO Size (shaft)	A10VO Size (shaft)	External gear pump Series (size)	available for size
ISO 3019-2						
ISO 80, 2-bolt	3/4 in	**B2**	10, 18 series 52/31 (S, R)			71 to 180
ISO 100, 2-bolt	7/8 in	**B3**	28 series 31 (S, R)			71 to 180
	1 in	**B4**	45 series 31 (S, R)			71 to 180
ISO 125, 4-bolt	1 in	**E1**	45 (S, R)			71 to 180
ISO 160, 4-bolt	1 1/4 in	**B8**	71 (S, R)			71 to 180
ISO 180, 4-bolt	1 1/2 in	**B9**	100 (S)			100 to 180
	1 3/4 in	**B7**	140 (S)			140 to 180
ISO 3019-1						
82-2(A)	5/8 in	**01**			F (5 to 22)	71 to 180
	3/4 in	**52**	10, 18 series 52/31 (S)			71 to 180
101-2(B)	7/8 in	**68**		28 series 31 (S, R)	N/G (26 to 49)	71 to 180
	1 in	**04**		45 series 31 (S, R)		71 to 180
127-4(C)	1 in	**E2**		45 (S, R)		45 to 180
127-4(C)	1 1/4 in	**15**		71 (S)		71 to 180
127-2(C)	1 1/2 in	**24**		100 (S)	PGH	100 to 180
152-4(D)	1 1/2 in	**96**		100 (S)		100 to 180
	1 3/4 in	**17**		140 (S)		140 to 180

2

Combination pumps A10VSO + A10VSO

Before finalising your design request a certified installation drawing. Dimensions in mm.

When using combination pumps it is possible to have multiple, mutually independent circuits without the need for a splitter gear-box.

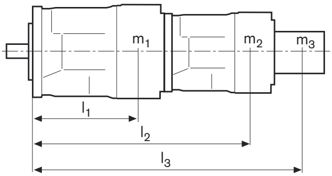
When ordering combination pumps the model codes for the first and the second pump must be joined by a „+“.

Ordering example: A10VSO100DR/32R-VPB32**UB8** + A10VSO71DRF/32R-VSB12N00

Permissible mass moment of inertia

It is permissible to use a combination of two single pumps of the same size (tandempump), considering a mass acceleration force of 10 g (98,1 m/s^2) without an additional support bracket.

Size			45	71	100	140	180
Perm. mass moment of inertia							
static	T_m	Nm	1370	3000	4500	4500	4500
dynamic at 10 g (98,1 m/s^2)	T_m	Nm	137	300	450	450	450
Weight	m	kg	30	47	69	73	78
Distance centre of gravity	l	mm	130	142	169	172	196



m_1, m_2, m_3	Weight of pumps	[kg]
l_1, l_2, l_3	Distance centre of gravity	[mm]

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \quad [\text{Nm}]$$

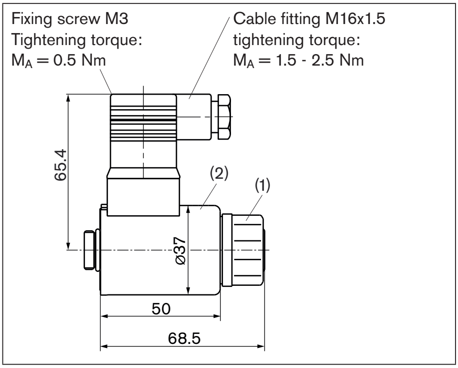
Connector for solenoides

HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

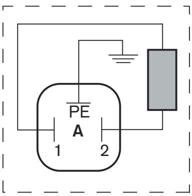
Without bidirectional suppressor diode ____________________ H
type of protection as per DIN/EN 60529_________________IP65

The sealing ring in the screw cable fitting is suitable for line diameters of 4.5 mm to 10 mm.

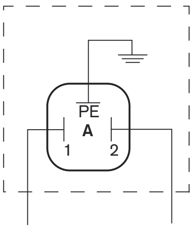
The line connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.
Bosch Rexroth material number: R902602623



Equipment connector as per DIN 43650



Line connector DIN EN 175301-803-A Wiring screw connector M 16x1.5



Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid.
   To do this, turn the mounting nut (1) one revolution counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the mounting nut of the solenoid.
   Tightening torque: 5+1 Nm. (size WAF26, 12-pt DIN 3124)

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

2

Electronic controls

Control	Electronics funktion	Electronics		Further information
Electric pressure control	Controlled power outlet	VT2000 1)	analog	RE 29 904
		VT 11029 1); VT 11030 1)	analog	RE 29741

1) only 24V nomilal voltage

Notes

Notes

Installation notes

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit empty via the hydraulic lines.

Especially with the installation position "drive shaft upwards" or "drive shaft downward", attention must be paid to a complete filling and air bleeding since there is a risk, for example, of dry running.

The case drain fluid in the case interior must be directed to the reservoir via the highest case drain port (L_1, $L_{2,}$ $_{L3}$).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating states, the suction line and case drain line must flow into the reservoir below the minimum fluid level . The permissible suction height h_S is a result of the overall pressure loss, but may not be greater than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

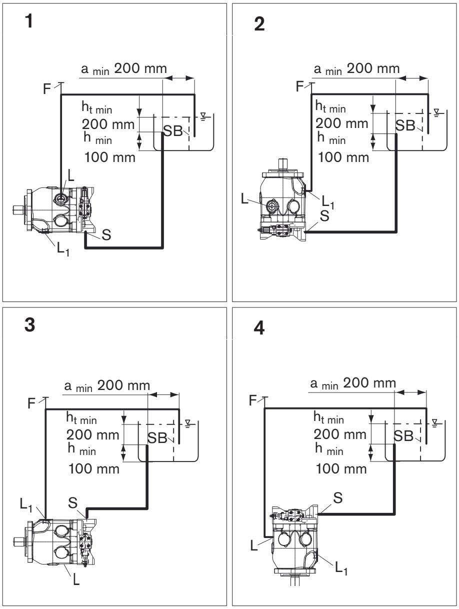
Installation position

See the following examples 1 to 12.
Additional installation positions are available upon request.

Recommended installation positions: 1 and 3.

Below-reservoir installation (standard)

Below-reservoir installation means the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1, 3	F	S + L, L_1 (F)
2, 4	F	S + L, L_1 (F)

Key, see page 43.

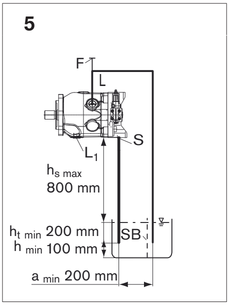
Installation notes

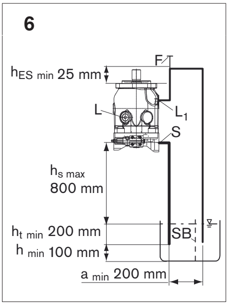
Above-reservoir installation

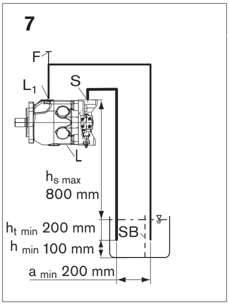
Above-reservoir installation means the axial piston unit is installed above the minimum fluid level of the reservoir. To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm is required in installation position 6

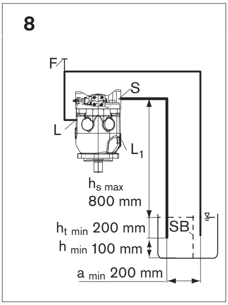
Observe the maximum permissible suction height $h_{S\ max} = 800$ mm.

A check valve in the case drain line is only permissible in individual cases. Consult us for approval.





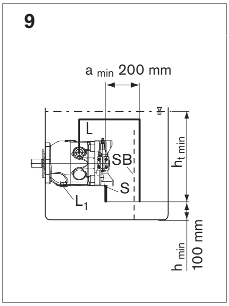


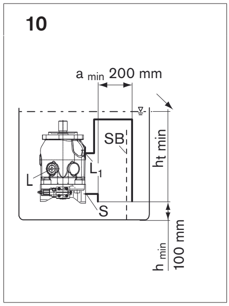


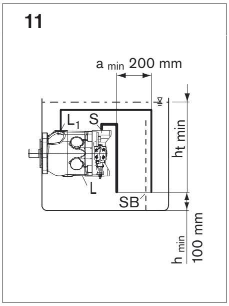
Installation position	Air bleed	Filling
5, 7	F	L, L_1 (F)
6, 8	F	S + L, L_1 (F)

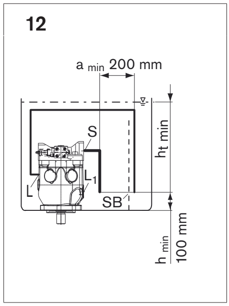
Inside-reservoir installation

Inside-reservoir installation means the pump is installed within the minimum reservoir fluid level.









Installation position	Air bleed	Filling
9, 11	L, L_1	L, L_1
10, 12	L, L_1	S + L, L_1

S	Filling / air bleeding
F	Air bleed port
S	Suction port
L, L_1	Case drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum necessary immersion depth (200 mm)
h_{min}	Minimum necessary spacing to reservoir base (100 mm)
$h_{ES\ min}$	Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
$h_{S\ max}$	Maximum permissible suction height (800 mm)
a_{min}	When designing the reservoir, ensure adequate distance between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

General information

– The A10VSO pump is designed to be used in open circuit.

– Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel.

– Before operating the axial piston unit, please read the appropriate operating instructions thoroughly and completely. If necessary, request these from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Service line ports:

  - The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

  - The service line ports and function ports are only designed to accommodate hydraulic lines.

  - Pressure cut-off and pressure control do not provide security against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.

  - Fixing screws:
    For fixing screws with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque individually according to VDI 2230.

  - Female threads in axial piston unit:
    The maximum permissible tightening torques MG_{max} are maximum values for the female threads and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metal threaded plugs supplied with the axial piston unit, the required tightening torques of the threaded plugs MV apply. For values, see the following table.

Ports Standard	Thread size	Maximum permissible tightening torque for female threads $M_{G\,max}$	Required tightening torque for the plugs M_V	WAF hexagon socket of the plugs
DIN ISO 228	G 1/4 in	70 Nm	–	–
ISO 11926	7/16-20 UNF-2B	40 Nm	15 Nm	3/16 in
	1 1/16-12 UNF-2B	360 Nm	147 Nm	9/16 in
DIN 3852	M14x1.5	80 Nm	35 Nm	6 mm
	M16x1.5	100 Nm	50 Nm	8 mm
	M18x1.5	140 Nm	60 Nm	8 mm
	M22x1.5	210 Nm	80 Nm	10 mm
	M27x2	330 Nm	135 Nm	12 mm

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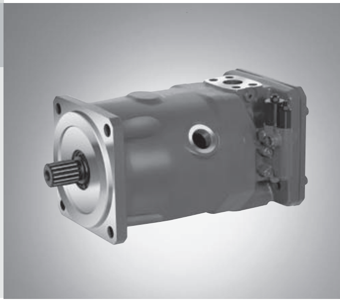
Rexroth
Bosch Group

Axial Piston Variable Pump A10VSNO

RE 92740/07.10 1/16

Data sheet



Series 32
Size 63
Nominal pressure 210 bar
Maximum pressure 250 bar
Open circuit

Contents

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DR – Pressure control	8
DRG – Pressure control remotely operated	9
DRS – Pressure and flow control	10
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General information	16

Features

– Variable pump in axial piston swashplate design
– The flow is proportional to the drive speed and the displacement
– Hydrostatic unloading of the cradle bearings
– Low noise level
– Low pressure pulsations
– High efficiency
– Compact design
– Excellent power to weight ratio
– Proven A10 rotary group technology

Type code for standard program

A10VSN	O	63		/	32		–	V		B	12	N00
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swashplate design, variable, nominal pressure 210 bar, maximum pressure 250 bar	**A10VSN**

Type of operation

02	Pump, open circuit	**O**

Size (NG)

03	Theoretical displacement $V_{g\ max}$ in cm^3 see table of values page 5	**063**

Control devices

				063	
04	Two point control	directly operated		●	**DG**
	Pressure control			●	**DR**
		hydraulic remotely operated		●	**DRG**
		with flow control hydraulic	X-T closed with flushing function	●	**DRS**

Series

		063	
05	Series 3, Index 2	●	**32**

Direction of rotation

			063	
06	With view on drive shaft	clockwise	●	**R**
		counter clockwise	●	**L**

Seals

		063	
07	FKM (Fluoro rubber)	●	**V**

Drive shaft

		063	
08	Splined shaft for higher torques to SAE J744	●	**R**
	Parallel keyed shaft to DIN 6885	●	**P**

Mounting flange

09	ISO 3019-2 – 4-bolt	**B**

Ports for service lines

		063	
10	SAE flange on top and at the bottom, opposite, Metric fixing threads	●	**12**
	SAE flange on top and at the bottom, opposite, Metric fixing thread, with universal through drive	❍	**22U**

Through drive[1)]

		063	
11	Without through drive	●	**N00**
	With through drive shaft, without shaft coupler, without adapter flange, closed with proper cover	❍	**00**

● = available ❍ = on request – = not available

1) For through drives and mounting options see RE 92714

Technical data

Fluid

Prior to project design please observe the extensive information on the selection of hydraulic fluids in our data sheets RE 90220 (mineral oil), RE 90221 (ecologically acceptable fluids) and RE 90223 (HF-fluids) .

When using HF- or ecologically acceptable fluids possible limitations on the technical data may be applicable, if necessary please consult us (when ordering please state the type of fluid to be used in clear text).

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected within the range

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

referred to the reservoir temperature (open circuit).

Limits of viscosity range

For extreme operating conditions the following limits apply:

ν_{min} = 10 mm²/s
short term ($t \leq 1$ min)
at max.permissible case drain temperature of 90 °C.

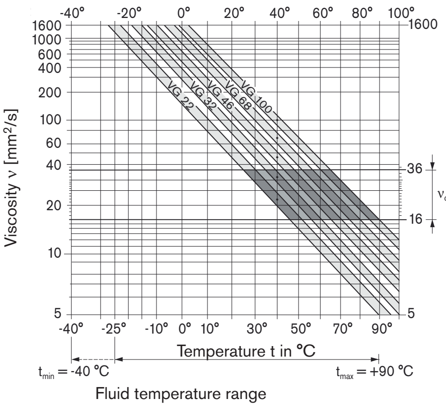
Please note, that the max. case drain temperature of 90 °C is also not exceeded in certain areas (eg. bearing area). The temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

ν_{max} = 1000 mm²/s
short term ($t \leq 1$ min)
on cold start
($t_{min} = p \leq 30$ bar, $n \leq 1000$ rpm, -25 °C)

At temperatures between -25 °C and -40 °C special measures may be required for certain installation positions, please contact us for further information.

For detailed information on operation at very low temperatures see RE 90300-03-B.

Selection diagram



Notes on the selction of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambiet temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selction diagram). We recommend that the higher viscosity grade should be selected in each case.

Example: At an ambient temperature of X °C the fluid temperature in the tank is 60 °C. In the optimum viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 or VG 68; VG 68 should be selected.

Important
The case drain temperature is influenced by pressure and speed and is typically higher than the tank temperature. However max. temperature at any point of the component may not exceed 90 °C.

If the above mentioned conditions cannot be kept due to extreme operating parameters or high ambient temperatures please consult us.

Filtration of fluid

The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston unit.

In order to guarantee a reliable function of the axial piston unit a gravimetric evaluation of the fluid to determine the particle contamination and the cleanliness class to ISO 4406 is necessary. A cleanliness class of at least 20/18/15 is necessary.
At very high fluid temperatures (90°C to maximum 115 °C) a cleanliness class of at least 19/17/14 to ISO 4406 is necessary.

If above mentioned cleanliness classes cannot be met please consult us.

Technical data

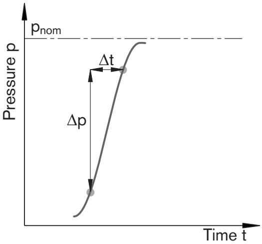
Operating pressure range

Pressure at outlet port (pressure port) B

Nominal pressure p_{nom} ______ 210 bar absolute

Maximum pressure p_{max} ______ 250 bar absolute
Individual operating period ______ 2.0 ms
Total operating period ______ 300 h
Minimum pressure**(high pressure side)** ______ 10 bar[2)]

Rate of pressure change $R_{A\ max}$ ______ 16000 bar/s



To safeguard against over pressure pump safety blocks to RE 25880 and RE 25890 for direct mounting onto the SAE flange ports can be ordered separately.

Pressure at suction port S (inlet)

Inlet pressure

At 1800 rpm
Minimum suction pressure $p_{abs\ min}$ ______ 0.8 bar absolute

Maximum suction pressure $p_{abs\ max}$ ______ 5 bar[1)] absolute

Case drain pressure

Maximum permissible case drain pressure
(at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ ______ 2 bar[1]

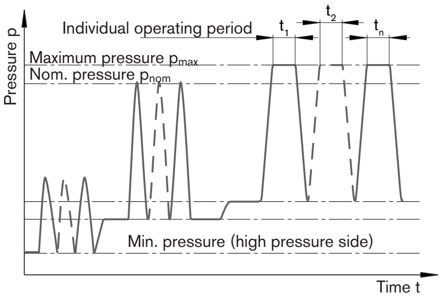
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum pressure within the individual operating period. The total of the individual operating periods must not exceed the total operating period.

Minimum pressure (in pump outlet)
Minimum pressure in the pump outlet side (port B) that is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period $= t_1 + t_2 + ... + t_n$

1) Other values on request

2) Lower pressure, depends on timeframe, please consult us.

Technical data

Tables of value (theoretical values, without efficiencies and tolerances: values rounded)

Size			NG	63
Displacement		$V_{g\,max}$	cm^3	63
Speed[1]				
maximum at $V_{g\,max}$		$n_{o\,max}$	rpm	1800
Flow				
at $n_{o\,max}$ and $V_{g\,max}$		$q_{vo\,max}$	L/min	113
at $n_E = 1500$ rpm		$q_{vE\,max}$	L/min	94
Power				
at $n_{o\,max}$, $\Delta p = 210$ bar		P_{max}	kW	39
at $n_E = 1500$ rpm		P_{max}	kW	33
Torque				
at $V_{g\,max}$ and	$\Delta p = 210$ bar	T_{max}	Nm	210
	$\Delta p = 100$ bar	T	Nm	100
Torsionsl stiffness	Drive shaft P	c	Nm/rad	41232
	Drive shaft R	c	Nm/rad	41025
Moment of inertia rotary group		J_{TW}	kgm^2	0.004
Case volume		V	L	1.0
Weight (without fluid fill) approx.		m	kg	30

1) The values are applicable for a pressure of 0,8 bar at suction port S and mineral hydraulic fluid.

Important

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible data.

Determination of size

Flow $$q_V = \frac{V_g \bullet n \bullet \eta_V}{1000} \quad [L/min]$$

Torque $$T = \frac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}} \quad [Nm]$$

Power $$P = \frac{2\pi \bullet T \bullet n}{60000} = \frac{q_V \bullet \Delta p}{600 \bullet \eta_t} \quad [kW]$$

V_g = Geometr. displacement per revolution in cm^3
Δp = Pressure differential in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \bullet \eta_{mh}$)

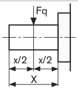
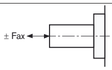
Mechanical flow limitation

Versions with port plate 22 (optional through drive plate) are not available with mechanical flow limitation. The max. displacement as stated in the order will be set to a fixed value .

Please state the desired $V_{g\,min}$ or $V_{g\,max}$ values in clear text.

Technical data

Permissible radial and axial forces on the drive shaft

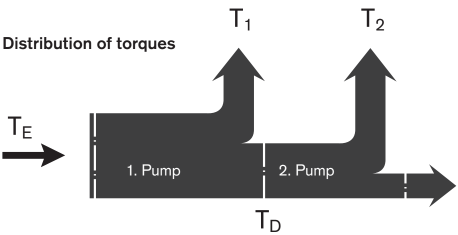
Size			NG		63
Radial force, maximum		at X/2	$F_{q\,max}$	N	1000
Axial force, maximum			$F_{ax\,max}$	N	1000

Permissible input and through drive torques

Size		NG	63
Torque, max. (at $V_{g\,max}$ and $\Delta p = 210$ bar[1])	T_{max}	Nm	210
Input torque with drive shaft maximum[2]			
P	$T_{E\,perm}$	Nm	210
DIN 6885		mm	25
R	$T_{E\,perm}$	Nm	400
SAE J744 (ANSI B92.1a-1996)		in	1
Through drive torque, maximum			
with drive shaft R	$T_{D\,perm}$	Nm	365

1) Without considering efficiency
2) For drive shafts without radial load

Distribution of torques



DG – Zweipunktverstellung direktgesteuert

The pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroking piston; a minimum pressure of $p_{st} \geq 50$ bar is required.

The pump can only be switched between $V_{g\ max}$ or $V_{g\ min.}$

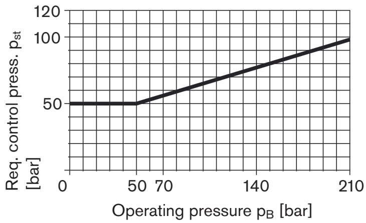
Please note, that the required control pressure at port X is directly dependent on the actual operating pressure p_B in port B. (see control pressure diagram).

Control pressure p_{st} in X = 0 bar $\triangleq V_{g\ max}$

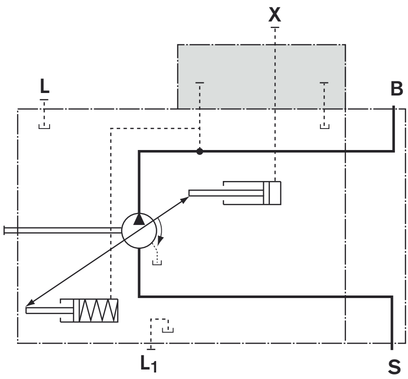
Control pressure p_{st} in X ≥ 50 bar $\triangleq V_{g\ min}$

The max. permissible control pressure amounts to p_{st} = 120 bar.

Control pressure diagram



Schematic



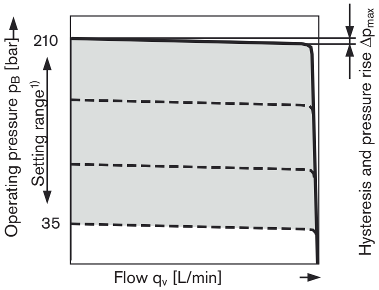
	Port for
B	Service line
S	Suction
L, L₁	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)

DR – Pressure control

The DR-pressure control limits the maximum pressure at the pump outlet within the pump's control range. The pump therefore supplies only the amount of fluid as required by the actuators. This maximum pressure level can be set steplessly at the control valve.

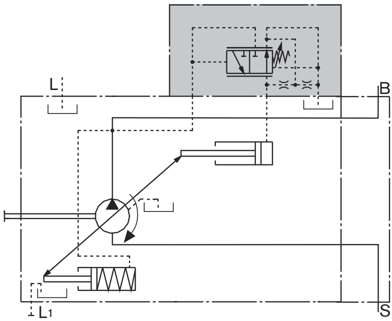
Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)



1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Schematic



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)

Control data

Hysteresis and repeatability Δp ________________ max. 3 bar

Pressure rise, max

Size		63
Δp	bar	6

Control fluid consumption____________ max. approx. 3 L/min

DRG – Pressure control remotely operated

The DR-pressure control (see page 8) is overriding this DRG-remote setting of max. outlet pressure.

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the pump supply.

The differential pressure at the DRG-control spool is set as standard to20 bar. This results in a pilot oil flow to the relief valve of approx. 1,5 L/min. If another setting is required (range from 10-22 bar) please state in clear text.

As a separate relief valve we can recommend:

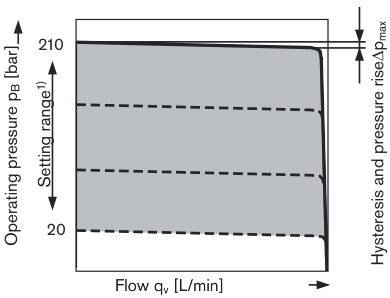
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice dia. 0,8 mm in P (electric)to RE 29166.

The max. lenght of piping should not exceed 2 m.

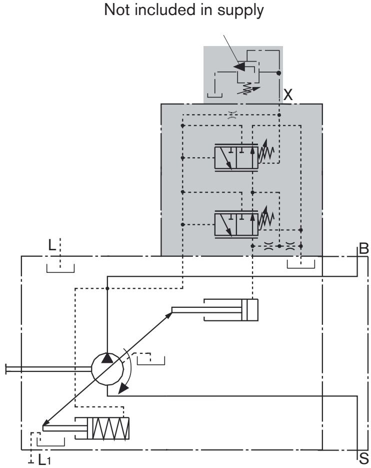
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50°C)



1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Schematic DRG



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)
M_B	Measuring operating pressure (plugged)

Control data

Hysteresis and repeatability Δp ________________ max. 3 bar

Pressure rise, max

Size		63
Δp	bar	6

Control fluid consumption____________max. approx. 4.5 L/min

2

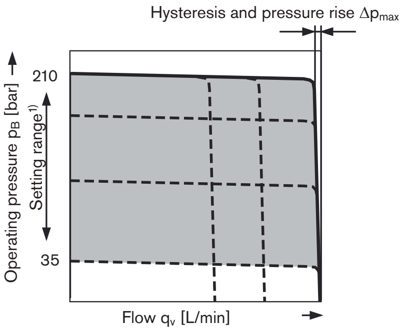
DRS – Pressure and flow control

In additon to the pressure control function (see page 8), the pump flow may be varied by means of a differential pressure over an orifice or valve spool installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

The pressure control overrides the flow control function.

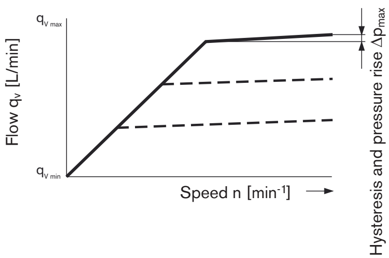
Note
The DRS-valve version has no connection between X and the tank (pump housing).
Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

Static characteristic
Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)

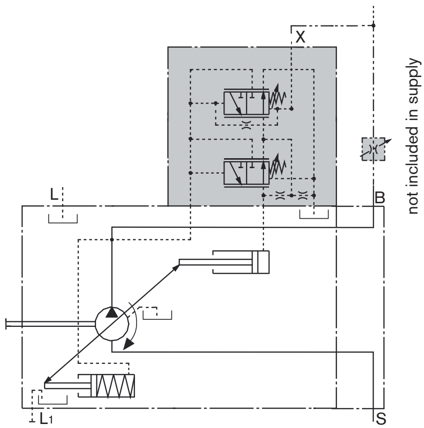


1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Static characteristic at variable speeds



Schematic



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)

Differential pressure Δp:

Standard setting: 14 to 22 bar.

If another setting is required, please state in clear text.
Unloading port X to tank (with outlet port B closed) results in a zero stroke (standby) pressure which lies about 1 to 2 bar higher than the Δp setting).

Controller data

Data pressure control DR see page 8
Maximum flow deviation measured with drive speed n = 1500 rpm.

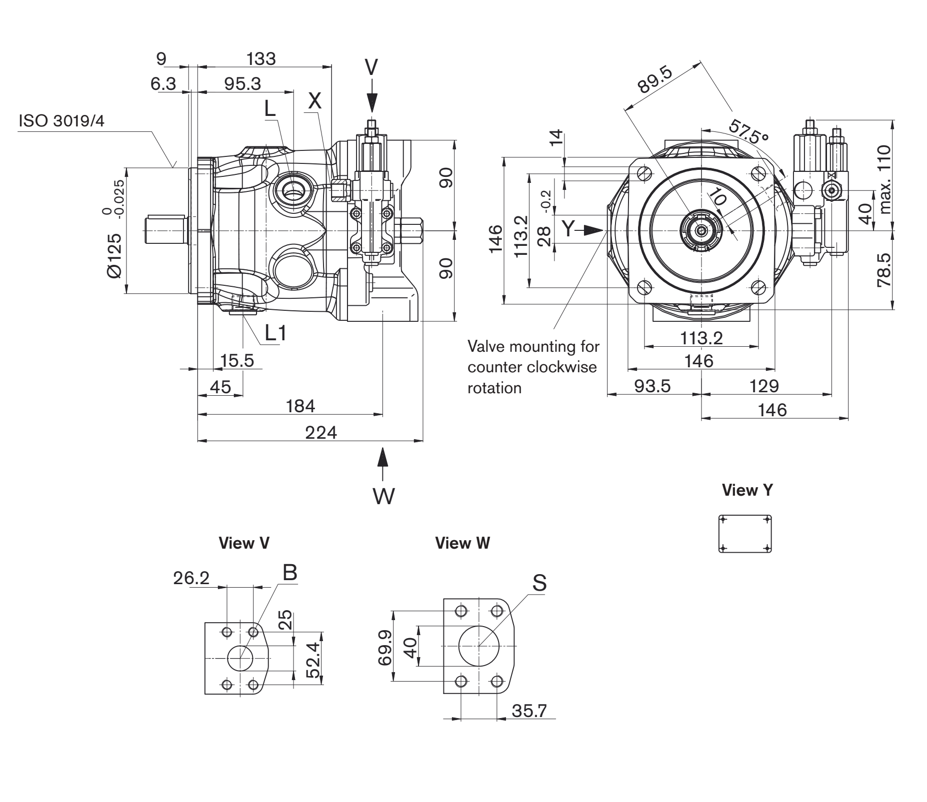
Size		**63**
$\Delta q_{v\,max}$	L/min	1.8

Control fluid consumption DRF __ max. approx. 3 bis 4.5 L/min
Control fluid consumption DRS________ max. approx. 3 L/min

Dimensions size 63

Before finalising your design request a certified installation drawing. Dimensions in mm

DRS Pressure and flow control



2

Ports

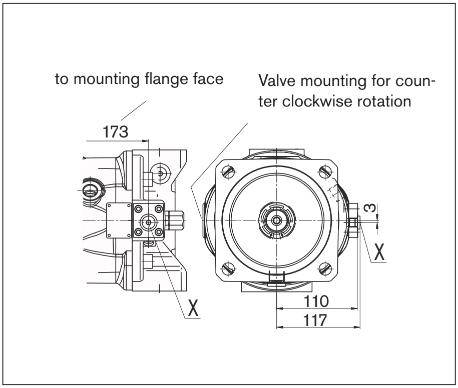
Designation	Port for	Standard	Size [1]	Maximum pressure [bar] [2]	State
B	Service line (standard pressure range) Fixing thread	SAE J518 DIN 13	1 in M10 x 1.5; 17 deep	250	O
S	Suction (standard pressure range) Fixing thread	SAE J518 DIN 13	1 1/2 in M12 x 1.75; 20 deepf	5	O
L	Case drain fluid	DIN 3852[4]	M 22 x 1.5; 14 deep	2	O [3]
L_1	Case drain fluid	DIN 3852[4]	M 22 x 1.5; 14 deep	2	plugged [3]
X	Load sensing pressure	DIN 3852	M14x1.5; 12 deep	250	O
X	Control pressure for DG control	DIN 3852	G 1/4 in	250	O

1) For the maximum tightening torques the general information on page 14 must be observed.
2) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
3) Depending on the installation postion, L or L_1 must be connected
4) The spot face can be deeper than as specified in the standard.
O = Must be connected (plugged on delivery)

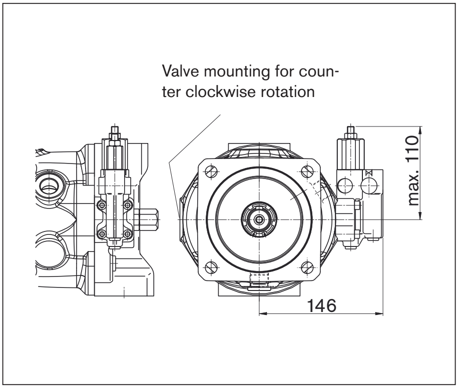
Dimensions size 63

Before finalising your design request a certified installation drawing. Dimensions in mm

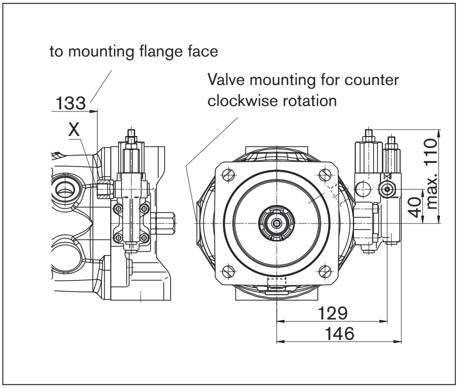
DG - Two point control, directly operated



DR - Pressure control

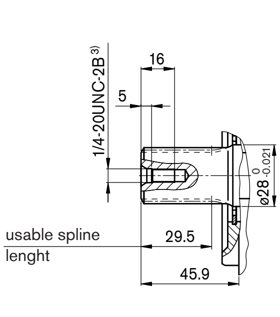


DRG - Pressure control, remotely operated

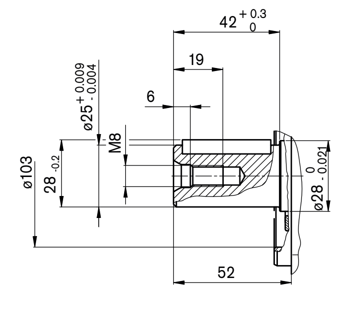


Drive shaft

R Splined shaft 1 in 15T 16/32 DP[1)] SAE J744 – 25-4 (B-B)



P Parallel keyed shaft DIN 6885



1) ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread in drive shaft „P“ to DIN 332.
3) For the maximum tightening torques the general information on page 14 must be observed.

Notes

Installation notes

General

The pump housing must be filled with fluid and deaerated during commissioning and operation. This is also to be observed, following a longer standstill periode as the system may empty via the hydraulic lines.

Especially with the installation position „drive shaft upwards or drive shaft downwards“ attention must be paid to a complete filling and deaeration, since there is a risk, that the bearings and shaft seal run dry and overheat therefore.

The highest of the case drain ports must be connected to tank with piping material for standard pressure rating suitable for the port size. In order to obtain the lowest noise level, all connections (inlet, outlet, and case drain line) must be linked by flexible members to the tank. Also, avoid above-tank installation.

In case of a combination pump with different case drain pressures make sure, that each pump has it‘s own case drain line to tank

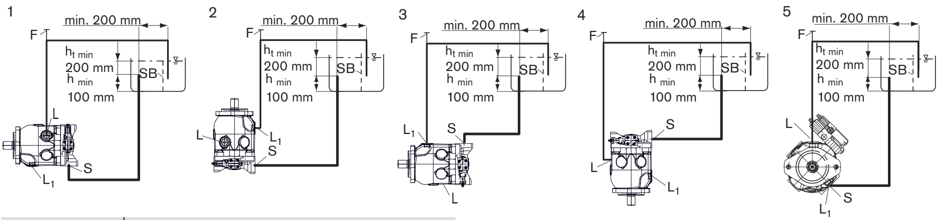
In all operating conditions, the suction line and case drain line must flow into the tank below the minimum fluid level ($h_{t\ min} = 200$ mm). The permissible suction height h is a result of the overall pressure loss, but may not be greater than $h_{max} = 800$ mm. Under static and dynamic loading the suction pressure at port S may not be below $p_{abs\ min} = 0{,}8$ bar absolute.

Installation position

See the following examples 1 to 15. Recommended positions: 1 and 3.
Other installation positions are also possible, please consult us.

Mounting below the reservoir (standard)

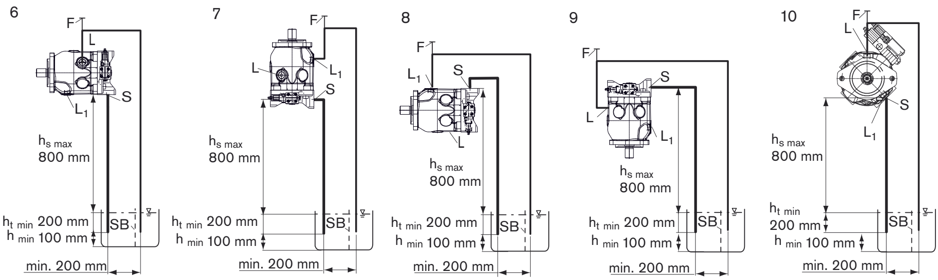
Mounting below the reservoir means, that the pump is mounted below the minimum fluid level. The pump can be mounted next to or below the reservoir.



installation position	Air bleed	Filling
1, 3 and 5	F	S + L, L_1 (F)
2 and 4	F	S + L, L_1 (F)

Installation above the reservoir

Installation above the reservoir means, that the pump is mounted above the minimum fluid level. A check valve in the case drain line is only permissible in individual cases. Consult us for approval



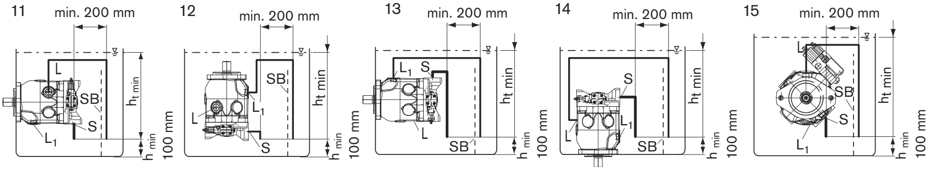
Installation position	Air bleed	Filling
6, 8 and 10	F	L, L_1 (F)
7 and 9	F	S + L, L_1 (F)

L/L_1 = case drain port, F = air bleed or filling port, S = suction port, SB = Baffle, $h_{t\ min}$ = minimum permissible immersion depth, $h_{S\ max}$ = maximum permissible suction height

Installation notes

Mounting inside the reservoir

Mounting inside the reservoir means, that the pump is mounted within the minimum fluid level.



Installation position	Air bleed	Filling
11, 13 und 15	L, L_1	L, L_1
12 und 14	L, L_1	S + L, L_1

L/L_1 = case drain port, F = air bleed or filling port, S = suction port, SB = baffle, $h_{t\,min}$ = minimum permissible immersion depth, $h_{t\,max}$ = maximum permissible suction height

General information

– The A10VSNO pump is designed to be used in open circuit.

– Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel

– Before operating the axial piston unit, read the appropriate operating instructions thoroughly and completely. If needed, request these from Rexroth.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Pressure ports:
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

– Pressure cut off and pressure control are not suitable for providing system protection against excessive pressures.A suitable overall main line relief valve must be incorporated.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849

– The following tightening torques apply:

- Female threads in axial piston unit:
The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.

- Fittings:
Observe the manufacturer‘s instructions regarding the tightening torques of the used fittings.

- Fixing screws:
For fixing screws according to DIN 13, we recommend checking the tightening torque individually according to VDI 2230.

- Plugs:
For the metal plugs, supplied with the axial piston unit, the required tightening torques of plugs M_V apply.
For values, see the following table

Thread size of ports		**Maximum permissible tightening torque for female threads $M_{G\ max}$**	**Required tightening torque for the plugs M_V**	**WAF hexagon socket of the plugs**
G 1/4 in	DIN 3852	70 Nm		
7/16-20 UNF-2B	ISO 11926	40 Nm	15 Nm	3/16 in
1 1/16-12 UNF-2B	ISO 11926	360 Nm	147 Nm	9/16 in
M14x1,5	DIN 3852	80 Nm	35 Nm	6 mm
M16x1,5	DIN 3852	100 Nm	50 Nm	8 mm
M18x1,5	DIN 3852	140 Nm	60 Nm	8 mm
M22x1,5	DIN 3852	210 Nm	80 Nm	10 mm
M27x2	DIN 3852	330 Nm	135 Nm	12 mm

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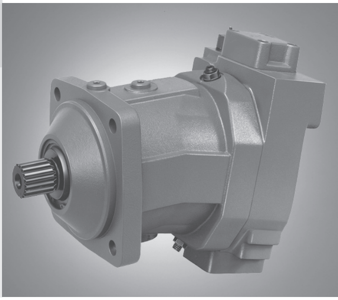
Rexroth
Bosch Group

Axial Piston Variable Pump A7VO

RE 92202/05.12 1/36
Replaces: 12.07



Data sheet

Series 63
Size 28 to 160
Nominal pressure 350 bar
Maximum pressure 400 bar
Open circuit

Contents

Ordering code for standard program	2
Technical data	4
LR – Power controller	9
DR – Pressure controller	12
HD – Proportional control hydraulic	15
EP – Proportional control electric	17
Dimensions size 28	18
Dimensions size 55	21
Dimensions size 80	24
Dimensions size 107	27
Dimensions size 160	30
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Installation instructions	34
General instructions	36

Features

- Variable pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open circuit
- For use in mobile and stationary applications
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the bent axis.
- Wide selection of control devices
- Compact, robust pump with long service life

Ordering code for standard program

A7V	O			/	63		–	V		B	01		
01	02	03	04		05	06		07	08	09	10	11	12

Axial piston unit

01	Bent-axis design, variable, nominal pressure 350 bar, maximum pressure 400 bar	A7V

Operating mode

02	Pump, open circuit	O

Sizes (NG)

03	Geometric displacement, see table of values on page 7	28	55	80	107	160
	Sizes 250, 355 and 500 See RE 92203					

Control devices

				28	55	80	107	160	
04	Power controller			●	●	●	●	●	LR
	with pressure cut-off			●	●	●	●	●	LRD
	with stroke limiter	negative control	Δp = 25 bar	–	●	●	●	●	LRH1
	with pressure cut-off and stroke limiter	negative control	Δp = 25 bar	–	●	●	●	●	LRDH1
	Pressure controller			●	●	●	●	●	DR
	remote controlled			●	●	●	●	●	DRG
	with load sensing			–	●	●	●	●	DRS
	Proportional control hydraulic	positive control	Δp = 10 bar	●	●	●	●	●	HD1
			Δp = 25 bar	●	●	●	●	●	HD2
	with pressure cut-off, remote controlled	positive control	Δp = 10 bar	●	●	●	●	●	HD1G
			Δp = 25 bar	●	●	●	●	●	HD2G
	Proportional control electric , without manual override	positive control	U = 24 V DC	●	●	●	●	●	EP2
	with pressure cut-off, remote controlled	positive control	U = 24 V DC	●	●	●	●	●	EP2G

Series

05	Series 6, index 3	63

Directions of rotation

			28 to 160	
06	Viewed on drive shaft	clockwise	●	R
		counter-clockwise	●	L

Seals

07	FKM (fluor-caoutchouc)	V

Drive shafts

		28 to 160	
08	Splined shaft DIN 5480	●	Z
	Parallel keyed shaft DIN 6885	●	P

Mounting flange

09	ISO 3019-2 – 4 hole	B

Port plate for service lines

10	SAE flange port A and S at rear (fastening thread metric)	01

● = Available – = Not available ▢ = Preferred program

Ordering code for standard program

A7V	O			/	63		–			B	01		
01	02	03	04		05	06		07	08	09	10	11	12

Connector for solenoids (see page 33)

11	Without connector (without solenoid, only with hydraulic controls; without code)	
	DEUTSCH - molded connector, 2 pin – without suppressor diode[1]	**P**

Standard / special version

12	Standard version (without code)	
	Special version	**-S**

2

● = Available – = Not available = Preferred program

1) Other connectors on request

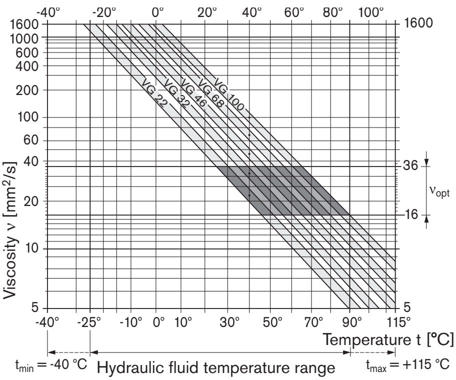
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and
RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump A7VO is not suitable for operation with HFA hydraulic fluid. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choise of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see the shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq -50$ °C $T_{opt} = +5$ °C to $+20$ °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up[1]	$\nu_{max} = 1600$	$T_{St} \geq -40$ °C	$t \leq 3$ min, without load ($p \leq 50$ bar), $n \leq 1000$ rpm
Permissible temperature difference		$\Delta T \leq 25$ K	between axial piston unit and hydraulic fluid
Warm-up phase	$\nu < 1600$ to 400	$T = -40$ °C to -25 °C	at $p \leq 0.7 \cdot p_{nom}$, $n \leq 0.5 \cdot n_{nom}$ and $t \leq 15$ min
Operating phase			
Temperature difference		$\Delta T =$ approx. 12 K	between hydraulic fluid in the bearing and at port R_1/R_2. The bearing temperature can be reduced by flushing via port U.
Maximum temperature		115 °C	in the bearing
		103 °C	measured at port R_1/R_2
Continuous operation	$\nu = 400$ to 10 $\nu_{opt} = 36$ to 16	$T = -25$ °C to $+90$ °C	measured at port R_1/R_2, no restrictions within the permissible data
Short-term operation	$\nu_{min} \geq 7$	$T_{max} = +103$ °C	measured at port R_1/R_2, $t < 3$ min, $p < 0.3 \cdot p_{nom}$
FKM shaft seal[1]		$T \leq +115$ °C	see page 5

1) At temperatures below −25°C, an NBR shaft seal is required (permissible temperature range: −40 °C to +90 °C).

Technical data

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

Case drain fluid

The case drain chamber is connected to the suction chamber. A case drain line from the case to the reservoir is not required (both ports "R" are plugged).
For versions with pressure controller or pressure cut-off, a case drain line for discharge from port T_1 to the reservoir is absolutely essential.

Direction of flow

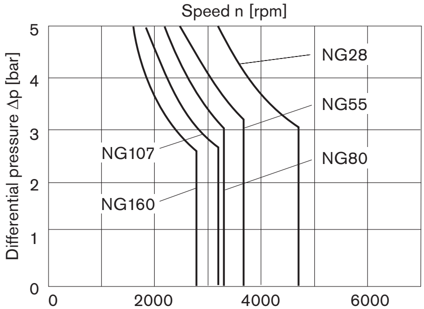
Direction of rotation, view on drive shaft	
clockwise	**counter clockwise**
S to **B**	**S** to **A**

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.



These values are valid for an ambient pressure $p_{abs} = 1$ bar.

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

2

Technical data

Operating pressure range
(Operating with mineral oil)

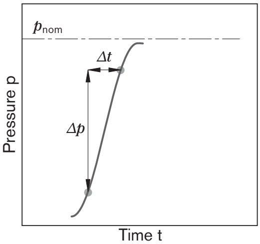
Pressure at service line port A

Nominal pressure p_{nom} ________________ 350 bar absolute

Maximum pressure p_{max} ________________ 400 bar absolute
Single operating period ________________ 10 s
Total operating period at n_{nom} ________________ 300 h

Minimum pressure (high-pressure side) ___ 10 bar absolute

Rate of pressure change $R_{A\ max}$ ____________ 16000 bar/s



Pressure at suction port S (Inlet)
Minimum pressure $p_{S\ min}$ ________________ 0.8 bar absolute
Maximum pressure $p_{S\ max}$ ________________ 2 bar absolute

Note
Values for other hydraulic fluids, please contact us.

Definition

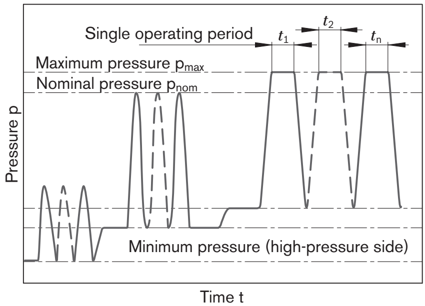
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Minimum pressure (Inlet)
Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed and displacement of the axial piston unit (see diagram on page 7).

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

Please contact us if these conditions cannot be satisfied.

Technical data

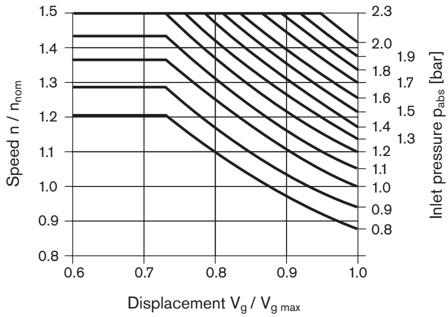
Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size		NG		28	55	80	107	160
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	28.1	54.8	80	107	160
Speed maximum[1]	at $V_{g\,max}$	n_{nom}	rpm	3150	2500	2240	2150	1900
	at $V_g < 0.74 \cdot V_{g\,max}$[2]	n_{max1}	rpm	4250	3400	3000	2900	2560
Speed maximum[2]		n_{max2}	rpm	4750	3750	3350	3200	2850
Flow	at n_{nom} and $V_{g\,max}$	q_V	L/min	89	137	179	230	304
Power	at n_{nom}, $V_{g\,max}$ and $\Delta p = 350$ bar	P	kW	52	80	105	134	177
Torque	at $V_{g\,max}$ and $\Delta p = 350$ bar	T	Nm	156	305	446	596	891
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	Nm/rad	5546	10594	15911	21469	36073
	$V_g/2$ to 0 (interpolated)	c_{max}	Nm/rad	16541	32103	48971	67666	104622
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0042	0.0042	0.0080	0.0127	0.0253
Maximum angular acceleration		α	rad/s^2	35900	31600	24200	19200	15300
Case volume		V	L	0.5	0.75	1.2	1.5	2.4
Mass approx.		m	kg	17	25	40	49	71

2

1) The values are valid:
- at an absolute pressure $p_{abs} = 1$ bar at suction port S
- for the optimum viscosity range from $\nu_{opt} = 36$ to 16 mm^2/s
- with hydraulic fluid based on mineral oils

2) Maximum speed (limiting speed) with increased inlet pressure p_{abs} at the suction port S and $V_g < V_{g\,max}$, see the following diagram.



Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

Determining the operating characteristics

Flow $$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{[L/min]}$$

Torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{[Nm]}$$

Power $$P = \frac{2\,\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces of the drive shafts

Size	NG		28	55	80	107	160
Drive shaft	Ø	mm	25	30	35	40	45
Maximum radial force at distance a (from shaft collar)	$F_{q\,max}$	N	5696	9280	11657	13580	18062
	a	mm	12.5	15	17.5	20	22.5
Maximum axial force[1]	$+F_{ax\,max}$	N	315	500	710	900	1120
	$-F_{ax\,max}$	N	0	0	0	0	0
Permissible axial force per bar of operating pressure	$\pm F_{ax\,per}$ /bar	N/bar	4.6	7.5	9.6	11.3	15.1

1) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.

Note
Influence of the direction of the permissible axial force:

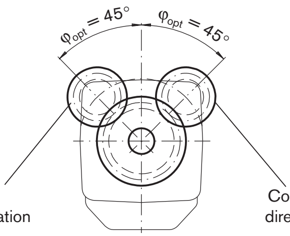
$+F_{ax\,max}$ = Increase in service life of bearings

$-F_{ax\,max}$ = Reduction in service life of bearings (avoid)

Effect of radial force F_q on the service life of bearings

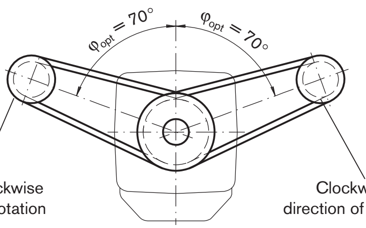
By selecting a suitable direction of radial force F_q, the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Example:

Toothed gear drive



Clockwise direction of rotation
Pressure at port **B**

V-belt drive



Counter-clockwise direction of rotation
Pressure at port **A**

Clockwise direction of rotation
Pressure at port **B**

LR – Power controller

The power controller regulates the displacement of the pump depending on the operating pressure so that a given drive power is not exceeded at constant drive speed.

$$p_B \cdot V_g = \text{constant}$$

p_B = operating pressure; V_g = displacement

The precise control with a hyperbolic control characteristic, provides an optimum utilization of available power.

The operating pressure acts on a rocker via a measuring piston. An externally adjustable spring force counteracts this, it determines the power setting.

If the operating pressure exceeds the set spring force, the control valve is actuated by the rocker, the pump swivels back (direction $V_{g\,min}$). The lever length at the rocker is shortened and the operating pressure can increase at the same rate as the displacement decreases without the drive powers being exceeded ($p_B \cdot V_g$ = constant).

When depressurized, the pump is swiveled to its initial position $V_{g\,max}$ by a return spring.

Setting range for beginning of control________ 50 to 220 bar

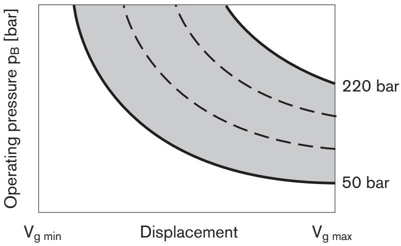
The hydraulic output power (characteristic LR) is influenced by the efficiency of the pump.

When ordering, state in plain text:

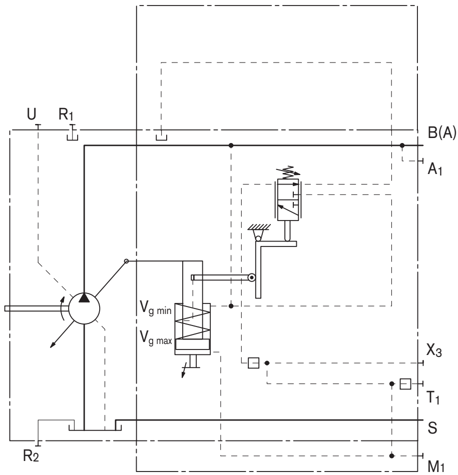
- Drive power P in kW
- Drive speed n in rpm
- Maximum flow $q_{v\,max}$ in L/min

After clarifying the details a power diagram can be created by our computer.

Characteristic LR



Schematic LR



2

LR – Power controller

LRD – Power controller with pressure cut-off

The pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\ min}$, when the pressure setting is reached.

This function overrides the power control, i. e. below the preset pressure value, the power function is effective.

The pressure cut-off is preset to a specified value at the factory.

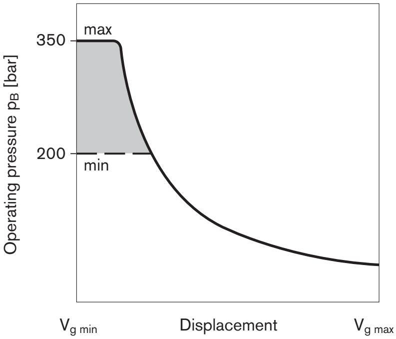
Setting range for pressure cut-off __________ 200 to 350 bar

Please state the pressure cut-off setting in plain text when ordering.

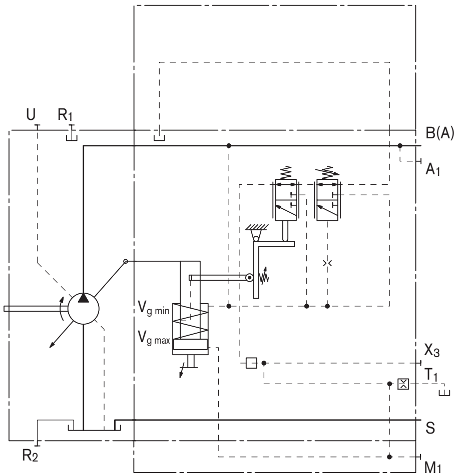
Note

- The pressure setting for the pressure cut-off must be at least a factor of 5 higher than the beginning of control of the power control.
  Example: Beginning of control of the power controller: 50 bar
  Minimum setting for pressure cut-off: 5 • 50 = 250 bar
  Higher settings for pressure cut-off are always possible.
- On versions with pressure cut-off, a case drain line from port T_1 to the reservoir is required.
  For a plugged case drain port the allowable actuated time for pressure cut-off is ≤ 2 min for $t_{reservoir}$ ≤ 50 °C.
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the pressure cut-off setting.

Characteristic LRD



Schematic LRD



LR – Power controller

LR... – Power controller with stroke limiter

The hydraulic stroke limiter, the displacement of the pump can be continuously varied or limited over the entire allowable range.The displacement is set proportionally by the pilot pressure p_{St} (maximum 40 bar) applied at port X_1.

The power controller overrides the hydraulic stroke limiter, i. e. below the hyperbolic power characteristic, the displacement is controlled by the pilot pressure.When exceeding the power characteristic with a set flow or operating pressure, the power control overrides and reduces the displacement following the hyperbolic characteristic.

A control pressure of 40 bar is required to swivel the pump from its initial position $V_{g\,max}$ to $V_{g\,min}$.

The necessary control power is taken from the operating pressure or the external control pressure applied to port Y_3.

To ensure functioning of the stroke limiter even at low operating pressure < 40 bar, port Y_3 must be supplied with external control pressure of approx. 40 bar.

LRH1 – Hydraulic stroke limiter (negative control)

Control from $V_{g\,max}$ to $V_{g\,min}$

With increasing pilot pressure the pump swivels to a smaller displacement.

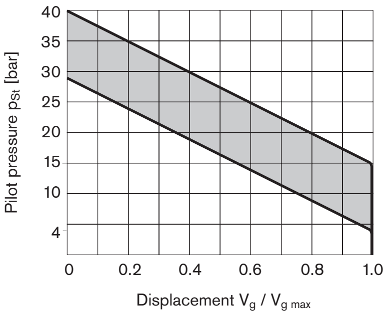
Beginning of control (at $V_{g\,max}$), adjustable ________ 4 to 15 bar

Please state the beginning of control in plain text when ordering.

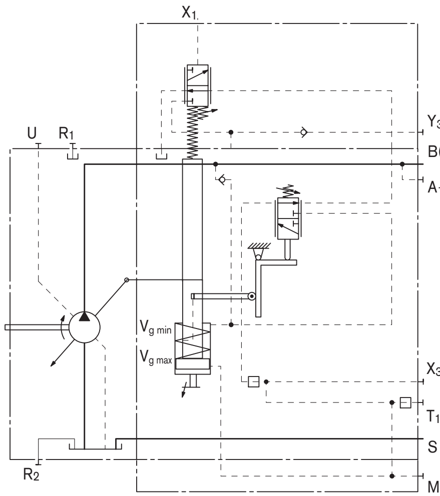
Initial position without control signal (pilot pressure): $V_{g\,max}$

Characteristic LRH1

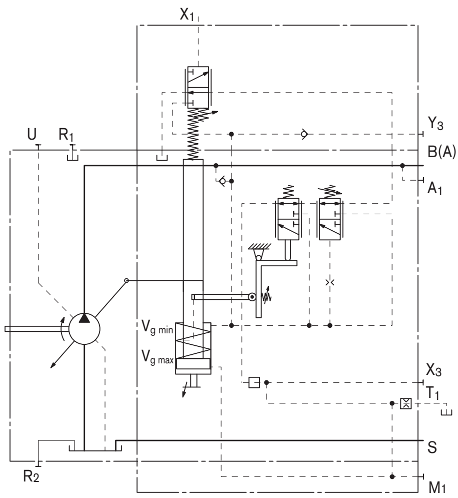
Pilot pressure increase ($V_{g\,max}$ – $V_{g\,min}$) __________ Δp = 25 bar



Schematic LRH1



Schematic LRDH1



DR – Pressure controller

The pressure controller limits the maximum pressure at the pump outlet within the control range of the pump. The variable pump only delivers as much hydraulic fluid as the consumers actually need. If the operating pressure exceeds the pressure setpoint set at the integrated pressure valve, the pump will regulate to a smaller displacement to reduce the control deviation.

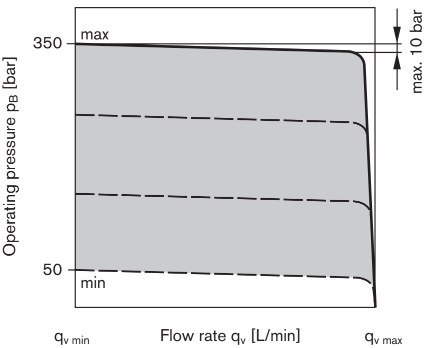
In a non-pressurized state, the pump is swiveled to its initial position to Vg max by a return spring.

Setting range for pressure control ____________ 50 to 350 bar

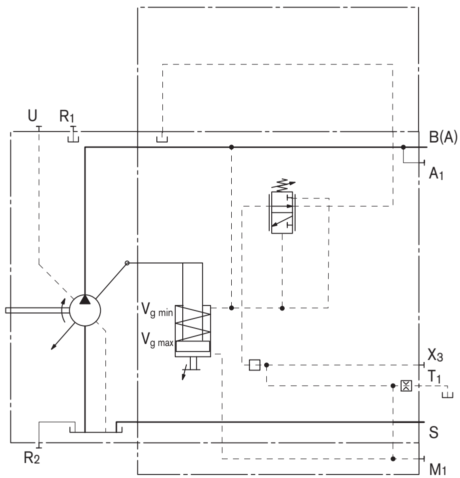
Please state the pressure control setting in plain text when ordering.

Note
- On versions with DR controller, a case drain line from port T_1 to the reservoir is essential.
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

Characteristic DR



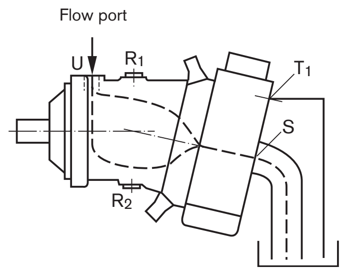
Schematic DR



Zero stroke operation

The standard version is designed for intermittent, constant-pressure operation. Short-term (< 1 min), zero-stroke operation is permissible up to an operating pressure p_{max} = 315 bar with reservoir temperature ≤ 50 °C.

In the case of longer zero-stroke operation, the bearings should be flushed by way of the flushing port U.



Flushing flow (Recommended)

NG		28	55	80	107	160
$q_{v\,flush}$	L/min	3	4	6	8	12

Temperature of the flushing fluid ≤ reservoir temperature

DR – Pressure controller

DRG – Pressure controller remotely controlled

A separate sequence valve with port plate provides the pressure control functionality. The valve is mounted away from the pump, whereby the length of the line should not exceed 5 m. The valve is supplied with high pressure from port A_1 of the pump. The control power of the valve is returned to the pump via port X_3 which retards the pump down to $V_{g\ min}$. Care should be taken that the ports T on the sequence valve and T_1 on the pump are connected to the reservoir (cooler).

Setting range for pressure control ____________50 to 315 bar

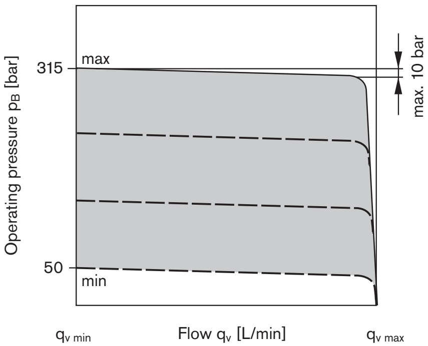
Please state the pressure control setting in plain text when ordering.

Note
- On versions with DRG controller, a case drain line from port T_1 to the reservoir is essential.
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

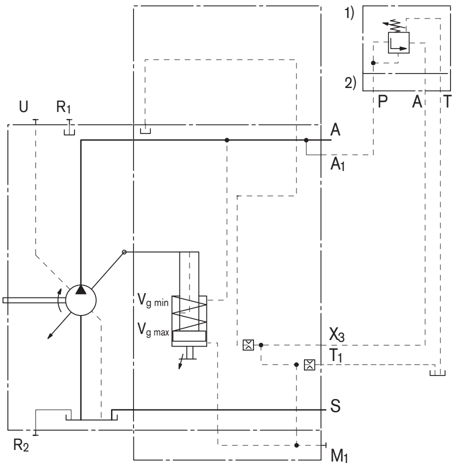
Sequence valve and port plate must be ordered separately.

Sequence valve (1): DZ5DP2-1X/315YMSO21
(Mat.No. R900495604)
Port plate (2): G 115/1 (Mat.No. R900424379)

Characteristic DRG



Schematic DRG



Positions (1) and (2) are not included in the delivery contents for the pump.

DR – Pressure controller

DRS – Pressure controller with load sensing

The load sensing controller is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the consumer flow requirement.

The flow of the pump depends here on the cross section of the external sensing orifice (1) fitted between the pump and the consumer. Below the setting for the pressure control and within the control range of the pump, the flow is independent of load pressure.

The sensing orifice is usually a separately mounted load-sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the sensing orifice and thus the flow of the pump.

The load sensing controller compares pressure before and after the sensing orifice and keeps the pressure drop (differential pressure Δp) and with it the pump flow constant.

If the differential pressure Δp at the sensing orifice increases, the pump is swivelled back (towards $V_{g\,min}$) and if the differential pressure Δp decreases, the pump is swivelled out (towards $V_{g\,max}$) until equilibrium is at the sensing orifice is restored.

$\Delta p_{sensing\ orifice} = p_{pump} - p_{consumer}$

Setting range for Δp ________ 14 to 25 bar

Standard setting ________ 18 bar

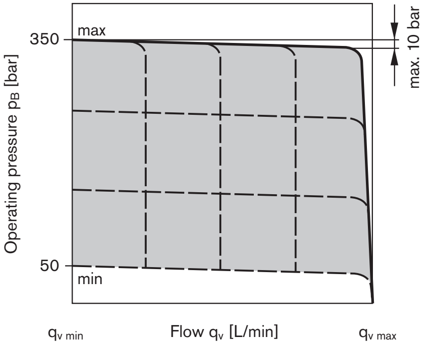
Please state the Δp setting in plain text when ordering.

The stand-by pressure during zero-stroke operation (sensing orifice closed) is slightly above the Δp setting.

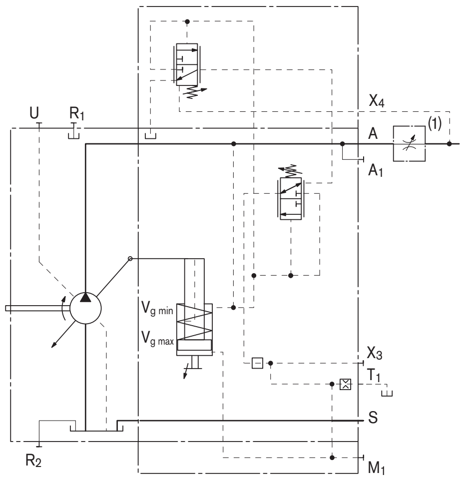
Note
On versions with DRS controller, a case drain line from port T_1 to the reservoir is essential.

The pressure controller overrides the load sensing controller, i. e. the load sensing function operates below the set pressure.

Characteristic DRS



Schematic DRS



(1) The sensing orifice (control block) is not included in the delivery contents.

HD – Proportional control hydraulic

The proportional hydraulic control provides infinite setting of the displacement, proportional to the pilot pressure applied to port X_1.

Maximum permissible pilot pressure $p_{St} = 40$ bar

Adjustment from $V_{g\,min}$ to $V_{g\,max}$ (positive control)

With increasing pilot pressure the pump swivels to a higher displacement.

Beginning of control (at $V_{g\,min}$), adjustable ______ 4 to 15 bar

Please state the beginning of control in plain text when ordering.

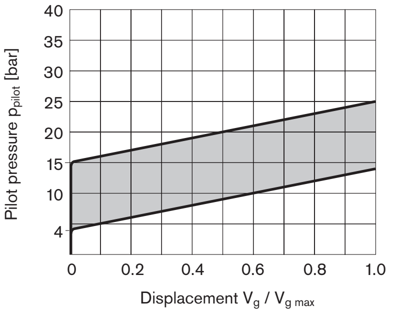
A control pressure of 40 bar is required to swivel the pump from its initial position $V_{g\,min}$ to $V_{g\,max}$.

The necessary control power is taken from the operating pressure or the external control pressure applied to port Y_3.

In order to ensure control function even at low operating pressures < 40 bar, port Y_3 must be supplied with an external control pressure of approx. 40 bar.

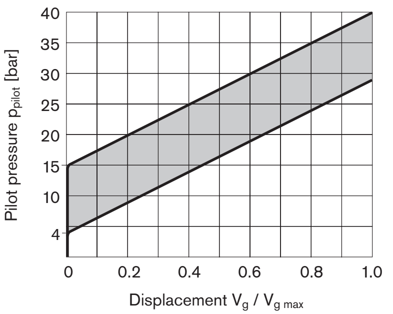
Characteristic HD1 positive control

Control pressure increase $V_{g\,min}$ to $V_{g\,max}$_______ $\Delta p = 10$ bar

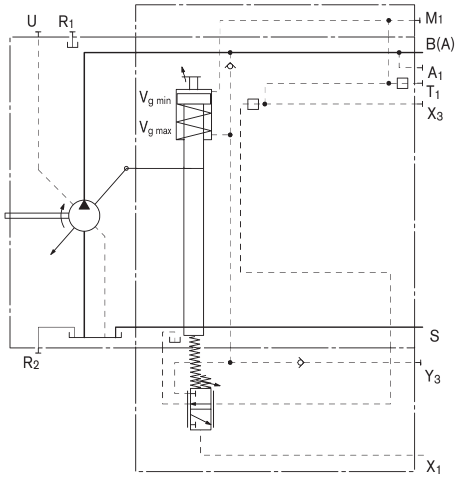


Characteristic HD2 positive control

Control pressure increase $V_{g\,min}$ to $V_{g\,max}$_______ $\Delta p = 25$ bar



Schematic HD



Note

The spring return feature in the controller is not a safety device.

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. - immediate stop).

HD – Proportional control hydraulic

HD.G – Hydraulic control with pressure cut-off, remotely controlled

A separate sequence valve with port plate provides the pressure cut-off functionality. The valve is mounted away from the pump, whereby the length of the line should not exceed 5 m. The valve is supplied with high pressure from port A_1 of the pump. By way of port X_3 the control power of the pump is transmitted to the valve and into the reservoir at port A of the port plate of the sequence valve whereby the pump is retarded to $V_{g\ min}$, if the target pressure value is exceeded.

Setting range for pressure cut-off ____________50 to 315 bar

Please state the pressure cut-off setting in plain text when ordering.

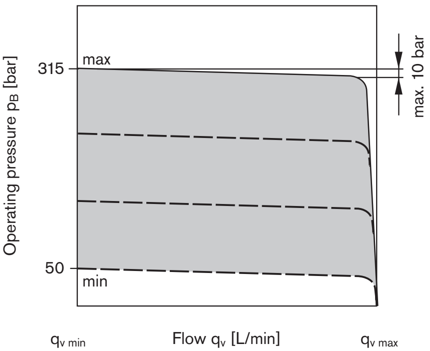
Note

- Port A of the sequence valve must be connected to the reservoir (cooler).
- Any pressure-relief valve included in the system to limit the maximum pressure must be set to a cracking pressure at least 20 bar above the controller setting.

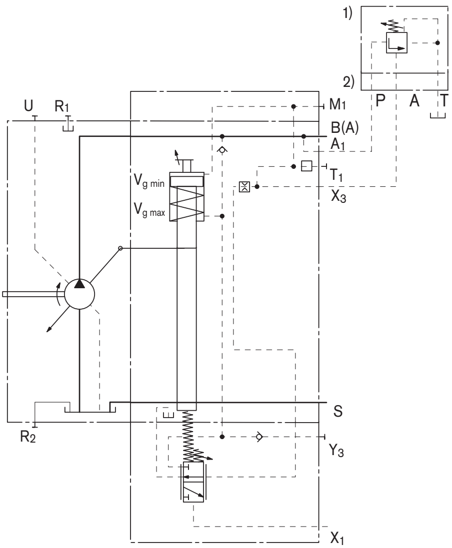
Sequence valve and port plate must be ordered separately.

Sequence valve (1): DZ5DP2-1X/315XYMSO20 (Mat.No. R900490554)
Port plate (2): G 115/1 (Mat.No. R900424379)

Characteristic HD.G positive control



Schematic HD.G



Positions (1) and (2) are not included in the delivery contents for the pump.

EP – Proportional control electric

The proportional electric control provides infinite adjustment of the displacement, proportional to the control current applied to the solenoid.

Adjustment from $V_{g\ min}$ to $V_{g\ max}$ (positive control)

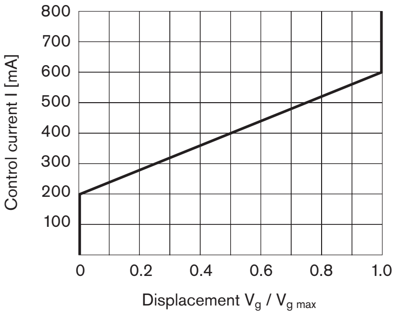
With increasing control current the pump swivels to a higher displacement.

A control pressure of 40 bar is required to swivel the pump from its initial position $V_{g\ min}$ to $V_{g\ max}$.

The necessary control power is taken from the operating pressure or the external control pressure applied to port Y_3.

In order to ensure control function even at low operating pressures < 40 bar, port Y_3 must be supplied with an external control pressure of approx. 40 bar.

Characteristic EP2 positive control



Technical data, solenoid

	EP2
Voltage	24 V (±20 %)
Control current	
Beginning of control	200 mA
End of control	600 mA
Limiting current	0.77 A
Nominal resistance (at 20 °C)	22.7 Ω
Dither frequency	100 Hz
Duty cycle	100 %
Type of protection see connector design page 33	

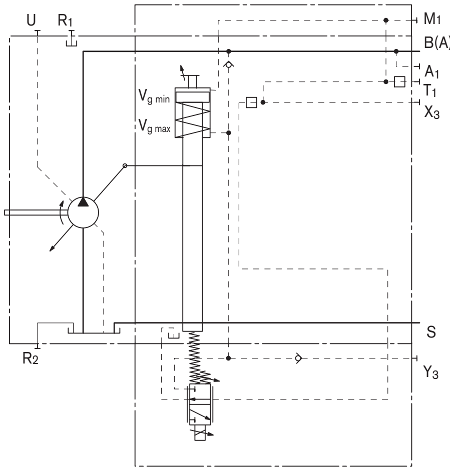
The following electronic controllers and amplifiers are available for controlling the proportional solenoids:

– BODAS controller RC
  Series 20 ______________ RE 95200
  Series 21 ______________ RE 95201
  Series 22 ______________ RE 95202
  Series 30 ______________ RE 95203, RE 95204
  and application software

– Analog amplifier RA ______________ RE 95230

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics

Schematic EP2



EP2G – Electric control with pressure cut-off, remotely controlled

See HD.G

Note

The spring return feature in the controller is not a safety device.

The controller can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

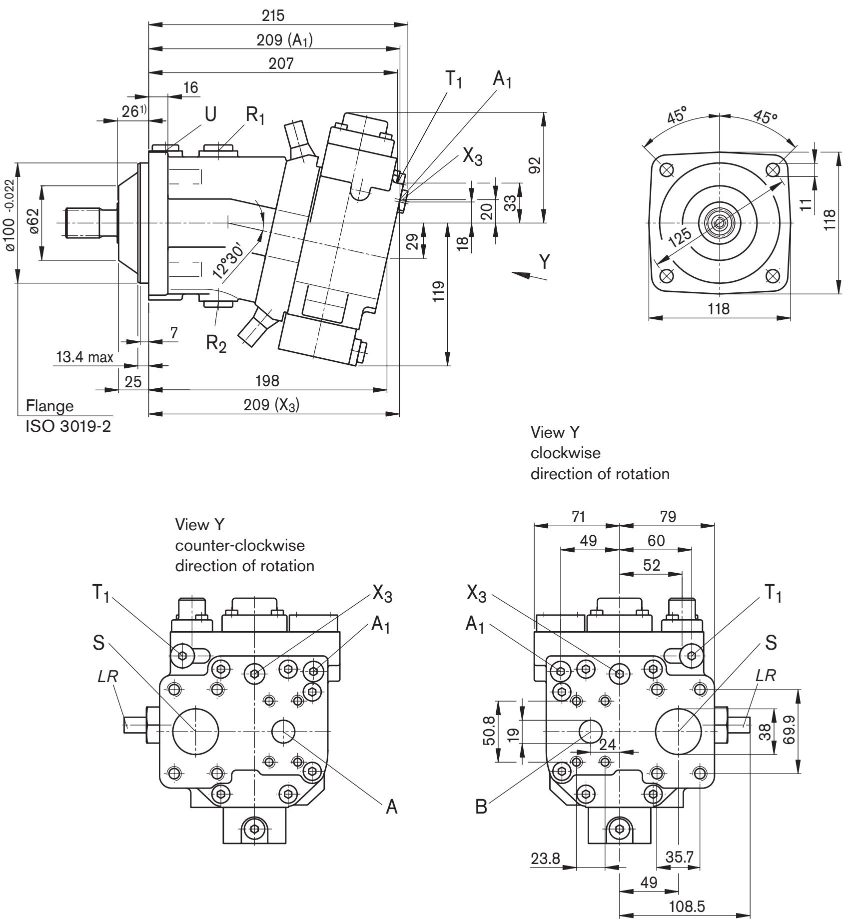
Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (e. g. - immediate stop).

Dimensions size 28

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



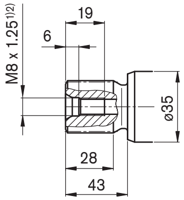
1) To shaft collar

Dimensions size 28

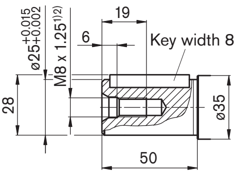
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft DIN 5480
W25x1.25x18x9g



P Parallel keyed shaft
DIN 6885, AS8x7x40



Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State[6)]
A	Service line (high pressure series) Fastening thread	SAE J518[4)] DIN 13	3/4 in M10 x 1.5; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518[4)] DIN 13	1 1/2 in M12 x 1.75; 20 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M16 x 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 x 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain (only DR, ..D..)	DIN 3852[5)]	M12 x 1.5; 12 deep	400	O
X_3	Override	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X
Y_3	External pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	O
M_1	Measuring control pressure	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X

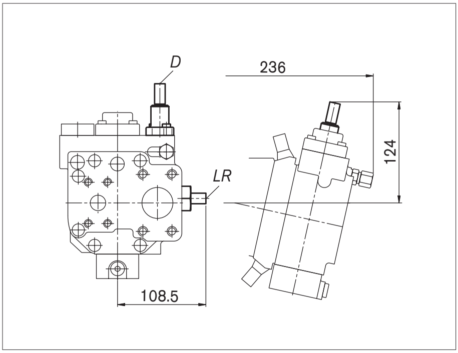
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 36 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 28

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

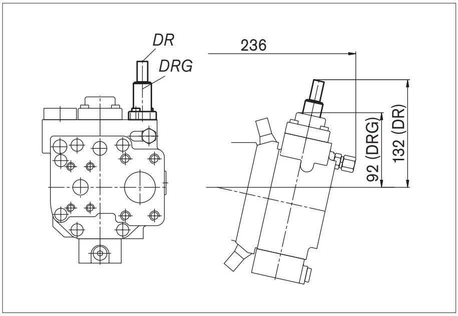
LRD

Power controller with pressure cut-off



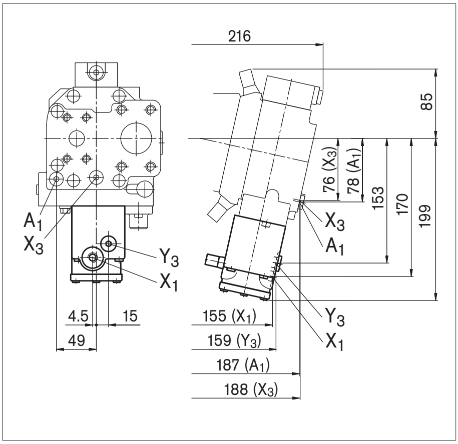
DR/DRG

Pressure controller / pressure controller remotely controlled



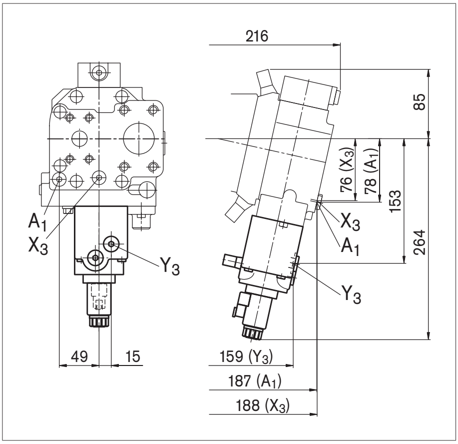
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control
and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control
and variants with pressure cut-off, remotely controlled

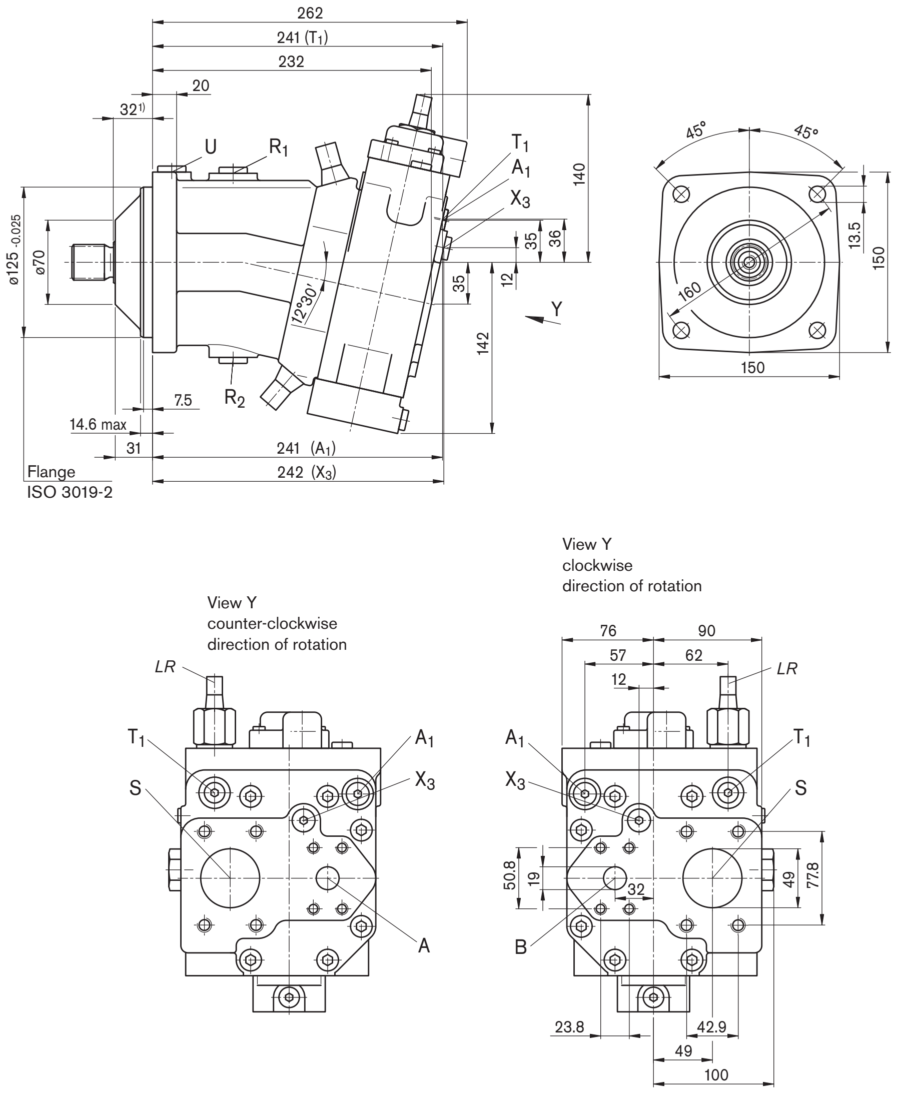


Dimensions size 55

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



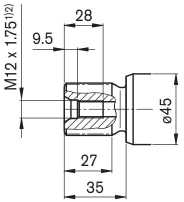
1) To shaft collar

Dimensions size 55

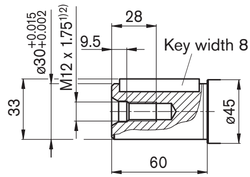
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft DIN 5480
W30x2x14x9g



P Parallel keyed shaft
DIN 6885, AS8x7x50



Ports

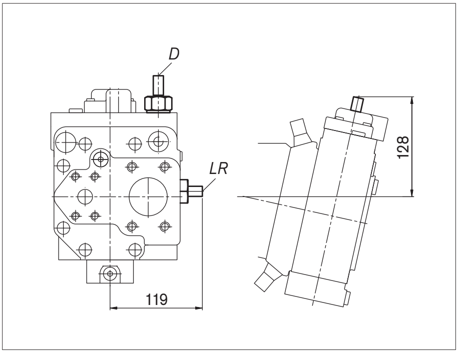
Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[6]
A	Service line (high pressure series) Fastening thread	SAE J518[4] DIN 13	3/4 in M10 x 1.5; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518[4] DIN 13	2 in M12 x 1.75; 20 deep[2]	2	O
U	Bearing flushing	DIN 3852[5]	M18 x 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5]	M18 x 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5]	M14 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain	DIN 3852[5]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain (only DR, ..D..)	DIN 3852[5]	M12 x 1.5; 12 deep	400	O
X_3	Override	DIN 3852[5]	M14 x 1.5; 12 deep	400	X
Y_3	External pilot pressure	DIN 3852[5]	M14 x 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5]	M14 x 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5]	M14 x 1.5; 12 deep	400	O
M_1	Measuring control pressure	DIN 3852[5]	M12 x 1.5; 12 deep	400	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 36 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

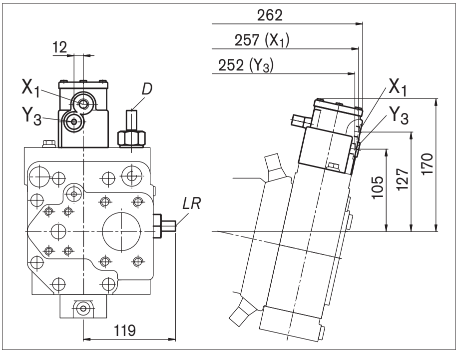
Dimensions size 55

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

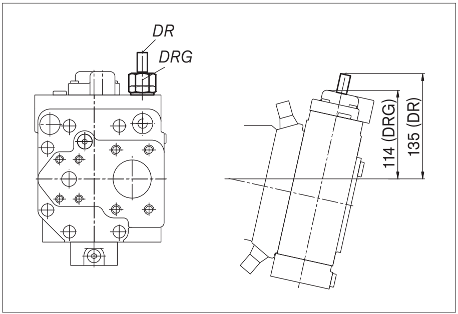
LRD
Power controller with pressure cut-off



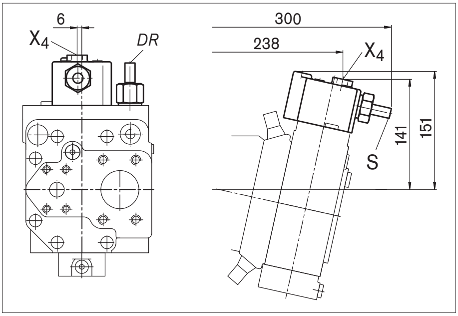
LRDH1
Power controller with pressure cut-off and stroke limiter



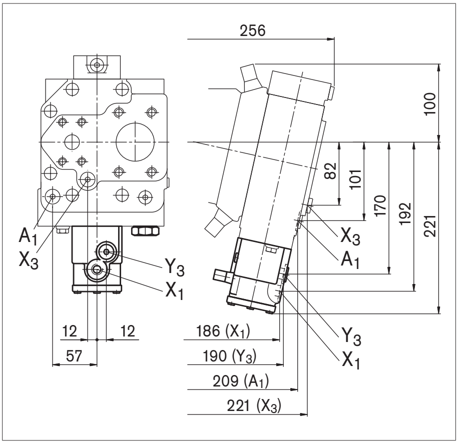
DR/DRG
Pressure controller / pressure controller remotely controlled



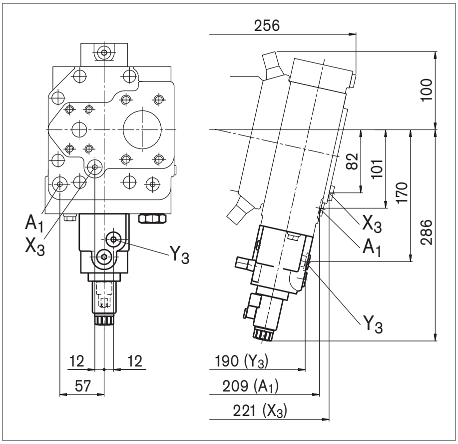
DRS
Pressure controller with load sensing



HD1, HD2/HD1G, HD2G
Proportional control hydraulic, positive control
and variants with pressure cut-off, remotely controlled



EP2/EP2G
Proportional control electric, positive control
and variants with pressure cut-off, remotely controlled

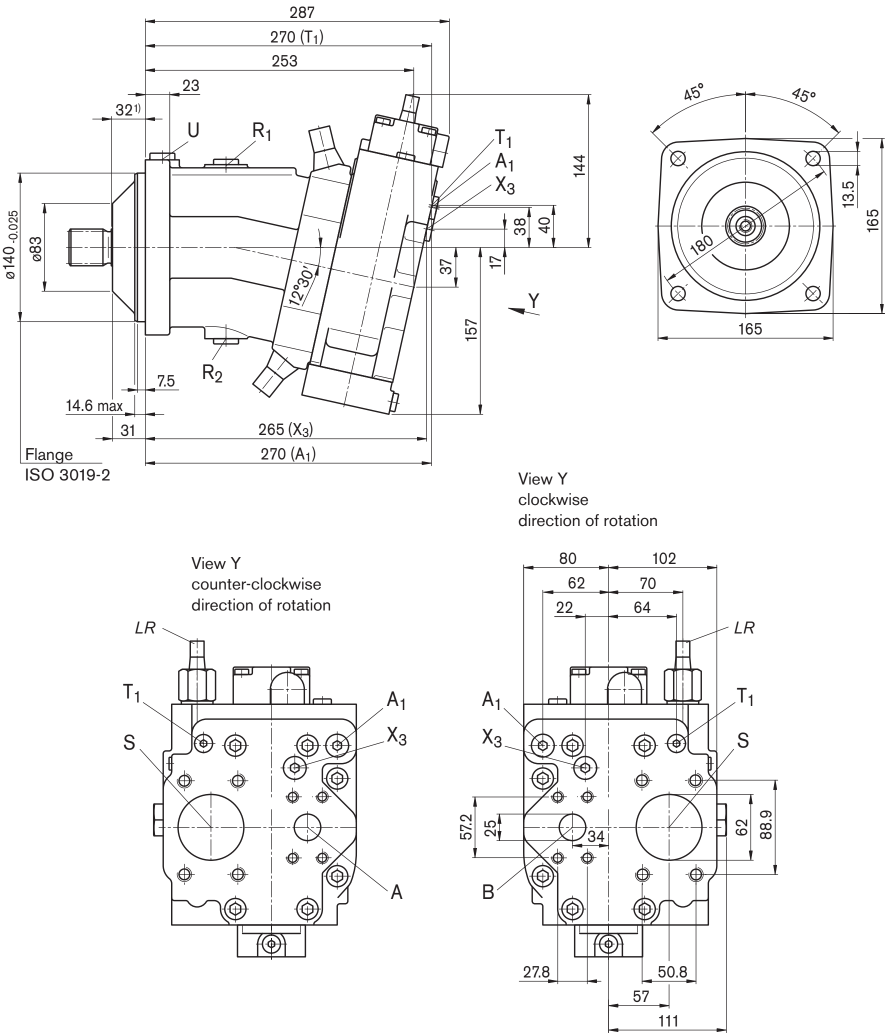


Dimensions size 80

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



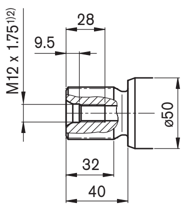
1) To shaft collar

Dimensions size 80

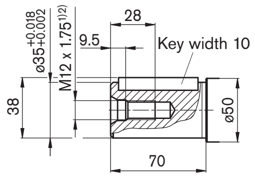
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft DIN 5480
W35x2x16x9g



P Parallel keyed shaft
DIN 6885, AS10x8x56



Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State[6)]
A	Service line (high pressure series) Fastening thread	SAE J518[4)] DIN 13	1 in M12 x 1.75; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518[4)] DIN 13	2 1/2 in M12 x 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M18 x 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M18 x 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M16 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain (only DR, ..D..)	DIN 3852[5)]	M12 x 1.5; 12 deep	400	O
X_3	Override	DIN 3852[5)]	M16 x 1.5; 12 deep	400	X
Y_3	External pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	400	O
M_1	Measuring control pressure	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X

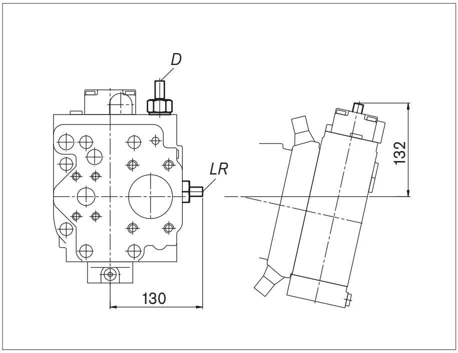
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 36 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 80

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

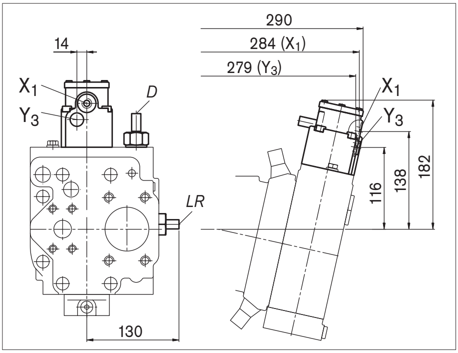
LRD

Power controller with pressure cut-off



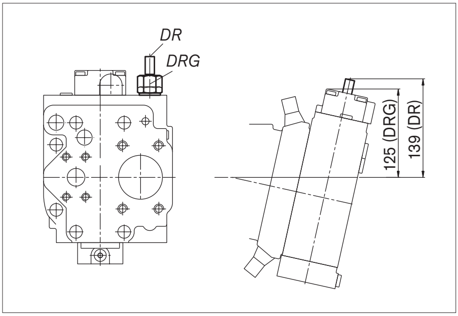
LRDH1

Power controller with pressure cut-off and stroke limiter



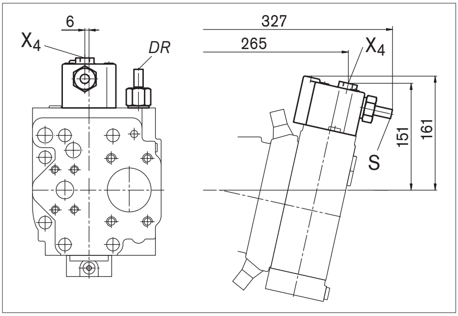
DR/DRG

Pressure controller / pressure controller remotely controlled



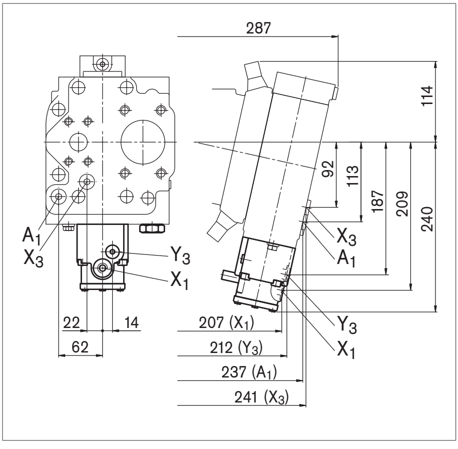
DRS

Pressure controller with load sensing



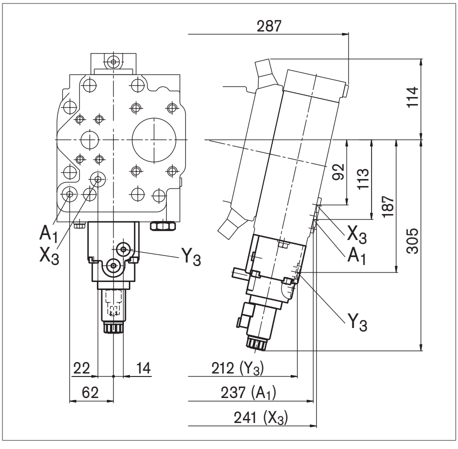
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control
and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control
and variants with pressure cut-off, remotely controlled

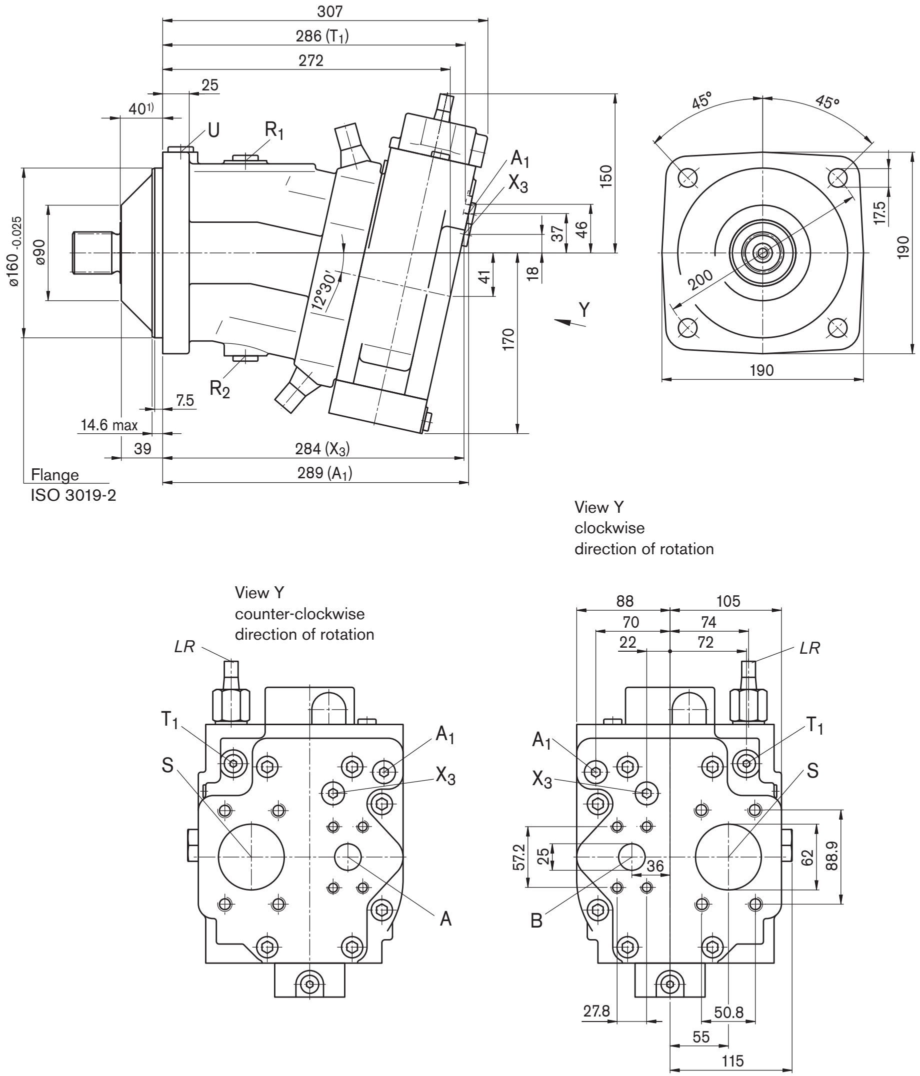


Dimensions size 107

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



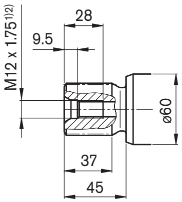
1) To shaft collar

Dimensions size 107

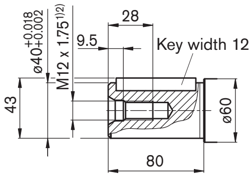
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft, DIN 5480
W40x2x18x9g



P Parallel keyed shaft
DIN 6885, AS12x8x63



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State[6]
A	Service line (high pressure series) Fastening thread	SAE J518[4] DIN 13	1 in M12 x 1.75; 17 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518[4] DIN 13	2 1/2 in M12 x 1.75; 17 deep	2	O
U	Bearing flushing	DIN 3852[5]	M18 x 1.5; 12 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5]	M18 x 1.5; 12 deep	2	X
A_1	Measuring high pressure	DIN 3852[5]	M16 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain	DIN 3852[5]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain (only DR, ..D..)	DIN 3852[5]	M12 x 1.5; 12 deep	400	O
X_3	Override	DIN 3852[5]	M16 x 1.5; 12 deep	400	X
Y_3	External pilot pressure	DIN 3852[5]	M14 x 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5]	M14 x 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5]	M14 x 1.5; 12 deep	400	O
M_1	Measuring control pressure	DIN 3852[5]	M12 x 1.5; 12 deep	400	X

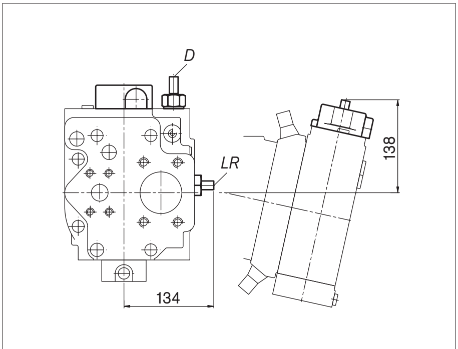
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 36 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 107

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

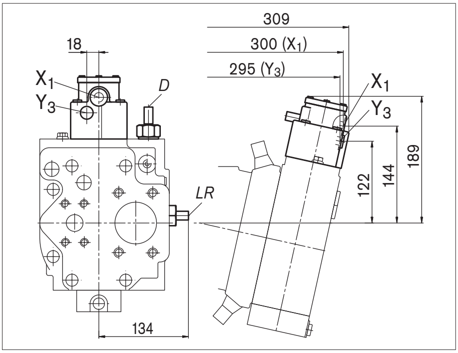
LRD

Power controller with pressure cut-off



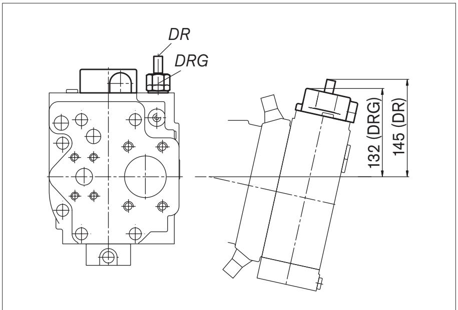
LRDH1

Power controller with pressure cut-off and stroke limiter



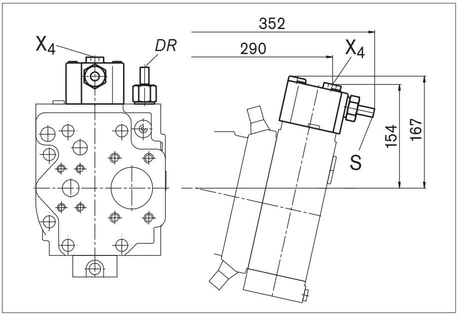
DR/DRG

Pressure controller / pressure controller remotely controlled



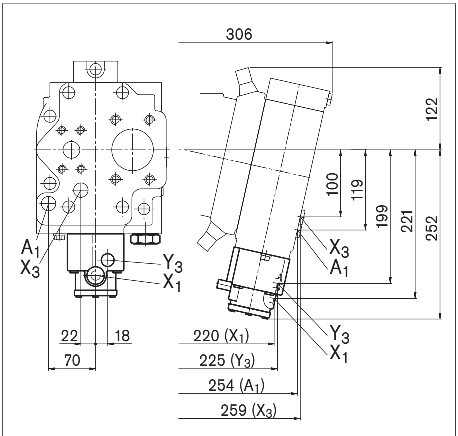
DRS

Pressure controller with load sensing



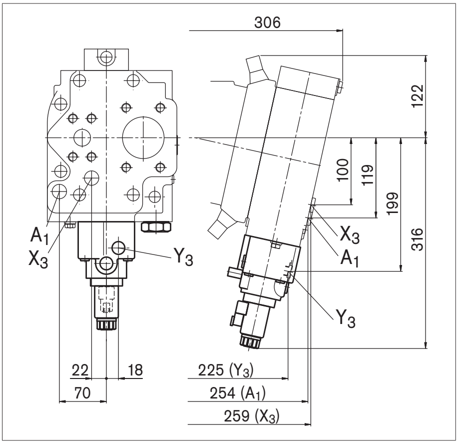
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled

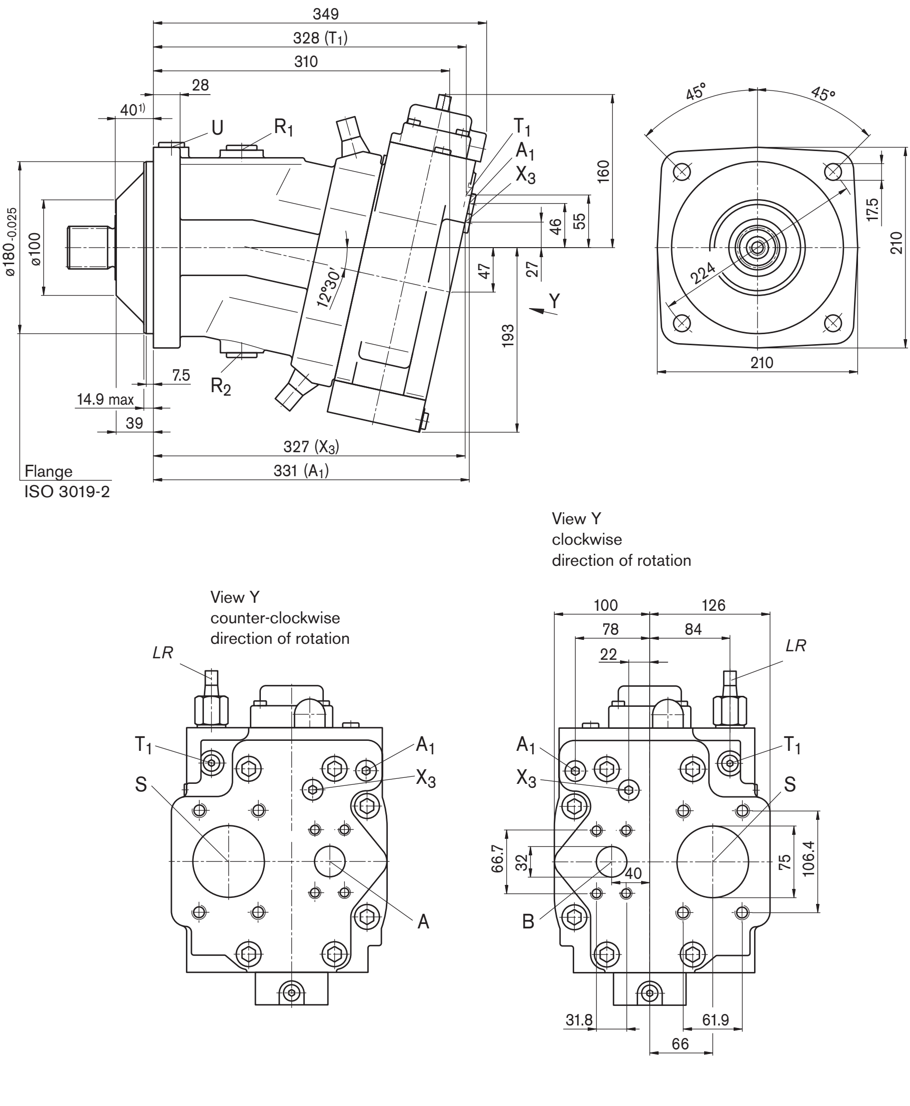


Dimensions size 160

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

LR – Power controller

Note: All versions of the controller are illustrated for clockwise direction of rotation (View Y).



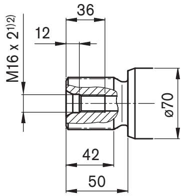
1) To shaft collar

Dimensions size 160

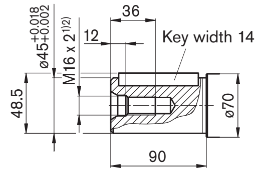
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

Z Splined shaft DIN 5480
W45x2x21x9g



P Parallel keyed shaft
DIN 6885, AS14x9x70



Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State[6)]
A	Service line (high pressure series) Fastening thread	SAE J518[4)] DIN 13	1 1/4 in M14 x 1.5; 19 deep	400	O
S	Suction line (standard series) Fastening thread	SAE J518[4)] DIN 13	3 in M16 x 1.5; 24 deep	2	O
U	Bearing flushing	DIN 3852[5)]	M22 x 1.5; 14 deep	2	X
R_1, R_2	Air bleed	DIN 3852[5)]	M26 x 1.5; 16 deep	2	X
A_1	Measuring high pressure	DIN 3852[5)]	M16 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X
T_1	Pilot fluid drain (only DR, ..D..)	DIN 3852[5)]	M12 x 1.5; 12 deep	400	O
X_3	Override	DIN 3852[5)]	M16 x 1.5; 12 deep	400	X
Y_3	External pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	X
X_1	Pilot pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	40	O
X_4	Load pressure	DIN 3852[5)]	M14 x 1.5; 12 deep	400	O
M_1	Measuring control pressure	DIN 3852[5)]	M12 x 1.5; 12 deep	400	X

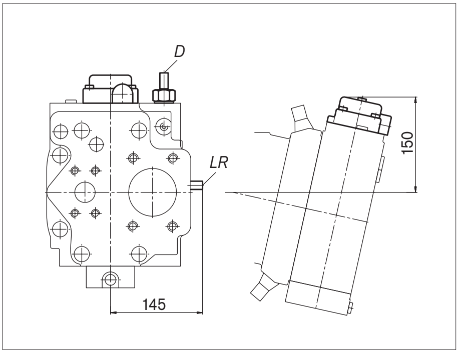
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 36 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The spot face can be deeper than specified in the appropriate standard.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 160

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

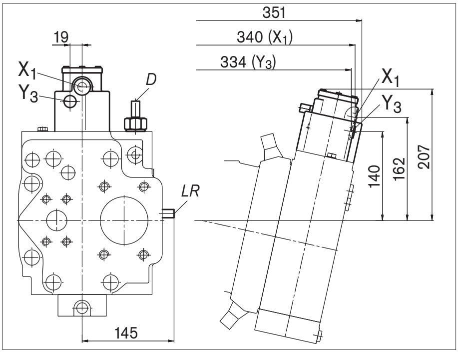
LRD

Power controller with pressure cut-off



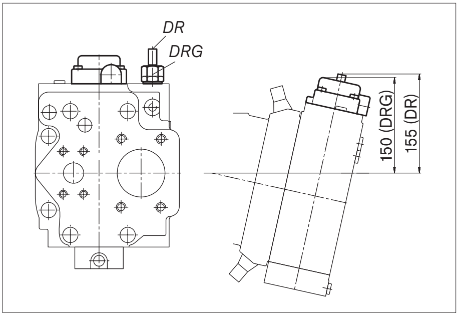
LRDH1

Power controller with pressure cut-off and stroke limiter



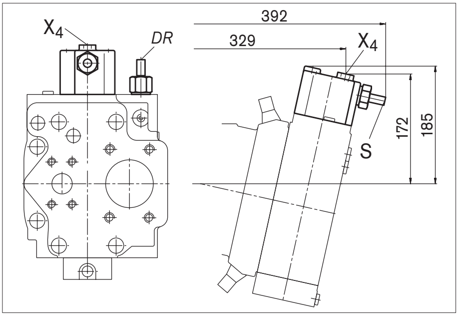
DR/DRG

Pressure controller / pressure controller remotely controlled



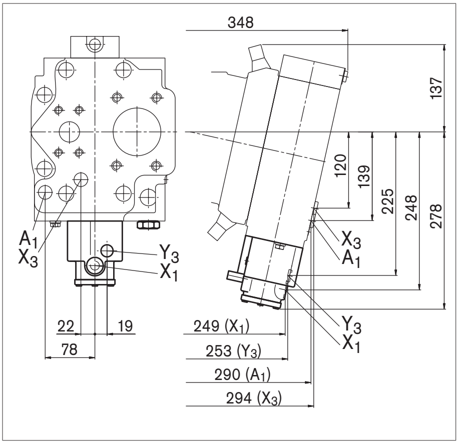
DRS

Pressure controller with load sensing



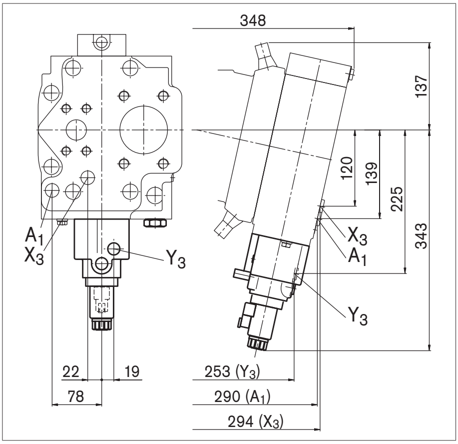
HD1, HD2/HD1G, HD2G

Proportional control hydraulic, positive control and variants with pressure cut-off, remotely controlled



EP2/EP2G

Proportional control electric, positive control and variants with pressure cut-off, remotely controlled



Connector for solenoids

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

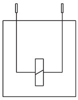
DEUTSCH DT04-2S-EP04

Molded, 2-pin, without bidirectional suppressor diode

There is the following type of protection with mounted mating connector:
IP67 ______________________ DIN/EN 60529

and IP69K ______________________ DIN 40050-9

Circuit symbol

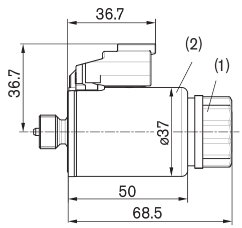


Mating connector

DEUTSCH DT06-2S-EP04
Bosch Rexroth Mat. No. R902601804

Consisting of:	DT designation
– 1 housing	DT06-2S-EP04
– 1 wedge	W2S
– 2 sockets	0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.



Changing connector orientation

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (WAF26, 12-sided DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.

2

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain chamber is internally connected to the suction chamber. A case drain line from the case to the reservoir is not required. Exception: for operation with pressure controller or pressure cut-off, a case drain line from port T_1 to the reservoir is required.

To achieve favorable noise values, decouple all connecting lines using elastic elements.

In all operating conditions, the suction and case drain lines must flow into the reservoir below the minimum fluid level. The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation.

Installation position

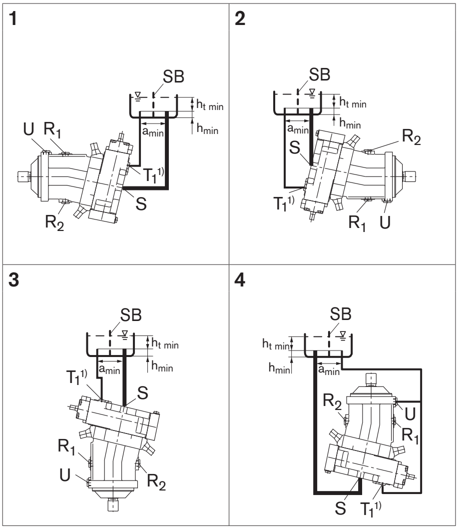
See the following examples 1 to 4.
Further installation positions are possible upon request.

Recommended installation position: 1 and 2.

Note
Axial piston units with electric components (e.g. electric controls, sensors) must not be installed in a reservoir below the fluid level.

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Air bleed	Filling
1	R_1	S
2	R_2	S
3	T_1	S
4	U	S

R_1, R_2 Air bleed port
U Bearing flushing
S Suction port
T_1 Drain port
$h_{t\,min}$ Minimum required immersion depth (200 mm)
h_{min} Minimum required spacing to reservoir bottom (100 mm)
SB Baffle (baffle plate)
a_{min} When designing the reservoir, ensure adequate space between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

1) Only for versions with pressure controller or pressure cut-off, a case drain line form port T_1 to the resorvoir is essential.

Notice

General instructions

– The pump A7VO is designed to be used in open circuit.

– The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.

– Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.

– Service line ports:

- The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

- The service line ports and function ports can only be used to accommodate hydraulic lines.

– Pressure cut-off and pressure controller do not provide security against pressure overload. A pressure-relief valve is to be provided in the hydraulic system.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to ISO 13849.

– The following tightening torques apply:

- Fittings:
Observe the manufacturer's instructions regarding the tightening torques of the fittings used.

- Mounting bolts:
For mounting bolts with metric ISO thread according to DIN 13 or thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.

- Female threads in the axial piston unit:
The maximum permissible tightening torques $M_{G\ max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.

- Threaded plugs:
For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports Standard	Size of thread	Maximum permissible tightening torque of the female threads $M_{G\ max}$	Required tightening torque of the threaded plugs M_V 1)	WAF hexagon socket of the threaded plugs
DIN 3852	M12 x 1.5	50 Nm	25 Nm 2)	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M26 x 1.5	230 Nm	120 Nm	12 mm

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.
2) In the "lightly oiled" state, the M_V is reduced to 17 Nm for M12 x 1.5.

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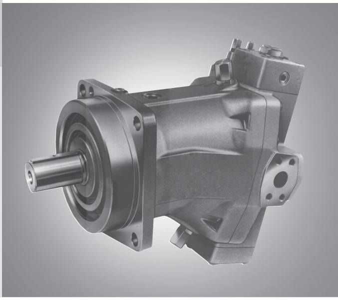
Rexroth
Bosch Group

Axial piston variable pump A7VO

RE 92203/06.09
Replaces: 05.99

Data sheet



Series 63
Sizes NG250 to 500
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

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Features

- Variable axial piston pump with tapered piston rotary group in bent axis design for hydrostatic drives in open circuits
- For operation in mobile and industrial applications
- The flow is proportional to the drive speed and the displacement and steplessly variable from $q_{v\,max}$ to $q_{v\,min} = 0$
- Wide range of controls and adjustment devices
- Compact, robust bearing system for long service life
- Available with Long Life bearings for special fluids and extreme service life requirements
- Pressure control is standard
- Optical or electric swivel angle indicator available

Type code for standard program

	A7V		O			/	63		–	V				
01	02	03	04	05	06		07	08		09	10	11	12	13

Fluid / Version

		250	355	500	
01	Mineral oil and HFD. HFD only in conjunction with Long-Life-Lagerung „L“ (no code)	●	●	●	
	For operation on HFC, special high performance version A4VSO...F see RE 92053	●	●	–	
	High-Speed-Version (only mineral oil)	●	–	–	H [1]

Axial piston unit

02	Bent axis design, variable, nominal pressure 350 bar, peak pressure 400 bar	A7V

Drive shaft bearings

		250	355	500	
03	Mechanical bearings (no code)	●	●	●	
	Long-Life-bearings	●	●	●	L

Type of operation

04	Pump, open circuit	O

Size

05	Displacement $V_{g\ max}$ [cm³]	250	355	500
	NG28 to160 see RE 92202			

Control devices

			250	355	500	
06	Pressure control		●	●	●	DR
	Pressure control, remotely adjustable		●	●	●	DRG
	Power control					
	with integrated pressure control (fixed setting)		●	●	●	LRD
	hydraulic stroke limiter initial position $V_{g\ max}$	Δp = 10 bar	●	●	●	LRDH1
		Δp = 25 bar	●	●	●	LRDH2
		Δp = 35 bar	●	●	●	LRDH3
	hydraulic stroke limiter initial position $V_{g\ min}$	Δp = 10 bar	●	●	●	LRDN1
		Δp = 25 bar	●	●	●	LRDN2
		Δp = 35 bar	●	●	●	LRDN3
	with pressure control remotely adjustable		●	●	●	LRG
	hydraulic stroke limiter initial position $V_{g\ max}$	Δp = 10 bar	●	●	●	LRGH1
		Δp = 25 bar	●	●	●	LRGH2
		Δp = 35 bar	●	●	●	LRGH3
	hydraulic stroke limiter initial position $V_{g\ min}$	Δp = 10 bar	●	●	●	LRGN1
		Δp = 25 bar	●	●	●	LRGN2
		Δp = 35 bar	●	●	●	LRGN3
	Hydraulic control, pilot pressure dependent,					
	with integrated pressure control (fixed setting)	Δp = 10 bar	●	●	●	HD1D
		Δp = 25 bar	●	●	●	HD2D
		Δp = 35 bar	●	●	●	HD3D
	with pressure control, remotely adjustable	Δp = 10 bar	●	●	●	HD1G
		Δp = 25 bar	●	●	●	HD2G
		Δp = 35 bar	●	●	●	HD3G
	Hydraulic control, with electric proportional valve [2]					
	with integrated pressure control (fixed setting)	Control voltage 12 V	●	●	●	EP1D
		Control voltage 24 V	●	●	●	EP2D
	with pressure control, remotely adjustable	Control voltage 12 V	●	●	●	EP1G
		control voltage 24 V	●	●	●	EP2G

[1] recommended for new projects
[2] for operation on HFD-fluids please observe RE 29181 (proportional pressure reducing valve type DRE4K)

Type code for standard program

	A7V		O			/	63		–	V				
01	02	03	04	05	06		07	08		09	10	11	12	13

	Series		250	355	500	
07	Series 6, Index 3		●	●	●	63

	Direction of rotation		250	355	500	
08	with view on drive shaft	clockwise	●	●	●	R
		counter clockwise	●	●	●	L

	Seals		250	355	500	
09	FKM (Fluoro-rubber)		●	●	●	V

	Drive shaft		250	355	500	
10	Splined shaft to DIN 5480		●	●	●	Z
	Keyed parallel shaft to DIN 6885		●	●	●	P

	Mounting flange		250	355	500	
11	Similar to ISO 3019-2	4-hole	●	–	–	B
		8-hole	–	●	●	H

	Service line connections		250	355	500	
12	SAE-flanged port B or A, at rear (metric fixing bolts) SAE flanged port S, at rear(metric fixing bolts)		●	●	●	01
	SAE- flanged ports B or A, on opposite side (metric fixing bolts) SAE- flanged port S, on opposite side (metric fixing bolts)		●	●	●	02

	Swivel angle indicator		250	355	500	
13	Without swivel angle indicator (no code)		●	●	●	
	With optical swivel angle indicator		●	●	●	V
	With electric swivel angle indicator		●	●	●	E

Note

Exact value for $V_{g\,min}$ and $V_{g\,max}$ (displacement) must be stated in clear text when ordering ($V_{g\,min}$ ......cm³/rev., $V_{g\,max}$ .....cm³/rev.)

Setting range $V_{g\,min}$: 0 to 0.2 • $V_{g\,max}$

$V_{g\,max}$: $V_{g\,max}$ down to 0.8 • $V_{g\,max}$

● = Available – = Not available ▒ = Preferred program

2

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and application conditions please consult our data sheets RE 90220 (mineral oils), RE 90221 (ecologically acceptable fluids) and RE 90223 (HF-fluids).

The variable pump A7VO is not suitable for operation on HFA fluids. When operating on HFD or ecologically acceptable fluids, limitations to the technical data and seals according to RE 90223 and RE 90221 must be observed.

For the sizes 250 and 355 with **operation on HFC-fluids**, the **A4VSO..*F*** must be used. For certain selected HFC fluids the same pressures and speeds are permissible as for operation on mineral oil. See RE 92053.

When ordering, state the fluid to be used in clear text.

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected in the range

ν_{opt} = opt. viscosity range 16...36 mm²/s

referred to tank temperature (open circuit).

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 3 min)
at max. permissible case drain temperature
t_{max} = +90°C.

ν_{max} = 1000 mm²/s
for short periods (on cold start maximum operating viscosity of 100 mm²/s should be reached within 15 min)
t_{min} = −25°C

Note, that the maximum fluid temperature of 90°C may not be exceeded at any point (e.g. around the bearings). The fluid temperature in the bearing area is influenced by drive speed and pressure, and is typically 12 K higher than the average case drain temperature.

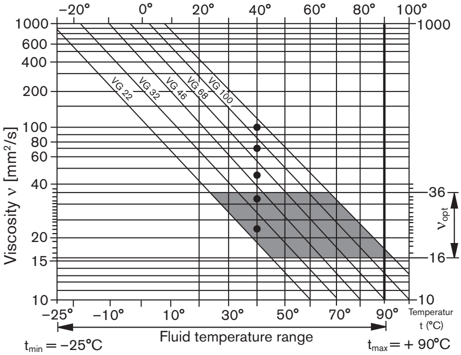
Temperature range

(see selection diagram)

t_{min} = −25°C
t_{max} = +90°C

For detailed information on operation with low temperatures see RE 90300-03-B.

Selection diagram



Notes on the selection of hydraulic fluids

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}) see shaded section in the selection diagram. We recommend, that the higher viscosity grade is selected in each case.

Example: at an ambient temperature of X° C the operating temperature in the tank is 60° C. In the optimum viscosity range (ν_{opt} ; shaded area), this corresponds to grades VG 46 or VG 68; select: VG 68.

Important:
The case drain temperature is influenced by pressure and speed and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 90° C.

If the above conditions cannot be met, due to extreme operating parameters we recommend a housing flushing via port U.

Filtration

The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston pump.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness class of

20/18/15 acc. to ISO 4406 is necessary.

.

Technical data

Operating pressure range

Depending on the operating fluid, limitations may apply, see the chapter on hydraulic fluids, page 4.

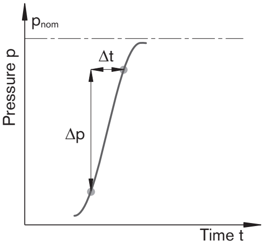
Pressure at the outlet ports (pressure ports) A or B

Nominal pressure p_{nom} ________ 350 bar absolute

Peak pressure p_{max} ________ 400 bar absolute
Total operating period ________ 300 h
Individual operating period ________ 1 s

Minimum pressure (in pump outlet) ________ 10 bar
For a lower pressure, please consult us.

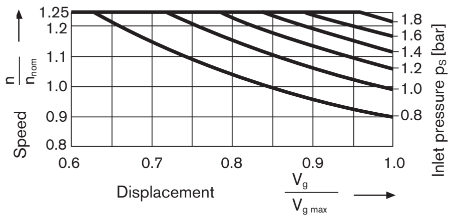
Rate of pressure change R_A ________ 16000 bar/s



Under pulsating load conditions above 315 bar we recommend the use of a splined shaft (to DIN 5480).

Pressure at the inlet port S (Suction)
Minimum inlet pressure $p_{S\,min}$ ________ 0.8 bar absolute
Maximum inlet pressure $p_{S\,max}$ ________ 8 bar absolute

Minimum inlet pressure
In order to avoid damage to the axial piston pump a certain minimum inlet pressure at the pump's suction port S is necessary This minimum inlet pressure is dependent on the drive speed and the displacement of the axial piston unit.



Note
– Maximum speed n_{max}
(Speed limit, see table of values, page 8)
– Minimum and maximum pressure at port S
– Permissible values for the shaft seal
(see diagram on page 7)

An increase in inlet pressure results in a higher control begin of the **LR**-control curve as well as a rise of the LR.**H**- and LR.**N**-pilot pressure characteristics.
Factory setting of the control begin is done at an inlet pressure p_S =1 bar absolute.
Exact details of the shifts in the control curves on request.

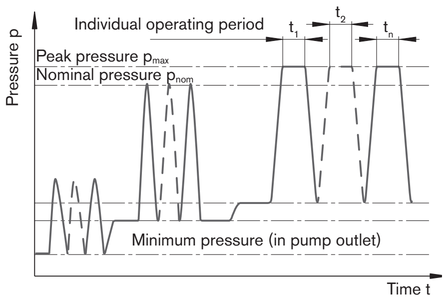
Definition

Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Peak pressure p_{max}
The peak pressure corresponds to the maximum pressure within the individual operating period. The total of the individual operating periods must not exceed the total operating period.

Minimum pressure (in pump outlet)
Minimum pressure in the pump outlet side (port A or B) that is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible pressure build-up and pressure reduction speed with a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + ... + t_n$

Direction of flow

Direction of rotation, with view on shaft end	
clockwise	counter clockwise
S to **B**	**S** to **A**

2

Technical data

Long-Life-Bearings (L)

For long service life requirements and when using HFD-fluids. Identical external dimensions as units with standard bearings. A retroactive conversion to Long-Life Bearings is possible. It is recommended, that the bearings and housing be flushed via port U.

Bearing flushing

Flushing flows (recommended)

NG	250	355	500
q_{flow} (L/min)	10	16	16

Operation in standby (in pressure control mode)

Operation in standby, without external flushing via port U is only permissible for short periods:

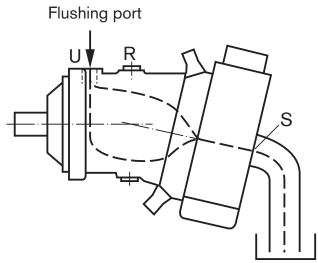
A7VO maximum	15 min at 200 bar 3 min at 350 bar
HA7VO maximum	5 min at 200 bar 1 min at 350 bar

For other pressure levels information on request

Influence of drive speed can be neglected

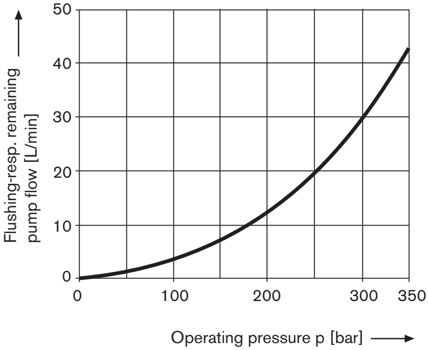
At tank temperature ≤ 50° C

For longer periods of standby operation it is necessary to implement housing flushing vie port U.



Flushing flows for A7VO same as bearing flushing

Flushing flows HA7VO (High-Speed-version)



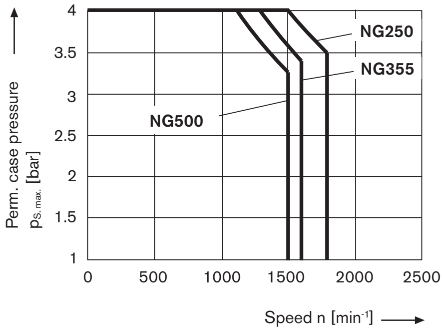
Technical data

Shaft seal FKM (Fluoro-rubber)

Permissible case pressure

The service life of the shaft seal is influenced by pump drive speed and case pressure. It is recommended not to exceed the continuous averaged case pressure of 3 bar abs. (max. perm. case pressure 4 bar abs. at reduced speed, see diagram).

The case pressure must be equal to or higher than the external pressure on the shaft seal (in case of the standard version). For the High-Speed-version please consult us.



Special operating conditions may make it necessary to restrict these values .

Important:

– maximum permissible drive speed of variable pump (see table of values, page 8)

– max. permissible case pressure $p_{S\,max}$ ______ 4 bar

– an increase in case pressure results in a higher control begin of the **HD**- and **DR**- controls.

  Exact details of the shift in control characteristics on request.

  Factory setting of the control begin at $p_S = 1$ bar.

Temperature range

The FKM shaft seal is suitable for case temperatures of -25° C to +90°C.

Technical data

Table of values (theoretical values, without considering η_{mh} and η_v; values rounded off)

Size			NG	250		355	500
			High-Speed-Version		250H		
Displacement		$V_{g\,max}$[1]	cm^3	250	250	355	500
		$V_{g\,min}$[1]	cm^3	0	0	0	0
Speed maximum [2)4)]	at $V_{g\,max}$	n_{nom}	rpm	1500	1800	1320	1200
Speed maximum [3)4)]	at $V_g \leq V_{g\,max}$	n_{max}	rpm	1800	–	1600	1500
Maximum flow [4)]	at n_{nom} ($V_{g\,max}$)	$q_{v\,max\,nom}$	L /min	375	450	469	600
Maximum power [4)]	at $q_{v\,nom}$ and $\Delta p = 350$ bar	P_{nom}	kW	219	262	273	350
Torque [4)]	at $V_{g\,max}$ and $\Delta p = 350$ bar (continuous operation)	T_{max}	Nm	1391	1391	1978	2785
Rotary stiffness	$V_{g\,max}$ to $0.5 \cdot V_{g\,max}$	c_{min}	Nm/rad	59500	59500	74800	115000
	$0.5 \cdot V_{g\,max}$ to $0_{(interpolated)}$	c_{max}	Nm/rad	181000	181000	262000	391000
Moment of inertia rotary group		J_{TW}	kgm^2	0.061	0.061	0.102	0.178
Angular acceleration maximum		α	rad/s^2	10000	10000	8300	5500
Case volume		V	L	3	3	5	7
Weight approx.		m	kg	102	102	173	234

1) Standard setting for limitation of the swivel angle. If another setting is required, please state in clear text.
Setting range $V_{g\,max}$: $V_{g\,max}$ to $0.8 \cdot V_{g\,max}$
$V_{g\,min}$: 0 to $0.2 \cdot V_{g\,max}$

2) Nominal speed in self priming operation with an absolute pressure (p_S) of 1 bar at inlet port S and mineral oil with a density of 0,88 kg/L

3) The values apply for $V_g \leq V_{g\,max}$ or an increase in inlet pressure p_S at the inlet port S (see diagram page 5)

4) Depending on the type of fluid, restrictions may be necessary, see chapter hydraulic fluids page 4

Important
Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. More details on limiting values for speed fluctuations, reduction in angular acceleration dependent on the frequency and the permissible starting angular acceleration (below the maximum angular acceleration) can be found in data sheet RE 90261.

Determination of size

Flow $$q_V = \frac{V_g \cdot n \cdot \eta_V}{1000} \quad [\text{L/min}]$$

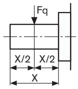
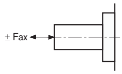
Drive torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad [\text{Nm}]$$

Power $$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \quad [\text{kW}]$$

V_g = Geometr. displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces on the drive shaft

Size		NG		250	355	500
Radial force, maximum [1)] (at $p_{A,B}$ = 1 bar)		$F_{q\ max}$	N	1200	1500	1900
Axial force, maximum [2)] (at $p_{A,B}$ = 1 bar)		$+ F_{ax\ max}$	N	4000	5000	6250
		$- F_{ax\ max}$	N	1200	1500	1900

2

1) When at standstill or pressureless circulation of the axial piston unit. Under pressurized condition higher forces are permissible, please consult us

2) Maximum permissible axial force at standstill or pressureless circulation of the axial piston unit

Regarding the permissible axial force, the direction of the force must be taken into consideration:

$- F_{ax\ max}$ = increase of bearing life

$+ F_{ax\ max}$ = decrease of bearing life

Influence of the radial force F_q on the bearing life

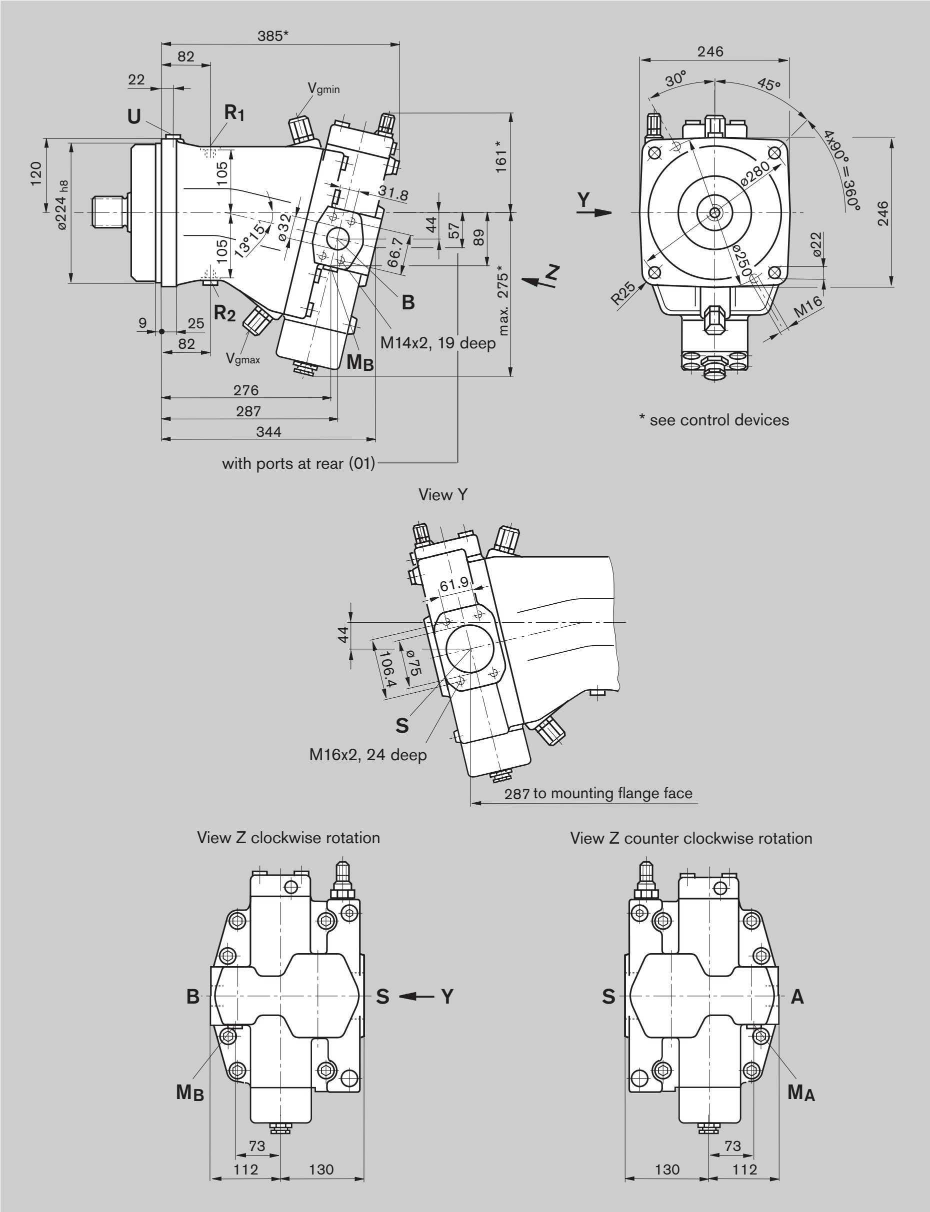
Through a favourable direction of the actuating radial force F_q,the internal load on the bearings can be compensated for and in this manner an optimum on bearing life can be obtained, please consult us.

Dimensions size 250

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S on opposite sides (02), clockwise rotation

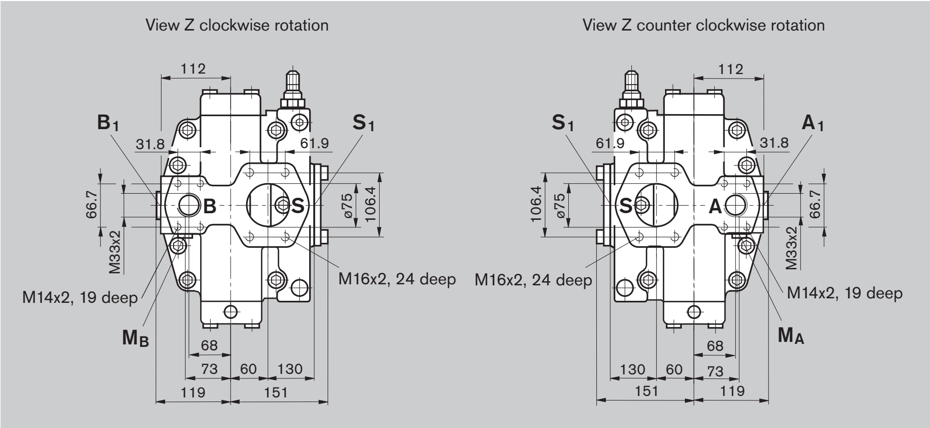
(without control devices)



Dimensions size 250

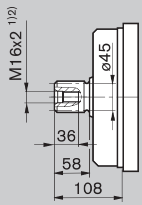
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

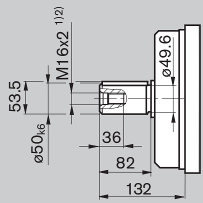


Drive shafts

Z Splined shaft DIN 5480 W50x2x24x9g



P Parallel keyed shaft DIN 6885, AS14x9x80



[1] Centering bore to DIN 332 (Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	7	O
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M22x1.5; 14 deep	3	O
R_2	Case drain	DIN 3852	M22x1.5; 14 deep	3	X
M_A, M_B	Measuring pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application, momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] Only dimensions to SAE J518

O = Must be connected (closed on delivery)

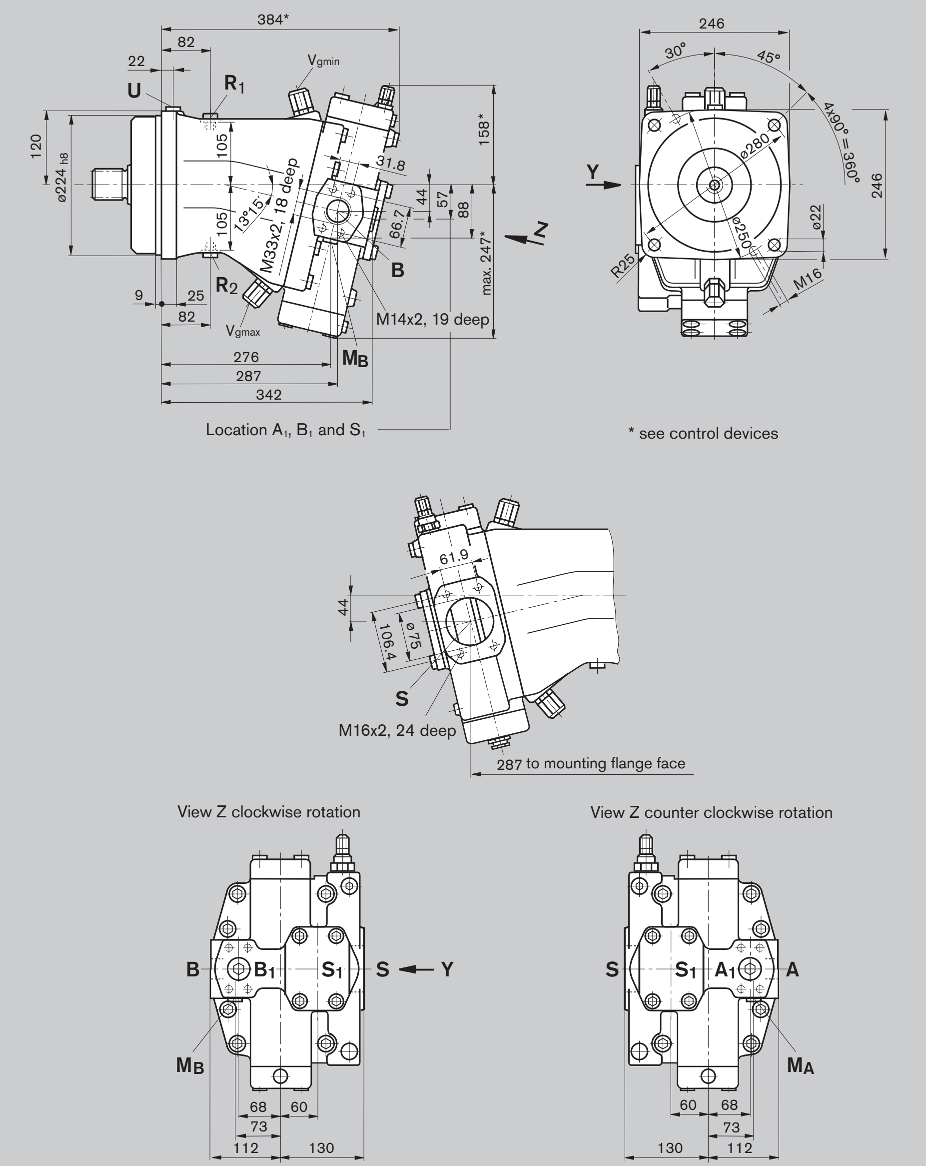
X = Plugged (in normal operation)

Dimensions size 250 High-Speed-Version

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S on opposite sides (02), clockwise rotation

(without control devices)

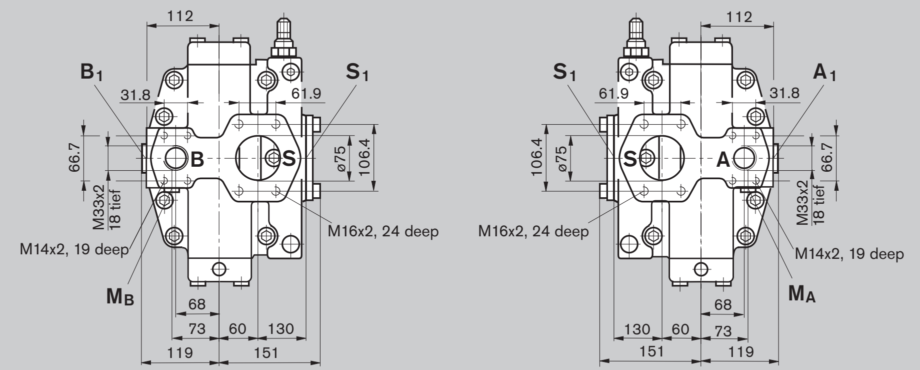


Ports A_1, B_1 and S_1 closed pressure tight with plug or flange plate, Dimensions like A, B and S

Dimensions size 250 High-Speed-Version

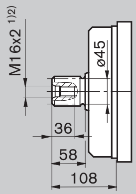
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

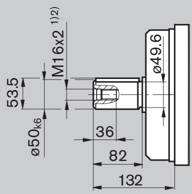


Drive shafts

Z Splined shaft DIN 5480 W50x2x24x9g



P Parellel keyed shaft DIN 6885, AS14x9x80



1) Centering bore to DIN 332 (Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure series) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	O
A_1, (B_1)	2. Pressure outlet (high pressure series) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	X [5]
S	Suction (standard pressure series) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	3[6]	O
S_1	2. Suction (standard pressure series) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	3[6]	X[7]
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1, R_2	Case drain	DIN 3852	M22x1.5; 14 deep	3	X[8]
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) Only dimensions to SAE J518

5) Closed pressure tight with plug M33x2

6) Note: suction chamber and leakage chamber are connected inside pump housing, observe permissible pressure load on shaft seal, see page 7

7) Closed pressure tight with flange plate

8) Both ports are plugged. Leakage chamber is connected with suction chamber. Separate case drain line to tank is not necessary.

O = Must be connected (closed on delivery)

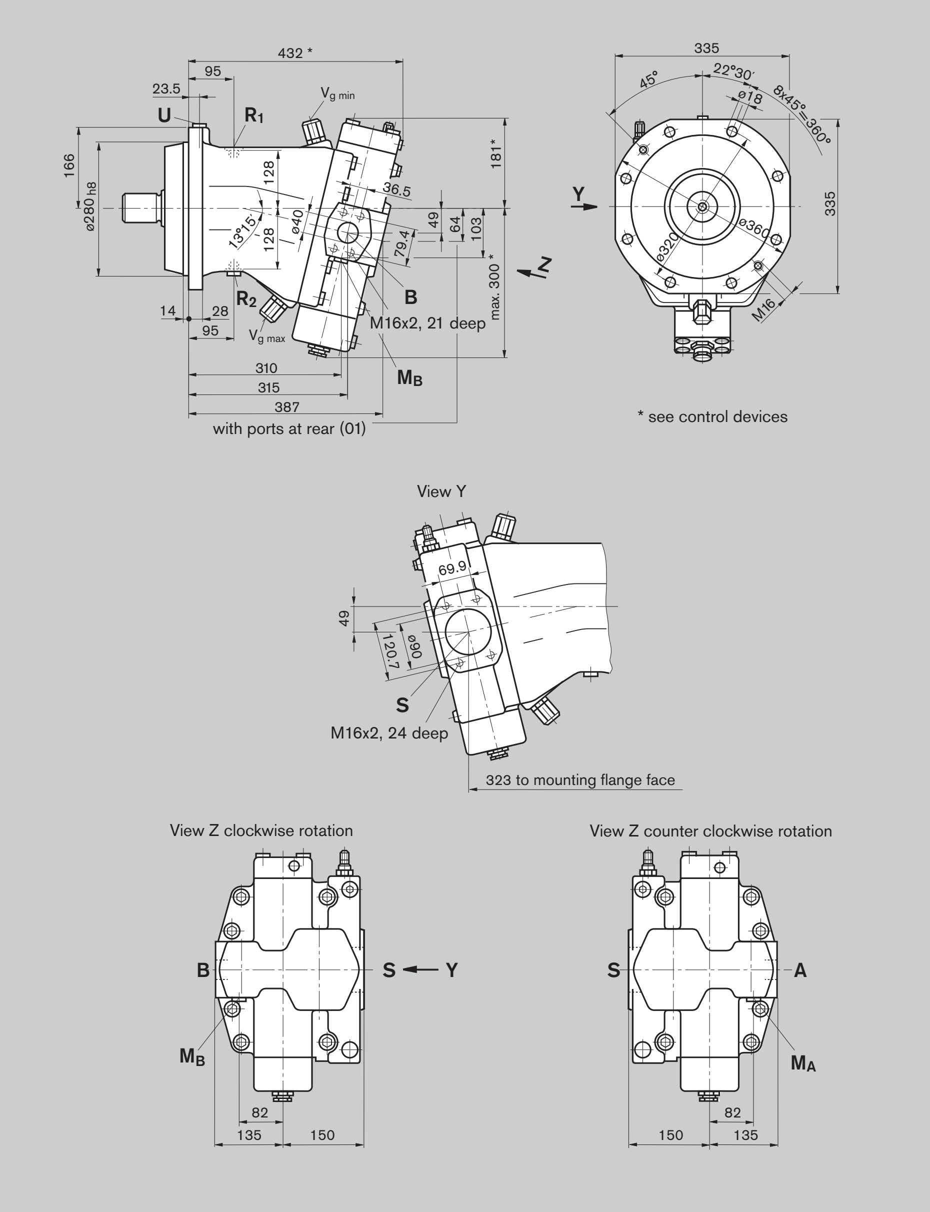
X = Plugged (in normal operation)

Dimensions size 355

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S on opposite sides (02), clockwise rotation

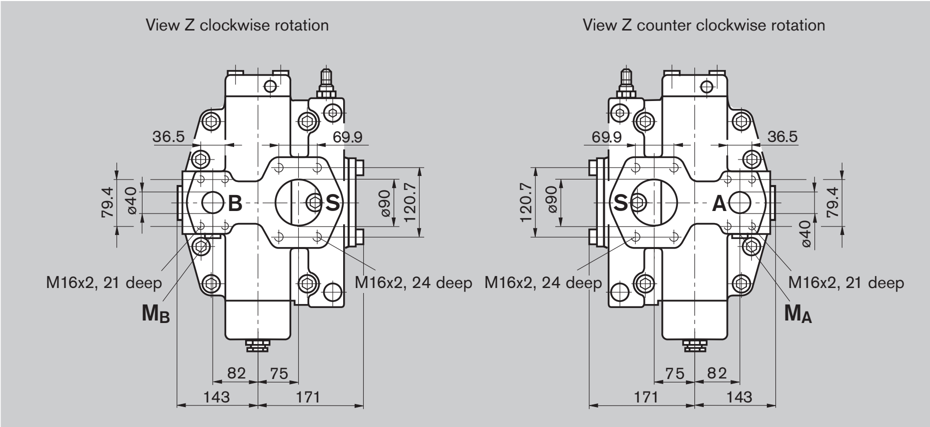
(without control devices)



Dimensions size 355

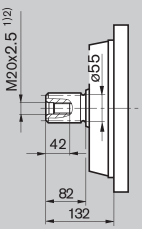
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

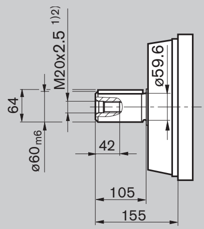


Drive shafts

Z Splined shaft DIN 5480 W60x2x28x9g



P Parallel keyed shaft DIN 6885, AS18x11x100



[1] Centering bore to DIN 332 (Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/2in M16x2; 21 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4]) DIN 13	3 1/2 in M16x2; 24 deep	7	O
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M33x2; 18 deep	3	O
R_2	Case drain	DIN 3852	M33x2; 18 deep	3	X
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] Only dimensions to SAE J518

O = Must be connected (closed on delivery)

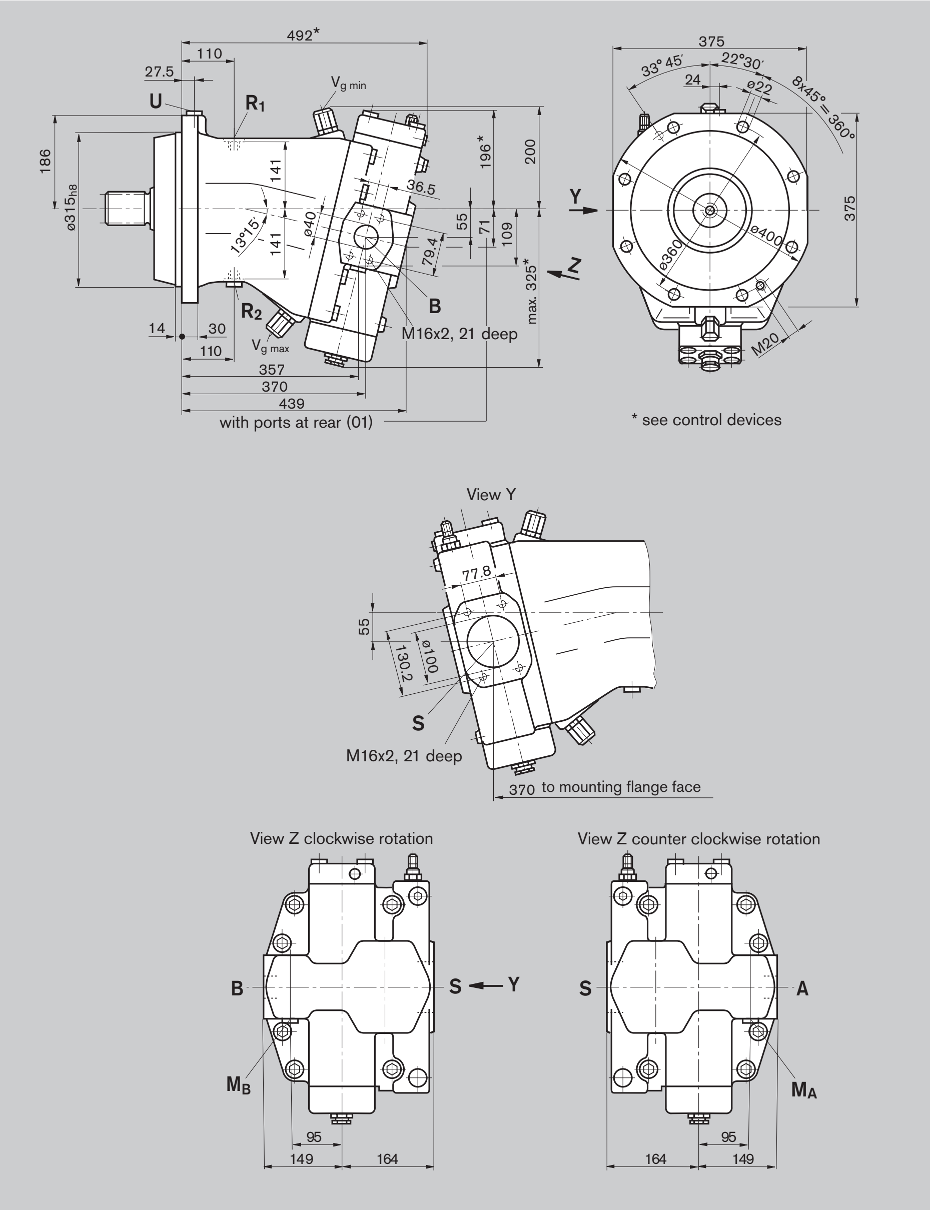
X = Plugged (in normal operation)

Dimensions size 500

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S on opposite sides (02), clockwise rotation

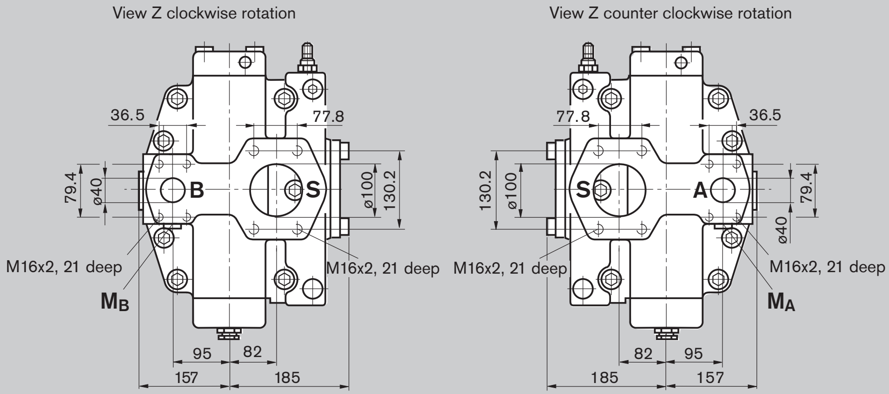
(without control devices)



Dimensions size 500

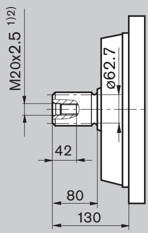
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

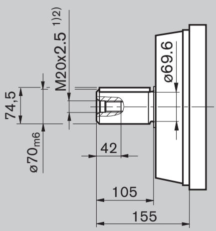


Drive shafts

Z Splined shaft DIN 5480 W70x3x22x9g



P Parallel keyed shaft DIN 6885, AS20x12x100



[1] Centering bore to DIN 332 (Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/2in M16x2, 21 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4] DIN 13	4 in M16x2, 21 deep	7	O
U	Flushing	DIN 3852	M18x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M33x2; 18 deep	3	O
R_2	Case drain	DIN 3852	M33x2; 18 deep	3	X
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] Only dimensions to SAE J518

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

DR Pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The pressure control limits the maximum pump output pressure within the control range of the pump. This max. pressure level can be set at the integrated control valve. When reaching this preset level, the pump destrokes and supplies only the amount of flow as needed by the users (actuators).

Setting range of the pressure control _______50 to 350 bar
Standard setting is 350 bar.

If another setting is required please state in clear text.

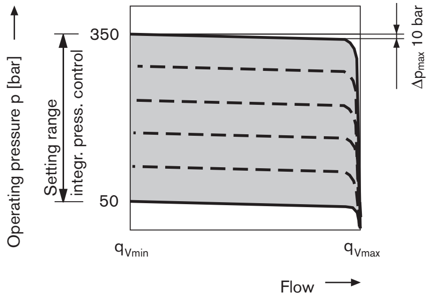
Important

– A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the DR control setting.

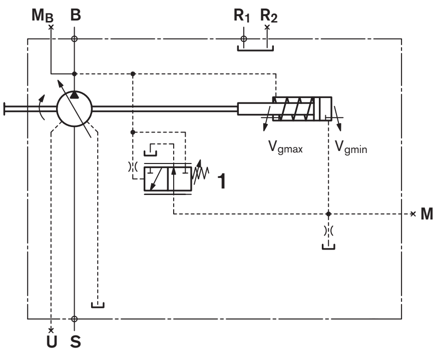
– The control begin and the DR-control characteristic is influenced by housing pressure. An increase in housing pressure results in a higher control begin and thus a parallel shifting of the control curve (see page 7).

– Operation in standby see page 6.

Characteristic



Schematic



Sub assemblies

1 Integrated pressure control valve

Ports for

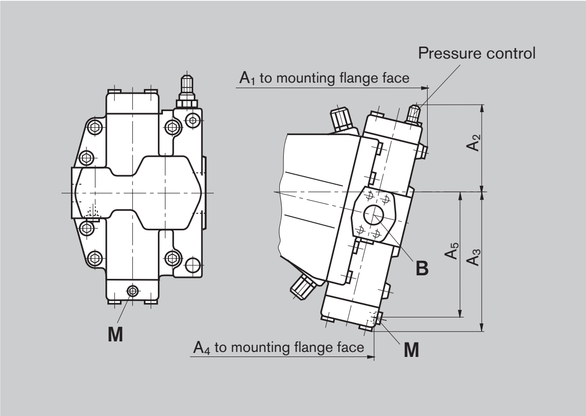
M Measuring pressure on control piston (plugged)

Dimensions **DR**

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

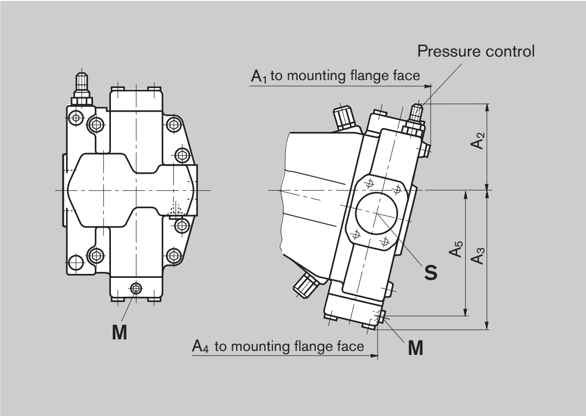
For general dimensions see pages 10 to 17

Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	161	248	297	227
355	430	175	279	333	257
500	490	200	306	382	284

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

X = Plugged (in normal operation)

DRG Pressure control remotely adjustable

Initial position: $V_{g\ max}$ in pressureless condition

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control _________50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement. $V_{g\ min}$.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

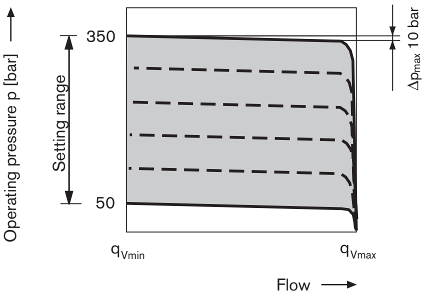
DBETR-SO 437 with dampened spool
(electric) see RE 29166

The max. line lenght should not exceed 2 m.

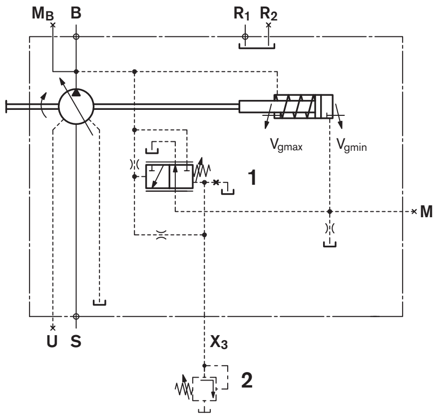
Note

- The beginning of control and the DRG control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.
- Standby operation see page 6.

Characteristic



Schematic



Sub assemblies

1 Integrated pressure compensator

2 Separate pilot pressure relief valve
(not in scope of supply)

Ports for

X_3 Separate pressure relief valve

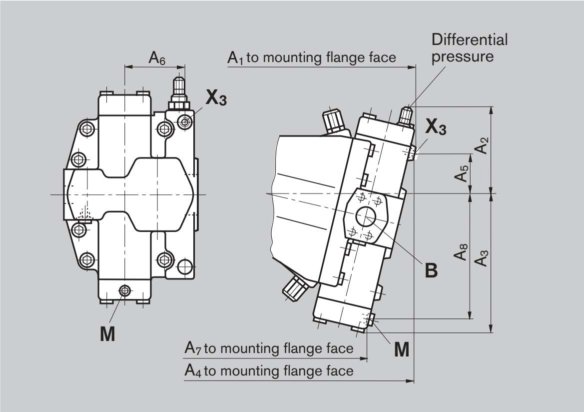
M Measuring pressure on control piston (plugged)

Dimensions DRG

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

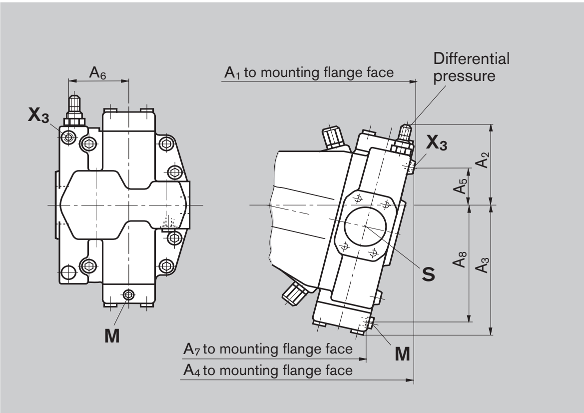


NG	A_1	A_2	A_3	A_4	A_5
250	385	161	248	380	74
355	430	175	279	425	82
500	490	200	306	483	96

NG	A_6	A_7	A_8
250	112	297	227
355	131	333	257
500	142	382	284

2

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2]	Peak pressure [bar][3]	State
X_3	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRD Power control with integrated pressure control

Initial position: $V_{g\,max}$ in pressureless condition

Power control

The power control adjusts the pump displacement in relation to the operating pressure in such a manner, that a given drive power at constant drive speed is not exceeded .

$$p_B \cdot V_g = \text{constant (drive power)}$$

p_B = operating pressure; V_g = displacement

This precise control along the hyperbolic control characteristic permits an optimum utilisation of drive power.

The operating pressure acts on a lever mechanism via the measuring spool in the displacement control piston. It is offset by the externally set spring force which acts on the pilot valve and determines the power setting.

When the operating pressure exceeds the set spring force, the power control pilot valve is actuated via the lever mechanism and the pump swivel towards a smaller displacement $V_{g\,min}$. This in turn reduces the effective moment on the lever mechanism and the operating pressure can increase in the same ratio by which the pump output flow is reduced, without exceeding the installed drive power ($p_B \cdot V_g$ = constant).

Setting range for the control begin of the power control from______________________________50 to 300 bar.

Note

– The control begin and the LR-power control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.

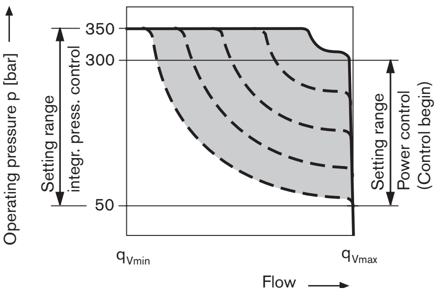
– The hydraulic output power (LR-characteristic) is influenced by pump efficiency

When ordering please state in clear text:

– Drive power P in kW
– Drive speed n in rpm
– Maximum flow $q_{v\,max}$ in L/min

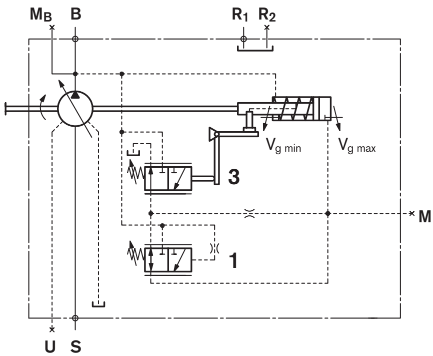
The integrated pressure control is standard and overrides the power control, description see page 24

Characteristic



Schematic

Power control with integrated pressure control



Sub assemblies

1 Pressure control

3 Power control

Port for

M Measuring pressure on control piston (plugged)

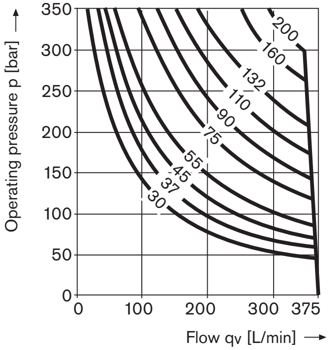
Dimensions see page 25

LRD Power control with integrated pressure control

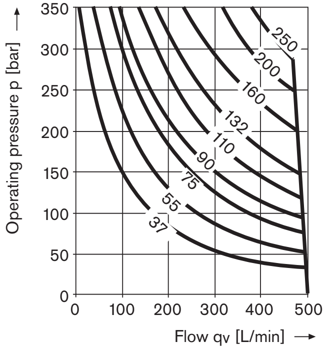
Initial position $V_{g\ max}$

Power control characteristics in kW

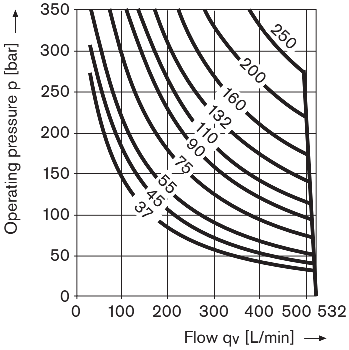
NG 250
at 1500 rpm



NG 500
at 1000 rpm



NG 355
at 1500 rpm



LRD with integrated pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The pressure control is overriding the power control.

It protects the pump against excessive pressure and consequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure level the pump will destroke towards lower displacement.

Setting range of the pressure control_______ 50 to 350 bar
Standard setting: 350 bar.

If another setting is required please state in clear text.

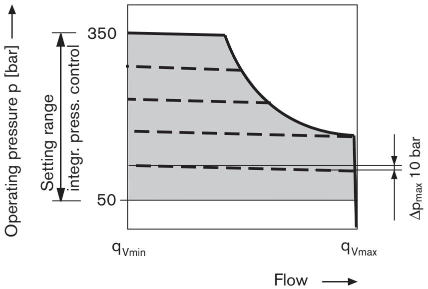
Note

– A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

– The control begin and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher control begin (see page 7) and thus a parallel shift of the characteristic.

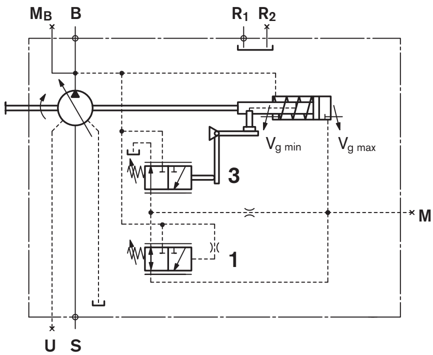
– Standby operation see page 6.

Characteristic



Schematic

Power control with integrated pressure control



Sub assemblies

1 Pressure control

3 Power control

Port for

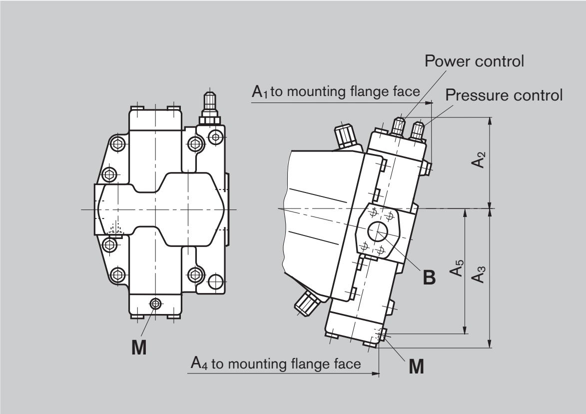
M Measuring pressure on control piston (plugged)

Dimensions LRD

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

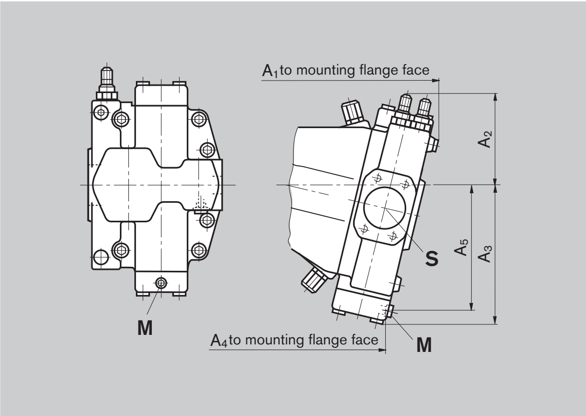
General dimensions see page 10 to 17

Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	170	248	297	227
355	430	175	279	333	257
500	490	200	306	382	284

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2)]	Peak pressure [bar][3)]	State
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2)] For the max. tightening torques the general information on page 52 must be ovserved

[3)] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

X = Plugged (in normal operation)

2

LRG with remotely adjustable pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The remotely adjustable pressure control overrides the power control.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control ________50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

DBETR-SO 437 with dampened spool
(electric) see RE 29166

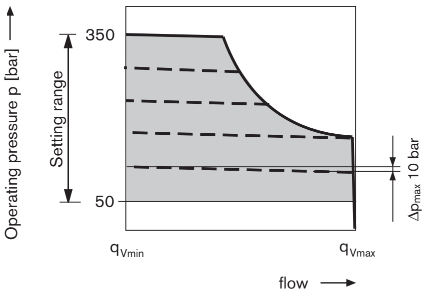
The max. line lenght should not exceed 2 m.

Note

– The beginning of control and the DRG control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

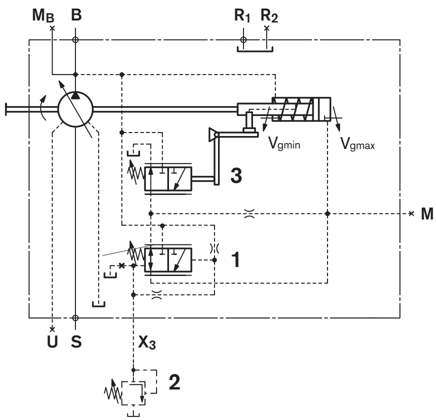
– Standby operation see page 6.

Characteristic



Schematic

Power control with remotely adjustable pressure control



Sub assemblies

1 Integrated pressure control compensator

2 Separate pressure relief valve
(not in scope of supply)

3 Power control

Ports for

X_3 Separate pressure relief valve

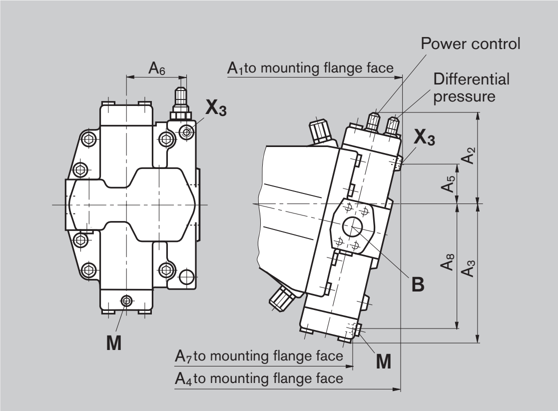
M Measuring pressure on control piston (plugged)

Dimensions LRG

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

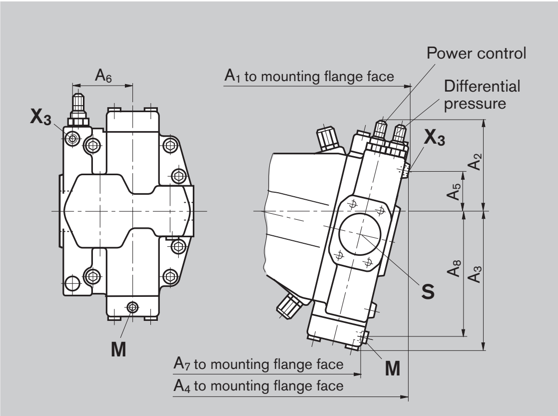


NG	A_1	A_2	A_3	A_4	A_5
250	385	170	248	380	74
355	430	175	279	425	82
500	490	200	306	483	96

NG	A_6	A_7	A_8
250	112	297	227
355	131	333	257
500	142	382	284

2

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2)]	Peak pressure [bar][3)]	State
X_3	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRDH with hydraulic stroke limitation

Initial position: $V_{g\,max}$ in pressureless condition

The hydraulic stroke limitation is used for infinite adjustment of the displacement from $V_{g\,max}$ bis $V_{g\,min}$.

It is overridden by the power control.

The displacement is set by the pilot pressure applied at port X_1

Maximum permissible pilot pressure ____________ 100 bar

The hydraulic stroke limitation takes the required control pressure from the pump output pressure. It must be noted, that the pump operating pressure must be at least 40 bar.

If the pressure is lower, the pump must be supplied with an external control pressure of at least 40 bar into port X_2.

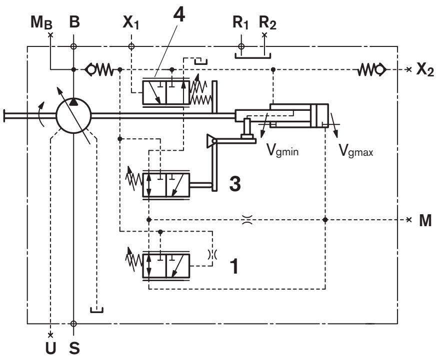
The control begin is adjustable.
Control begin (bar), please state in clear test when ordering.

Note

– The control begin and the LRDH-control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.

Schematic

Power control with integrated pressure control and hydraulic stroke limitation H



Sub assemblies

1	Pressure control
3	Power control
4	Hydraulic stroke limitation H

Ports for

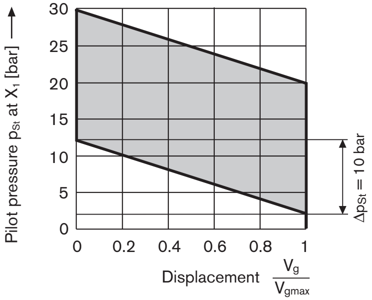
X_1	Pilot pressure
X_2	External control pressure (plugged)
M	Measuring pressure on control piston(plugged)

Dimensions see page 30

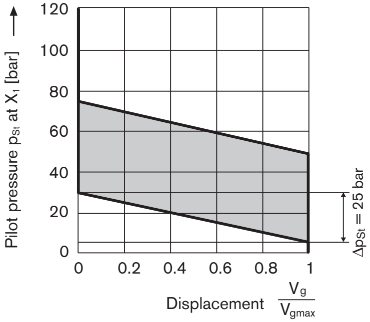
LRDH with hydraulic stroke limitation

Characteristics

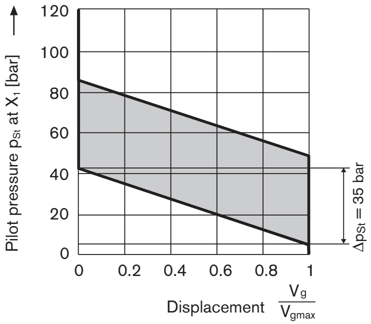
H1 Δp_{St} for hydraulic stroke limitation ____________ 10 bar
Control begin adjustable____________________ 2 to 20 bar
Standard setting of control begin ____________ 5 bar



H2 Δp_{St} for hydraulic stroke limitation ____________ 25 bar
Control begin adjustable____________________ 5 to 50 bar
Standard setting of control begin ____________ 10 bar



H3 Δp_{St} for hydraulic stroke limitation ____________ 35 bar
Control begin adjustable____________________ 7 to 50 bar
Standard setting of control begin ____________ 10 bar



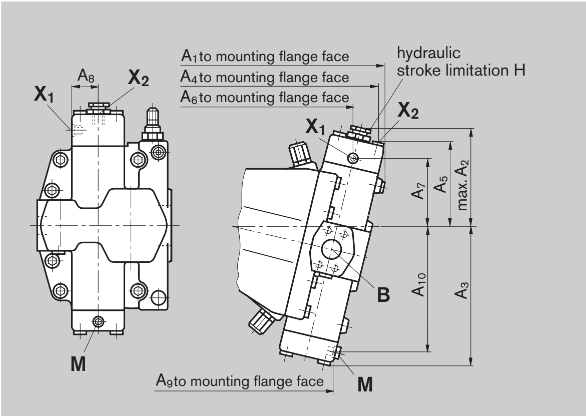
2

Dimensions LRDH

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

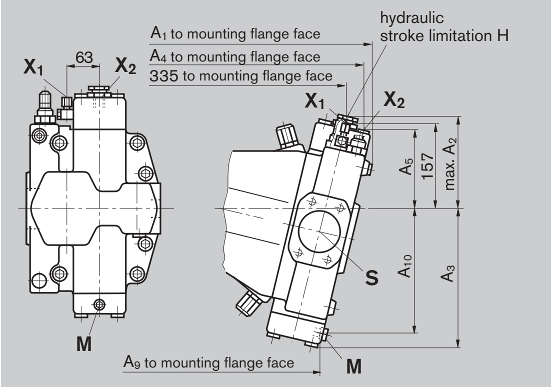


NG	A_1	A_2	A_3	A_4	A_5
250	385	188	248	370	144
355	432	203	279	416	157
500	490	215	306	470	169

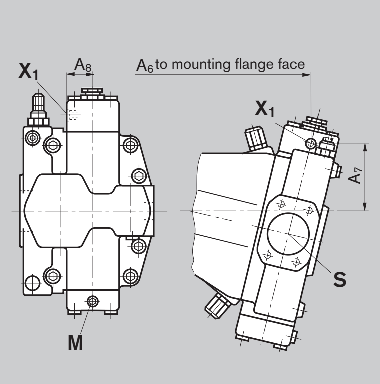
NG	A_6	A_7	A_8	A_9	A_{10}
250	327	123	49	297	227
355	366	137	54	333	257
500	417	148	61.5	382	284

Counter clockwise rotation

Port X_1, showing NG250



Port X_1, showing NG355 and 500



Ports

Designation	Ports for	Standard	Size[2)]	Peak pressure [bar][3)]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852 DIN 3852	M14x1.5; 12 deep (NG250 a. 355) M18x1.5; 12 deep (NG500)	400 400	X X
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRDN with hydraulic stroke limitation

Initial position: $V_{g\ min}$ in pressureless condition

The hydraulic stroke limitation is used for infinite adjustment of the displacement from $V_{g\ min}$ to $V_{g\ max}$.

It is overridden by the power control.

Displacement is set by the pilot pressure applied at port X_1.

Maximum permissible pilot pressure p ______ 100 bar

A minimum pressure of 40 bar is required for hydraulic stroke limitation. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\ min}$ > 0. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure source of at least 40 bar must be connected to port X_2.

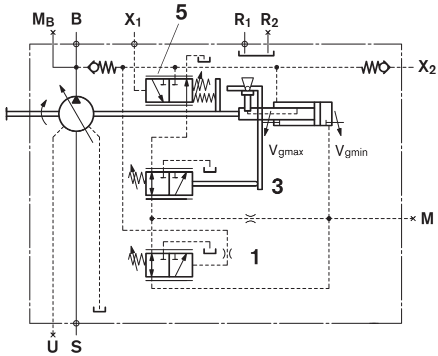
The control begin is adjustable.
Control begin (bar), please state in clear text when ordering.

Note

– The control begin and the LRDN-control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.

Schematic

Power control with integrated pressure control and hydraulic stroke limitation N



Sub assemblies

1 Pressure control

3 Power control

5 Hydraulic stroke limitation N

Ports for

X_1 Pilot pressure

X_2 External control pressure

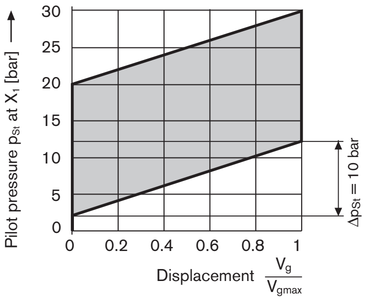
M Measuring of pressure on control piston (plugged)

Dimensions see page 33

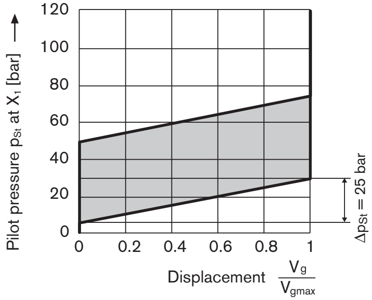
LRDN with hydraulic stroke limitation

Characteristics

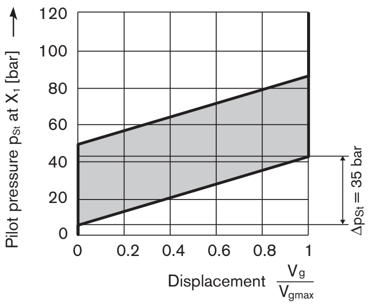
N1 Δp_{St} for hydraulic stroke limitation ______ 10 bar
Control begin adjustable ______ 2 to 20 bar
Standard setting of control begin ______ 5 bar



N2 Δp_{St} for hydraulic stroke limitation ______ 25 bar
Control begin adjustable ______ 5 to 50 bar
Standard setting of control begin ______ 10 bar



N3 Δp_{St} for hydraulic stroke limitation ______ 35 bar
Control begin adjustable ______ 7 to 50 bar
Standard setting of control begin ______ 10 bar

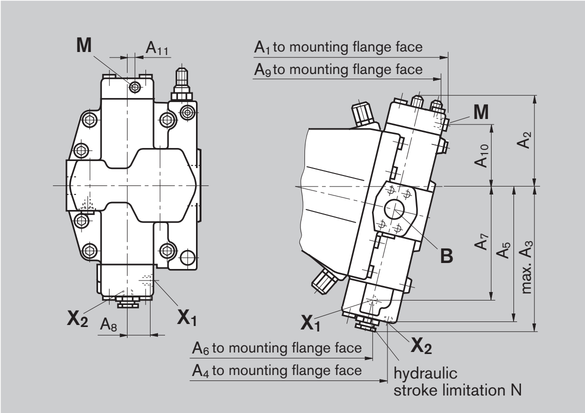


Dimensions LRDN

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

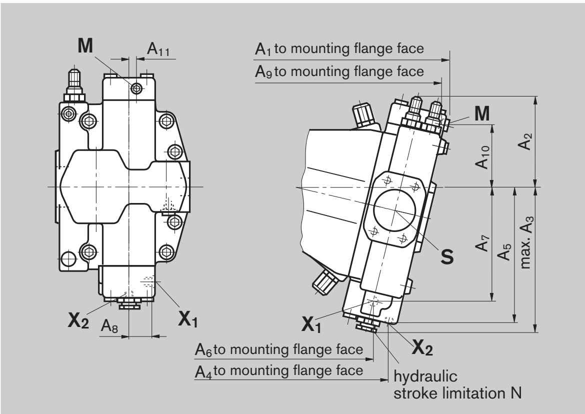


NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	170	275	276	248	248
355	430	175	300	315	275	278
500	492	200	325	359	300	322

NG	A_7	A_8	A_9	A_{10}	A_{11}
250	210	49	377	116	14
355	234	54	425	132	20
500	258	61.5	483	144	20

2

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2]	Peak pressure [bar][3]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852 DIN 3852	M14x1.5; 12 deep (NG250 a. 355) M18x1.5; 12 deep (NG500)	400 400	O [4] O [4]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

HD.D Hydraulic control, pilot pressure dependent

Initial position: $V_{g\,min}$ in pressureless condition

The hydraulic pilot pressure dependent control enables an infinite adjustment of the pump displacement in accordance with the applied pilot pressure signal. The displacement setting is proportional to the pilot pressure in port X_1.

A minimum control pressure of 40 bar is required. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\,min}$ > 0. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure of at least 40 bar must be connected to port X_2.

Maximum permissible pilot pressure p_{St} ______ 100 bar

The control begin is adjustable.
Control begin (bar), please state in clear text when ordering.

Note

– The beginning of control and the HD control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

Integrated pressure control is standard. Description see page 37

Note

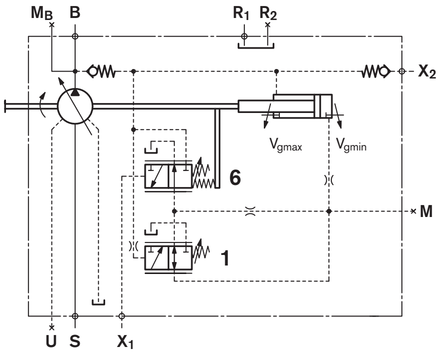
The spring return feature in the control unit is not a safety device

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop).

Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Pressure control

6 HD-pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

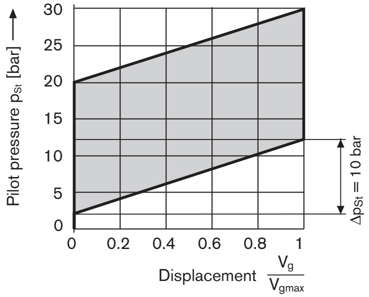
M Measuring pressure on control piston

Dimensions see page 36

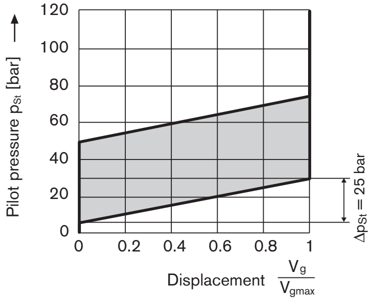
HD.D Hydraulic control, pilot pressure dependent

Characteristics

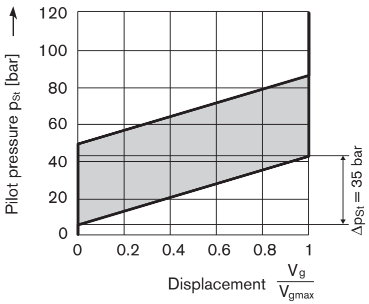
HD1D Δp_{St} ____________________ 10 bar
Control begin adjustable ____________ 2 to 20 bar
Standard setting of control begin __________ 5 bar



HD2D Δp_{St} ____________________ 25 bar
Control begin adjustable ____________ 5 to 50 bar
Standard setting of control begin __________ 10 bar



HD3D Δp_{St} ____________________ 35 bar
Control begin adjustable ____________ 7 to 50 bar
Standard setting of control begin __________ 10 bar

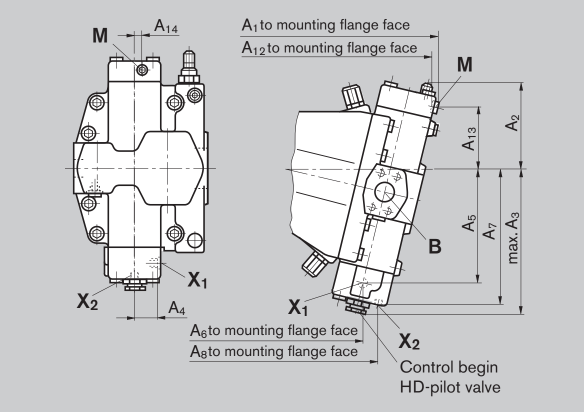


Dimensions HD.D

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

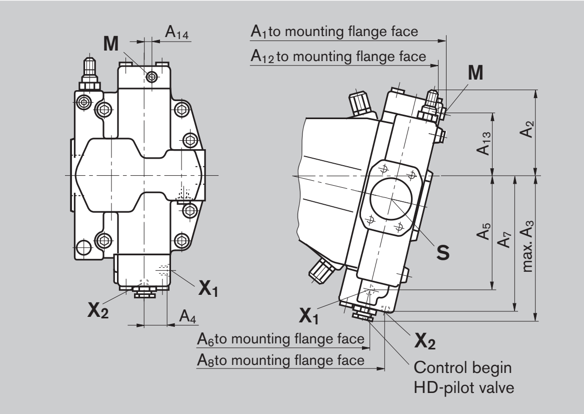


NG	A_1	A_2	A_3	A_4	A_5
250	385	161	275	49	210
355	432	181	300	54	234
500	492	200	325	61.5	258

NG	A_6	A_7	A_8
250	248	248	276
355	278	275	315
500	322	300	359

NG	A_{12}	A_{13}	A_{14}
250	377	116	14
355	425	132	20
500	483	144	20

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2)]	Peak pressure [bar][3)]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4)]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4)]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2)] For the max. tightening torques the general information on page 52 must be observed

[3)] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4)] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

HD.D with integrated pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the HD-function i.e. below the setting of the pressure control the HD-function can be operated

It protects the pump against excessive pressure and subsequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure control level the pump will swivel towards a lower displacement.

Setting range of the pressure control _______ 50 to 350 bar
Standard setting at 350 bar.

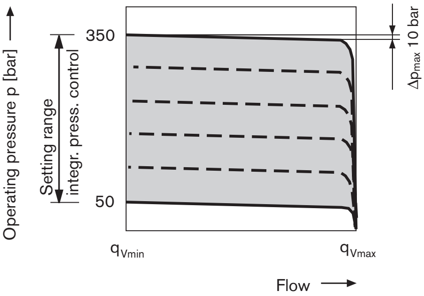
If a different setting is required, please state in clear text.

A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

Note

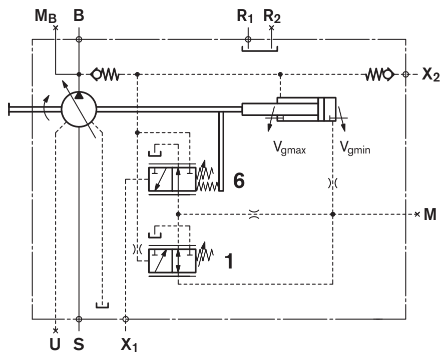
- The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic
- Standby operation see page 6.

Characteristic



Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Pressure control

6 HD-Pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

M Measuring pressure on control piston (plugged)

Dimensions see page 39

HD.G with remotely adjustable pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the HD function.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control ________50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

DBETR-SO 437 with dampened spool
(electric) see RE 29166

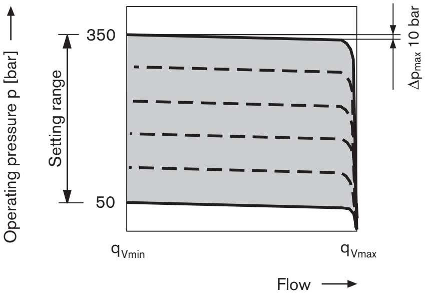
The max. line lenght should not exceed 2 m.

Note

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

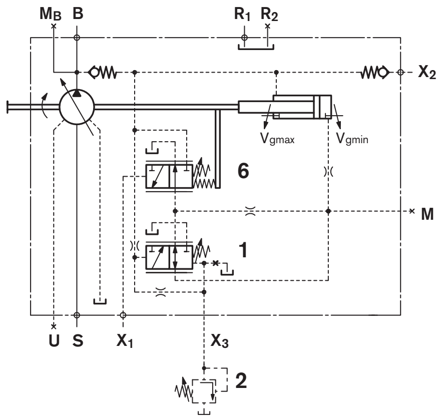
– Standby operation see page 6.

Characteristic



Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Integrated pressure control compensator

2 Separate pressure relief valve (not in scope of supply)

6 HD-pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

X_3 Separate pressure relief valve
(for HDG)

M Measuring of pressure on control piston (plugged)

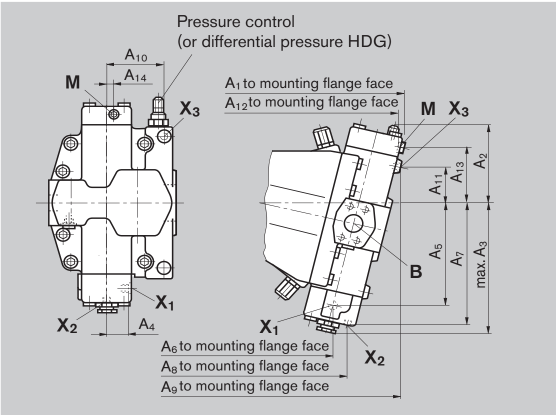
Dimensions see page 39

Dimensions HD.D and HD.G

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation

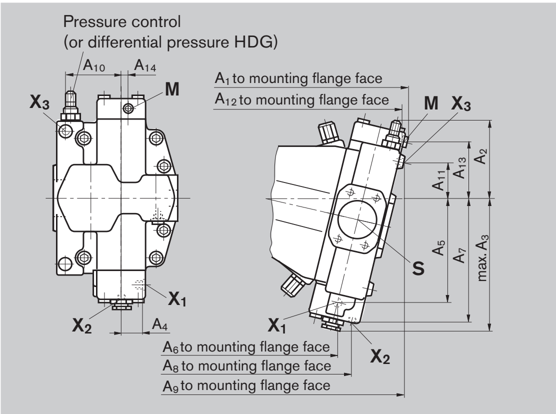


NG	A_1	A_2	A_3	A_4	A_5
250	385	161	275	49	210
355	432	181	300	54	234
500	492	200	325	61.5	258

NG	A_6	A_7	A_8	A_9	A_{10}
250	248	248	276	380	112
355	278	275	315	425	131
500	322	300	359	483	142

NG	A_{11}	A_{12}	A_{13}	A_{14}
250	74	377	116	14
355	82	425	132	20
500	96	483	144	20

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2)]	Peak pressure [bar][3)]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4)]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4)]
X_3 (for HDG)	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring of pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

EP.D Electric control with proportional valve

Initial position: $V_{g\ min}$ in pressureless condition

The electro-hydraulic control with proportional valve enables a stepless adjustment of the pump displacement dependent on an electric current signal.

The displacement is proportional to the current signal to the solenoid of a proportional pressure reducing valve DRE4K (see RE 29181), i.e. an increasing current signal results in an increasing displacement.

A minimum control pressure of 40 bar is required. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\ min} > 0$. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure of at least 40 bar must be connected to port X_2.

A pilot pressure of 30 bar is required at port P to actuate the proportional valve DRE4K.

Pilot pressure at port P

Required p_{min} ______ 30 bar

p_{max} ______ 100 bar

Important

– For operation on HF-fluids please observe the information in RE 29181
(Proportional-pressure reducing valve Type DRE4K).

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

– Type of protection proportional valve to IP65

Note

The spring return feature in the control unit is not a safety device

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a safe position (e.g. immediate stop).

Technical data proportional-press. reducing valve

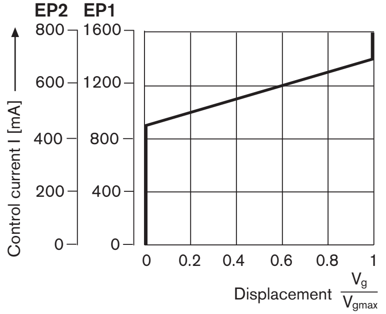
	EP1	EP2
Operating valtage (DC)	12V(±20%)	24V (±20%)
Control current		
Control begin at $V_{g\ min}$	900 mA	450 mA
Control end at $V_{g\ max}$	1400 mA	700 mA
Current limit	2,2 A	1,0 A
Nom. resistance (at 20°C)	2,4 Ω	12 Ω
Duty cycle	100 %	100 %
Type of protection (HIRSCHMANN) to DIN EN 60529	IP65	IP65

Various amplifiers for control of the proportional valve are available in the Rexroth program, see RE 29181.

Integrated pressure control EP.D is standard and overrides the EP function. Description see page 43.

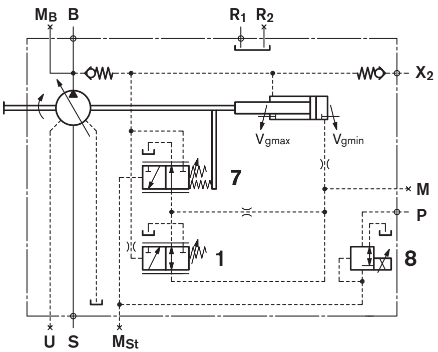
EP.D Electric control with proportional valve

Characteristic



Schematic

Electric control with proportional pressure reducing valve



Sub assemblies

1 Pressure control

7 Pilot valve

8 Proportional pressure reducing valve (see RE 29181) incl. conductor box (Hirschmann plug without suppressor diode) see page 50

Ports for

P Pilot pressure

X_2 External control pressure

M Measuring pressure on control piston (plugged)

M_{St} Measuring pilot pressure (plugged)

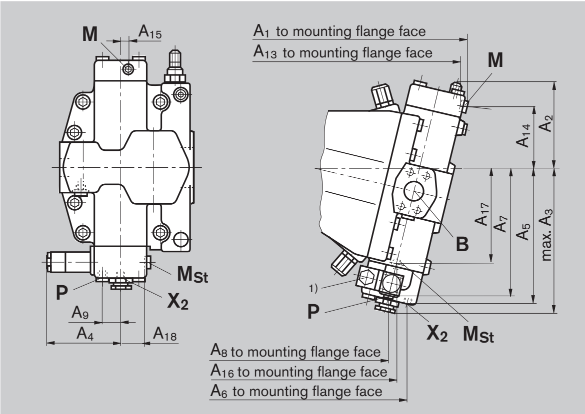
Dimensions see page 42

Dimensions EP.D

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation



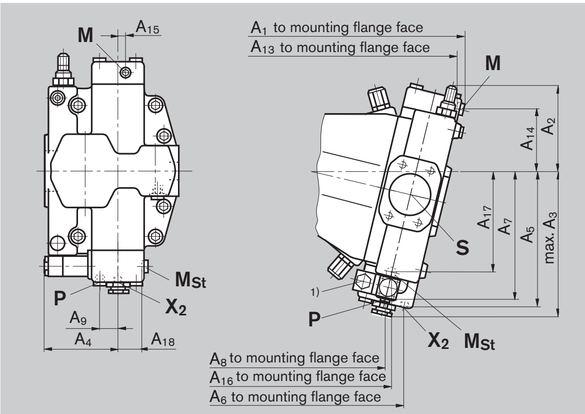
NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	161	275	115	248	276
355	432	181	300	116	275	315
500	492	200	325	123	300	359

NG	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
250	238	241	36	112	380	74
355	268	286	36	131	425	82
500	294	328	43	142	483	96

NG	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}
250	377	116	14	248	210	49
355	425	132	20	278	234	54
500	483	144	20	322	258	61.5

1) Cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
P	Pilot pressure for proportional valve	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X
M_{St}	Measuring pilot pressure	DIN 3852	M14x1.5; 12 deep	100	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

EP.D with integrated pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the EP-function i.e. below the setting of the pressure control the EP-function can be operated.

It protects the pump against excessive pressure and subsequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure control level the pump will swivel towards a lower displacement.

Setting range of the pressure control_______ 50 to 350 bar
Standard setting at 350 bar.

If a different setting is required, please state in clear text.

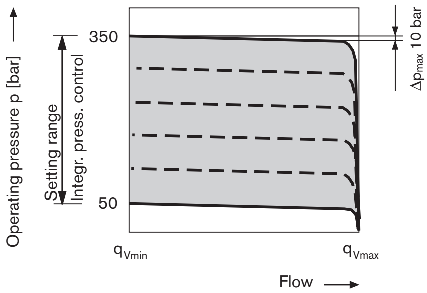
A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

Note

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic

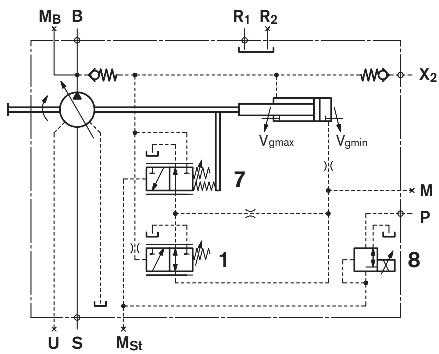
– Standby operation see page 6.

Characteristic



Schematic

Electric control with proportional pressure reducing valve



Sub assemblies

1 Pressure control

7 Pilot valve

8 Proportional pressure reducing valve incl. conductor box (Hirschmann plug without suppressor diode) see page 46

Ports for

P	Pilot pressure
X_2	External control pressure
M	Measuring pressure on control piston (plugged)
M_{St}	Measuring pilot pressure (plugged)

Dimensions see page 45

2

EP.G with remotely adjustable pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the EP- function.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve must be ordered separately to the DRG control.

Setting range of the pressure control ________50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

DBETR-SO 437 with dampened spool (electric) see RE 29166

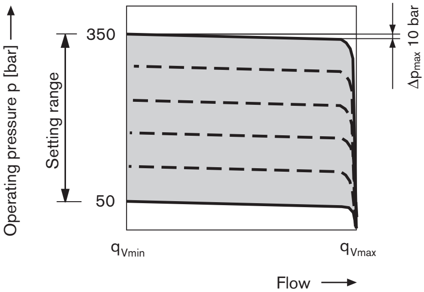
The max. line lenght should not exceed 2 m.

Note

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

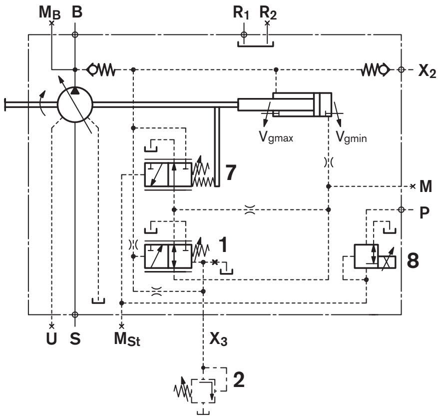
– Standby operation see page 6.

Characteristic



Schematic

Electric control with proportional pressure reducing valve and remotely adjustable pressure control



Sub assemblies

1	Integrated pressure control compensator
2	Separate pressure relief valve (not in scope of supply)
7	Pilot valve
8	Proportional pressure reducing valve

Ports for

P	Pilot pressure for proportional valve
X_2	External control pressure
X_3	Separate pressure relief valve (EPG)
M	Measuring pressure on control piston (plugged)
M_{St}	Measuring pilot pressure (plugged)

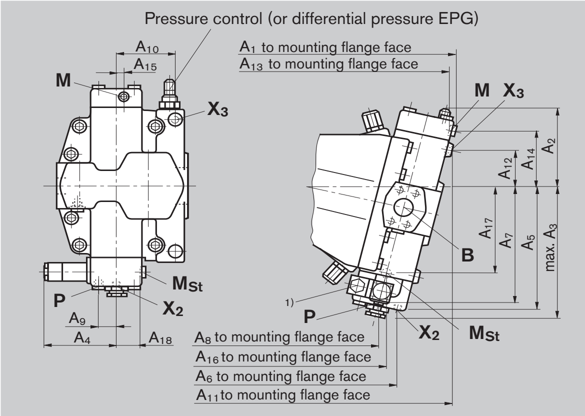
Dimensions see page 45

Dimensions EP.D and EP.G

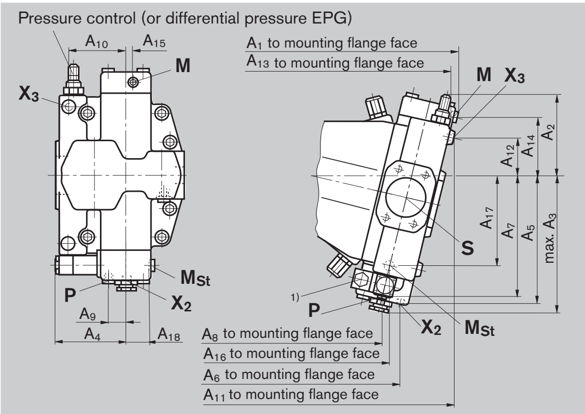
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation



Counter clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	161	275	115	248	276
355	432	181	300	116	275	315
500	492	200	325	123	300	359

NG	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
250	238	241	36	112	380	74
355	268	286	36	131	425	82
500	294	328	43	142	483	96

NG	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}
250	377	116	14	248	210	49
355	425	132	20	278	234	54
500	483	144	20	322	258	61.5

1) Cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

2

Ports

Designation	Port for	Standard	Size[2)]	Peak pressure [bar][3)]	State
P	Pilot pressure for proportional valve	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O
X_3 (for EPG)	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X
M_{St}	Measuring pilot pressure	DIN 3852	M14x1.5; 12 deep	100	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

Visual swivel angle indicator

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

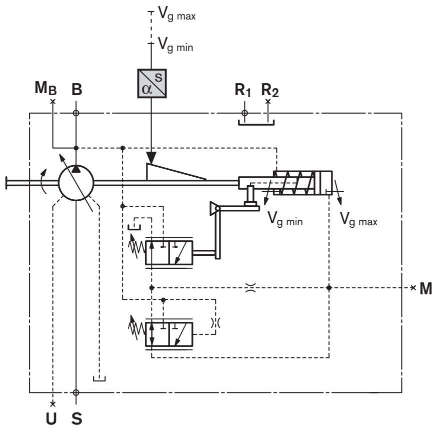
The swivel angle is indicated by a pin at the side of the port plate (the cap nut must be removed).

The protruding lenght of the pin varies in accordance with the position of the lens plate.

The pump is at zero if the pin is flush with the port plate.

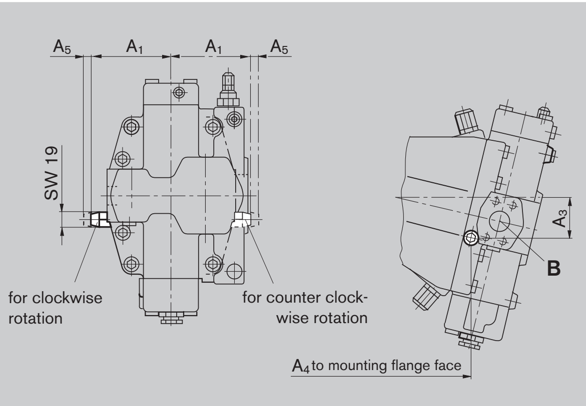
The lenght of the pin is approx. 8 mm when swivelled to max. angle $\mathbf{V}_{g\ max}$.

Schematic example LRD – intial position $V_{g\ max}$



Dimensions

General dimensions see page 10 to 17



NG	A_1	A_3	A_4	A_5*
250	136.5	73	238	11
355	159.5	84	266	11
500	172.5	89	309	11

* Dimension to remove the cap nut

Electric swivel angle indicator

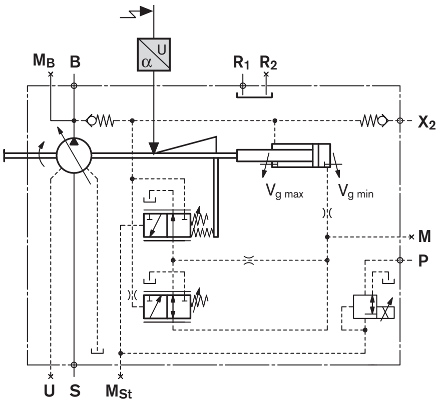
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

In this case the pump swivel angle is indicated via an inductive position transducer.

It converts the displacement of the control device into an electrical signal This signal can be used to feed the value of swivel angle to an amplifier card for example.

Inductive transducer Type IW9 – 03 – 01

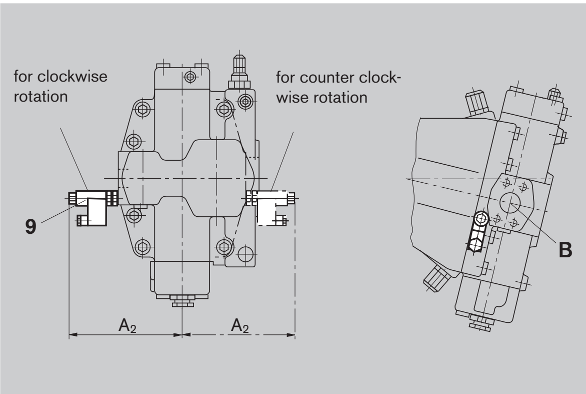
Schematic example EPD – intial position $V_{g\ min}$



2

Dimensions

General dimensions see page10 to 17



NG	A_2
250	182
355	205
500	218

Sub assemblies

9 Inductive transducer IW9-03-01
with conductor box (mating plug) Hirschmann plug without suppressore diode, with cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

Installation instructions standard version

General

During commissioning and operation the axial piston unit must be full with fluid at all times and must be deaerated. This is also important after prolonged periods of standstill since the system can empty itself via the hydraulic lines

The leakage fluid in the housing must be drained to tank via the highest positioned case drain port.

Under all operating conditions the case drain line and the suction line inside the reservoir must be below the minimum fluid level

The minimum inlet pressure at port S may not fall below 0.8 bar absolute.

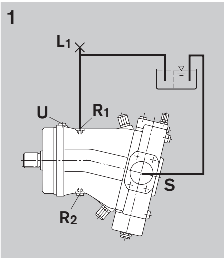
Installation position

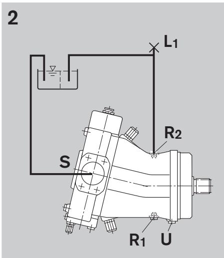
See examples below. Further installation positions are possible, please consult us.

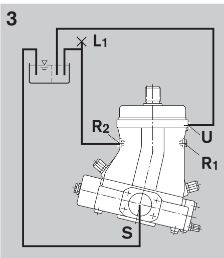
Mounting below the reservoir (standard)

Pump below the minimum reservoir fluid level

Recommemded installation position: 1 and 2

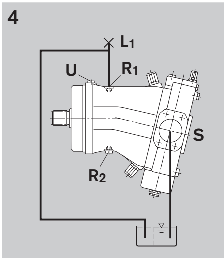


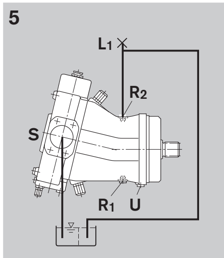




Installation position	Deaerate	Filling
1	–	R_1 (L_1)
2	–	R_2 (L_1)
3	U	R_2 (L_1)

Mounting above the reservoir





Installation position	Deaerate	Filling
4	–	R_1 (L_1)
5	–	R_2 (L_1)

Installation instructions High-Speed-version

General

During commissioning and operation the axial piston unit must be full with fluid at all times and must be deaerated. This is also important after prolonged periods of standstill since the system can empty itself via the hydraulic lines

The leakage chamber and suction chamber are connected inside the pump housing. A case drain line to tank is not necessary.

The suction line inside the reservoir must end up below the minimum fluid level under all operating conditions.
The minimum inlet pressure at port S may not fall below 0.8 bar absolute.

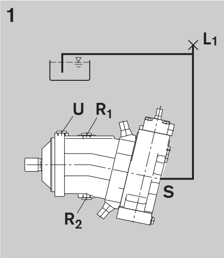
Installation position

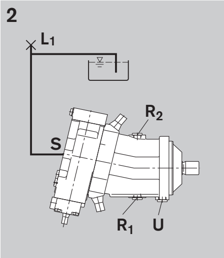
See examples below. Further installation positions are possible, please consult us

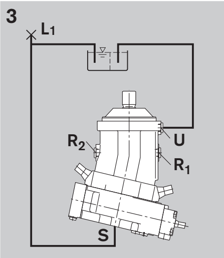
Mounting below the reservoir (standard)

Pump below the minimum reservoir fluid level

Recommended installation position: 1 and 2.







Installation position	Deaerate	Filling
1	R_1	S (L_1)
2	R_2	S (L_1)
3	U	S (L_1)

Plug

On EP-control and electric swivel angle indicator E

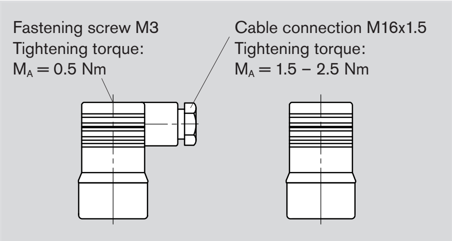
HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

Without bi-directional suppressor diode

Type of protection to DIN/EN 60529: IP65

The sealing ring in the cable connection is suitable for a cable diameter of 4.5 mm to 10 mm.

The HIRSCHMANN-plug is included in the delivery of the pump.



Notes

Safety information

– The pump A7VO was designed for operation in open loop circuits

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned; take suitable safety measures (wear protective clothing).

– Dependent on the operating conditions of the axial piston pump (operating pressure, fluid temperature) deviations in the performance curves can occur.

– Pressure ports:
All materials and port threads are selected and designed in such a manner, that they can withstand the peak pressures.
The machine and system manufacturer must ensure, that all connecting elements and hydraulic lines are suitable for the actual operating conditions (pressures, flow, fluid, temperature) in accordance with the necessary safety factors.

– All given data and information must be adhered to..

– The product has not been released as a component in the safety concept of a total machine system acc. to DIN EN ISO 13849.

– The following tightening torques are valid:

- Female threads in the axial piston unit:
the maximum permissible tightening torques M_{GMax} are maximum values for the female threads in the pump casting and may not be exceeded. For values see table below. -

- Fittings:
please comply with the manufacturer's information regarding the max. permissible tightening torques for the used fittings.

- Fastening bolts:
for fastening bolts to DIN 13 we recommend to check the permissible tightening torques in each individual case to VDI 2230.

- Plugs:
for the metal plugs, supplied with the axial piston unit the following min. required tightening torques M_V apply (see table)

Port thread size		**Max. perm. tightening torque in female threads $M_{G\ max}$**	**Required tightening torque of plugs or fittings M_V**	**Across the flats in Allan screws**
M14x1.5	DIN 3852	80 Nm	35 Nm	6 mm
M18x1.5	DIN 3852	140 Nm	60 Nm	8 mm
M22x1.5	DIN 3852	210 Nm	80 Nm	10 mm
M33x2	DIN 3852	540 Nm	225 Nm	17 mm

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www.boschrexroth.com/axial-piston-pumps

The Drive & Control Company

Rexroth
Bosch Group

Axial Piston Variable Pump A1VO Series 10

RE 92650
Issue: 02.2013
Replaces: 01.2012

- Size 35
- Nominal pressure 250 bar
- Maximum pressure 280 bar
- Open circuit

Features

- Variable pump in axial piston swashplate design for hydrostatic drives in an open circuit
- The flow is proportional to the drive speed and displacement.
- The volume flow can be infinitely varied by adjusting the swashplate angle.
- A wide range of highly adaptable control devices with different pilot and regulating functions, for all important applications.
- Compact design
- High efficiency
- High power density
- Low noise

Contents

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D3/D4 – Pressure control with override	10
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Ordering code

01	02	03	04	05	06	07	08		09	10	11	12	13	14	15	16	17		18
A1V	**O**	**035**		**C**	**2**		**0**	**/**	**10**	**B**		**V**	**B2**		**1**		**0**	**–**	**0**

Axial piston unit

01	Swashplate design, variable, nominal pressure 250 bar, maximum pressure 280 bar		**A1V**

Operating mode

02	Pump, open circuit	**O**

Sizes (NG)

03	Geometric displacement, see table of values on page 7	**035**

Control devices

04	Pressure controller		●	**DR**
	with override, electrically proportional, negative control	*U* = 12 V	○	**D3**
		U = 24 V	○	**D4**
	with load sensing		●	**DRS0**

Controller design and mounting

05	Cartridge	**C**

Setting

06	Adjustable	**2**

Connector for solenoids[1)]

07	Without connector (without solenoid, only for hydraulic control)	●	**0**
	DEUTSCH – molded connector, 2-pin, without suppressor diode (see page 16)	○	**P**

Auxiliary function

08	Without additional function	**0**

Series

09	Series 1, index 0	**10**

Configuration of ports and fastening threads

10	ANSI, port threads with O-ring seal according to ISO 11926, metric fastening thread on through drive version	**B**

Directions of rotation

11	Viewed on drive shaft	cw	**R**
		ccw	**L**

Seals

12	FKM (fluor-caoutchouc)	**V**

Mounting flange

13	SAE J744	101-2	**B2**

Drive shafts (for permissible input torque, see page 8)

14	Splined shaft, ANSI B92.1a	7/8 in 13T 16/32 DP, not for through drive	**S4**
		1 in 15T 16/32DP	**S5**

● = Available ○ = On request

1) Connectors for other electric components can deviate

Ordering code

01	02	03	04	05	06	07	08		09	10	11	12	13	14	15	16	17		18
A1V	**O**	**035**		**C**	**2**		**0**	**/**	**10**	**B**		**V**	**B2**		**1**		**0**	**–**	**0**

Service line ports

15	Threaded connections A/B and S on opposite sides	**1**

Through drives (for fitting options, see page 15)

16	Flange SAE J744			Coupling for splined shaft[2]			
		Fitting variant					
	Diameter	Symbol[3]	Designation	Diameter		Designation	
	Without through drive						**0000**
	82-2 (A)	o-o	A2	5/8 in	9T 16/32 DP	S2	**A2S2**
				3/4 in	11T 16/32 DP	S3	**A2S3**
				7/8 in	13T 16/32 DP	S4	**A2S4**
	101-2 (B)	o-o	B2	7/8 in	13T 16/32 DP	S4	**B2S4**
				1 in	15T 16/32 DP	S5	**B2S5**

Auxiliary function

17	Without additional function	**0**

Standard / special version

18	Standard version	**0**

● = Available ○ = On request

2) Coupling for splined shaft according to ANSI B92.1a

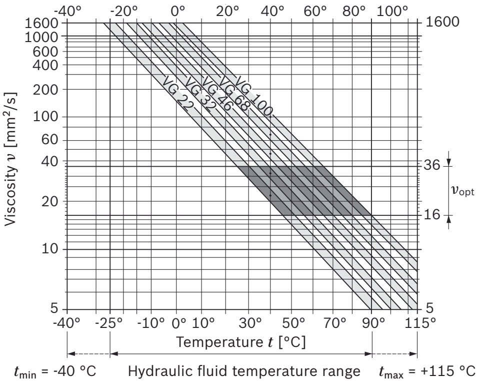
3) Configuration of securing holes when viewed to through drive, with service line port B on right.

Hydraulic fluid

Prior to project planning, please refer to the detailed information in our data sheet RE 90220 (mineral oil) concerning the choice of hydraulic fluid and application conditions.

Further hydraulic fluids only after approval examination. Please contact us.

▼ **Selection diagram**



Notes on the choice of hydraulic fluid
Choosing the correct hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature, in an open circuit the reservoir temperature.
The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.
Example: at an ambient temperature of X °C the operating temperature is 60 °C. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68. To be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.
Please contact us if the above conditions cannot be maintained due to extreme operating parameters.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		T_{min} ≥ -50 °C T_{opt} = +5 °C to +20 °C	Factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up	ν_{max} = 1600	T_{St} ≥ -25 °C	t ≤ 1 min, without load (p ≤ 30 bar), n ≤ 1000 rpm
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid
Warm-up phase	ν < 1600 to 400		At $p \leq 0.7 \cdot p_{nom}$, $n \leq 0.5 \cdot n_{nom}$ and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 5 K	between hydraulic fluid in the bearing and at port L
Maximum temperature		115 °C	in the bearing
		110 °C	measured at port L
Continuous operation	ν = 400 to 10 ν_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port L, no restriction within the permissible data
Short-term operation	ν_{min} ≥ 10	T_{max} = +110 °C	measured at port L, t < 1 min, $p < 0.3 \cdot p_{nom}$
FKM shaft seal		T ≤ +115 °C	See page 5

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.
To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.
At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Shaft seal

The FKM shaft seal is permissible for case drain temperatures of -25 °C to +115 °C.

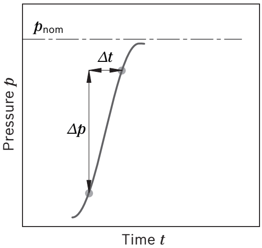
Note

For the temperature range below -25 °C, the values in the table on page are4 to be observed.

Operating pressure range

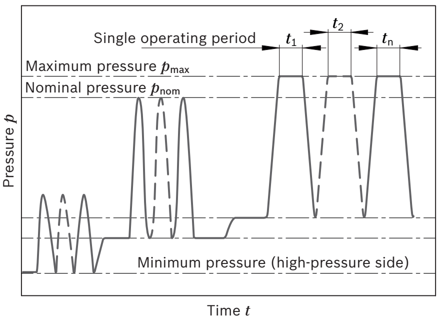
Pressure at service line port B		**Definition**
Nominal pressure p_{nom}	250 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	280 bar absolute	The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period (maximum number of cycles: approx. 1 million).
Single operating period	0.05 s	
Total operating period	14 h	
Minimum pressure (high-pressure side)	14 bar[1] absolute	Minimum pressure on the high-pressure side (B) that is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	16000 bar/s	Maximum permissible rate of pressure builld-up and reduction during a pressure change over the entire pressure range.
Pressure at suction port S (inlet)		
Minimum pressure $p_{S\ min}$	0.8 bar absolute	Minimum pressure at suction port S (inlet) that is required in order to prevent damage to the axial piston unit. The minimum pressure depends on the speed and displacement of the axial piston unit.
Maximum pressure $p_{S\ max}$	5 bar absolute	
Case drain pressure at port L_1, L_2		
Maximum pressure $p_{L\ max}$	2 bar absolute	Maximum 0.5 bar higher than inlet pressure at port S, but not higher than $p_{L\ max}$.

▼ **Rate of pressure change $R_{A\ max}$**



Note
Operating pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

▼ **Pressure definition**



Total operating period = $t_1 + t_2 + ... + t_n$

1) Please contact us about lower pressures

Technical data

Size		NG		35
Geometric displacement, per revolution		$V_{g\,max}$ $V_{g\,min}$	cm^3 cm^3	35 0
Rotational speed, maximum[1)2)]	at $V_{g\,max}$[3)] at $V_g \leq V_{g\,max}$[4)]	n_{nom} n_{max}	rpm rpm	3000 3000
Flow	at n_{nom} and $V_{g\,max}$	q_v	L/min	105
Power	At n_{nom}, $V_{g\,max}$ and Δp = 250 bar	P	kW	44
Torque	at $V_{g\,max}$ and Δp = 250 bar	T	Nm	139
Rotary stiffness	Drive shaft S4	c	kNm/rad	18.6
	Drive shaft S5	c	kNm/rad	22.9
Moment of inertia for rotary group		J_{TW}	kgm^2	0.00159
Angular acceleration, maximum[5)]		α	rad/s^2	5000
Case volume		V	L	0.6
Weight (without through drive) approx.		m	kg	16.9

Formulas		
Flow	$q_v = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]
Torque	$T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	[Nm]
Power	$P = \dfrac{2\,\pi \cdot T \cdot n}{60000} = \dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]

Key

V_g	=	Displacement per revolution in cm^3
Δp	=	Differential pressure in bar
n	=	Speed in rpm
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Note

- ▶ Theoretical values, without efficiency and tolerances; values rounded.
- ▶ Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

1) The following values apply:
– For the optimum viscosity range from ν_{opt} = 36 to 16 mm^2/s
– For hydraulic fluid based on mineral oils

2) If pressure $p_{suction}$ < 1 bar absolute at suction port S, please contact us.

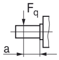
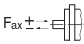
3) These values are applicable at absolute pressure $p_{suction} \geq$ 1 bar at suction port S.

4) Maximum rotational speed (limit speed) at $V_g \leq V_{g\,max}$.

5) The data are valid for values between the minimum required and maximum permissible speed. Valid for external excitation (e. g. engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value applies for a single pump only. The load capacity of the connection parts must be considered.

2

Permissible radial and axial forces of the drive shafts

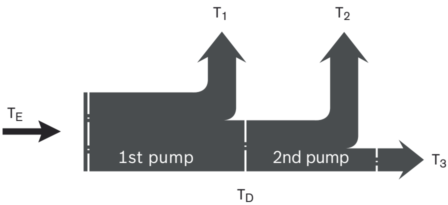
Size		NG		35	35
Drive shaft			in	7/8	1
Maximum radial force at distance a (from shaft collar)		$F_{q\ max}$	N	Please consult us if radial and/or axial forces occur.	
		a	mm		
Maximum axial force		$+F_{ax\ max}$	N		
		$-F_{ax\ max}$	N		

Note
For drives with radial loading (pinion, V-belt drives), please contact us!

Permissible input and through-drive torques

Size			NG		35
Torque at $V_{g\ max}$ and Δp = 250 bar[1]			T_{max}	Nm	139
Input torque at drive shaft, maximum[2]					
	S4	7/8 in	$T_{E\ max}$	Nm	198
	S5	1 in	$T_{E\ max}$	Nm	319
Maximum through-drive torque			$T_{D\ max}$	Nm	139[1]

▼ **Torque distribution**



Torque at 1st pump	T_1		
Torque at 2nd pump	T_2		
Torque at 3rd pump	T_3		
Input torque	T_E	=	$T_1 + T_2 + T_3$
	T_E	<	$T_{E\ max}$
Through-drive torque	T_D	=	$T_2 + T_3$
	T_D	<	$T_{D\ max}$

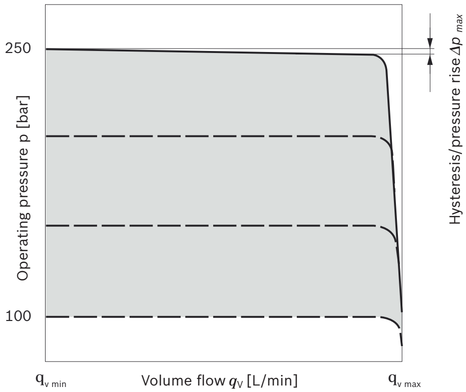
1) Efficiency not considered
2) For drive shafts without radial force

DR – Pressure control

The pressure control limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers. If the operating pressure exceeds the pressure setting at the pressure valve, the pump will regulate to a smaller displacement to reduce the control differential.

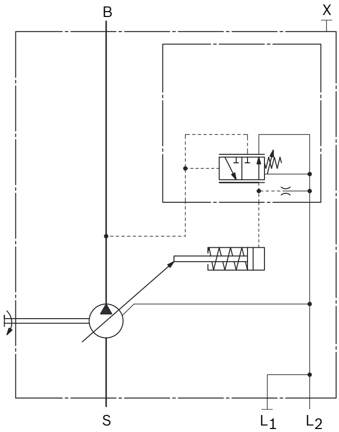
- Basic position in depressurized state: $V_{g\ max}$.
- Setting range[1)] for pressure control: 100 to 250 bar.

▼ **Characteristic DR**



Characteristic valid for n_1 = 1500 rpm and t_{fluid} = 50 °C.

▼ **Circuit diagram DR**



Controller data

NG	35
Hysteresis and repeat precision Δp	Maximum 5 bar
Pilot fluid consumption	Maximum approx. 3 L/min

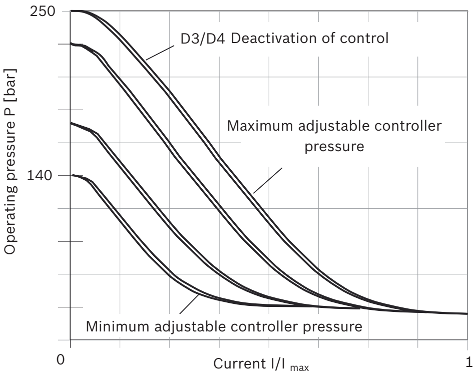
1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. Lower values on request

2

D3/D4 – Pressure control with override

With electric pressure adjustment using a proportional solenoid, the high pressure can be freely adjusted depending on the solenoid current. When the load pressure is changed at the consumer, the pump flow volume is adjusted so that the specified pressure is achieved again. If the solenoid current drops below the start of control, the unit will go to the set maximum pressure. The same thing applies if the pilot signal is lost.

▼ **Current-pressure characteristic (negative characteristic)**



Characteristic measured with pump in zero stroke.
Further information on request.

2

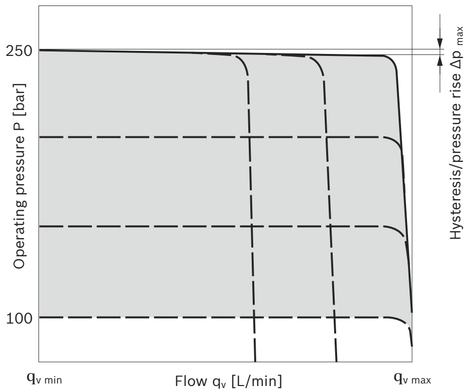
DRS0 – Pressure control with load sensing

In addition to the pressure control function (DR), the load-sensing controller works as a flow controller that operates as a function of the load pressure to regulate the pump displacement to match the consumer flow requirement. The load-sensing controller compares pressure before and after the sensing orifice and keeps the pressure drop (differential pressure Δp) across the orifice – and therefore the flow constant.
The swiveling in due to the pressure or flow controller will always take priority.

- Setting range[1)] for pressure control: 100 to 250 bar.

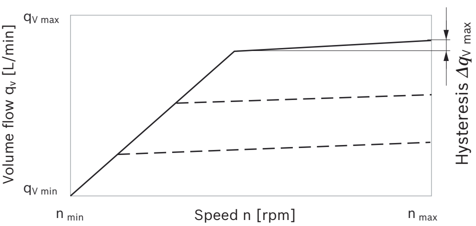
Note
The DRS0 version has no connection from **X** to the reservoir so the LS relief has to be incorporated into the system.

▼ **Characteristic DRS0**



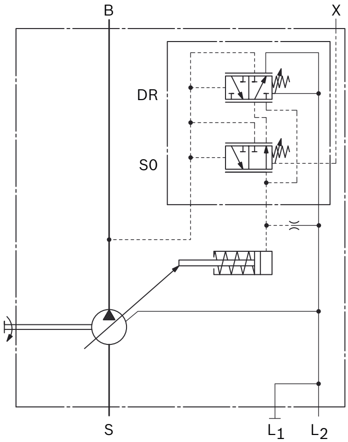
Characteristic valid for n_1 = 1500 rpm and t_{fluid} = 50 °C.

▼ **Characteristic at variable speed**



1) In order to prevent damage to the pump and the system, the permissible setting range must not be exceeded. Lower values on request

▼ **Circuit diagram DRS0**



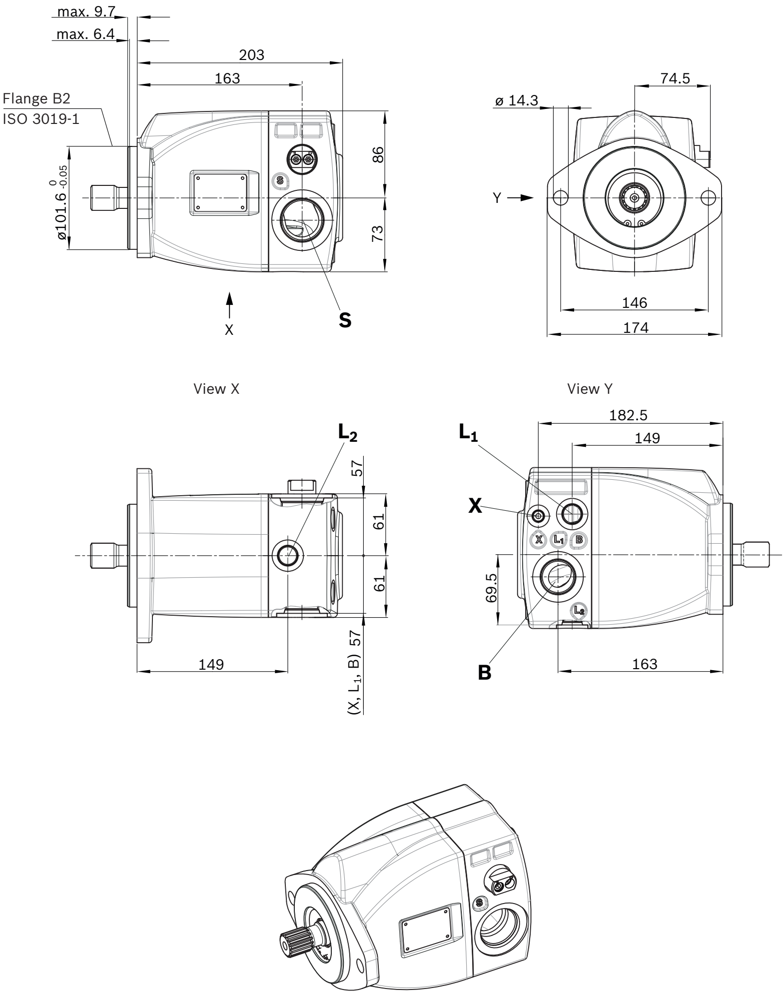
Differential pressure Δp
Standard setting: 14 bar. If another setting is required, please state in clear text.

Controller data
For data for the pressure control DR, please refer to page 9. Maximum flow differential (hysteresis and increase) measured at drive speed n = 1500 rpm and t_{fluid} = 50 °C

NG	35
Volume flow difference $\Delta q_{V\,max}$	3 L/min
Maximum control fluid consumption, approx.	4 L/min

Dimensions, size 35

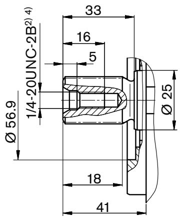
DR – Pressure control / DRS0 – Pressure control with load sensing,
clockwise rotation



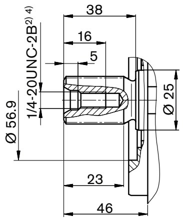
Drive shafts

Splined shaft SAE J744

S4 7/8 in 13T 16/32DP[1]



S5 1 in 15T 16/32DP[1]



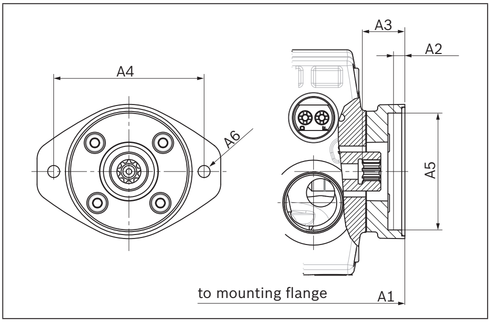
Ports

Designation	Port for	Standard[3]	Size[4]	p_{max} [bar][5]	State[8]
B	Service line	ISO 11926	1 5/16-12UN-2B; 20 deep	280	O
S	Suction line	ISO 11926	1 5/8-12UN-2B; 20 deep	5	O
L_1	Case drain fluid	ISO 11926	3/4-16UNF-2B; 15 deep	10	O[6]
L_2	Case drain fluid	ISO 11926	3/4-16UNF-2B; 15 deep	10	X[6]
X	Load sensing	ISO 11926	7/16-20UNF-2B; 12 deep	280	O[7]

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) The spot face can be deeper than specified in the appropriate standard.
4) Observe the general instructions on page20 concerning the maximum tightening torques.
5) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on the installation position, L or L1 L2 must be connected (see also installation instructions on page 17).
7) Only if an S0 controller is present.
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions, through drive

Flange SAE J744			Coupling for splined shaft[1)]			Short designation
Diameter	**Fitting variant**					
	Symbol[2)]	**Designation**	**Diameter**		**Designation**	
Without through drive						0000
82-2 (A)	o-o	A2	5/8 in	9T 16/32 DP	S2	A2S2
			3/4 in	11T 16/32 DP	S3	A2S3
			7/8 in	13T 16/32 DP	S4	A2S4
101-2 (B)	o-o	B2	7/8 in	13T 16/32 DP	S4	B2S4
			1 in	15T 16/32 DP	S5	B2S5



Short des.	NG	A1	A2	A3	A4	A5	A6[3)]
A2S2	35	227.6	8	32	106.4	82.55	M10 x 1.5
A2S3	35	227.6	8	38	106.4	82.55	M10 x 1.5
A2S4	35	227.6	8	41	106.4	82.55	M10 x 1.5
B2S4	35	227.6	8	41	146	101.6	M12 x 1.75
B2S5	35	227.6	8	46	146	101.6	M12 x 1.75

1) Coupling for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Configuration of securing holes when viewed to through drive, with service line port B on right.
3) Continuous thread according to DIN 13; observe the general instructions on page20 concerning the maximum tightening torques.

Overview of fitting options

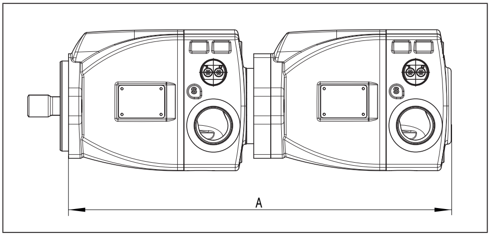
Through drive[1]			Fitting options – 2nd pump							
Flange	**Coupling for splined shaft**	**Short des.**	**A1VO BR10 NG**	**A4VG BR32 NG**	**A10VG BR10 NG**	**A10VO BR52/53 NG**	**A10VNO BR52/53 NG**	**A10VWO BR52 NG**	**A10V(S)O BR31 NG**	**External gear pump**
82-2 (A)	5/8 in	A2S2	–	–	–	10 (U), 18 (U)	–	–	18 (U)	Series F[2]
	3/4 in	A2S3	–	–	–	10 (S), 18 (S, R)	28 (R)	–	18 (S, R)	–
101-2 (B)	7/8 in	B2S4	–	–	18 (S)	28 (S, R)	–	28 (S)	28 (S, R)	Series N[2] Series G[2]
	1 in	B2S5	35 (S5)	28 (S)	28 (S)	–	–	–	–	–

Combination pumps A1VO + A1VO

Total length A

A1VO (1st pump)	A1VO (2nd pump) NG35
NG35	431

By using combination pumps, it is possible to have several independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "**+**".
Ordering example:
A1VO035DRS0C100/10BRVB2S51B2S500+
A1VO035DRS0C100/10BRVB2S51000000
It is permissible to use a combination of two single pumps of the same size (tandem pump), considering a dynamic mass acceleration of maximum 10 *g* (= 98.1 m/s^2) without additional support brackets.
For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque.

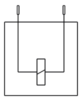


1) Additional through drives are available on request
2) Bosch Rexroth recommends special versions of the external gear pumps. Please contact us.

Connector for solenoids

DEUTSCH DT04-2P-EP04
Molded connector, 2-pin, without bidirectional suppressor diode
There is the following type of protection with mounted mating connector:
- IP67 (DIN/EN 60529) and
- IP69K (DIN 40050-9)

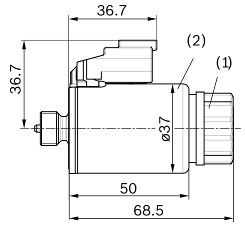
▼ **Circuit symbol**



Mating connector
DEUTSCH DT06-2S-EP04
Bosch Rexroth material number R902601804

Consisting of:	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.



Changing connector orientation
If necessary, you can change the connector orientation by turning the solenoid housing.
To do this, proceed as follows:
- Loosen the mounting nut (**1**) of the solenoid. To do this, turn the mounting nut (**1**) one turn counter-clockwise.
- Turn the solenoid body (**2**) to the desired orientation.
- Retighten the mounting nut.
  Tightening torque: 5+1 Nm.
  (size WAF 26, 12kt DIN 3124)

On delivery, the position of the connector may differ from that shown in the brochure or drawing.

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.
Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The case drain fluid in the case interior must be directed to the reservoir via the highest available drain port (**L_1**, **L_2**).
When multiple units are combined, make sure that the case pressure of each unit is not exceeded. In the event of pressure differences at the reservoir ports of the units, the shared reservoir line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate reservoir lines must be laid as required.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level . The permissible suction height h_S results from the overall loss of pressure. However, it must not be higher than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port **S** must also not fall below 0.8 bar absolute during operation and during cold start.

Installation position

See the following examples 1 to 11.
Additional installation positions are available upon request.
Recommended installation positions: 1 and 2

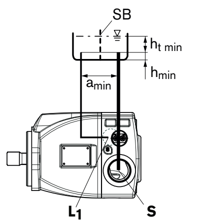
Note

In certain installation positions, an influence on the control characteristics can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristics and changes in response time.

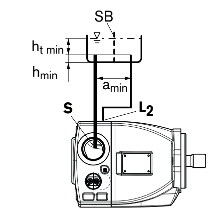
Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

1



2



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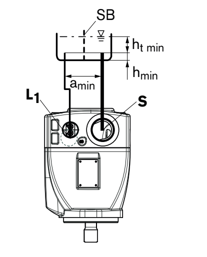

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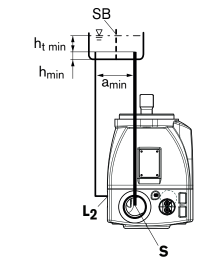


Installation position	Air bleed	Filling
1	L_1	S + L_1
2	L_2	S + L_2
3	L_1 or L_2	S + L_1 or L_2
4[1)]	L_1 or L_2	S + L_1 or L_2

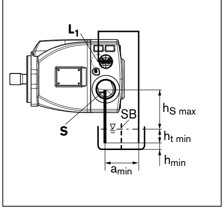
For key, see page 18.

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm.

5



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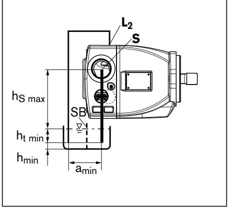

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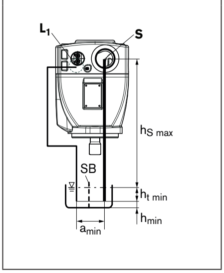

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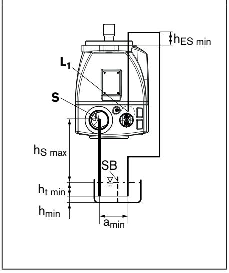


Installation position	Air bleed	Filling
5	L_1	L_1
6	L_2	L_2
7	L_1 or S	L_1 or S
8[1)]	L_1	L_1

Key	
L	Filling / air bleeding
S	Suction port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)
$h_{ES\ min}$	Minimum necessary height needed to protect the axial piston unit from draining (25 mm).
$h_{S\ max}$	Maximum permissible suction height (800 mm)
a_{min}	When designing the reservoir, make sure that there is sufficient spacing between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Inside-reservoir installation

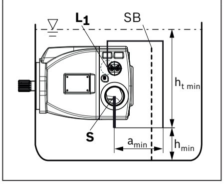
Inside-reservoir installation is when the axial piston unit is installed in the reservoir below the minimum fluid level. The axial piston unit is completely below the hydraulic fluid.

If the minimum fluid level is equal to or below the upper edge of the pump, see chapter "Above-reservoir installation".

Note

Axial piston units with electrical component must not be installed below the hydraulic fluid level.

9



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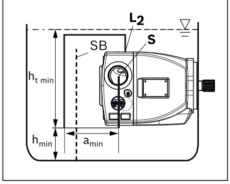

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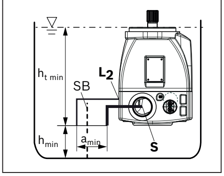

Installation position	Air bleed	Filling
9	L_1	L_1 or S
10	L_2	L_2 or S
11[1)]	L_2	L_2 or S

1) Because complete air bleeding and filling are not possible in this position, the pump should be air bled and filled in a horizontal position before installation.

General instructions

- The A1VO pump is designed to be used in open circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports are only designed to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- Before finalizing your design, request a binding installation drawing.
- Not all versions of the product are approved for use in a safety function pursuant to ISO 13849. If you require characteristic values relating to reliability (e.g. $MTTF_d$) for functional safety, please consult the responsible contact person at Bosch Rexroth.
- Pressure controls are not backups against pressure overload. A separate pressure relief valve is to be provided in the hydraulic system.
- The following tightening torques apply:
  - Fittings:
    Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
  - Mounting bolts:
    For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque for the individual case according to VDI 2230.
  - Female threads of the axial piston unit:
    The maximum permissible tightening torques $M_{G\,max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.
  - Threaded plugs:
    For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports Standard	Thread size	Maximum permissible tightening torque of the female threads $M_{G\,max}$	Required tightening torque of the threaded plugs M_V	WAF Hexagon socket for the threaded plugs
ISO 11926	7/16-20UNF-2B	40 Nm	18 Nm	3/16 in
	3/4-16 UNF-2B	160 Nm	70 Nm	5/16 in
	1 5/16-12 UN-2B	540 Nm	270 Nm	5/8 in
	1 5/8-12 UN-2B	960 Nm	320 Nm	3/4 in

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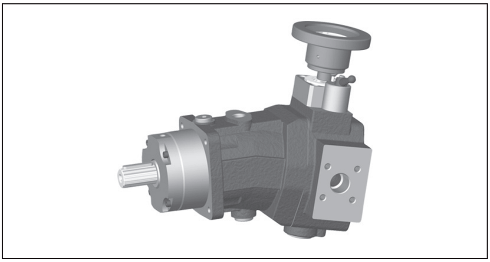
The Drive & Control Company

Rexroth
Bosch Group

Axial piston variable pump A7VK Series 10 Metering pump for polyurethane components

RE 94010
Issue: 04.2013
Replaces: 03.2009



- Sizes 12, 28, 55, 107
- Nominal pressure 250 bar
- Maximum pressure 315 bar
- Open and closed design

Features
- Compact design
- Reduced dimensions and mass in comparison to A2VK
- Mounting flange, drive shaft and functions identical to A2VK, thus easy to replace
- Increased corrosion protection through special surface treatment
- Manual adjustment with prescision display and clamp unit to prevent accidental adjustment
- Double shaft sealing made of special material and flushing chamber to identify damage and protect environment
- Improved volumetric efficiency through robust rotary group using proven axial tapered piston technology
- Optionally available with mounted high-pressure relief valve
- Low noise level

Closed design (A7VKG)
- High permissible filling pressure for highly-viscous media or hydraulic fluid by separating the filling channel and pump housing
- Case drain fluid must be discharged

Open design (A7VKO)
- The housing is connected to the suction chamber. A case drain line between the housing and reservoir is not requires

Note
The axial piston pump is approved for pumping polyurethane components (polyol and isocynate).

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Ordering code

01	02	03	04		05	06	07	08	09	10	11	12		13
A7VK			**MA**	**/**	**10**	**M**		**S**			**5**		**–**	

Axial piston unit

01	Variable bent-axis design, nominal pressure 250 bar, maximum pressure 315 bar	**A7VK**

Operation modes

02	Pump, closed design	**G**
	Pump, open design	**O**

Sizes (NG)

03	Geometric displacement, see table of values on page 4	**012**	**028**	**055**	**107**

Control device

04	Control, manual with handwheel	**MA**

Series

05	Series 1, index 0	**10**

Version of port and fixing threads

06	Metric, port threads with profile sealing ring according to DIN 3852	**M**

Directions of rotation

07	Viewed from drive shaft	clockwise (standard)	**R**
		counter-clockwise (option)	**L**

Seals

08	FKM (fluor-caoutchouc), shaft seal in PTFE (polytetrafluor ethylene)	**S**

Mounting flanges

			012	028	055	107	
09	Similar to ISO 3019-2 – 4-bolt	80-4	●	–	–	–	**KG**
	(can be changed to A2VK)	100-4	–	●	–	–	**LG**
		125-4	–	–	●	–	**MS**
		160-4	–	–	–	●	**PS**

Drive shafts

			012	028	055	107	
10	Parallel keyed shaft according to DIN 6885	ø20	●	–	–	–	**P3**
		ø25	–	●	–	–	**P5**
		ø30	–	–	●	–	**P6**
		ø40	–	–	–	●	**P9**

Service line ports

11	Closed design: threaded ports A and B, at side, opposite side	**5**
	Open design: threaded ports A and S, at side, opposite side	

Pressure relief valves

12	Without pressure relief valves (standard)		**0000**
	High-pressure relief valve, diret controlled, fixed setting, Δp-setting value [bar] optional	100	**A100**
		150	**A150**
		200	**A200**
		230	**A230**
		250	**A250**

Standard / special version

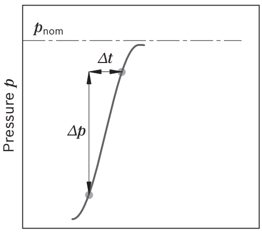
13	Standard version	**0**
	Special version	**S**

● = Available ○ = On request – = Not available

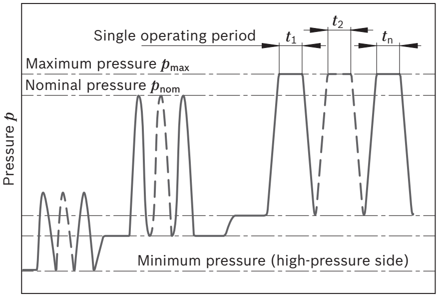
Operating pressure range

Pressure at the service line ports A or B (high-pressure side)		Definition
Nominal pressure p_{nom}	250 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	315 bar absolute	The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.
Single operating period	10 s	
Total operating period	50 h	
Minimum pressure	10 bar absolute	Minimum pressure on the high-pressure side (**A** or **B**) that is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	9000 bar/s	Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.
Closed design **Pressure at the service line ports A or B (low-pressure side)**		
Minimum filling pressure	> 1 bar absolute	Depending on viscosity and flow, the filling pressure must be adjusted in such a way that a complete filling of the low pressure side of the pump is ensured.
Maximum filling pressure	30 bar absolute	
Open design **Pressure on suction port S (inlet)**		
Minimum filling pressure	1 bar absolute	Depending on viscosity and flow, the filling pressure must be adjusted in such a way that a complete filling of the low pressure side of the pump is ensured.
Maximum filling pressure	6 bar absolute	

▼ **Rate of pressure change $R_{A\ max}$**



▼ **Pressure definition**



Total operating period = $t_1 + t_2 + ... + t_n$

Note
Values for other hydraulic fluids, please contact us.

Shaft seal

Permissible pressure loading
The service life of the shaft seal is affected by the speed of the pump, the case pressure (case drain pressure) and the properties of the medium being pumped. Momentary (t < 0.1 s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

Note
For monitoring the shaft seal for zero leakage, we recommend connecting a barrier fluid monitor at ports $\mathbf{U_1}$ to $\mathbf{U_4}$.

The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.

Hydraulic fluids

The pump is approved for pumping and metering polyurethane components (polyol and isocynate). For other hydraulic fluids, consult with Bosch Rexroth Service.

Operating viscosity range

The limiting values for viscosity are as follows:

- ▶ ν_{min} = 5 mm²/s
- ▶ ν_{max} = 1600 mm²/s

Please contact us if different values are required.
On applications with highly viscous fluids bearing flushing is recommended. Recommended flushing flow:

Size	[L/min]
12	2.5
28	4
55	4
107	8

Operating temperature range

- ▶ Optimum operating temperature range t = 10 bis 50 °C
- ▶ Maximum operating temperature range t_{max} = 80 °C

The permissible operating temperature is dependent on the lubricity of the respective hydraulic fluid.
The maximum operating temperature must not be exceeded even locally.

Filtration of the hydraulic fluid

The filter should be arranged so that only filtered fluid enters the pump. The finer the filter, the longer the service life of the axial piston pump.

- ▶ We recommend a filter grade $\eta_{abs} \leq 125$ µm

Case drain fluid at closed design

The pump ports **A** and **B** are separated from the housing. The case drain fluid must be removed via port $\mathbf{T_1}$ or $\mathbf{T_2}$ using a separate line.

- ▶ Maximum case drain pressure $p_{L\ max}$ = 6 bar

Case drain fluid at open design

The housing is connected to the suction chamber. The pressure on port **S** is also applied in the housing and must not exceed 6 bar. A case drain line between the housing and reservoir is not required (port $\mathbf{T_1}$, $\mathbf{T_2}$ plugged).

Technical data

Size			NG		12	28	55	107
Displacement geometrical, per revolution			$V_{g\ max}$	cm³	11.6	28.1	54.8	107
			$V_{g\ min}$	cm³	0	0	0	0
Flow	at $V_{g\ max}$ and speed n	n = 1500 min⁻¹	q_v	L/min	17.4	42.2	82.2	160.5
		n = 1800 min⁻¹	q_v	L/min	20.9	50.6	98.6	192.6
Power	at $V_{g\ max}$, Δp = 250 bar and speed n	n = 1500 min⁻¹	P	kW	7.3	17.6	34.2	66.9
		n = 1800 min⁻¹	P	kW	8.7	21.1	41.1	80.3
Torque	at $V_{g\ max}$ and Δp = 250 bar		T	Nm	46.2	111.8	218.0	425.7
Mass (approx.)			m	kg	11.7	22.1	31	55

Determining the operating characteristics

Formulas			
Flow	$q_v = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$		[L/min]
Torque	$T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$		[Nm]
Power	$P = \dfrac{2\pi \cdot T \cdot n}{60000}$	$= \dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]

Key		
V_g	=	Displacement per revolution in cm³
Δp	=	Differential pressure in bar
n	=	Speed in min⁻¹
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Note
Theoretical values, without efficiency and tolerances; values rounded

MA control

Turning the handwheel turns a threaded spindle which steplessly adjusts the pump's rotary group, and thus the flow in the range from $V_{g\,min}$ to $V_{g\,max}$. A manual locking device, which is fitted as standard equipment, prevents unintentional adjustment. The precision adjustment display is integrated in the handwheel.

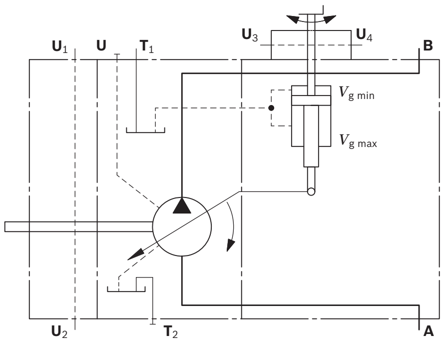
Size		12	28	55	107
Rotation on the handwheel $V_{g\,min}$ to $V_{g\,max}$	approx. U_s	23	30	40	50
Maximum torque in the handwheel T_{max}	approx. Nm	3.5	3.5	3.5	3.5

Flow direction

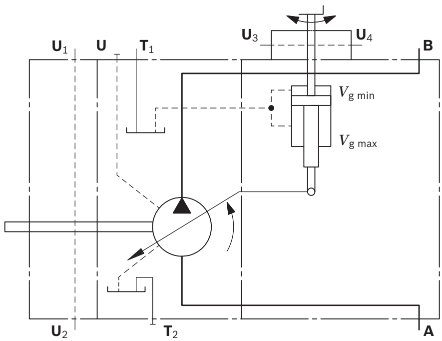
Direction of rotation, viewed from drive shaft		
Design	**clockwise**	**counter-clockwise**
Closed	**A** to **B**	**B** to **A**
Open	**S** to **A**	**S** to **A**

Closed design

▼ **Schematic clockwise**

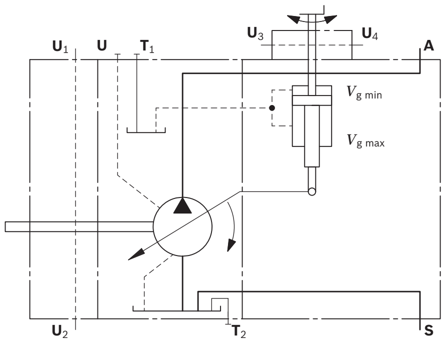


▼ **Schematic counter-clockwise**

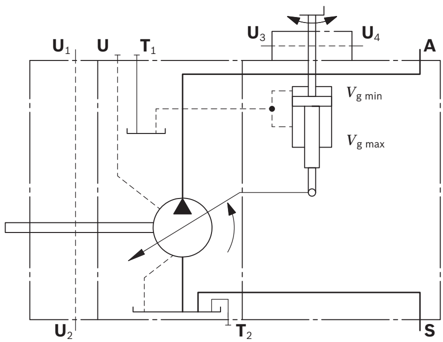


Open design

▼ **Schematic clockwise**

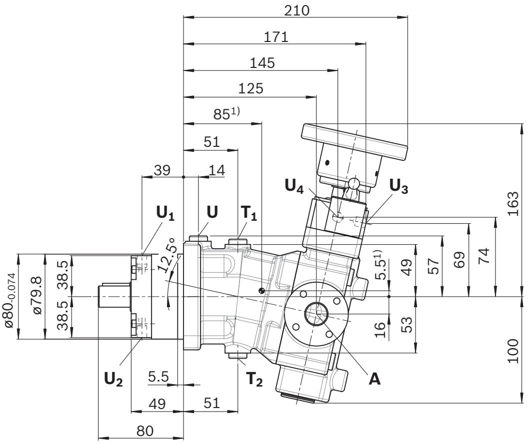


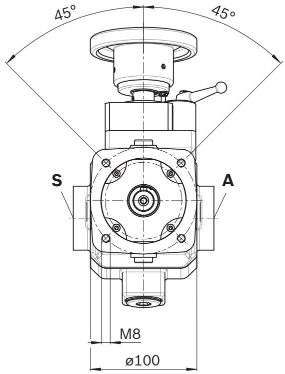
▼ **Schematic counter-clockwise**



Dimensions size 12 – open design

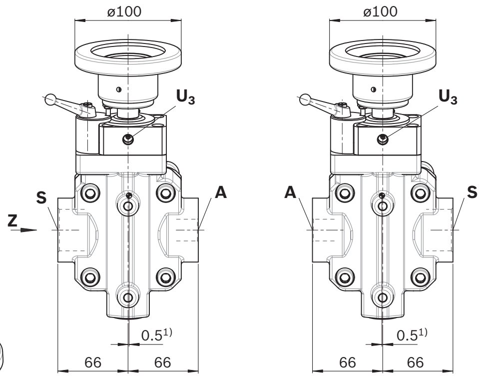
Direction of rotation clockwise



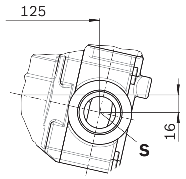


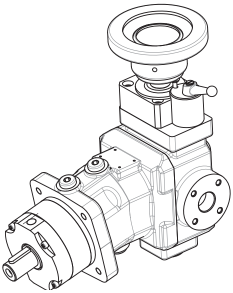
Direction of rotation counter-clockwise

Direction of rotation clockwise



View Z

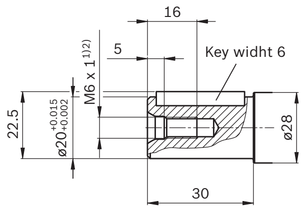




1) Center of gravity

▼ **Parallel keyed shaft to DIN 6885**

P3 – A6x6x25.5

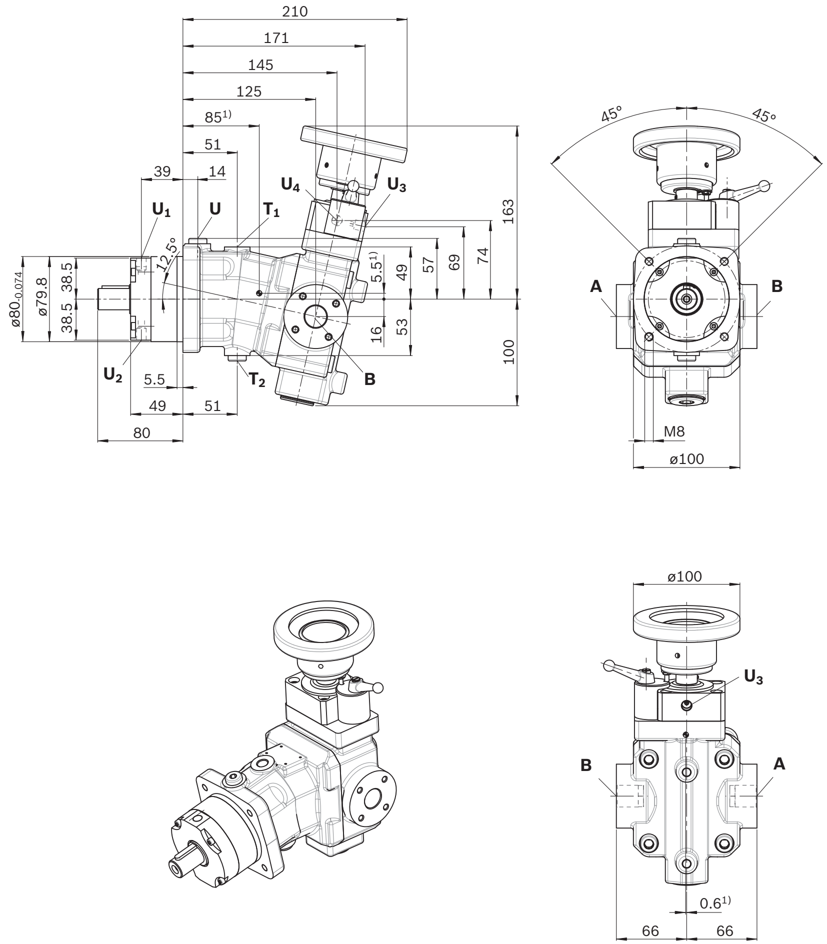


Ports		**Standard**[4)]	**Size**[2)]	p_{max} **[bar]**[3)]	**State**[6)]
A	Service port	DIN 3852	M22 x 1.5; 14 tief	315	O
S	Suction/filling port	DIN ISO 228	G1 1/4; 20 tief	6	O
T_1	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M12 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 12 – closed design

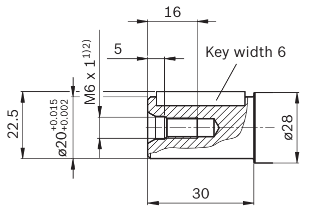
Direction of rotation clockwise and counter-clockwise identical dimensions



1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

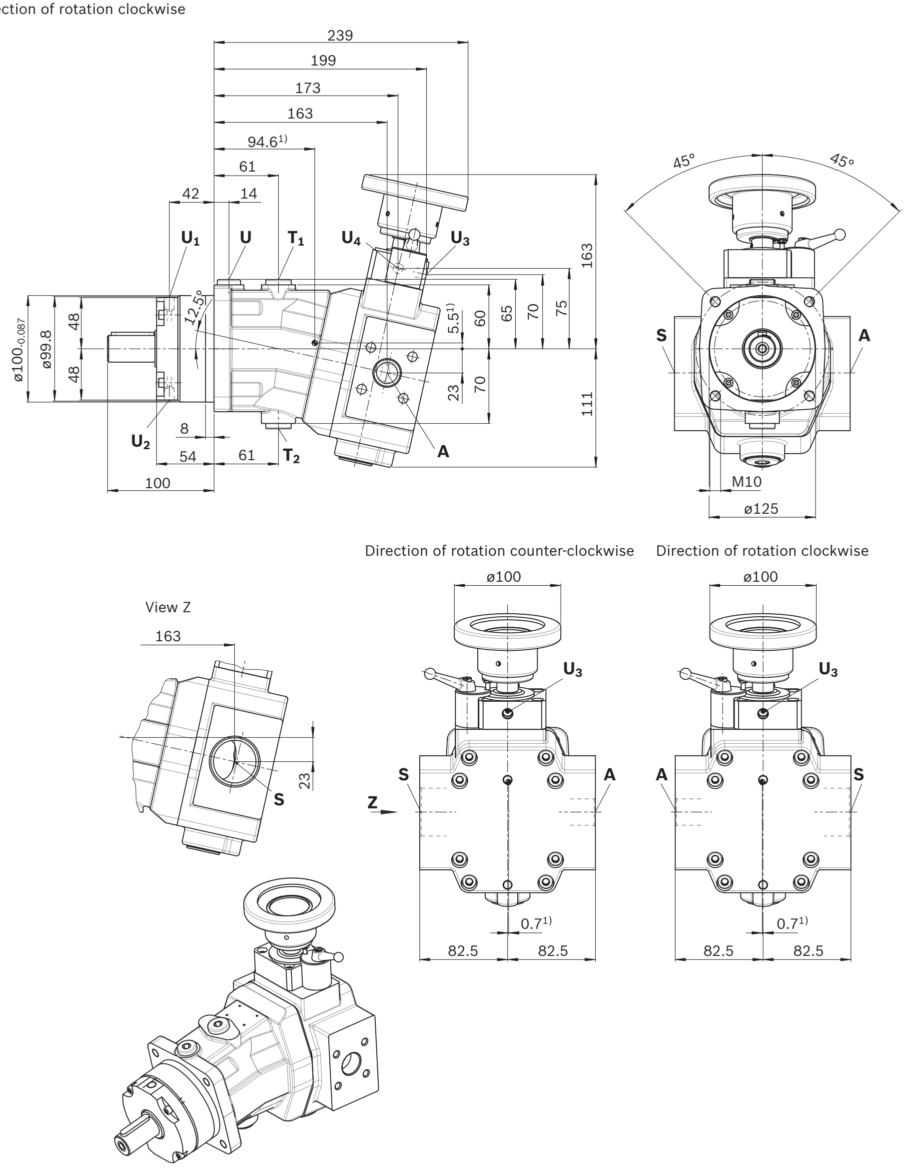
P3 – A6x6x25.5



Ports		**Standard**4)	**Size**2)	p_{max} **[bar]**3)		**State**7)
A	Service port	DIN 3852	M22 x 1.5; 14 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M22 x 1.5; 14 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6		O6)
T_2	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6		X6)
U	Bearing flushing	DIN 3852	M12 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	35)		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	35)		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

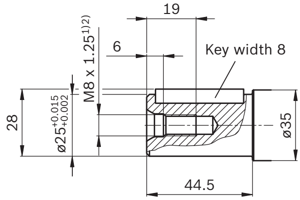
Dimensions size 28 – open design



1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P5 – AS8x7x40

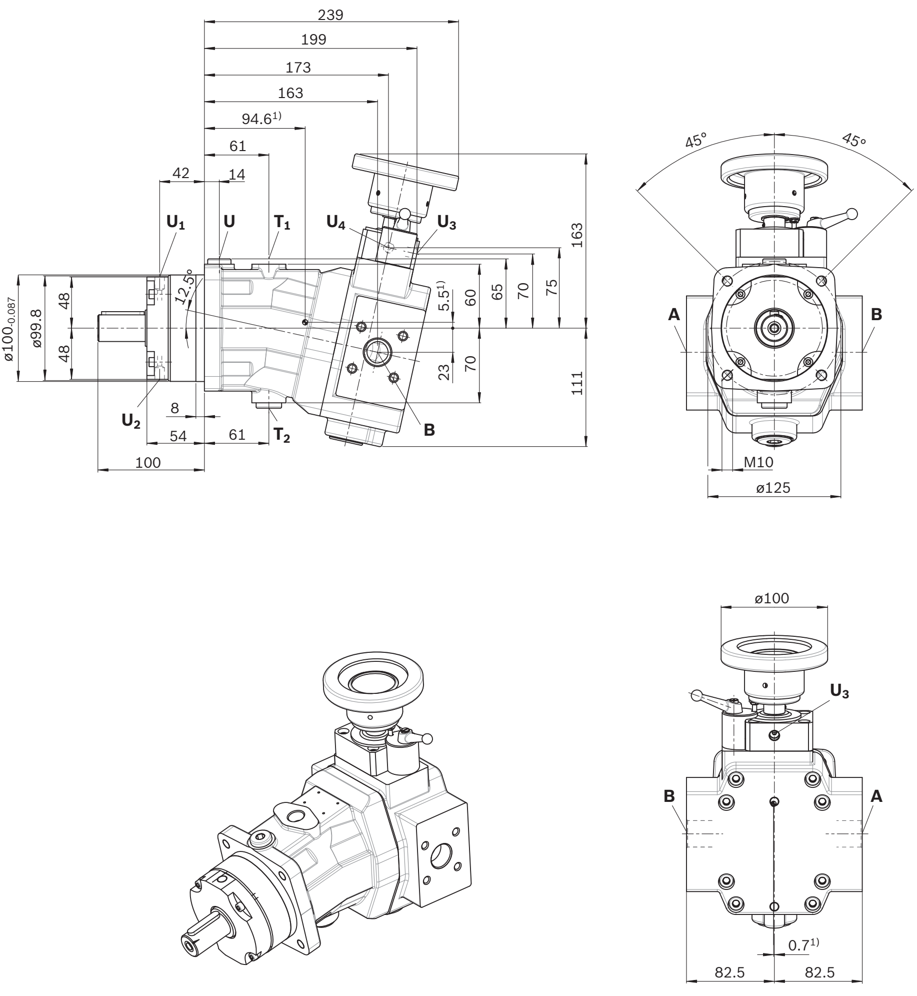


Ports		**Standard**[4]	**Size**[2]	p_{max} **[bar]**[3]	**State**[6]
A	Service port	DIN 3852	M27 x 2; 16 tief	315	O
S	Suction/filling port	DIN ISO 228	G1 1/2; 20 tief	6	O
$\mathbf{T_1}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
$\mathbf{T_2}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M16 x 1.5; 12 tief	6	X
$\mathbf{U_1, U_2}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O
$\mathbf{U_3, U_4}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 28 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions

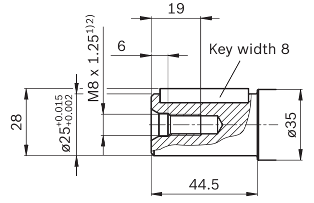


1) Center of gravity

2

▼ **Parallel keyed shaft DIN 6885**

P5 – AS8x7x40

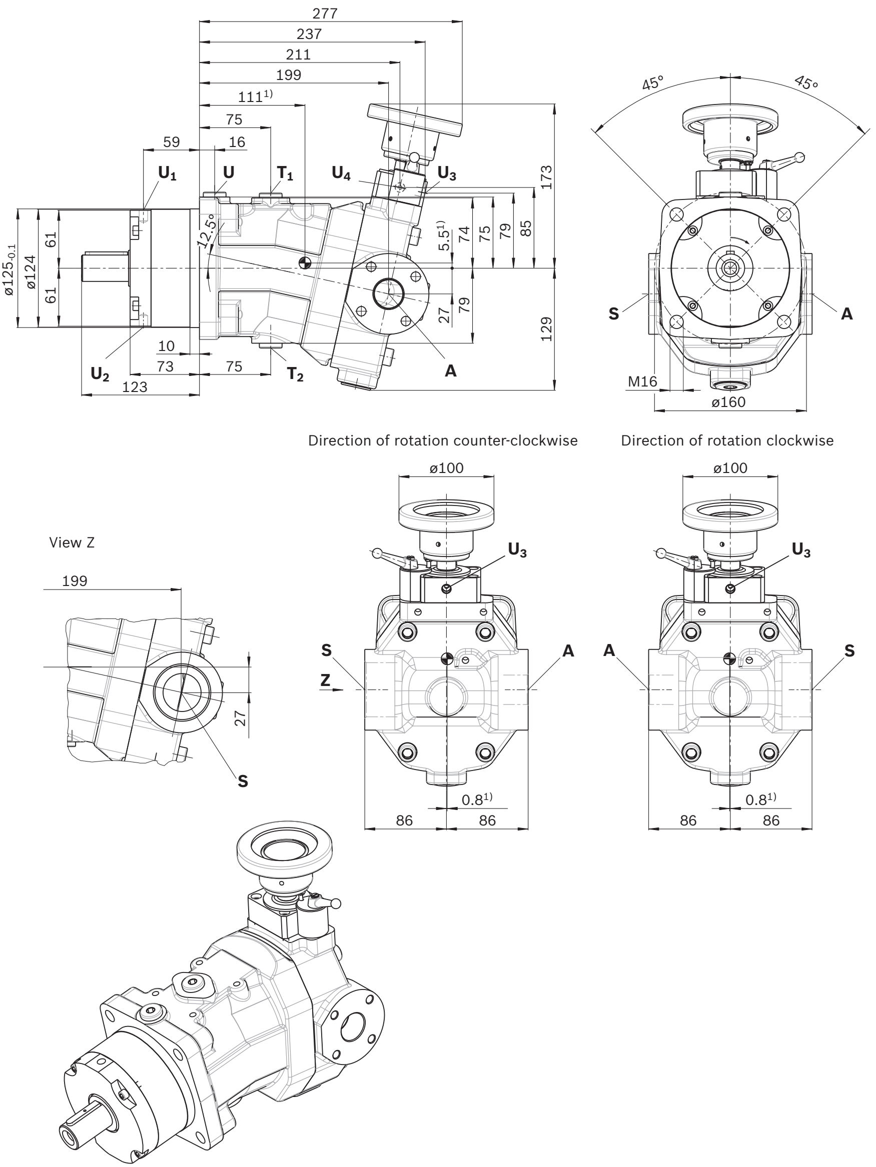


Ports		Standard4)	Size2)	p_{max} [bar]3)		State7)
A	Service port	DIN 3852	M27 x 2; 16 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M27 x 2; 16 tief	clockwise	315	O
				counter-clockwise	30	
$\mathbf{T_1}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O6)
$\mathbf{T_2}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X6)
U	Bearing flushing	DIN 3852	M16 x 1.5; 12 tief	6		X
$\mathbf{U_1}$, $\mathbf{U_2}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	35)		O
$\mathbf{U_3}$, $\mathbf{U_4}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	35)		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, $\mathbf{T_1}$ or $\mathbf{T_2}$ must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 55 – open design

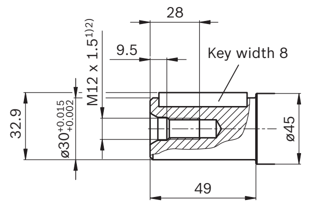
Direction of rotation clockwise



1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P6 – AS8x7x43

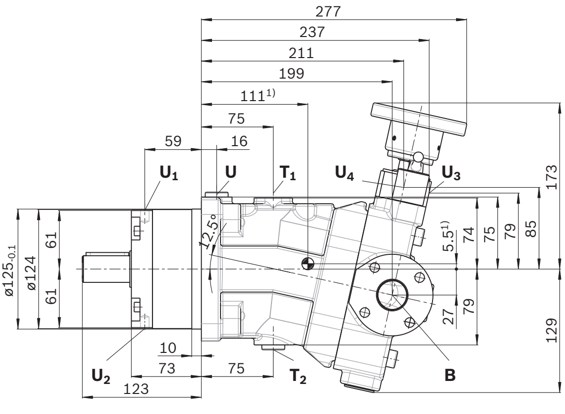


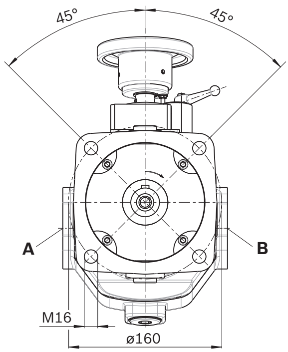
Ports		Standard[4]	Size[2]	p_{max} [bar][3]	State[6]
A	Service port	DIN 3852	M33 x 2; 18 tief	315	O
S	Suction/filling port	DIN ISO 228	G2; 27 tief	6	O
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O

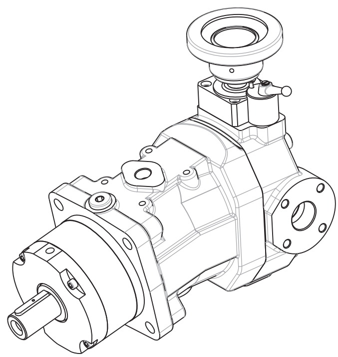
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

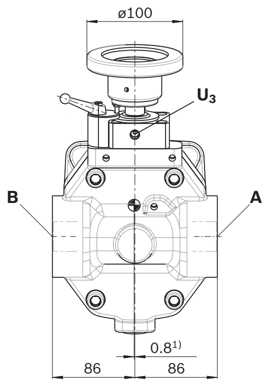
Dimensions size 55 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions





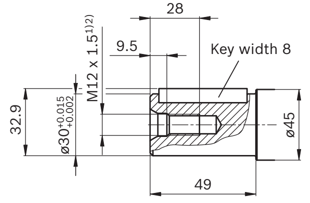




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

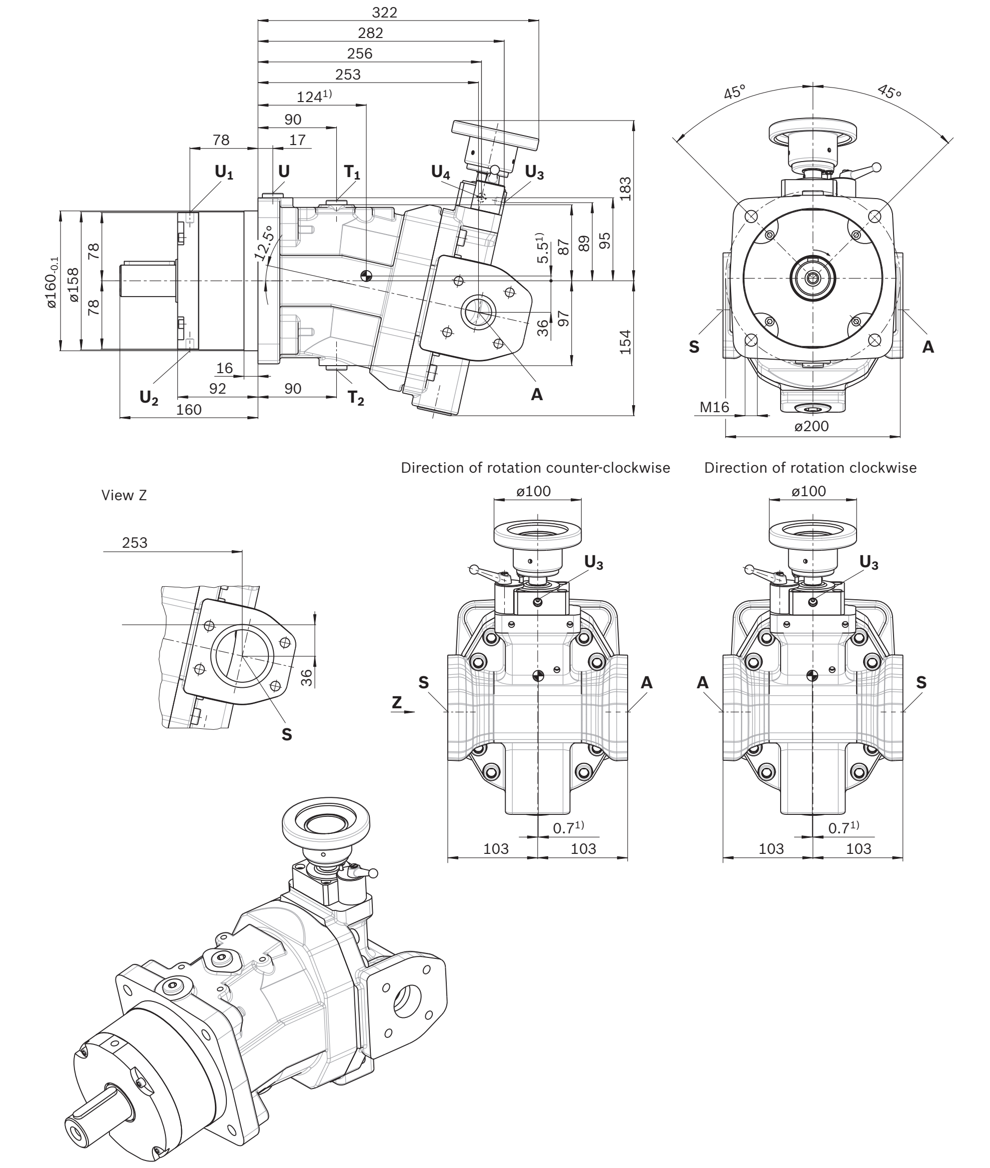
P6 – AS8x7x43



Ports		Standard[4]	Size[2]	p_{max} [bar][3]		State[7]
A	Service port	DIN 3852	M33 x 2; 18 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M33 x 2; 18 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O[6]
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X[6]
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

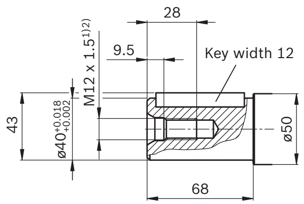
Dimensions size 107 – open design



1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P9 – AS12x8x63

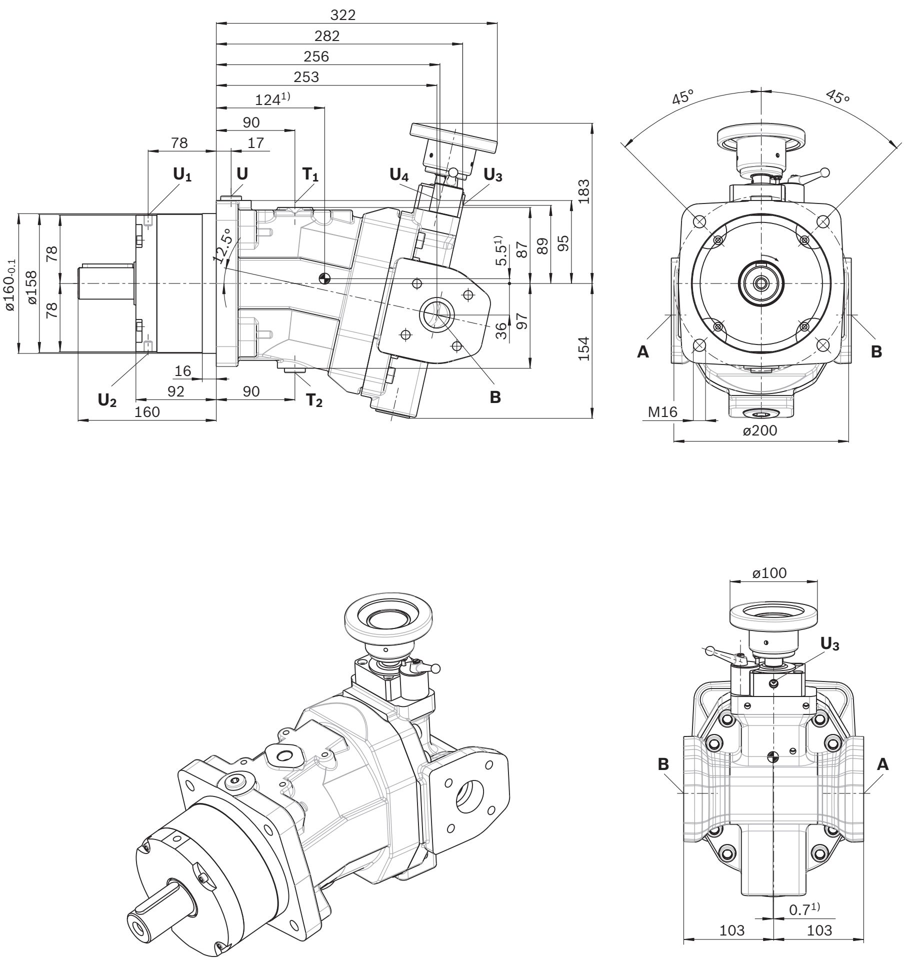


Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]	State[6)]
A	Service port	DIN 3852	M42 x 2; 20 tief	315	O
S	Suction/filling port	DIN ISO 228	G2 1/2; 30 tief	6	O
$\mathbf{T_1}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
$\mathbf{T_2}$	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6	X
$\mathbf{U_1}$, $\mathbf{U_2}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O
$\mathbf{U_3}$, $\mathbf{U_4}$	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 107 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions

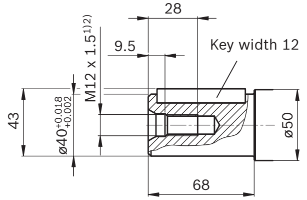


1) Center of gravity

Dimensions [mm]

▼ **Parallel keyed shaft DIN 6885**

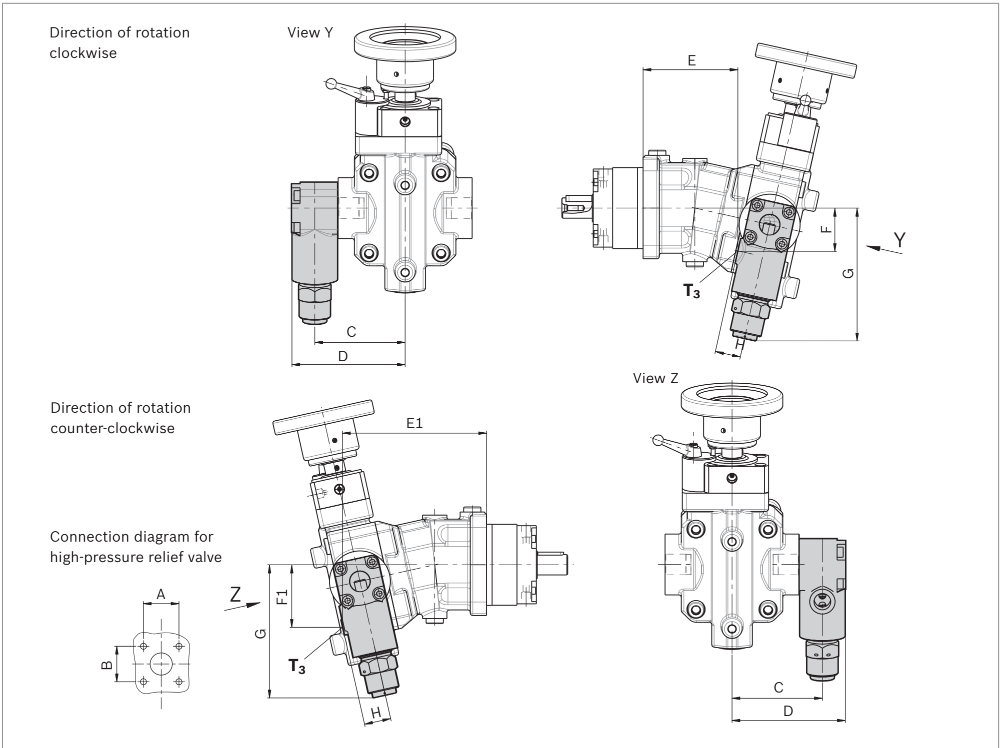
P9 – AS12x8x63



Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]		State[7)]
A	Service port	DIN 3852	M42 x 2; 20 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M42 x 2; 20 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O[6)]
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X[6)]
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

High-pressure relief valve direct operated



NG	A[2)]	B[2)]	C	D	E	E1	F	F1	G	H	Service line port A, B[1)]	Return port T_3[1)]
12	32	32	89	112	93.5	142	42	53	131	25	M22 x 1.5	M18 x 1.5
28	40	40	107.5	132.5	127.5	181	54	67	143	26	M27 x 2	M22 x 1.5
55	48	48	114	142	157	221	65	79	162	31.5	M33 x 2	M27 x 2
107	60	60	135.5	168	208	272	86	100	206	38.5	M42 x 2	M33 x 2

Differential pressure setting

The following values are available for selection of the differential pressure setting (fixed setting):

Preferred values [bar]: 100, 150, 200, 230, 250

If not specified in the order, valves will be set to the differential pressure Δp = 250 bar.

Mounting

Mounting of the high-pressure relief valve depends on the direction of rotation.

With the closed design, the PRV is always mounted at pressure port **A**. As described, the position of port **A** depends here on the direction of rotation.

In the closed design, the PRV is mounted at pressure port **B** (viewed on drive shaft – right side) for clockwise rotation. For counter-clockwise rotation, it is mounted at pressure port **A** (viewed on drive shaft – left side).

1) DIN 3852, observe the general instructions on page 24 for the maximum tightening torques.

2) Fixing thread according to DIN 13; observe the general instructions on page 24 for the maximum tightening torques.

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. The barrier liquid chambers must be filled with suitable barrier liquid. This must also observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.
To achieve favorable noise values, decouple all connecting lines using elastic elements.
In all operating conditions, the suction and case drain lines must flow into the reservoir below the minimum fluid level.

Closed design

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (**T_1**, **T_2**).

Open design

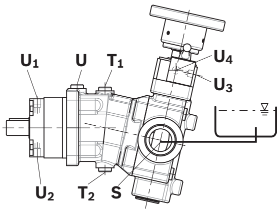
The housing is internally connected to the suction chamber. A case drain line between the housing and reservoir is not required.

Note
For monitoring the shaft seals for zero leakage, we recommend connecting a barrier fluid monitor at ports **U_1** to **U_4**.

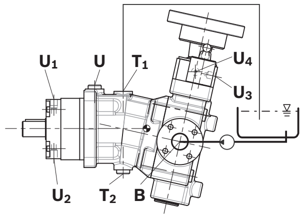
Installation position

A standard installation shows the drive shaft in a horizontal position. Further installation positions are available upon request.

Installation position	Air bleed	Filling
1 Open design	T_1	S



Installation position	Air bleed	Filling
2 Closed design	T_1	T_1



Key	
B	Service line port
S	Suction/filling port
T_1/T_2	Filling/air bleeding case drain port
U_1 bis **U_4**	Barrier fluid port
U	Bearing flushing

2

General instructions

- The pump A7VK is designed for pumping polyurethane components in open and closed design.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and pressure relief valve on the service line port. Take appropriate safety measures (e.g. by wearing protective clothing).
- Service line ports
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports are only designed to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- Before finalizing your design, request a binding installation drawing.
- Not all versions of the product are approved for use in a safety function pursuant to ISO 13849. If you require characteristic values relating to reliability (e.g. MTTFd) for functional safety, please consult the responsible contact person at Bosch Rexroth.
- A pressure relief valve is to be fitted in the hydraulic system.
- The following tightening torques apply:
  - **Fittings:** Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
  - **Mounting bolts:** For mounting bolts with metric ISO thread according to DIN 13, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - **Female threads in the axial piston unit:** The maximum permissible tightening torques $M_{G\ max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
  - **Threaded plugs:** For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports Standard	Thread size	Maximum permissible tightening torque of the female threads $M_{G\ max}$	Required tightening torque of the threaded plugs M_V	WAF hexagon socket of the threaded plugs
DIN 3852[1)]	M10 x 1	30 Nm	15 Nm[2)]	5 mm
	M12 x 1.5	50 Nm	25 Nm[2)]	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
DIN ISO 228	G1 1/4	720 Nm	–	–
	G1 1/2	960 Nm	–	–
	G2	1200 Nm	–	–
	G2 1/2	2000 Nm	–	–

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.

2) In the "lightly oiled" state, the M_V is reduced to 10 Nm for M10 x 1 and to 17 Nm for M12 x 1.5.

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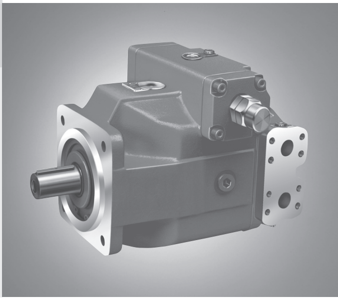
Rexroth
Bosch Group

Axial Piston Variable Pump A4VSG

Data sheet



Series 10, 11 and 30
Size 40 to 1000
Nominal pressure 350 bar
Maximum pressure 400 bar
Closed circuit

Contents

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Features

- Flow and pressure side reversible (over centre operation)
- Motor mode possible
- Low noise level
- Long service life
- Drive shaft can absorb axial and radial forces
- High power/weight ratio
- Modular design
- Short response times
- Through drive and pump combinations possible
- Visual swivel angle indicator
- Optional installation position
- Operation on HF-fluids under reduced operational data possible

The A4VSG axial piston variable pump in swashplate design is designed for hydrostatic drives in closed circuits. Flow is proportional to drive speed and displacement. By adjusting the swashplate angle it is possible to steplessly vary the output flow.

For descriptions of the control devices, see separate data sheets:

RE 92056, RE 92060, RE 92072,
RE 92076, RE 92080, RE 92084

Ordering code for standard program

	A4VS	G			/			–				10			
01	02	03	04	05		06	07		08	09	10	11	12	13	14

Hydraulic fluid

		40	71	125	180	250	355	500	750	1000	
01	Mineral oil and HFD-fluids (no code)	●	●	●	●	●	●	●	●	●	
	HFA-, HFB and HFC-hydraulic fluids	●	●	●	●	●	●	●	–	–	E–

Axial piston unit

02	Swashplate design, variable	A4VS

Operation mode

03	Pump, closed circuit	G

Size (NG)

04	≙ displacement $V_{g\ max}$ [cm^3]	40	71	125	180	250	355	500	750	1000

Control devices

05	Manual control	(RE 92072)	●	●	●	●	●	●	●	–	–	MA..
	Electric motor control	(RE 92072)	●	●	●	●	●	●	●	–	–	EM..
	Hydraulic control, control volume dependent	(RE 92076)	●	●	●	●	●	●	●	●	●	HM..
	Hydraulic control, with servo/proportional valve	(RE 92076)	●	●	●	●	●	●	●	●	●	HS..
	Hydraulic control, with proportional valve	(RE 92076)	●	●	●	●	●	●	●	●	●	EO..
	Hydraulic control, pilot pressure dependent	(RE 92080)	●	●	●	●	●	●	●	●	●	HD..[1]
	Electrohydraulic control with proportional solenoid	(RE 92084)	●	●	●	●	●	●	●	●	❍	EP..[1]
	Pressure control, swiveling to one side of centre	(RE 92060)	●	●	●	●	●	●	●	●	●	DR..[1,2]
	Pressure control for parallel operation	(RE 92060)	●	●	●	●	●	●	●	●	●	DP..[1,2]
	Secondary speed control	(RE 92056)	●	●	●	●	●	●	●	●	●	DS..

Series

06	Series 1, index 0 (index 1)	●	●	–	–	–	–	–	–	–	10(11)[3]
	Series 3, index 0	–	–	●	●	●	●	●	●	●	30

Direction of rotation

07	Viewed on drive shaft	clockwise	R
		counter clockwise	L
		bi-directional	W[1]

Seals

		40	71	125	180	250	355	500	750	1000	
08	NBR (nitrile-caoutchouc), shaft seal FKM	●	●	●	●	●	●	●	●	●	P
	FKM (fluor-caoutchouc) / HFD operation	●	●	●	●	●	●	●	●	●	V

Drive shaft

09	Parallel keyed shaft DIN 6885	P
	Splined shaft DIN 5480	Z

Mounting flange

			40	71	125	180	250	355	500	750	1000	
10	Based on ISO 3019-2 metric	4-hole	●	●	●	●	●	●	–	–	–	B
		8-hole	–	–	–	–	–	–	●	●	●	H

● = Available ❍ = On request – = Not available

1) Bi-directional rotation not possible in all cases, please observe separate data sheets for the controls
2) Operation only on one side of centre
3) Design with HD- and EP-controls in series 11

Ordering code for standard program

01	02	03	04	05		06	07		08	09	10	11	12	13	14
	A4VS	G			/			–				10			

Service line ports

11	SAE flange ports A and B, located on same side, metric fastening thread	10

Through drive

	Flange	Coupler for splined shaft	to mount	40	71	125	180	250	355	500	750	1000	
12	Without attachment pump, without through drive			●	●	●	●	●	●	●	●	●	N00
	With through drive for mounting an axial piston or gear pump			●	●	●	●	●	●	●	●	●	K...
	125, 4-hole (ISO[4)])	32x2x14x9g	A4VSO/G 40	●	●	●	●	●	❍	❍	❍	❍	31
	140, 4-hole (ISO[4)])	40x2x18x9g	A4VSO/G 71	–	●	●	●	●	●	●	❍	●	33
	160, 4-hole (ISO[4)])	50x2x24x9g	A4VSO/G 125	–	–	●	●	●	●	●	❍	❍	34
	160, 4-hole (ISO[4)])	50x2x24x9g	A4VSO/G 180	–	–	–	●	●	●	●	❍	❍	34
	224, 4-hole (ISO[4)])	60x2x28x9g	A4VSO/G, A4CSG 250	–	–	–	–	●	●	●	●	●	35
	224, 4-hole (ISO[4)])	70x3x22x9g	A4VSO/G, A4CSG 355	–	–	–	–	–	●	●	❍	❍	77
	315, 8-hole (ISO[4)])	80x3x25x9g	A4VSO/G, A4CSG 500	–	–	–	–	–	–	●	❍	❍	43
	400, 8-hole (ISO[4)])	90x3x28x9g	A4VSO/G, A4CSG 750	–	–	–	–	–	–	–	●	●	76
	400, 8-hole (ISO[4)])	100x3x32x9g	A4VSO/G 1000	–	–	–	–	–	–	–	–	●	88
	80, 2-hole (ISO[4)])	3/4in 19-4 (SAE A-B)	A10VSO 10/52, 18/31	❍	❍	❍	❍	❍	❍	❍	❍	❍	B2
	100, 2-hole (ISO[4)])	7/8in 22-4 (SAE B)	A10VSO 28/31	●	❍	●	❍	●	❍	❍	❍	❍	B3
	100, 2-hole (ISO[4)])	1in 25-4 (SAE B-B)	A10VSO 45/31	❍	●	❍	●	●	❍	❍	❍	❍	B4
	125, 2-hole (ISO[4)])	1 1/4in 32-4 (SAE C)	A10VSO 71/31	–	●	●	●	●	●	●	❍	❍	B5
	160, 4-hole (ISO[4)])	1 1/4in 32-4 (SAE C)	A10VSO 71/32	–	❍	❍	❍	❍	❍	❍	❍	❍	B8
	125, 2-hole (ISO[4)])	1 1/2in 38-4(SAE C-C)	A10VSO 100/31	–	–	●	●	●	●	●	●	❍	B6
	180, 4-hole (ISO[4)])	1 1/2in 38-4 (SAE C-C)	A10VSO 100/32	–	–	❍	❍	❍	❍	❍	❍	❍	B9
	180, 4-hole (ISO[4)])	1 3/4in 44-4 (SAE D)	A10VSO 140/31/32	–	–	–	●	●	●	●	●	❍	B7
	82-2 (SAE A)	5/8in 16-4 (SAE A)	AZPF-1X-004...022	●	●	●	●	●	●	●	●	❍	01
	82-2 (SAE A)	3/4in 19-4 (SAE A-B)	A10VSO 10, 18/31/52(3)	❍	❍	❍	❍	❍	●	❍	❍	❍	52
	101-2 (SAE B)	7/8in 22-4 (SAE B)	AZPN-1X-020...032, A10VO 28/31/52(3)	●	●	●	●	●	●	●	❍	❍	68
	101-2 (SAE B)	1in 25-4 (SAE B-B)	PGH4, A10VO45/31	❍	●	●	●	●	●	●	❍	❍	04
	127-2 (SAE C)	1 1/4in 32-4 (SAE C)	A10VO 71/31	–	❍	●	●	●	●	●	●	●	07
	127-2 (SAE C)	1 1/2in 38-4 (SAE C-C)	PGH5, A10VO100/31	–	–	●	●	●	●	●	●	●	24
	152-4 (SAE D)	1 3/4in 44-4 (SAE D)	A10VO 140/31	–	–	●	●	●	●	●	●	❍	17
	with through-drive shaft, without shaft coupler, without adapter flange, closed with cover plate			●	●	●	●	●	●	●	●	●	99
	Boost pump mounted												
	A piped auxiliary pump for the boost circuit			●	●	●	●	▲	▲	▲	▲	●	H02
	A common piped auxiliary pump for the boost and control circuit (only for EO1 and EO1K)			●	●	●	–	▲	–	–	–	–	H04
	Separately piped auxiliary pumps for the boost circuit and the control circuit (only for HD1T and HD1U) including a pressure relief valve for the control circuit			●	●	●	●	▲	▲	▲	▲	●	H06

Combination pumps

1. Combination pumps consisting of axial piston units – for ordering example, see page 34; for summary of mounting options, see page 36
2. If delivery with mounted gear pump is desired, please contact us

● = Available ▲ = Not for new projects, please contact us, replacement A4CSG see RE 92105
❍ = On request – = Not available

4) Acc. to ISO 3019-2 metric

Ordering code for standard program

	A4VS	G			/			–				10			
01	02	03	04	05		06	07		08	09	10	11	12	13	14

Valves

		40	71	125	180	250	355	500	750	1000	
13	Without valve block	●	●	●	●	●	●	●	●	●	**0**
	Valve block SDVB mounted	●	●	●	●	▲	▲	▲	▲	●	**9**
	Valve block SDVB 16/40 mounted[5)]	❍	❍	❍	❍	–	–	–	–	–	**4**

Filtration

		40	71	125	180	250	355	500	750	1000	
14	Without filter	●	●	●	●	●	●	●	●	●	**N**
	Filter mounted in boost circuit	●	●	●	●	●	●	●	❍	❍	**F**
	Sandwich plate filter (for HS- and DS-control, see RE 92076 and RE 92056)	●	●	●	●	●	●	●[6)]	–	–	**Z**
	Filter mounted in boost circuit and sandwich plate filter for HS- and DS-controls	●	●	●	●	●	●	●[6)]	–	–	**U**

● = Available ▲ = Not for new projects, please contact us, replacement A4CSG see RE 92105
❍ = On request – = Not available

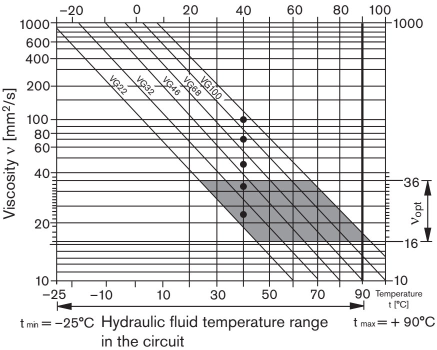
5) With direct operated flushing spool and pilot operated high-pressure relief valve
6) For the size 500 only available for the DS-control, HS see RE 92076

Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and conditions of use.
The variable pump A4VSG is suitable for operation with HFA, HFB, HFC and HFD fluids.
When operating with HF or environmentally acceptable hydraulic fluids, restrictions of the technical data and seals are required acc. to RE 90223 or RE 90221.
When ordering, indicate the hydraulic fluid that is to be used.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit, the circuit temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt}), see shaded area of the selection diagram. We recommend, that the higher viscosity class is selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, is always higher than the circuit temperature. At no point of the component may the temperature be higher than 90 °C, however.
If the above conditions cannot be maintained due to extreme operating parameters, please contact us.

Viscosity and temperature

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage		$T_{min} \geq -50$ °C $T_{opt} = +5$ °C to $+20$ °C	up to 12 months with standard factory preservation up to 24 months with long-term factory preservation
(Cold) start-up[1)]	$\nu_{max} = 1000$	$T_{St} \geq 40$ °C	$t \leq 3$ min, without load ($p \leq 50$ bar), $n \leq 1000$ rpm
Permissible temperature difference		$\Delta T \leq 25$ K	between axial piston unit and hydraulic fluid
Warm-up phase	$\nu < 1000$ to 100	$T = -40$ °C to -25 °C	for p_{nom}, $0.5 \cdot n_{max}$ and $t \leq 15$ min
Operating phase			
Maximum temperature		90 °C	measured at the case drain port
Continuous operation	$\nu = 100$ to 15 $\nu_{opt} = 16$ to 36	$T = -25$ °C to $+90$ °C	measured at the case drain port, no restriction within the permissible data
Short-term operation	$\nu_{min} =< 15$ to 5	$T_{max} = +90$ °C	measured at the case drain port, $t < 3$ min, $p < 0.3 \cdot p_{nom}$
FKM shaft seal[1)]		$T \leq +90$ °C	see page 6

1) At temperatures below −25 °C, an NBR shaft seal is required (permissible temperature range: −40 °C to +90 °C).

Technical data

Bearing flushing

For the following operating conditions bearing flushing is required for a safe, continuous operation:

– Applications with water-containing special fluids due to limited lubricity and narrow operating temperature range

– Operation with limiting conditions for temperature and viscosity

– With vertical installation (drive shaft facing upwards) to ensure lubrication of the front bearing and the shaft seal.

Bearing flushing is carried out at port "U" in the front flange area of the variable pump. The flushing fluid flows through the front bearing and leaves the pump together with the case drain fluid.

Depending on pump size, the following flushing flows are recommended:

Size		40	71	125	180	250
recommended flushing flow q_{Sp}	L/min	3	4	5	7	10

Size		355	500	750	1000
recommended flushing flow q_{Sp}	L/min	15	20	30	40

These recommended flushing flows will cause a pressure drop of approx. 2 bar (series 1) and 3 bar (series 3) between the entrance to port„U“ and the pump case (including the pipe fittings.

Notes regarding series 30

When using external bearing flushing, the throttle screw in port U must be turned in to the end stop.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A **cleanliness level** of at least **20/18/15** is to be maintained.

Depending on the system and the application, for the A4VSG, we recommend

Filter cartridges $\beta_{20} \geq 100$.

With an increasing differential pressure at the filter cartridges, the β value must not deteriorate.

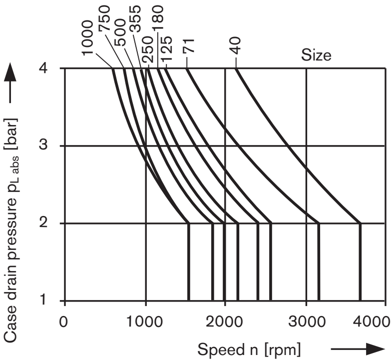
"A filter mounted in the boost circuit" is optionally available with er designation **F** or **U**.
For description, see page 65

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the pump speed and the case drain pressure. It is recommended that the average, continuous case drain pressure of 2 bar absolute at operating temperature not be exceeded (maximum permissible case drain pressure 4 bar absolute at reduced speed, see diagram). Momentary ($t < 0.1$ s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or greater than the external pressure on the shaft seal.



Temperature range

The FKM shaft seal is permissible for case drain temperatures from -25 °C to +90 °C.

Note
For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). See RE 90300-03-B.

Technical data

Operating pressure range

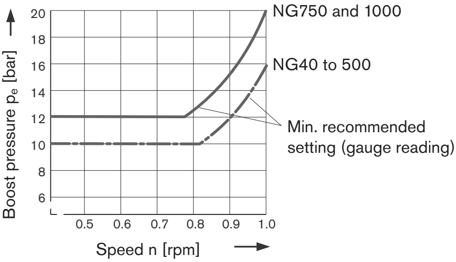
Pressure at service line port (pressure port) A or B

Nominal pressure p_{nom} ________________ 350 bar absolute

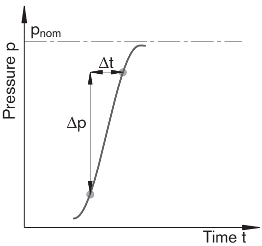
Maximum pressure p_{max} ______________ 400 bar absolute
Single operating period ____________________________ 1 s
Total operating period ___________________________ 300 h

Minimum pressure (high-pressure side) __________ 15 bar

Minimum pressure (low-pressure side)
The minimum pressure is speed related, see diagram



Rate of pressure change $R_{A\ max}$ _____________ 16000 bar/s



Inlet

Recommended boost pressure p_{Sp}

NG	40	71	125	180	250	355	500	750	1000
bar	16	16	16	16	16	16	16	25	25

Recommended boost pressure for a common auxiliary pump for boost and control fluid circuit (EO1...H04)
p_{Sp} ____ 25 bar

Maximum boost pressure – auxiliary pump $p_{Sp\ max}$ for
MA-, EM-, HM-, HS-, EO-, DS-control _____________ 50 bar
HD- and EP-control ______________________________ 25 bar
DR- and DP-control_______________________________16 bar

Auxiliary pump inlet pressure,see data sheet for the mounted auxiliary pump.

Boost pump, see page 54.

Observe details on the **control pressure** from the respective, separate data sheets for the control devices.

Definition

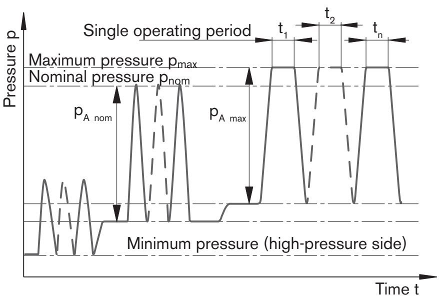
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Minimum pressure (low-pressure side)
Minimum pressure at the low-pressure side (A or B), which is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.

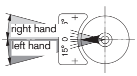


Total operating period = $t_1 + t_2 + ... + t_n$

Flow direction

Direction of rotation		Swivel range*
clockwise	counter-clockwise	
B to **A**	**A** to **B**	right hand
A to **B**	**B** to **A**	left hand

* cf. swivel angle indicator



2

Technical data

Table of values (theoretical values, without efficiency levels and tolerances; values rounded)

Size		NG		40	71	125	180	250	355	500	750	1000
Displacement geometric, per revolution		$V_{g\,max}$	cm^3	40	71	125	180	250	355	500	750	1000
Speed maximum at $V_{g\,max}$		n_{max}	rpm	3700	3200	2600	2400	2200	2000	1800	1600	1600
Flow at n_{max}		$q_{v\,max}$	L/min	148	227	325	432	550	710	900	1200	1600
at n_E = 1500 rpm		q_{VE}	L/min	60	107	186	270	375	533	750	1125	1500
Power at n_{max}	Δp = 350 bar	P_{max}	kW	86	132	190	252	321	414	525	700	933
at n_E = 1500 rpm		P_E	kW	35	62	109	158	219	311	438	656	875
Torque at $V_{g\,max}$ and	Δp = 350 bar	T_{max}	Nm	223	395	696	1002	1391	1976	2783	4174	5565
	Δp = 100 bar	T	Nm	64	113	199	286	398	564	795	1193	1590
Rotary stiffness of drive shaft	P	c	kNm/rad	80	146	260	328	527	800	1145	1860	2730
	Z	c	kNm/rad	77	146	263	332	543	770	1136	1812	2845
Moment of inertia for rotary group		J_{GR}	kgm^2	0.0049	0.0121	0.03	0.055	0.0959	0.19	0.3325	0.66	1.20
Maximum angular acceleration[1)]		α	rad/s^2	17000	11000	8000	6800	4800	3600	2800	2000	1450
Case volume		V	L	2	2.5	5	4	10	8	14	19	27
Mass approx. (Pump with HS4-control without valve block)		m	kg	42	60	107	112	220	235	335	500	644

1) The data are valid for values between zero and maximum permissible speed.
Valid for external excitation (e. g. engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency).
The limit value applies for a single pump only.
The load capacity of the connection parts must be considered.

Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Calculation of pump size

Flow $q_V = \dfrac{V_g \cdot n \cdot \eta_V}{1000}$ [L/min]

Torque $T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

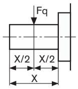
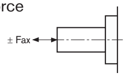
Power $P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

For boost pump parameters, see page 54.

Technical data

Permissible radial and axial forces on the drive shaft

Size				40	71	125	180	250	355	500	750*	1000
Maximum radial force for X/2		$F_{q\,max}$	N	1000	1200	1600	2000	2000	2200	2500	3000	3500
Maximum axial force		$\pm F_{ax\,max}$	N	600	800	1000	1400	1800	2000	2000	2200	2200

2

Note
Special requirements apply in the case of belt drives. Please contact us.

Influence on the direction of the permissible axial force:

$+ F_{ax\,max}$ = Increase in bearing life

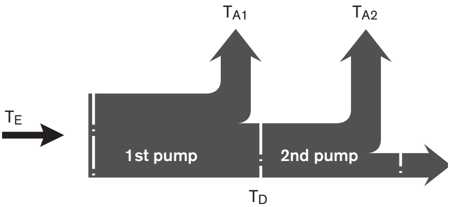
$- F_{ax\,max}$ = Reduction in bearing life (avoid)

Permissible input and through-drive torques

Size	NG		40	71	125	180	250	355	500	750	1000
Torque at $V_{g\,max}$ and $\Delta p = 350$ bar[1]	T_{max}	Nm	223	395	696	1002	1391	1976	2783	4174	5565
Input torque at drive shaft, maximum[2]											
Splined shaft Z	$T_{E\,max}$	Nm	446	790	1392	2004	2782	3952	5566	8348	11130
Shaft key P	$T_{E\,max}$	Nm	380	700	1392	1400	2300	3557	5200	7513	9444
Maximum through-drive torque			$T_{D\,max} = T_{E\,max}$								

1) Efficiency not considered
2) For drive shafts without radial force

Torque distribution

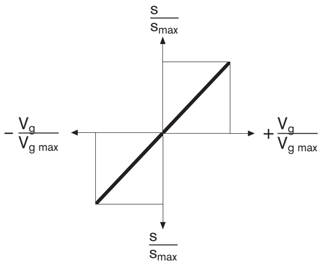


Summary of control devices

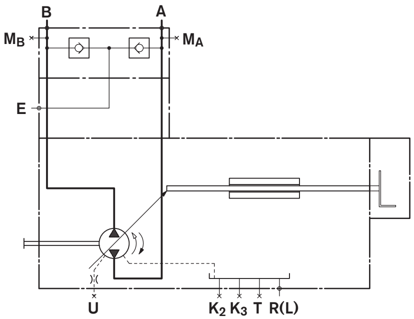
MA – Manual control
(see RE 92072)

Infinitely variable adjustment of displacement by means of a handwheel.

Characteristic



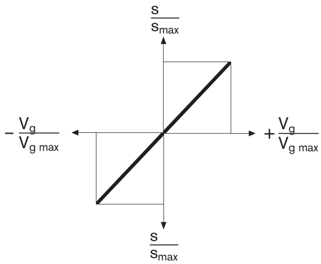
Schematic



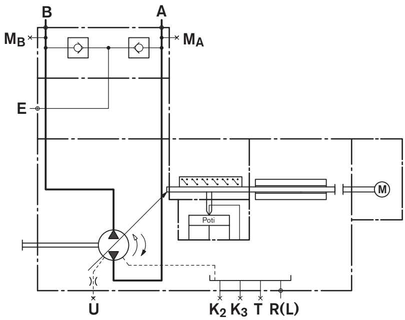
EM – Electric motor control
(see RE 92072)

Infinitely variable adjustment of displacements via an electric motor.
Various intermediate displacement values can be selected with a programmed sequence control by means of built on limit switches and an optional potentiometer for feedback of the swivel angle.

Characteristic



Schematic



Summary of control devices

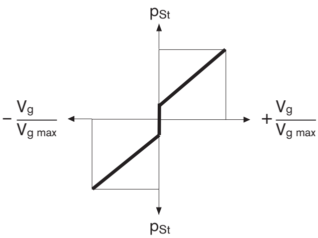
HD – Hydraulic control, pilot-pressure related

(see RE 92080)

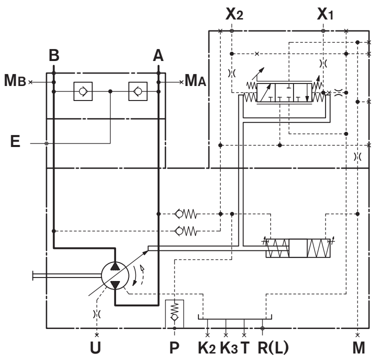
Infinitely variable adjustment of the pump displacement in relation to the pilot pressure. The control is proportional to the applied pilot pressure (difference between pilot pressure and case pressure).

Optional:
Pilot pressure curves (HD1, HD2, HD3)
Pressure control (HD.A, HD.B, HD.D)[1],
Remote pressure control (HD.GA, HD.GB, HD.G)[1]
Overriding power control (HD1P)
Electric control of pilot pressure signal (HD1T)

Characteristic



Schematic



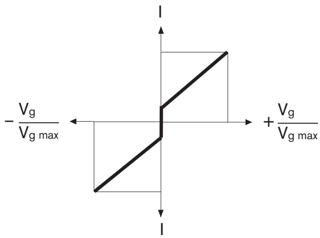
EP – Electrohydraulic control with proportional solenoid

(see RE 92084)

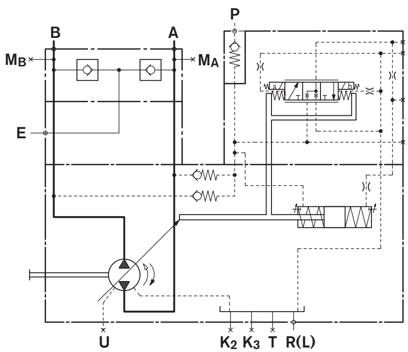
EP control adjusts the pump displacement proportionally to the current at the solenoid. Current-regulated controllers with pulse-width modulation are recommended for controlling the solenoids.

Optional:
Pressure control (EPA, EPB, EPD)[1]
Remote pressure control (EPGA, EPGB, EPG)[1]

Characteristic



Schematic



1) Bi-directional direction of rotation not possible.

Summary of control devices

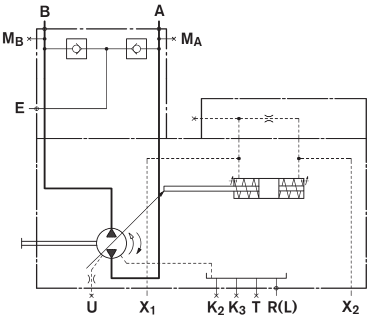
HM 1/2 – Hydraulic control, volume dependent

(see RE 92076)

The pump displacement is infinitely variable in relation to the control oil volume in ports X_1 and X_2

Application:
– 2-point control
– Basic control device for servo or proportional valve control.

Schematic



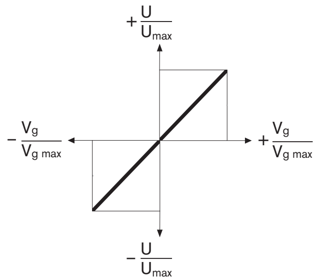
HS – Control system with servo valve

(see RE 92076)

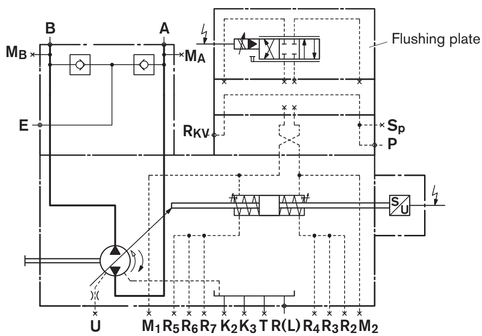
This infinitely variable displacement control is accomplished by means of a servo valve and electrical feedback of the swivel angle.

Optional:
Short circuit valve (HSK);
Without valves (HSE).

Characteristic



Schematic



Summary of control devices

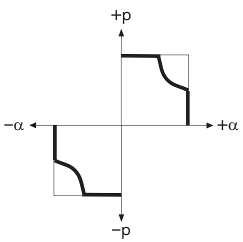
HS4 – Control system, with proportional valve

(see RE 92076)

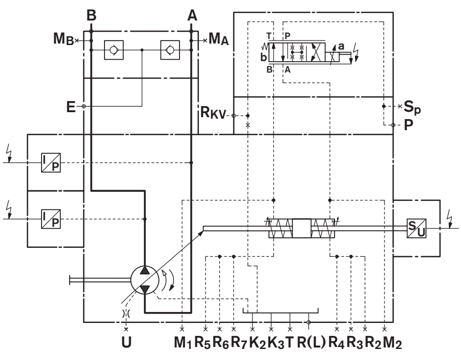
The infinitely variable displacement control is accomplished by means of a proportional valve and electrical feedback of the swivel angle.
The HS4P control system is equipped with mounted pressure transducers, which makes it suitable for electric pressure and power control.

Optional:
With pressure transducer (HS4P);
Short circuit valve (HS4K, HS4KP);
For oil-immersed use (HS4M)

Characteristic



Schematic



EO1/2 – Control system

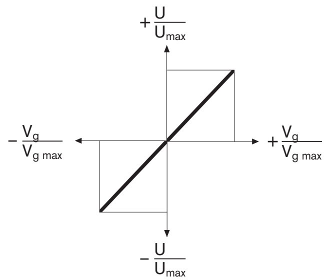
(see RE 92076)

This infinitely variable displacement control is accomplished by means of a proportional valve and electrical feedback of the swivel angle.
This makes it suitable for electric control of displacement

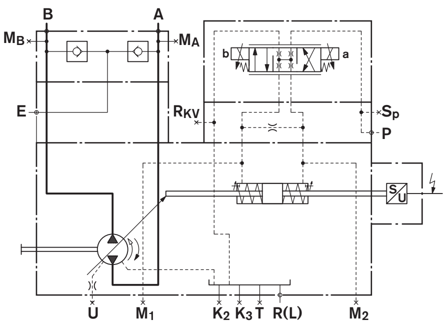
Optional:

Control pressure range (EO1, EO2)
Short circuit valve (EO1K, EO2K)

Characteristic



Schematic



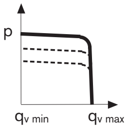
Summary of control devices

DR - Pressure control
(see RE 92060)

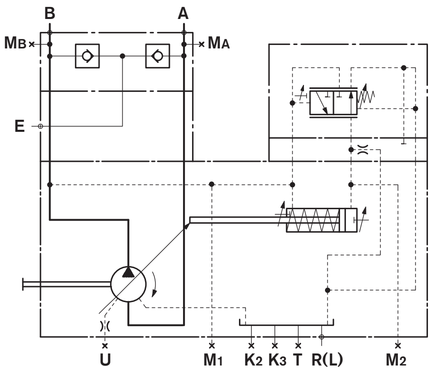
Swiveling to one side of centre
The DR pressure control limits the maximum pressure at the pump outlet within the control range of the pump. This max. pressure level can be steplessly set at the control valve.
Recommended setting range 50...350 bar
Bi-directional rotation not possible.

Optional:
Remote control (DRG)

Characteristic



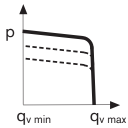
Schematic



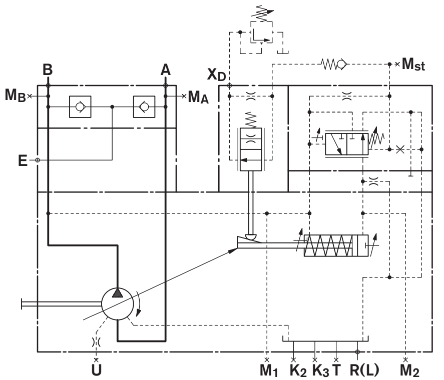
DP – Pressure control for parallel operation
(see RE 92060)

Swiveling to one side of centre
Suitable for pressure control of multiple A4VSG axial piston units in parallel operation.
Bi-directional rotation not possible.

Characteristic



Schematic



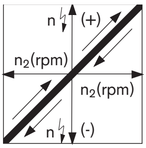
Summary of control devices

DS1 – Secondary speed control

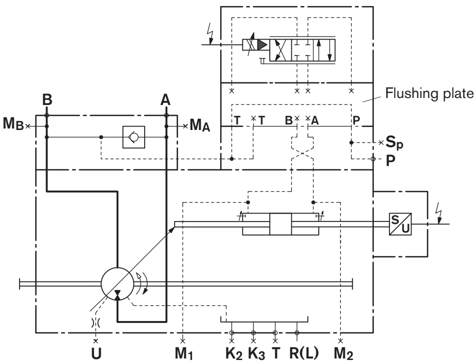
(see RE 92056)

The speed control DS1 controls the secondary unit (motor) in such a manner, that this motor delivers sufficient torque to maintain the required output speed. When connected to a constant pressure system, this torque is proportional to motor displacement and thus also proportional to the swivel angle.

Characteristic



Schematic

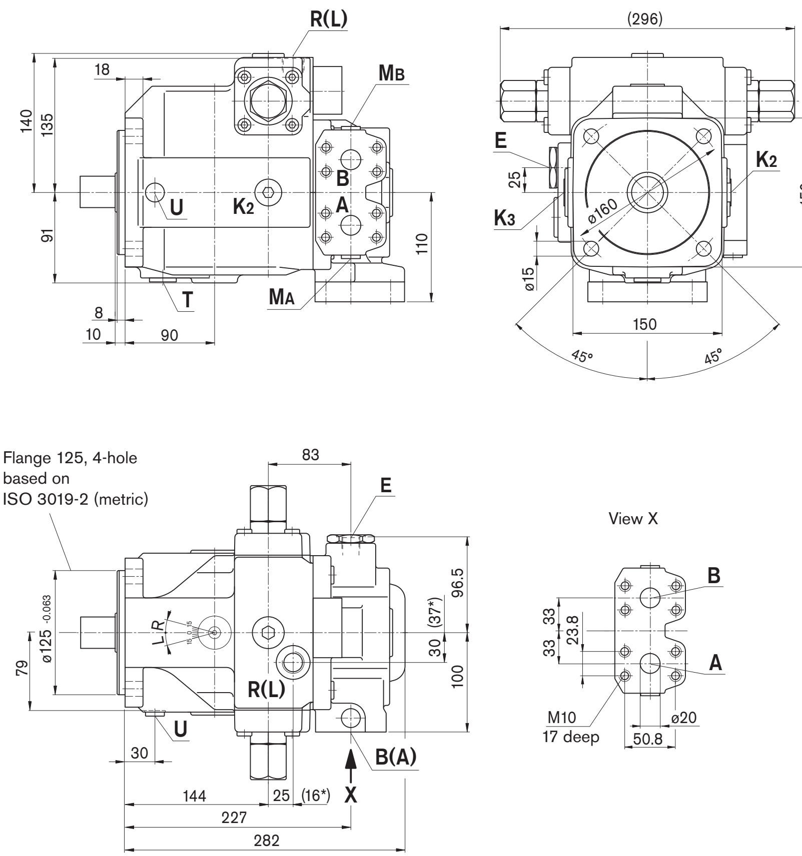


Dimensions size 40

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 1

Example: HM control; for exact dimensions of the control device, see separate data sheets



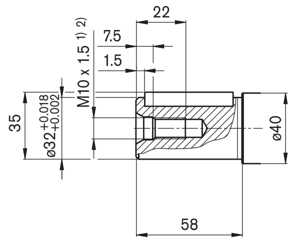
* For HD and EP control

Dimensions size 40

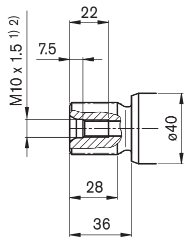
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS10x8x56



Z Splined shaft to DIN 5480
W32x2x14x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	3/4 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M10 x 1.5; 17 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M22 x 1.5; 14 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M18 x 1.5; 12 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M22 x 1.5; 14 deep	4	X[6]
R(L)	Tank line(case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M14 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

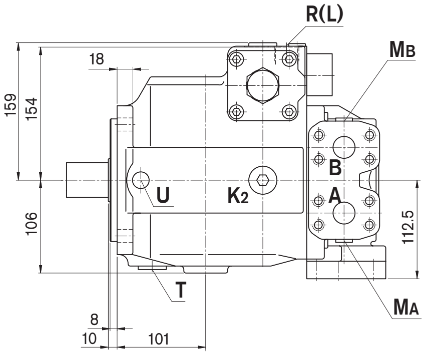
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

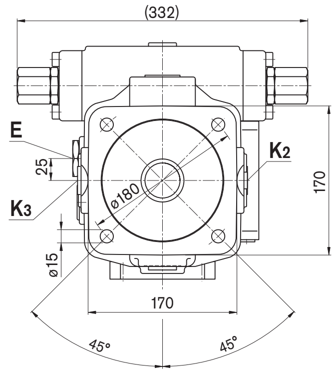
Dimensions, size 71

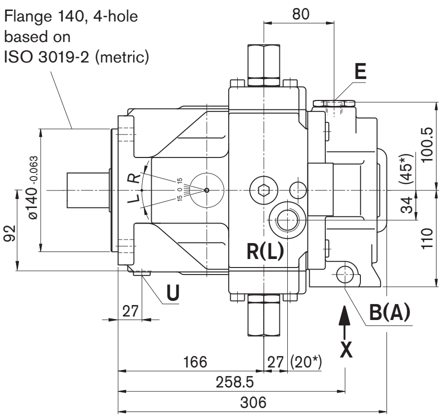
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

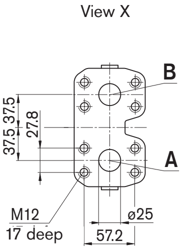
Series 1

Example: HM control; for exact dimensions of the control device, see separate data sheets









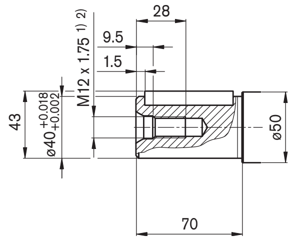
* For HD and EP control

Dimensions, size 71

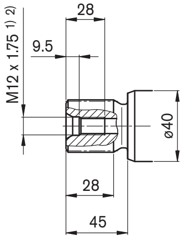
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS12x8x68



Z Splined shaft to DIN 5480
W40x2x18x9g



2

Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	1 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M12 x 1.75; 17 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M27 x 2; 16 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M18 x 1.5; 12 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M27 x 2; 16 deep	4	X[6]
R(L)	Tank line(case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M14 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

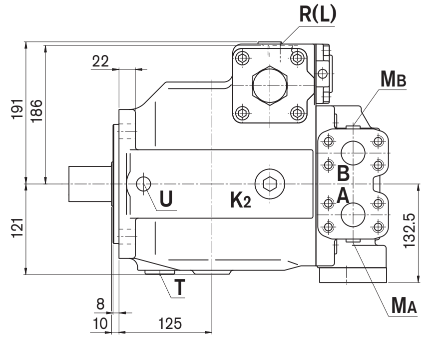
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

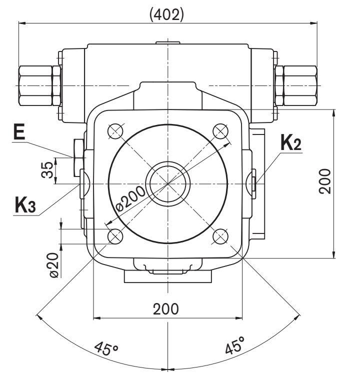
Dimensions size 125

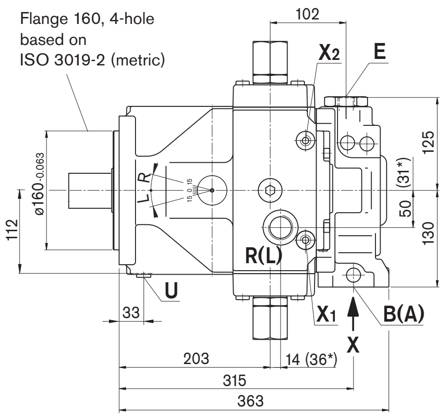
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

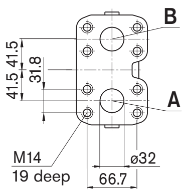
Example: HM control; for exact dimensions of the control device, see separate data sheets







View X



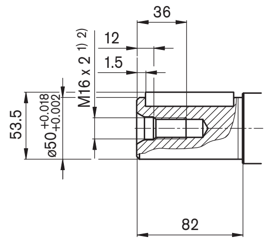
* For HM1-, EO1, MA- and EM-control

Dimensions size 125

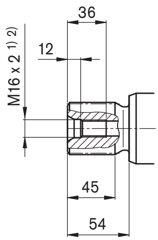
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS14x9x80



Z Splined shaft to DIN 5480
W50x2x24x9g



2

Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	1 1/4 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M14 x 2; 19 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M33 x 2; 18 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M22 x 1.5 14 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M33 x 2; 18 deep	4	X[6]
R(L)	Tank line(case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M14 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

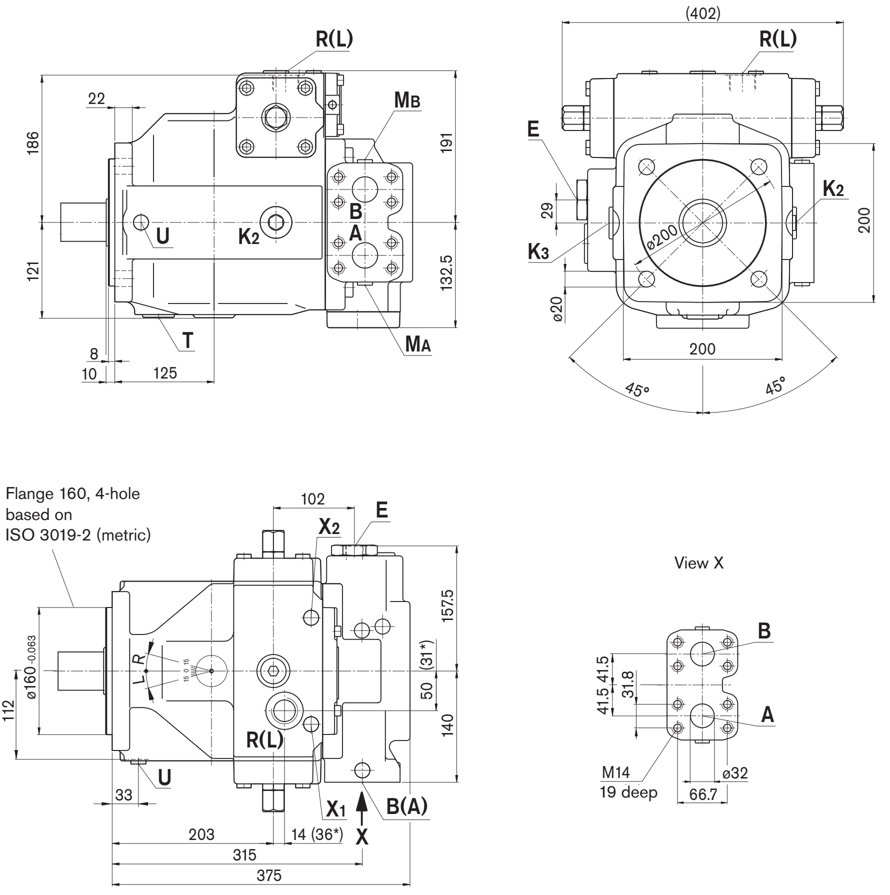
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 180

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets



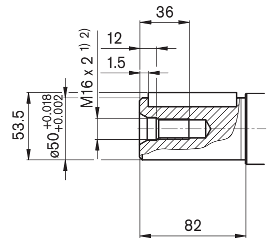
* For MA- and EM-control

Dimensions size 180

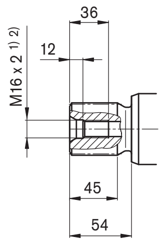
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS14x9x80



Z Splined shaft to DIN 5480
W50x2x24x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	1 1/4 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M14 x 2; 19 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M33 x 2; 18 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M22 x 1.5; 14 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M33 x 2; 18 deep	4	X[6]
R(L)	Tank line (case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M14 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

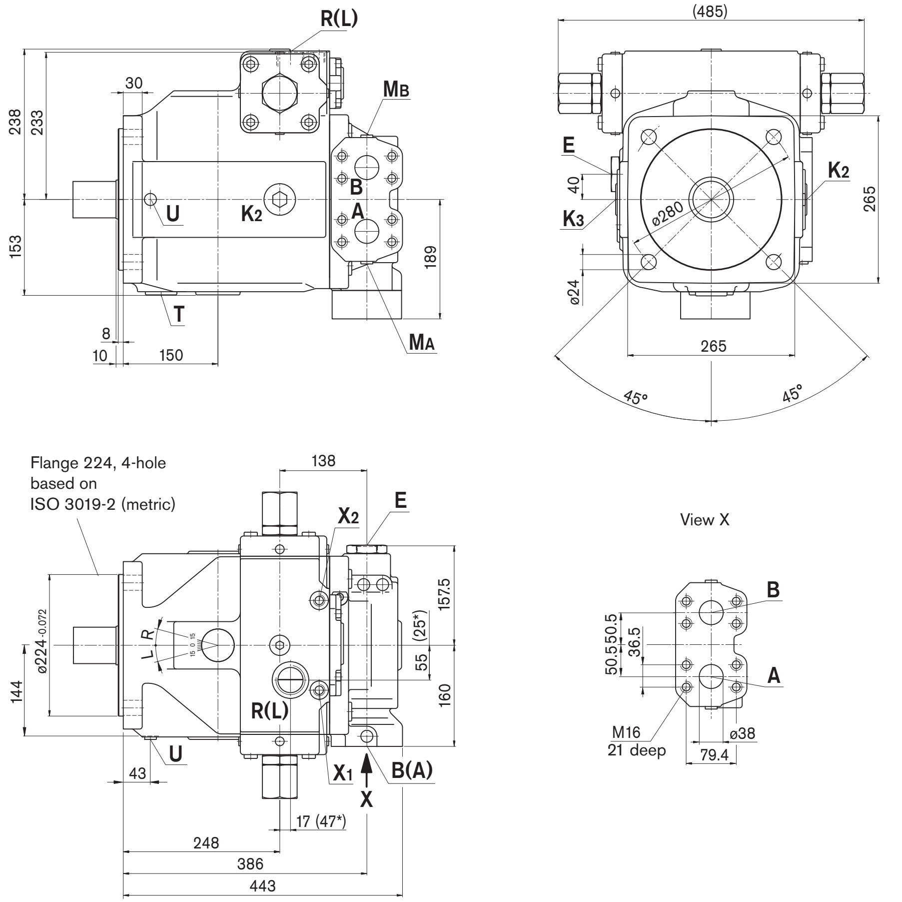
2

Dimensions size 250

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets



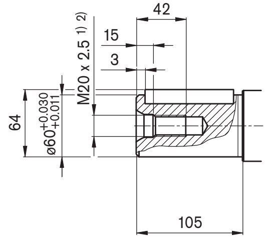
* For HM1-, EO1, MA- and EM-control

Dimensions size 250

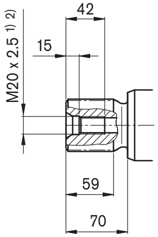
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS18x11x100



Z Splined shaft to DIN 5480
W60x2x28x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	1 1/2 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M16 x 2; 21 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M42 x 2; 20 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M33 x 2; 18 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M42 x 2; 20 deep	4	X[6]
R(L)	Tank line (case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M14 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

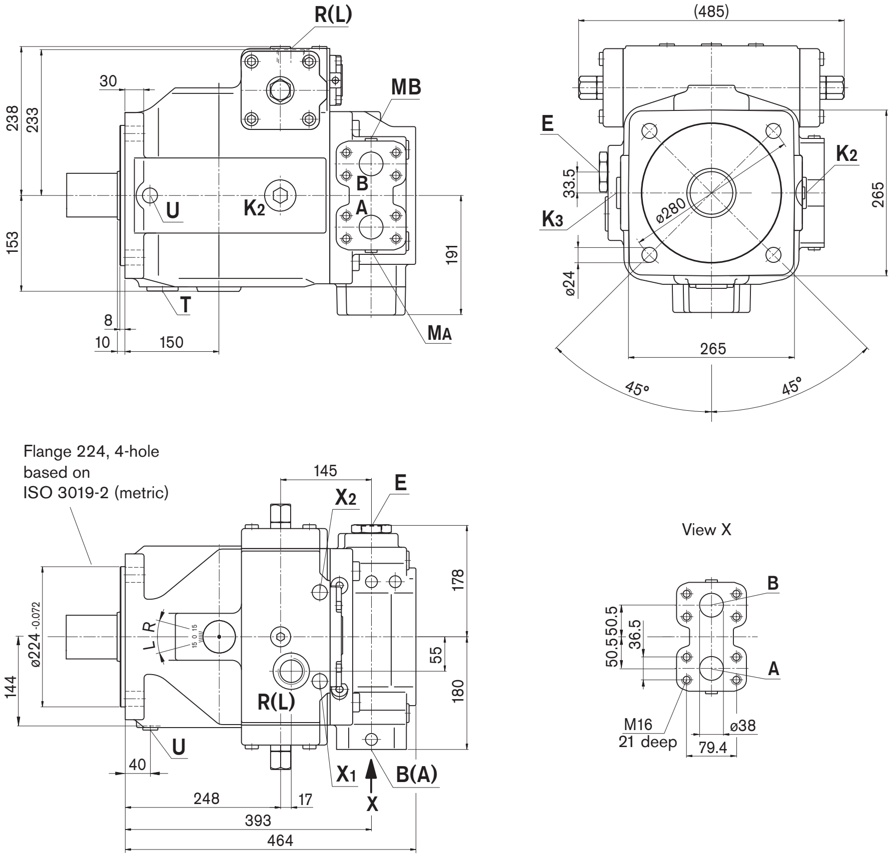
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 355

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets

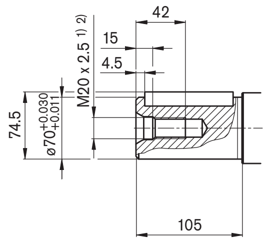


Dimensions size 355

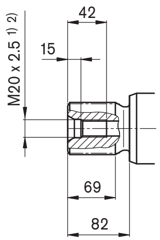
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS20x12x100



Z Splined shaft to DIN 5480
W70x3x22x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	1 1/2 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M16 x 2; 21 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M14 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M42 x 2; 20 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M33 x 2; 18 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M42 x 2; 20 deep	4	X[6]
R(L)	Tank line (case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M18 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

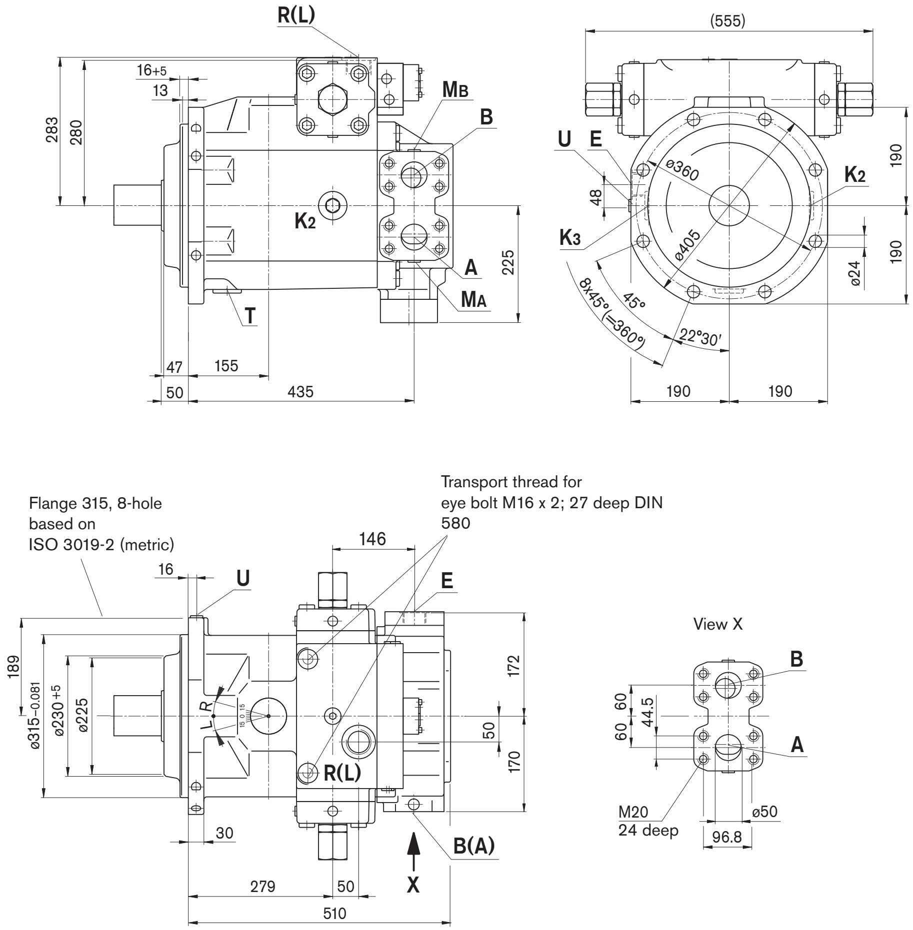
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 500

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets

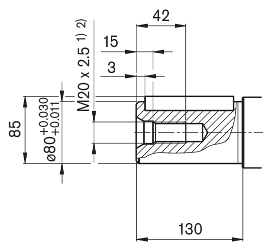


Dimensions size 500

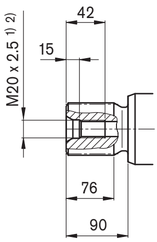
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS22x14x125



Z Splined shaft to DIN 5480
W80x3x25x9g



2

Ports

Designation	Port for	Standard	Size[2)]	Maximum pressure [bar][3)]	State
A, B	Service line (pressure port)	SAE J518[4)]	2 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M20 x 2.5; 24 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M18 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5)]	M48 x 2; 20 deep	4	X[6)]
E	Boost pressure inlet	DIN 3852	M33 x 2; 18 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5)]	M48 x 2; 20 deep	4	X[6)]
R(L)	Tank line (case drain port)			4	O[6)]
U	Bearing flushing	DIN 3852[5)]	M18 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

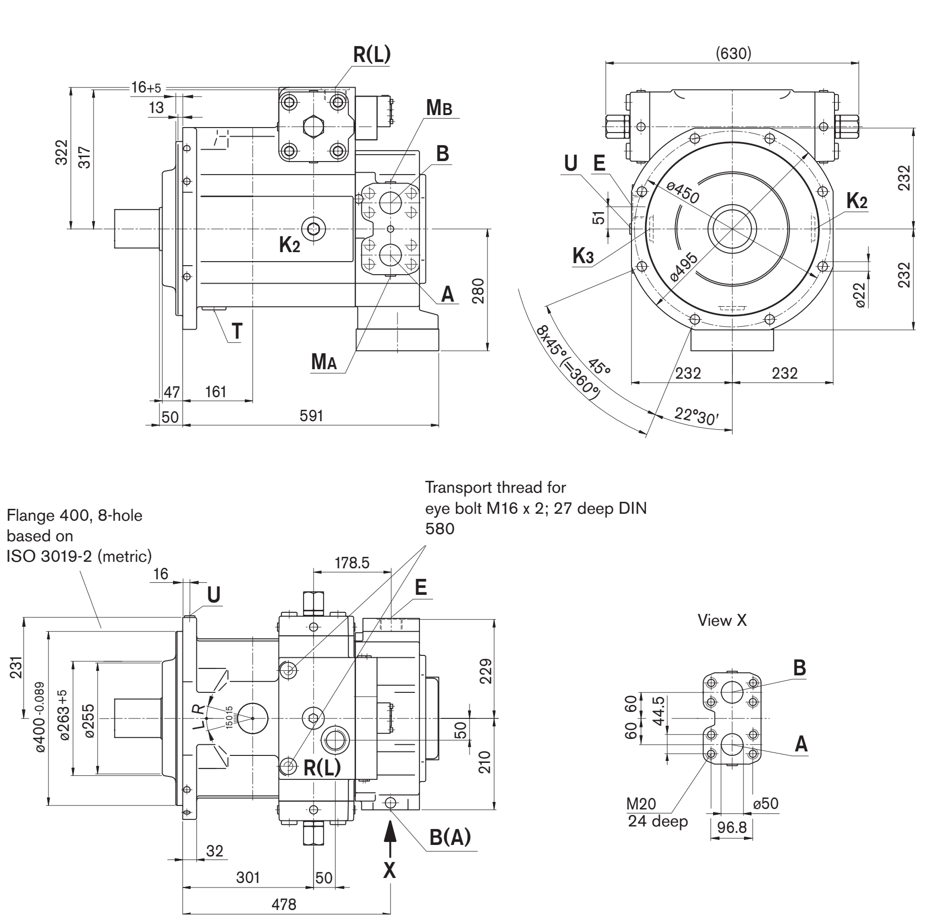
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 750

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets

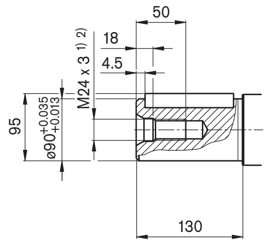


Dimensions size 750

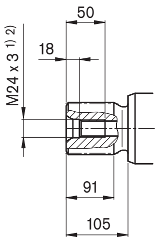
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS25x14x125



Z Splined shaft to DIN 5480
W90x3x28x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	2 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M20 x 2.5; 24 deep		O
M_A, M_B	Measuring operating pressure A/B	DIN 3852	M18 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M48 x 2; 20 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M48 x 2; 20 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M48 x 2; 20 deep	4	X[6]
R(L)	Tank line (case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M18 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard..
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

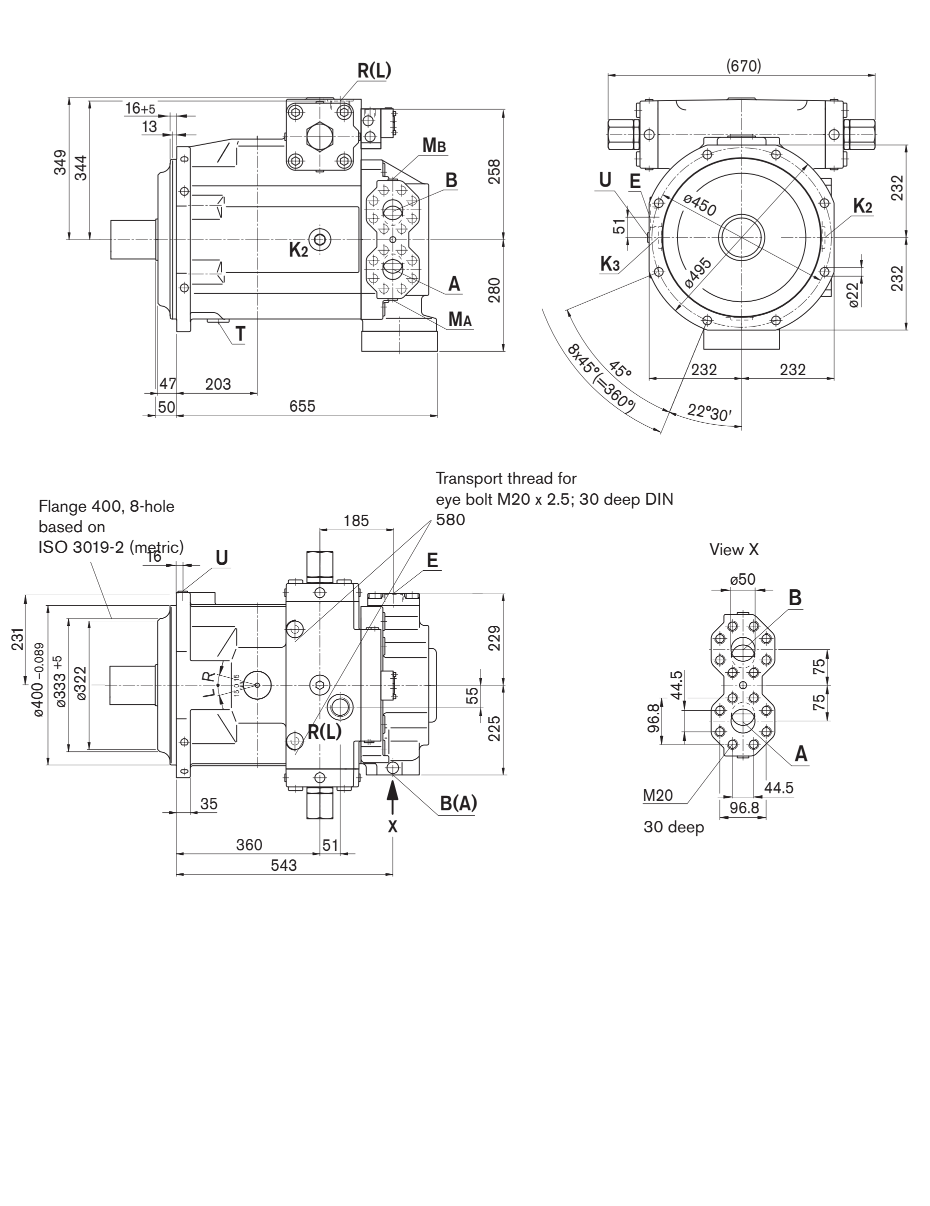
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 1000

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Series 3

Example: HM control; for exact dimensions of the control device, see separate data sheets

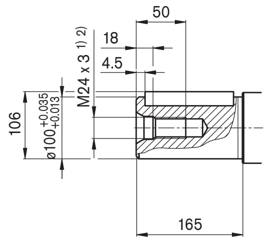


Dimensions size 1000

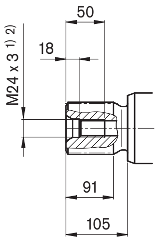
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

P Keyed to DIN 6885
AS28x16x160



Z Splined shaft to DIN 5480
W100x3x32x9g



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [bar][3]	State
A, B	Service line (pressure port)	SAE J518[4]	2 in (high-pressure series)	400	O
	Fastening thread A/B	DIN 13	M20 x 2.5; 30 deep		O
M_{A1}, M_{B1}	Measuring operating pressure	DIN 3852	M18 x 1.5; 12 deep	400	X
T	Drain	DIN 3852[5]	M48 x 2; 20 deep	4	X[6]
E	Boost pressure inlet	DIN 3852	M48 x 2; 20 deep	50	O
K_2, K_3	Fill + air bleed	DIN 3852[5]	M48 x 2; 20 deep	4	X[6]
R(L)	Tank line (case drain port)			4	O[6]
U	Bearing flushing	DIN 3852[5]	M18 x 1.5; 12 deep	7	X

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 68 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, K_2, K_3 or R(L) must be connected (see also pages 66 and 67)

O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Through drive

The A4VSG axial piston unit can be delivered with a through drive, as shown in the type code on page 3.
The through drive version is designated by codes K 31 through 99.

The maximum number of units in a combination pump is determined by the permissible mass bending moment, see page 35.

Single pump with through drive

If no further pumps are factory-mounted the simple type code is sufficient.

The delivery contents include:

For all through drives except for K 99
Coupling, fixing screws, seal and, if applicable, an intermediate flange

For K 99
With through-drive shaft, without coupling, without intermediate flange; unit is closed fluid tight with pressure-tight cover.

Combination pumps

Independent circuits are available for the user when further pumps are built on.

1. If the combination pump consists of **2 Rexroth axial piston units** and these are to **be supplied pre-assembled**, the two model designations are to be linked with "+".

   Ordering example:
   A4VSG 125 EO1 / 30 R – PPB10K339F **+** A4VSG 71 HM1 / 10 R – PZB10N000N
2. If a **gear pump** is to be **factory mounted** as attachment pump, please contact us.
3. **Mounted and piped auxiliary pumps** (see page 54)
   Depending on the application, various auxiliary pumps and/or piping are available.

   Ordering example: A4VSG 125 EO1 / 30R – PPB10H029F
   A4VSG with a mounted auxiliary pump piped for the boost circuit.

   A4VSG 71EO1/10R – PPB10 H069F
   A4VSG with two mounted auxiliary pumps; one is piped for the boost circuit and the other for the control circuit.

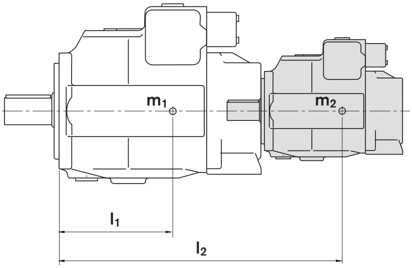
Note for control units HD.P, HD.T and HD.U:

For **combination pump** in tandem design **A4 + A4**, some combinations may result in dimensional restrictions for the mounting of the power control valve or proportional pressure relief valve.
In the following cases, we recommend to carry out the valve mounted on the rear pump or to consult us:

NG40	+	NG40
NG71 with pressure control	+	NG71

Permissible mass bending moment of inertia

Relative to the mounting flange of the main pump



m_1, m_2 [kg] Weight of pump

l_1, l_2 [mm] Distance center of gravity

$$T_m = m_1 \cdot l_1 \cdot \frac{1}{102} + m_2 \cdot l_2 \cdot \frac{1}{102} \text{ [Nm]}$$

Size			40	71	125	180	250	355	500	750	1000
Permissible mass moment	$T_{m\ perm.}$	Nm	1800	2000	4200	4200	9300	9300	15600	19500	19500
Permissible mass moment at dynam. acceleration 10 g ≙ 98.1 m/sec^2	$T_{m\ perm.}$	Nm	180	200	420	420	930	930	1560	1950	1950
Weight (A4VSG...EO2...9)	m	kg	47	60	100	114	214	237	350	500	630
Distance center of gravity	l_1	mm	120	140	170	180	210	220	230	260	290

Overview of mounting options on A4VSG

Through drive - A4VSG			Mounting option of 2nd pump					Through drive
Flange	Coupling for splined shaft	Code	A4VSO/G NG (shaft)	A4CSG NG (shaft)	A10V(S)O/31(2) 5) NG (shaft)	A10V(S)O/52(3) NG (shaft)	External/internal gear pump	available for NG
Flange ISO 3019-2 (metric)								
80, 2-hole	19-4 (3/4in, 11T)3)	**KB2**	–	–	18 (S)/31	10 (S)	–	71, 125
100, 2-hole	22-4 (7/8in, 13T)3)	**KB3**	–	–	28 (S)/31	–	–	40 to 180
	25-4 (1in, 15T)3)	**KB4**	–	–	45 (S)/31	–	–	40 to 500
125, 2-hole	32-4 (1 1/4in, 14T)3)	**KB5**	–	–	71 (S)/31	–	–	71 to 500
	38-4 (1 1/2in, 17T)3)	**KB6**	–	–	100 (S)/31	–	–	125 to 750
125, 4-hole	W 32x2x14x9g2)	**K31**	40 (Z)	–	–	–	–	40 to 500
140, 4-hole	W 40x2x18x9g2)	**K33**	71 (Z)	–	–	–	–	71 to 1000
160, 4-hole	W 50x2x24x9g2)	**K34**	125 (Z)	–	–	–	–	125 to 750
			180 (Z)	–	–	–	–	180 to 750
	32-4 (1 1/4in, 14T)3)	**KB8**	–	–	71 (S)/32	–	–	in preparation
180, 4-hole	44-4 (1 3/4in, 13T)3)	**KB7**	–	–	140 (S)/31/32	–	–	180 to 750
	38-4 (1 1/2in, 17T)3)	**KB9**	–	–	100 (S)/32	–	–	in preparation
224, 4-hole	W 60x2x28x9g2)	**K35**	250 (Z)	250 (Z)	–	–	–	250 to 1000
	W 70x3x22x9g2)	**K77**	355 (Z)	355 (Z)	–	–	–	355, 500
315, 8-hole	W 80x3x25x9g2)	**K43**	500 (Z)	500 (Z)	–	–	–	500, 750
400, 8-hole	W 90x3x28x9g2)	**K76**	750 (Z)	750 (Z)	–	–	–	750, 1000
	W 100x3x32x9g2)	**K88**	1000 (Z)	–	–	–	–	1000
Flange SAE J 744 (ISO 3019-1)								
82-2 (A)1)	16-4 (5/8in, 9T)3)	**K01**	–	–	–	–	AZ-PF-1X-004 to 0224)	40 to 750
	19-4 (3/4in, 11T)3)	**K52**	–	–	18 (S)/31	10, 18 (S)	–	40, 71, 355
101-2 (B)1)	22-4 (7/8in, 13T)3)	**K68**	–	–	28 (S)/31	28 (S)	AZ-PN-1X-020 to 0324)	40 to 750
	25-4 (1in, 15T)3)	**K04**	–	–	45 (S)/31	45 (S)	PGH4	40 to 500
127-2 (C) 1)	32-4 (1 1/4in, 14T)3)	**K07**	–	–	71 (S)/31	–	–	71 to 1000
	38-4 (1 1/2in, 17T)3)	**K24**	–	–	100 (S)/31	85 (S)	PGH5	125 to 1000
152-4 (D) 1)	44-4 (1 3/4in, 13T)3)	**K17**	–	–	140 (S)/31	–	–	180 to 750

1) 2 = 2-hole, 4 = 4-hole

2) According to DIN 5480

3) Splined shafts acc. to SAEJ744 OCT83

4) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.

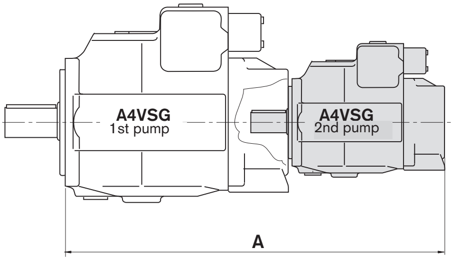
5) If a through drive for an A10V(S)O with R-shaft is desired, please contact us.

Notes

Combination pumps dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG + A4VSG



Overall length A

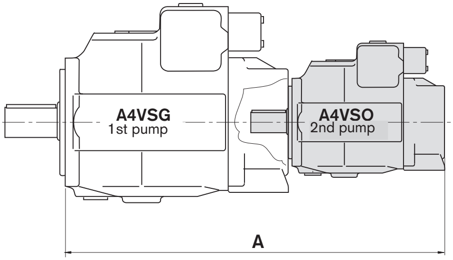
A4VSG (1st pump)	A4VSG (2nd pump) NG40	NG71	NG125	NG180	NG250	NG355	NG500	NG750	NG1000
NG40	570	–	–	–	–	–	–	–	
NG71	598	622	–	–	–	–	–	–	
NG125	655	679	743	–	–	–	–	–	
NG180	679	703	766	778	–	–	–	–	
NG250	713	737	832	844	912	–	–	–	
NG355	*	766	861	873	941	962	–	–	
NG500	*	811	868	880	984	1005	1100	–	
NG750	*	*	*	*	1034	*	*	1246	
NG1000	*	934	*	*	1107	*	*	1319	1383

* on request

Combination pumps dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG + A4VSO



Overall length A

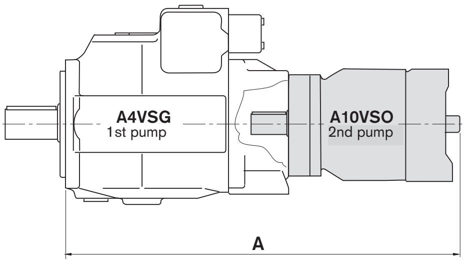
A4VSG	A4VSO (2nd pump)								
(1st pump)	NG40	NG71	NG125	NG180	NG250	NG355	NG500	NG750	NG1000
NG40	554	–	–	–	–	–	–	–	
NG71	582	611	–	–	–	–	–	–	
NG125	639	668	735	–	–	–	–	–	
NG180	663	692	758	778	–	–	–	–	
NG250	697	726	824	844	904	–	–	–	
NG355	*	755	853	873	933	962	–	–	
NG500	*	800	860	880	976	1005	1110	–	
NG750	*	*	*	*	1026	*	*	1215	
NG1000	*	923	*	*	1099	*	*	1288	1361

* on request

Combination pumps dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG + A10VSO



Overall length A

A4VSG (1st pump)	A10VSO.../31 (2nd pump) NG18	NG28	NG45	NG71	NG100	NG140
NG40	*	496	*	–	–	–
NG71	*	*	540	578	–	–
NG125	*	584	*	635	707	732
NG180	*	*	595	659	731	756
NG250	*	637	655	688	780	*
NG355	*	*	*	717	809	835
NG500	*	*	*	762	834	*
NG750	*	*	*	*	884	917
NG1000	*	*	*	*	*	*

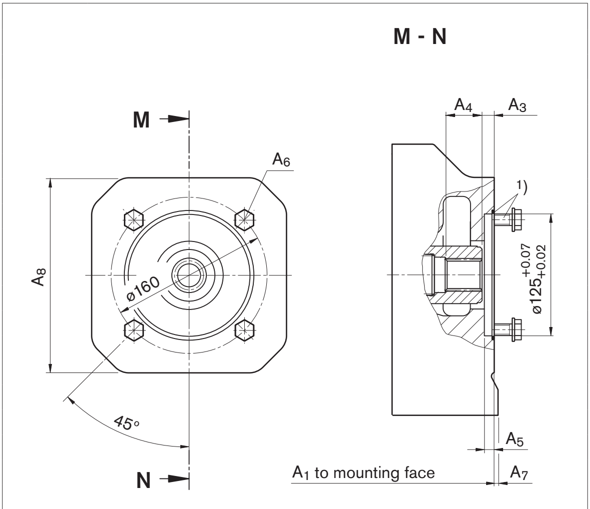
* on request

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K31

Flange ISO 3019-2 125, 4-hole
Shaft coupler to DIN 5480 N32x2x14x8H
for mounting an A4VSO/G 40 splined shaft

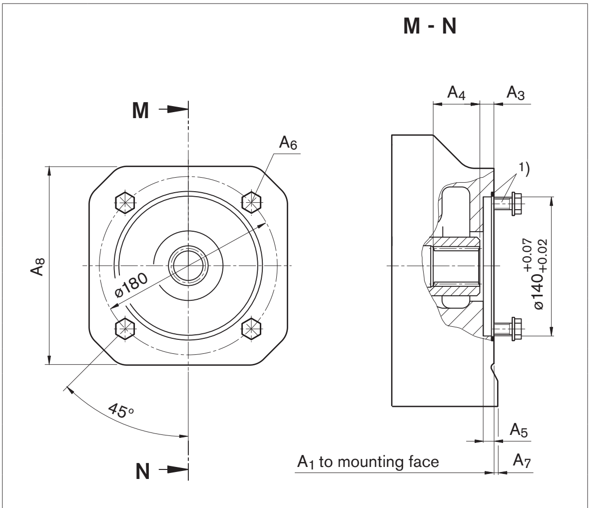


NG	A_1	A_3	A_4	A_5	A_6 [2)]
40	288	12.5	41.4	10	M12
71	316	12.5	33.6	10	M12
125	373	12.5	42	10	M12
180	397	12.5	42	10	M12
250	431	12.5	37.9	10	M12
355	on request				
500	on request				
750	on request				
1000	on request				

NG	A_7	A_8
40	–	–
71	–	–
125	–	–
180	–	–
250	10	200
355	on request	
500	on request	
750	on request	
1000	on request	

K33

Flange ISO 3019-2 140, 4-hole
Shaft coupler to DIN 5480 N40x2x18x8H
for mounting an A4VSO/G 71 splined shaft



NG	A_1	A_3	A_4	A_5	A_6 [2)]
71	316	12	44	9	M12
125	373	12.5	50	10	M12
180	397	12.5	43.8	10	M12
250	431	12.5	49	10	M12
355	460	12.5	49	10	M12
500	505	12.5	44	10	M12
750	on request				
1000	628	12.5	64.5	10	M12

NG	A_7	A_8
71	–	–
125	–	–
180	–	–
250	10	200
355	–	–
500	–	–
750	on request	
1000	27	280

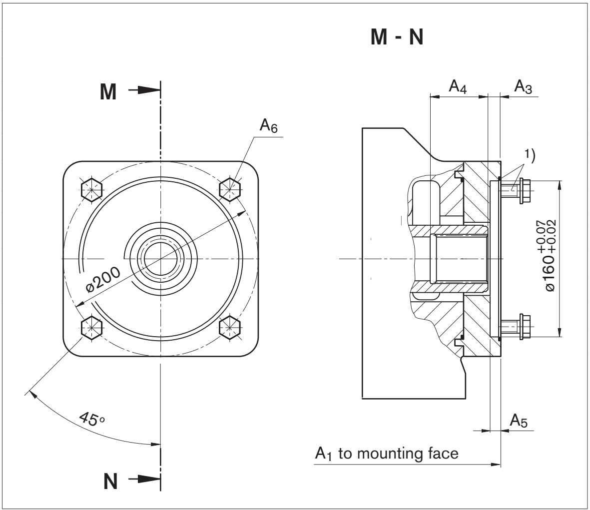
1) Fastening screws and O-ring seal are included in the delivery contents.
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K34

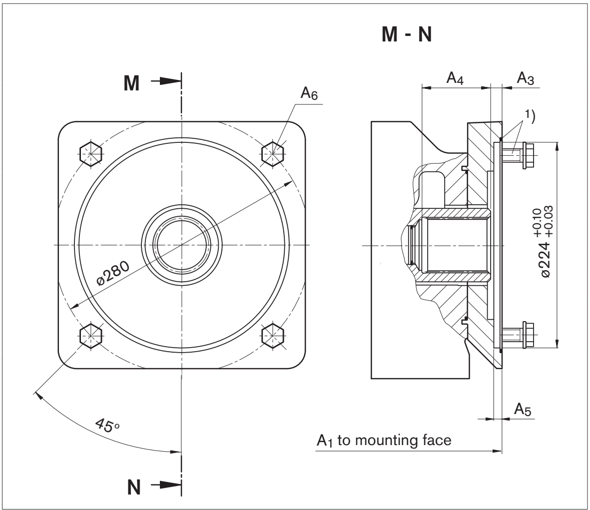
Flange ISO 3019-2 160, 4-hole
Shaft coupler to DIN 5480 N50x2x24x8H
for mounting an A4VSO/G 125 or 180 splined shaft



NG	A_1	A_3	A_4	A_5	A_6 2)
125	380	12.5	58	10	M16
180	403	12.5	58	10	M16
250	469	12.5	60	10	M16
355	498	12.5	60	10	M16
500	505	12.5	60	10	M16
750	on request				
1000	on request				

K35

Flange ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N60x2x28x8H
for mounting an A4VSO/G or A4CSG 250 splined shaft



NG	A_1	A_3	A_4	A_5	A_6 2)
250	469	12.5	75	9	M20
355	498	12.5	75	9	M20
500	541	12.5	74	10	M20
750	591	12.5	74	10	M20
1000	664	12.5	69.5	10	M20

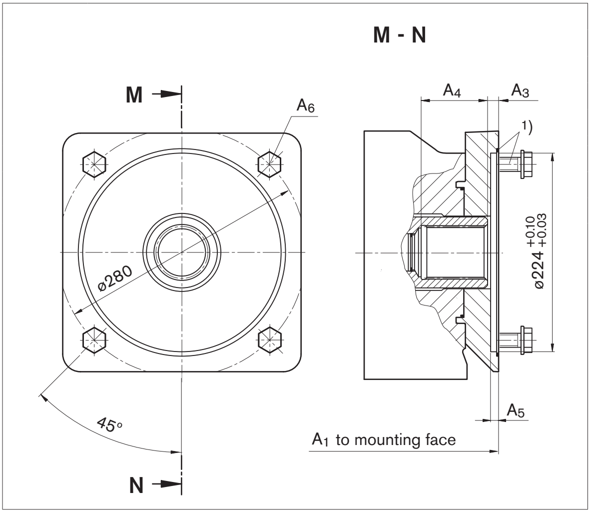
1) Fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K77

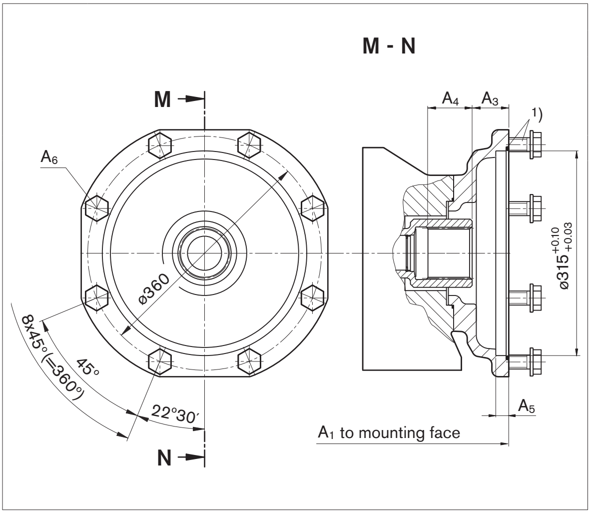
Flange ISO 3019-2 224, 4-hole
Shaft coupler to DIN 5480 N70x3x22x8H
for mounting an A4VSO/G or A4CSG 355 splined shaft



NG	A_1	A_3	A_4	A_5	A_6 2)
355	498	12.5	82	9	M20
500	541	12.5	82	10	M20
750	on request				
1000	on request				

K43

Flange ISO 3019-2 315, 8-hole
Shaft coupler to DIN 5480 N80x3x25x8H
for mounting an A4VSO/G or A4CSG 500 splined shaft



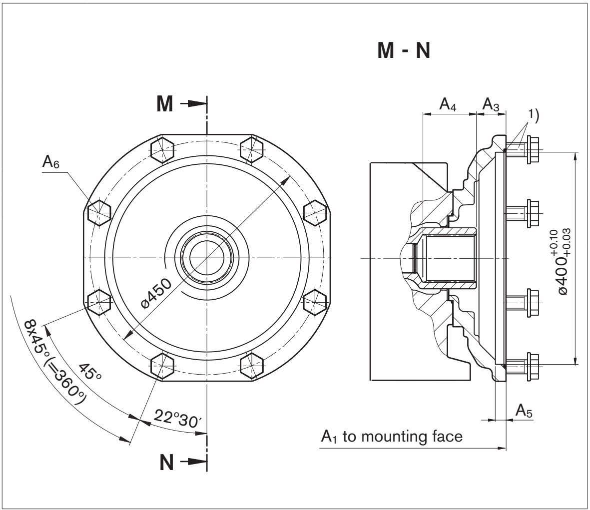
NG	A_1	A_3	A_4	A_5	A_6 2)
500	590	53.5	71.9	19	M20
750	on request				
1000	on request				

1) Fastening screws and O-ring seal are included in the delivery contents.
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

Through drive dimensions

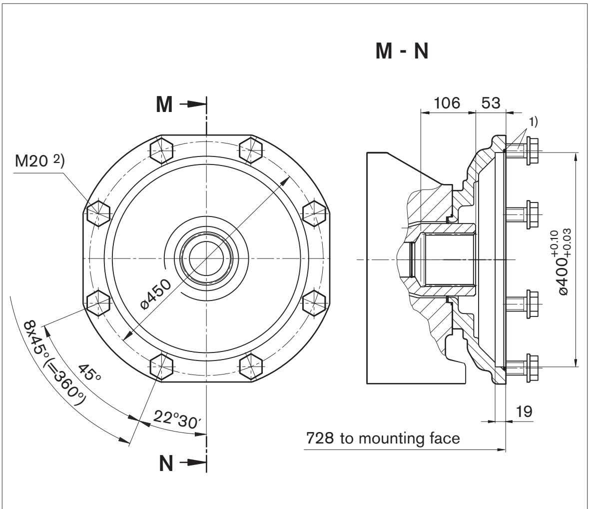
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K76 **Flange** ISO 3019-2 400, 8-hole
Shaft coupler to DIN 5480 N90x3x28x8H
for mounting an A4VSO/G, A4CSG 750 splined shaft



NG	A_1	A_3	A_4	A_5	A_6 2)
750	655	104	53	19	M20
1000	728	109	53	19	M20

K88 **Flange** ISO 3019-2 400, 8-hole
Shaft coupler to DIN 5480 N100x3x32x8H
for mounting an A4VSO/G 1000 splined shaft



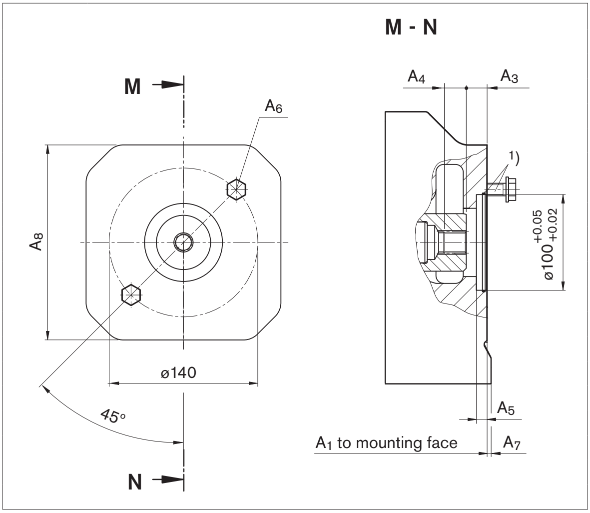
1) Fastening screws and O-ring seal are included in the delivery contents.
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

KB3

Flange ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13 T[3)]
for mounting an A10VSO 28/31 splined shaft S (see RE 92711)

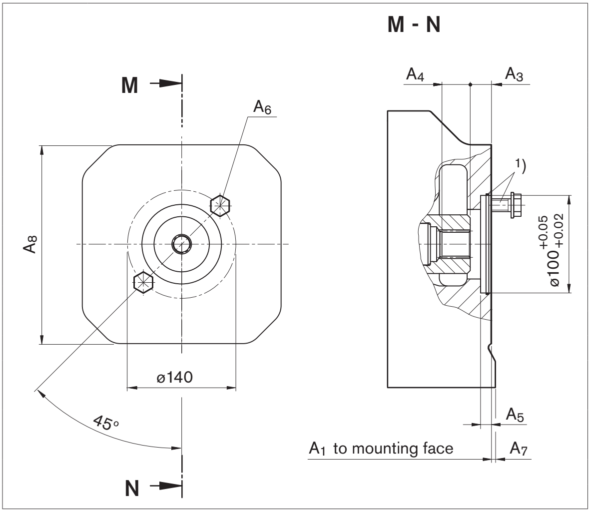


NG	A_1	A_3	A_4	A_5	A_6[2)]
40	290	20.4	23	10	M12
71	on request				
125	378	20.3	24.5	10	M12
180	on request				
250	431	20.5	23	10	M12
355	on request				
500	on request				
750	on request				
1000	on request				

NG	A_7	A_8
40	–	–
71	on request	
125	–	–
180	on request	
250	10	200
355	on request	
500	on request	
750	on request	
1000	on request	

KB4

Flange ISO 3019-2 100, 2-hole
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15 T[3)]
for mounting an A10VSO 45/31 splined shaft S – see RE 92711



NG	A_1	A_3	A_4	A_5	A_6[2)]
40	on request				
71	316	20.8	27.5	8	M12
125	on request				
180	371	21.8	27.9	10	M12
250	431	20.9	27.5	10	M12
355	on request				
500	on request				
750	on request				
1000	on request				

NG	A_7	A_8
40	on request	
71	–	–
125	on request	
180	–	–
250	10	200
355	on request	
500	on request	
750	on request	
1000	on request	

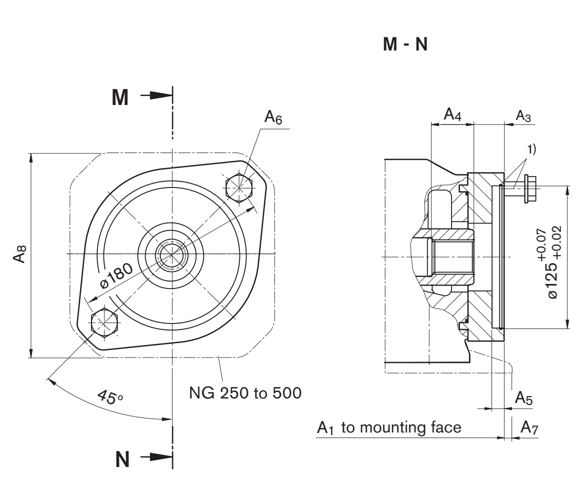
1) 2 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

KB5

Flange ISO 3019-2 125, 2-hole
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14 T[3]
for mounting an A10VSO 71/31 splined shaft S – see RE 92711

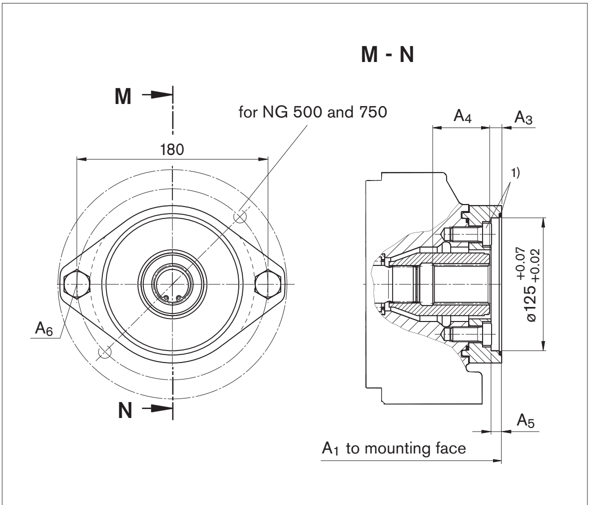


NG	A_1	A_3	A_4	A_5	A_6[2)]
71	321	23.1	38.1	10	M16
125	378	23.7	38.1	10	M16
180	402	23.7	38.1	10	M16
250	431	22	36.1	10	M16
355	460	22	36.1	10	M16
500	505	19.3	40.4	10	M16
750	on request				
1000	on request				

NG	A_7	A_8
71	–	–
125	–	–
180	–	–
250	10	200
355	–	–
500	–	–
750	on request	
1000	on request	

KB6

Flange ISO 3019-2 125, 2-hole
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17 T[3]
for mounting an A10VSO 100/31 – see RE 92711



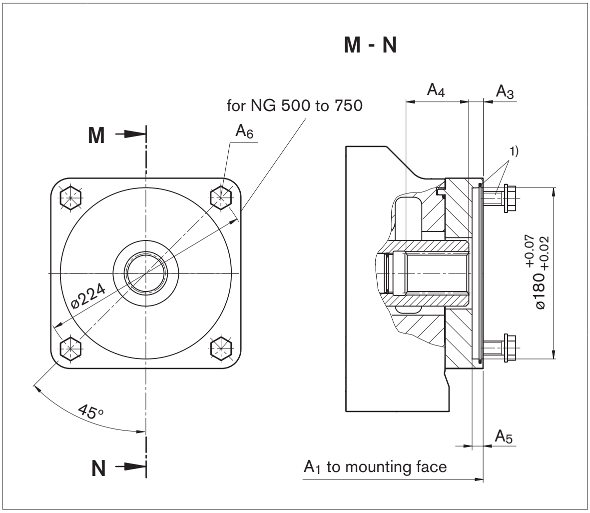
NG	A_1	A_3	A_4	A_5	A_6[2)]
125	378	11.4	54	10	M16
180	402	11.4	54	10	M16
250	451	11	57.1	10	M16
355	480	11	57.1	10	M16
500	505	11	56	10	M16
750	555	11	56	10	M16
1000	on request				

1) 2 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

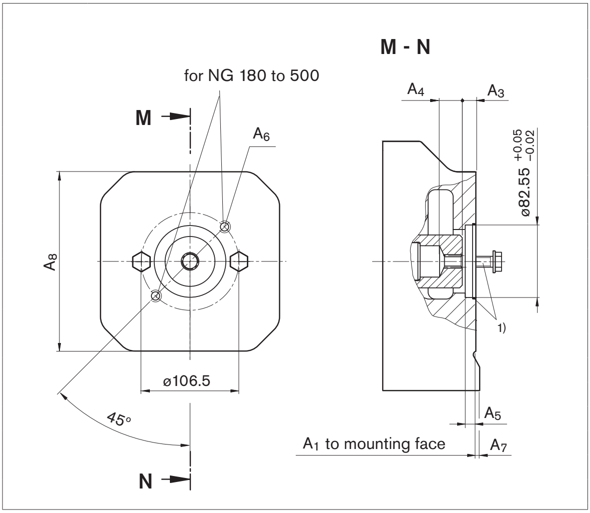
KB7 **Flange** ISO 3019-2 180, 4-hole
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in, 8/16 DP; 13 T3)
for mounting an A10VSO 140/31/32 splined shaft S – see RE 92711 (RE 92714)



NG	A_1	A_3	A_4	A_5	A_6 2)
125	395	10.5	45	10	M16
180	419	10.5	45	10	M16
250	on request				
355	498	11	69.3	10	M16
500	on request				
750	580	11	63	10	M16
1000	on request				

2

K01 **Flange** ISO 3019-1 82-2 (SAE A)
Shaft coupler for splined shaft 16-4 SAE A, 5/8 in, 16/32 DP; 9T 3)
for mounting an external gear pump AZ-PF-1X-004...022 (see RE 10089)
Bosch Rexroth recommends a special version of the gear pumps, please contact us



NG	A_1	A_3	A_4	A_5	A_6 2)
40	263	9	25.9	10	M10
71	291	10.5	25.4	10	M10
125	347	10.3	28	10	M10
180	371	9	28	10	M10
250	431	9	30	10	M10
355	460	10	30	10	M10
500	505	10	33	10	M10
750	555	10	33	10	M10
1000	on request				

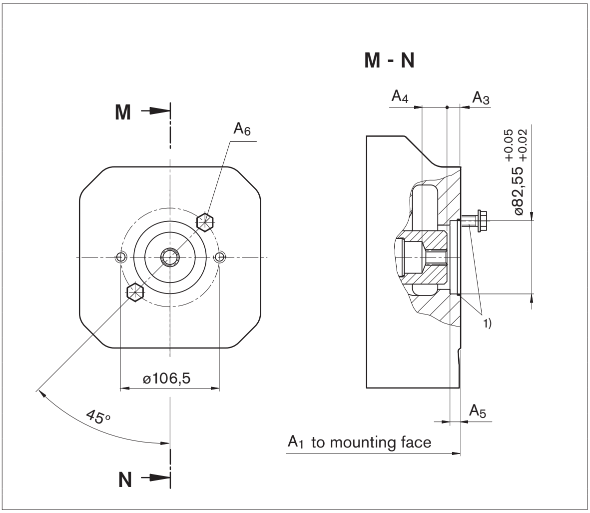
NG	A_7	A_8
40	18	130
71	15	140
125	13	150
180	–	–
250	10	200
355	–	–
500	–	–
750	–	–
1000	on request	

1) 2 or 4 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Through drive dimensions

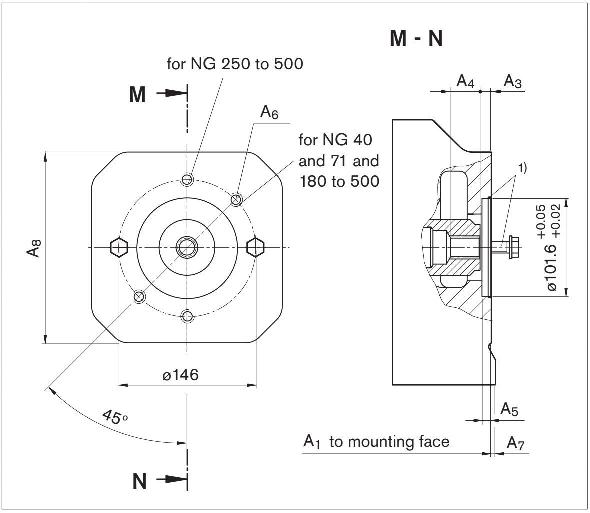
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K52 **Flange** ISO 3019-1 82-2 (SAE A)
Shaft coupler for splined shaft 19-4 SAE A-B, 3/4 in, 16/32 DP; 11T [3]
for mounting an A10VSO 18/31 splined shaft S (see RE 92711)
or A10VSO 10/52 or 18/53 splined shaft S (see RE 92703)



NG	A_1	A_3	A_4	A_5	A_6[2]
40	on request				
71	on request				
125	on request				
180	on request				
250	on request				
355	460	11	32.4	10	M10
500	on request				
750	on request				
1000	on request				

K68 **Flange** ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13T [3]
for mounting an external gear pump AZ-PN-1X020...032 (see RE 10091) or an A10VO 28/31 and 52(53) splined shaft S (see RE 92701 and 92703) Bosch Rexroth recommends special versions of the gear pumps, please contact us



NG	A_1	A_3	A_4	A_5	A_6[2]
40	290	11	33.2	10	M12
71	322	11	34.4	10	M12
125	347	11	35.3	10	M12
180	371	11	38.7	10	M12
250	431	20.5	29.4	10	M12
355	460	19.2	32.9	10	M12
500	505	11	41	10	M12
750	on request				
1000	on request				

NG	A_7	A_8
40	–	–
71	–	–
125	13	150
180	–	–
250	10	200
355	–	–
500	–	–
750	on request	
1000	on request	

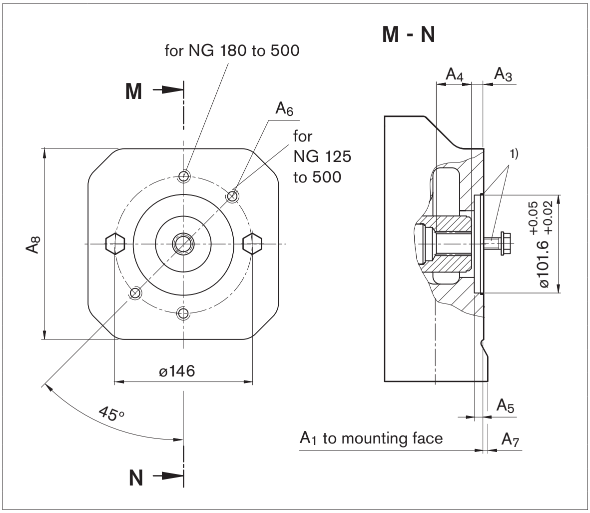
1) 2 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K04

Flange ISO 3019-1 101-2 (SAE B)
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15T 3)
for mounting an A10VO 45/31 and /52 (53) splined shaft S (see RE 92701 and 92703) or an internal gear pump PGH4 (see RE 10223)

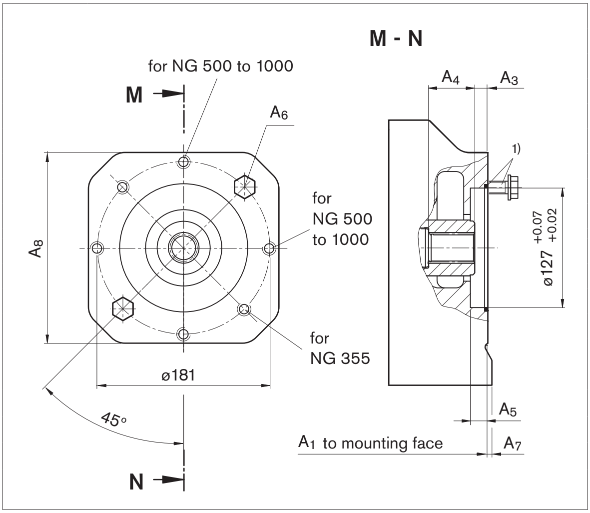


NG	A_1	A_3	A_4	A_5	A_6 2)
40	on request				
71	322	11	35.1	10	M12
125	379	12.4	37.5	10	M12
180	371	11	35.3	10	M12
250	431	11	41.4	10	M12
355	460	11	41.4	10	M12
500	505	11	44	10	M12
750	on request				
1000	on request				

NG	A_7	A_8
40	18	130
71	–	–
125	–	–
180	–	–
250	10	200
355	–	–
500	–	–
750	on request	
1000	on request	

K07

Flange ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14 T3)
for mounting an A10VO 71/31 splined shaft S (see RE 92701)



NG	A_1	A_3	A_4	A_5	A_6 2)
71	on request				
125	377	10.4	50	13	M16
180	401	10.4	50	13	M16
250	431	10.4	51	13	M16
355	460	10.4	51	13	M16
500	505	11.3	51.7	13	M16
750	555	11.3	51.7	13	M16
1000	628	10.4	54.6	13	M16

NG	A_7	A_8
71	on request	
125	–	–
180	–	–
250	10	200
355	–	–
500	–	–
750	23	250
1000	25	280

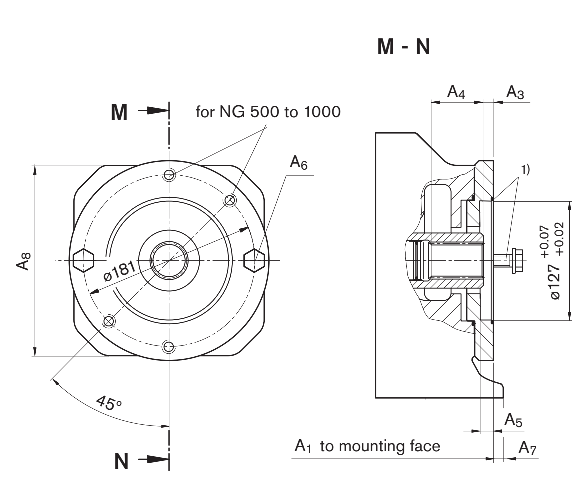
1) 2 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K24

Flange ISO 3019-1 127-2 (SAE C)
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17 T[3)]
for mounting an A10VO 100/31 splined shaft S (see RE 92701) or an A10VO 85/52(53) splined shaft S (see RE 92703) or a PGH5 internal gear pump (see RE 10223)

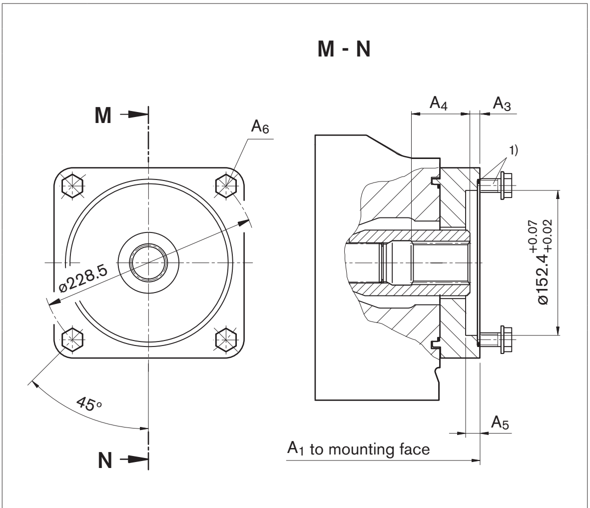


NG	A_1	A_3	A_4	A_5	A_6[2)]
125	377	10.4	53.7	13	M16
180	401	10.4	54	13	M16
250	451	10.5	57.6	13	M16
355	480	10.5	57.6	13	M16
500	505	10.3	56.7	13	M16
750	555	10.3	56.7	13	M16
1000	628	10.4	56.6	13	M16

NG	A_7	A_8
125	–	–
180	–	–
250	–	–
355	–	–
500	–	–
750	23	250
1000	25	280

K17

Flange ISO 3019-1 152-4 (SAE D)
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in 8/16 DP; 13 T[3)]
for mounting an A10VO 140/31 splined shaft S (see RE 92701)



NG	A_1	A_3	A_4	A_5	A_6[2)]
125	382	10.4	67	13	M16
180	406	10.4	67	13	M16
250	469	10.4	62	13	M16
355	498	10.5	62	13	M16
500	530	10.4	63.6	13	M16
750	580	10.4	63.6	13	M16
1000	in preparation				

1) 2 or 4 fastening screws and O-ring seal are included in the delivery contents
2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
3) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Notes

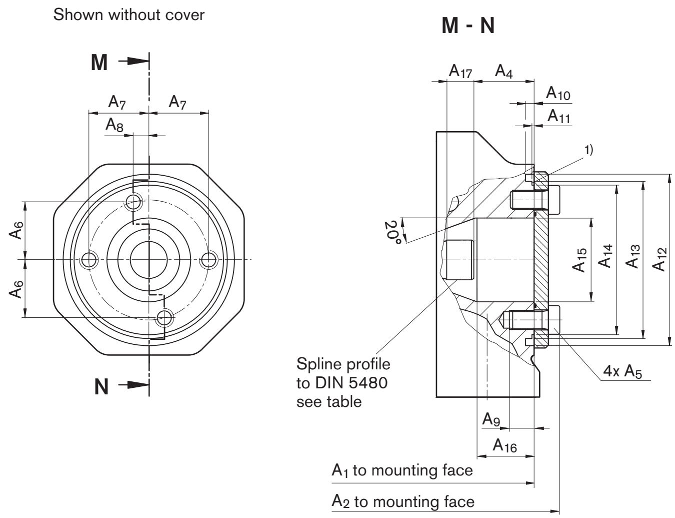
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K99 Sizes 40 to 355

with through-drive shaft, without shaft coupler, without adapter flange, **closed with fluid-tight and pressure-tight cover**



Depiction shows
NG 71

NG Main pump	A_1	A_2	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}
40	263	280	51.3±1	M12x25	37±0.2	37±0.2	0	18	9	$2.3^{+0.1}$	ø118	ø105$_{g6}$
71	291	310	48±1	M12x25	42.3 ±0.15	45 ±0.15	15.4±0.15	18	9	$2.7^{+0.1}$	ø130	ø116$_{g6}$
125	347	368	49.7±1	M14x30	47	47	0	18	7	$2.3^{+0.1}$	ø137	ø124$_{g6}$
180	371	392	49.7±1	M14x30	47	47	0	18	7	$2.3^{+0.1}$	ø137	ø124$_{g6}$
250	431	458	61.4±1	M20x40	63	63	0	26	9	$2.3^{+0.1}$	ø180	ø165$_{g6}$
355	460	487	61.4±1	M20x40	63	63	0	26	9	$2.3^{+0.1}$	ø180	ø165$_{g6}$

NG Main pump	A_{14}	A_{15}	A_{16}	A_{17}	**Spline profile to DIN 5480**	1) **O-ring** for retrofitting (not included in the delivery contents)
40	ø97.6$_{-0.4}$	ø52	44	14	W25 x 1.25 x 18 x 9g	99 x 3 70 SH A
71	ø106.4$_{-0.4}$	ø63	39	16	W30 x 1.25 x 22 x 9g	110.72 x 3.53 70 SH A
125	ø116$_{-0.4}$	ø70	46	22	W35 x 1.25 x 26 x 9g	119 x 3 70 SH A
180	ø116$_{-0.4}$	ø70	57	25	W35 x 1.25 x 26 x 9g	119 x 3 70 SH A
250	ø157$_{-0.4}$	ø88	64	34.2	W42 x 1.25 x 32 x 9g	160 x 3 70 SH A
355	ø157$_{-0.4}$	ø88	64	34.3	W42 x 1.25 x 32 x 9g	160 x 3 70 SH A

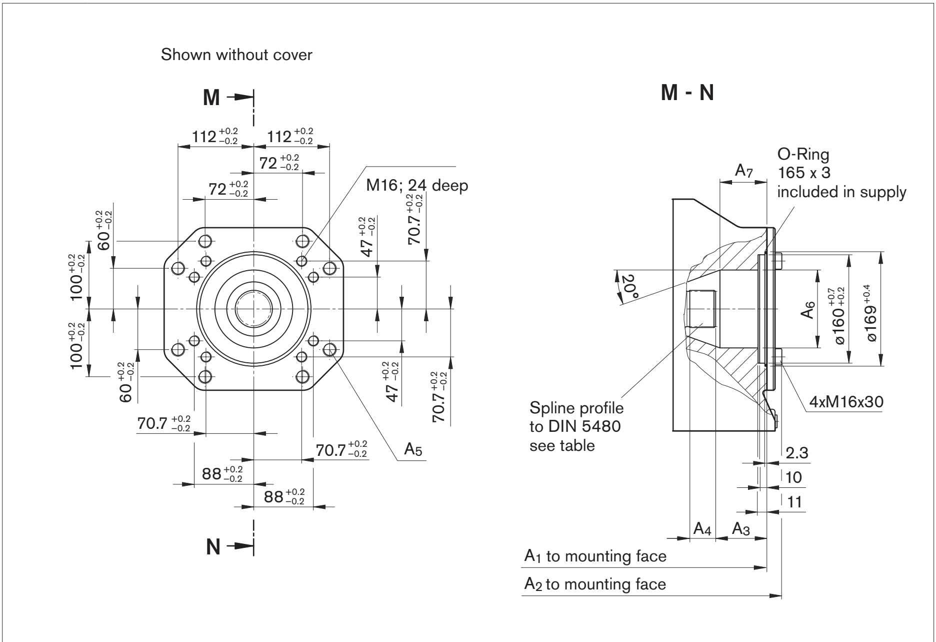
Sizes 500 to 1000, see page 53

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

K99 Sizes 500 to 1000

with through-drive shaft, without shaft coupler, without adapter flange, **closed with fluid-tight and pressure-tight cover**



NG Main pump	A_1	A_2	A_3	A_4	A_5	A_6	A_7	Spline profile to DIN 5480
500	505	520	73	41	M20; 24 deep	ø115	75	W55 x 1.25 x 42 x 9g
750	555	577	73	41	M20; 24 deep	ø115	75	W55 x 1.25 x 42 x 9g
1000	628	653	75	50	M20; 30 deep	ø142	65	W65 x 1.25 x 50 x 9g

Sizes 40 to 355 see page 52

Mounted and piped auxiliary pumps H02, H04 and H06

Factory mounted and piped are the following auxiliary pumps:

Code designation	Size A4VSG		40	71	125	180	250	355	500	750	1000
H02	**A piped auxiliary pump for the boost circuit**										
	Auxiliary pump type		AZPF		AZPN		AZPG	PGH4	PGH5		
	Size		11	16	25	32	38	80	100	160	200
H04	**A common piped auxiliary pump for the boost and control circuit (only EO1 and EO1K)**										
	Auxiliary pump type		–	AZPF	AZPN	–	AZPG	–	–	–	–
	Size		–	16	25	–	38	–	–	–	–
H06	**Separately piped auxiliary pumps for the boost circuit and the control circuit (only for HD1T and HD1U) including a pressure relief valve for the control circuit [1]**										
	Boost circuit	Auxiliary pump type	AZPF		AZPN		AZPG	PGH4	PGH5		
		Size	11	16	25	32	38	80	100	160	200
	Control circuit	Auxiliary pump type	AZPF					PGF2			
		Size	08					11			

Note: The different leakage rates of the gear pump at various speeds must be considered in all cases.

Additional technical data sheets are available for the technical data of the gear pumps:

AZPF: RE 10 089

AZPN: RE 10 091

AZPG: RE 10 093

PGF2: RE 10 213

PGH4 and PGH5: RE 10 223

Note: The AZPF, AZPN and AZPG series are special versions of gear pumps for mounting on axial piston pumps. They are adapted to fit onto the through drive shaft end and the flange mounting pattern on axial piston pumps.

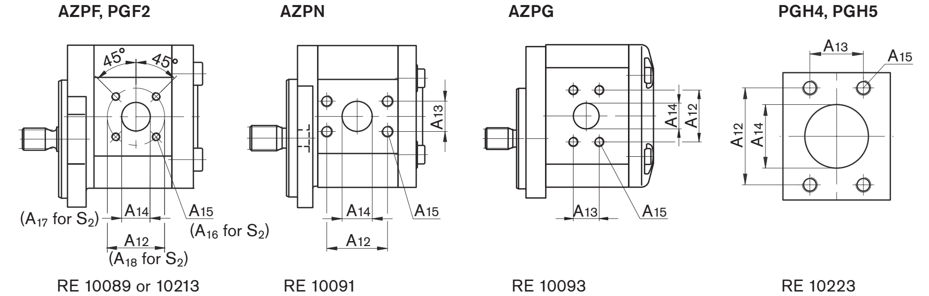
1) DB 10 K2-4X/50YV
pressure setting to 50 bar

Dimensions suction port - auxiliary pumps

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports S, S_1 and S_2 (for selection, see page 54)

Views Z and W from pages 58 and 62



Ports[1)]

NG	S, S_1	S_2 (2nd auxiliary pump - control pump)
40	Square flange	Square flange
71	Square flange	Square flange
125	SAE 1 in (standard pressure series)	Square flange
180	SAE 1 in (standard pressure series)	Square flange
250	SAE 1 in (standard pressure series)	Square flange
355	SAE 2 in (standard pressure series)	Square flange
500	SAE 2 in (standard pressure series)	Square flange
750	SAE 3 in (standard pressure series)	Square flange
1000	SAE 3 in (standard pressure series)	Square flange

1) Observe the general instructions on page 68 for the maximum tightening torques.

Dimensions

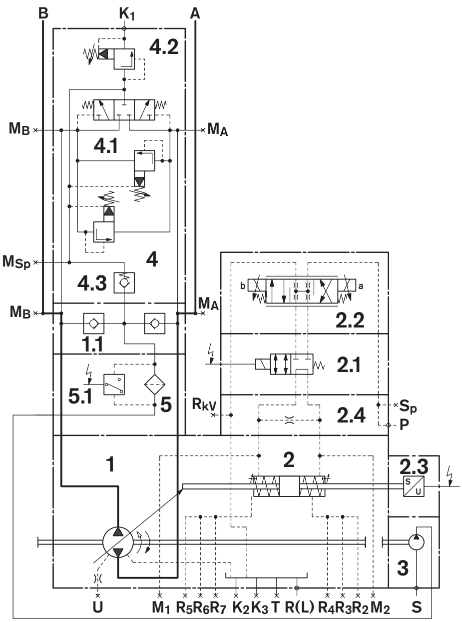
					(2nd auxiliary pump - control pump)		
NG	**A_{12}**	**A_{13}**	**A_{14}**	**A_{15} for S and S_1**	**A_{16} for S_2**	**A_{17} for S_2**	**A_{18} for S_2**
40	ø40	–	ø20	M6; 13 deep	M6; 13 deep	ø20	ø40
71	ø40	–	ø20	M6; 13 deep	M6; 13 deep	ø20	ø40
125	52.4	26.2	ø26	M10; 14 deep	M6; 13 deep	ø20	ø40
180	52.4	26.2	ø26	M10; 14 deep	M6; 13 deep	ø20	ø40
250	52.4	26.2	ø26	M10; 16 deep	M6; 13 deep	ø20	ø40
355	77.8	42.9	ø51	M12; 10 deep	M6; 10 deep	ø20	ø40
500	77.8	42.9	ø51	M12; 10 deep	M6; 10 deep	ø20	ø40
750	106.4	61.9	ø76	M16; 10 deep	M6; 10 deep	ø20	ø40
1000	106.4	61.9	ø76	M16; 10 deep	M6; 10 deep	ø20	ø40

Complete schematic H02

A4VSG with an auxiliary pump for the boost circuit, valve block and filter

Example: H029F with EO2K

Sizes 40 to 180 (other sizes on request)



Ports

Designation	Port for	State
A, B	Service line (pressure port)	O
S	Suction - auxiliary pump	O
K_1	Outlet circuit flushing	O
R(L)	Fill and air bleed (case drain port)	O
K_2, K_3	Fill and air bleed (case drain port)	X
T	Drain	X
M_A, M_B	Measuring operating pressure	X
P	Control pressure	O
S_P	Accumulator - control pressure	X
M_{Sp}	Measuring flushing pressure	X
M_1, M_2	Measuring control pressure	X
R_{kV}	Control fluid return line	X
U	Bearing flushing	X
$R_2...R_7$	Air bleeding of stroking chamber	X

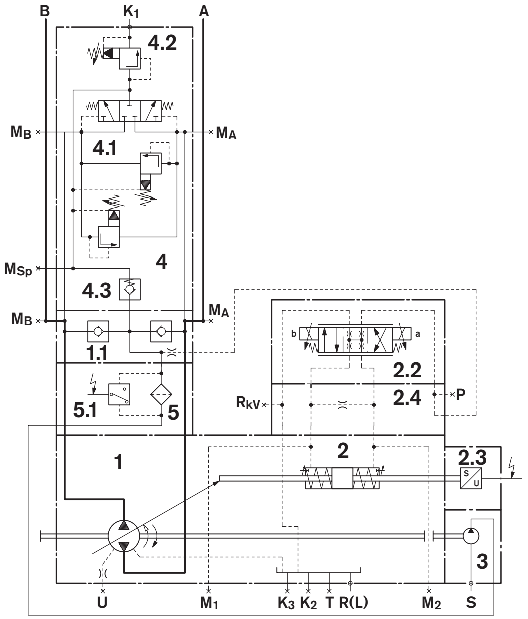
For components, see page 57; for dimensions, see pages 58 and 59

Complete schematic H04

A4VSG with a common auxiliary pump for boost and control circuit, valve block and filter

Example: H049F with EO1

Sizes 40, 71, 125 and 250



Component

Item		Order designation			Information
1	Variable pump A4VSG 40-180	A4VSG			
1.1	Boost check valves	standard for A4VSG			
2	Hydraulic control device	EO2K	or	EO1	See RE 92076
2.1	Short circuit valve (for EO.K)				
2.2	4/3-directional proportional valve				
2.3	Inductive pos. transducer (actual value transmitter)				
2.4	Adapter plate				
3	An auxiliary pump for the boost circuit only (mounted and piped)	H 02	or		For selection, see page 54
	A common, mounted and piped auxiliary pump for the boost and control circuit (only for EO1 and EO1K)	H 04			
4	Valve block SDVB 16 for A4VSG 40 to 180	9			For NG250 to 500 SDVB 30, switching type 1 is used and for NG750 and 1000, SDVB 50 is used acc. to RE 95533
4.1	Main high pressure relief				
4.2	Flushing valve				
4.3	Check valve				
5	Boost circuit filter	F			See page 65
5.1	Optical contamination indicator				
	Control electronics are not included in delivery contents, please order separately				

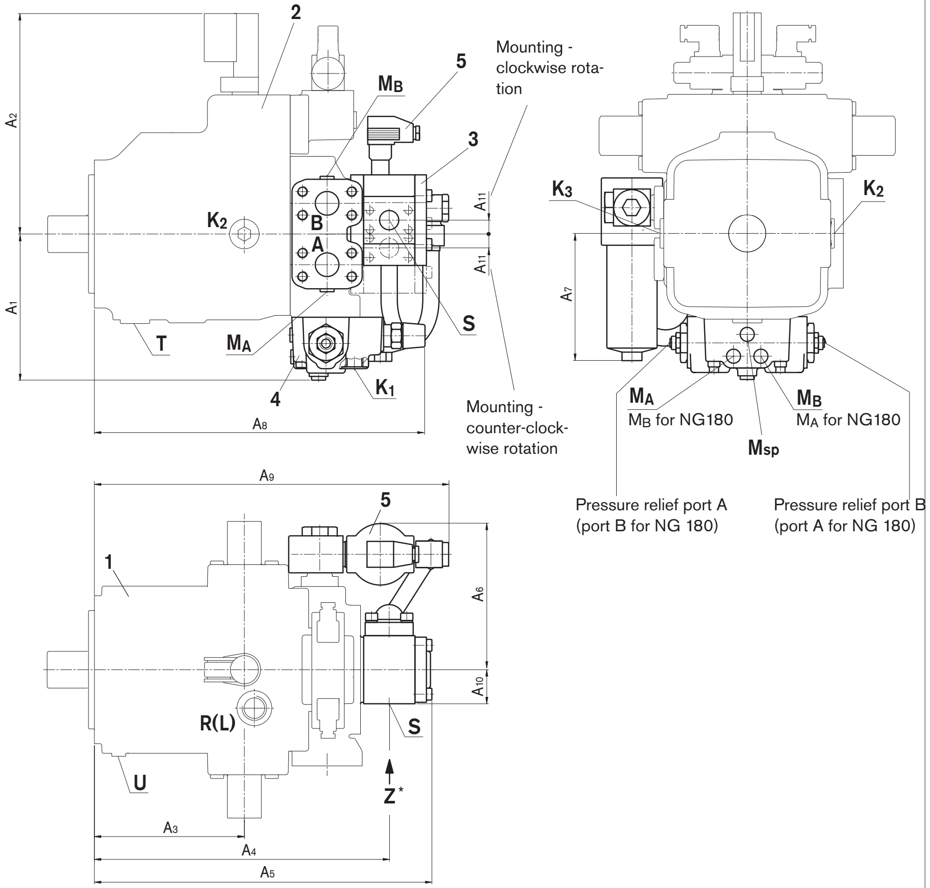
For dimensions, see page 58

Dimensions H02 9F and H04 9F

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG with an auxiliary pump, valve block and filter

Example: sizes 40 to 180



* View Z, see page 55

Values and ports, see page 59; components, see page 57

Dimensions H02 9F and H04 9F

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG with an auxiliary pump, valve block and filter

Ports

Designation	Port for	Standard	Maximum pressure [bar][1]	State
S	See data sheet for auxiliary pump; for selection, see page 54			
K_1	Flushing	DIN 3852-1	5	O
M_{Sp}	Measuring flushing pressure	DIN 3852-1	50	X
M_A, M_B	Measuring operating pressure	DIN 3852-1	400	X

1) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring equipment and fittings.
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
For other ports, see dimensions of base pump A4VSG beginning on page 16 and separate data sheet of the control unit.

2

Ports[2]

NG	K_1	M_{SP}	M_A, M_B
40	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
71	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
125	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
180	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
250	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
355	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
500	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
750	M48 x 2; 20 deep	M14 x 1.5; 12 deep	M18 x 1.5; 12 deep
1000	M48 x 2; 20 deep	M14 x 1.5; 12 deep	M18 x 1.5; 12 deep

2) Observe the general instructions on page 68 for the maximum tightening torques.

Dimensions

NG	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}
40	174	246	144	310	357	175	115	364	400	42	15.7
71	178	265	166	338	395	181	115	386	421	42	15.7
125	198	298	203	402	463	201	172(240)[3]	448	481	46	18.75
180	198	298	203	430	495	234	178(233)[3]	448	506	46	18.75
250	317	345	248	497	574	245	211	448	651	55	22.9
355	319	345	248	559	664	264	217	464	657	74.6	–
500	353	392	279	628	739	370	203	510	705	105.3	–
750	446	427	301	693	819	393	372	591	*	105.3	–
1000	446	456	360	775	910	427	372	655	*	105.3	–

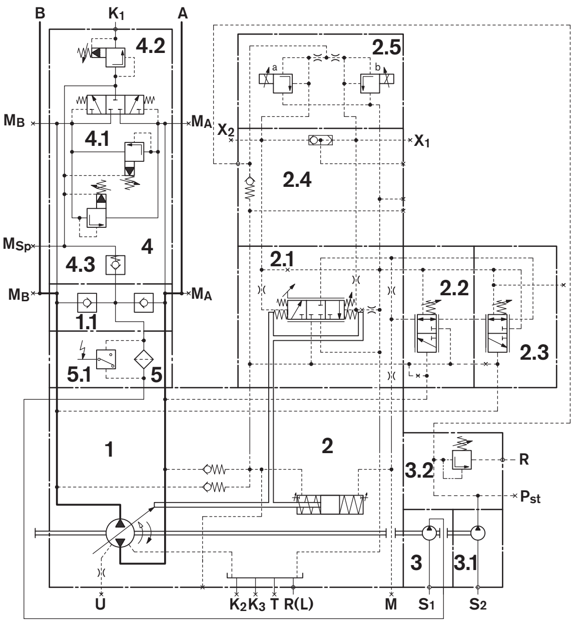
* On request
3) With HD.D and HD.G control

Complete schematic H06 9F

A4VSG with a separately auxiliary double pump for boost and control circuit, valve block and filter

Example: H069F with HD1DT

Sizes 40 to 180 (other sizes on request)



Ports

Designation	Port for	State
A, B	Service line (pressure port)	O
S_1, S_2	Suction - auxiliary pump	O
K_1	Outlet circuit flushing	O
R(L)	Fill and air bleed (case drain port)	O
K_2, K_3	Fill and air bleed (case drain port)	X
T	Drain	X
M_A, M_B	Measuring operating pressure	X
M	Measuring stroking chamber pressure	X
P_{St}, X_1, X_2	Measuring pilot pressure	X
R	Return line	O
M_{Sp}	Measuring flushing pressure	X
U	Bearing flushing	X

For components, see page 61; for dimensions, see pages 62 and 63.

Components H06 9F

A4VSG with a separate double auxiliary pump for boost and control circuit, valve block and filter

Example: H069F with HD1DT

Sizes 40 to 180 (other sizes on request)

Components

Item		Ordering code	Information
1	Variable pump A4VSG 40-180	A4VSG	
1.1	Boost check valves	standard for A4VSG	
2	Hydraulic control device	HD1DT	See RE 92080
2.1	Control device		
2.2	Pressure control valve, port A (port B for counter-clockwise rotation)		
2.3	Pressure control valve, port B (port A for counter-clockwise rotation)		
2.4	Sandwich plate for mounting proportional valve		
2.5	Proportional pressure relief valve		
3	Auxiliary pump for the boost circuit (mounted and piped)	H 06	For selection, see page 54
3.1	Auxiliary pump for the control circuit (mounted and piped)		
3.2	Pressure relief valve, control circuit DB 10 K2-4X/50YV		
4	Valve block SDVB 16 for A4VSG 40-180	9	For NG250 to 500 SDVB 30, operating type 1 is used and for NG750 and 1000, SDVB 50 is used acc. to RE 95533
4.1	Pressure relief		
4.2	Flushing valve		
4.3	Check valve		
5	Boost circuit filter	F	See page 65
5.1	Optical contamination indicator		

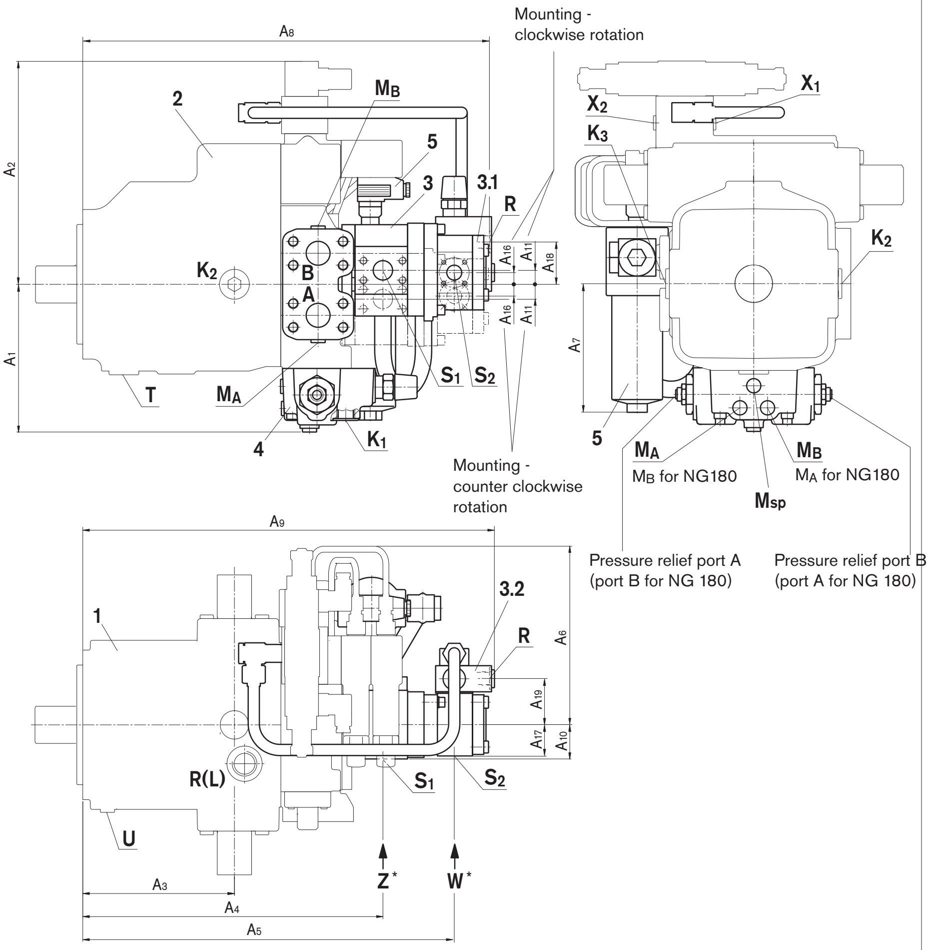
For dimensions, see pages 62 and 63.

Dimensions H06 9F

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG with a separate double auxiliary pump for the boost and control circuit, valve block and filter

Example: sizes 40 to 180



* For views Z and W, see page 55
For values and ports, see page 63; for components, see page 61

Dimensions H06 9F

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

A4VSG with a separate double auxiliary pump for boost and control circuit, valve block and filter

Ports

Designation	Port for	Standard	Maximum pressure [bar][1]	State
S_1, S_2	See data sheet for auxiliary pump; for selection, see page 54			
K_1	Flushing	DIN 3852-1	5	O
M_{Sp}	Measuring flushing pressure	DIN 3852-1	50	X
M_A, M_B	Measuring operating pressure	DIN 3852-1	400	X

1) Moomentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring equipment and fittings.
O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)
For other ports, see dimensions of base pump A4VSG beginning on page 16 and separate data sheet of the control unit.

2

Ports[2]

NG	K_1	M_{SP}	M_A, M_B
40	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
71	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
125	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
180	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep	M14 x 1.5; 12 deep
250	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
355	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
500	M33 x 2; 18 deep	M22 x 1.5; 14 deep	M14 x 1.5; 12 deep
750	M48 x 2; 20 deep	M14 x 1.5; 12 deep	M18 x 1.5; 12 deep
1000	M48 x 2; 20 deep	M14 x 1.5; 12 deep	M18 x 1.5; 12 deep

2) Observe the general instructions on page 68 for the maximum tightening torques.

Dimensions

NG	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{16}	A_{17}	A_{18}	A_{19}
40	174	*	144	310	400	*	115	*	*	42	15.7	15.7	42	*	*
71	178	*	166	338	436	*	115	*	*	42	15.7	15.7	42	*	*
125	198	302	203	402	498	239	240	547	552	46	18.75	15.7	42	56.7	61.5
180	198	302	203	430	529	236	233	602	607	46	18.75	20.25	42	61.3	61.5
250	317	336	248	497	619	243	167	672	669	55	22.9	20.25	42	56.7	61.5
355	319	336	248	559	775	264	218	824	830	74.6	5.4	7.7	52.5	48.2	72
500	353	406	279	628	840	369	203	888	895	105.3	–	7.7	52.5	33.3	72
750	446	423	301	693	945	392	372	994	1000	105.3	–	7.7	52.5	48.2	72
1000	446	444	360	775	1036	426	372	1084	1091	105.3	–	7.7	52.5	48.2	72

* On request

Valve block SDVB

The following versions are mounted standard:

Valve block SDVB 16 for A4VSG sizes 40 to 180,

SDVB 30 operating type 1 for A4VSG sizes 250 to 500 and

SDVB 50 for A4VSG sizes 750 and 1000

For technical data and detailed information, see RE 95533

Filter mounted in boost circuit...F

If a filter is factory mounted in the boost circuit (ordering code: **F**), the following filters (with electric optical contamination indicator) are used depending on the size of the axial piston units:

Sizes 40 and 71: ____________ LFBN/HC60G20D1.0/V-L24

Sizes 125 and 180: _________ LFBN/HC110G20D1.0/V-L24

Sizes 250 and 355: _________ LFBN/HC240G20D1.0/V-L24

Size 500: ________________ LFBN/HC330G20D1.0/V-L24

Sizes 750 and 1000: ________ LFBN/HC660G20D1.0/V-L24

Please contact us for further details on the filter

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

The commissioning must be carried out at low speed and without load until the system has been air bled completely.

Especially when mounted with the "**drive shaft upwards**" (examples 6 and 12) , **bearing flushing** is necessary for lubrication of the front bearing and of the shaft seal at port U.
See page 6.

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (T, R(L), K_2, K_3).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction and case drain lines must flow into the reservoir below the minimum fluid level. At version with mounted attachment pump the permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\ max} = 800$ mm.
The minimum suction pressure at port S may not fall below 0.8 bar absolute in operation.
With mounted attachment pumps, please refer to the data sheet for details on the minimum suction pressure, see page 54.

Installation position

See the following examples 1 to 12.
Further installation positions are available upon request.

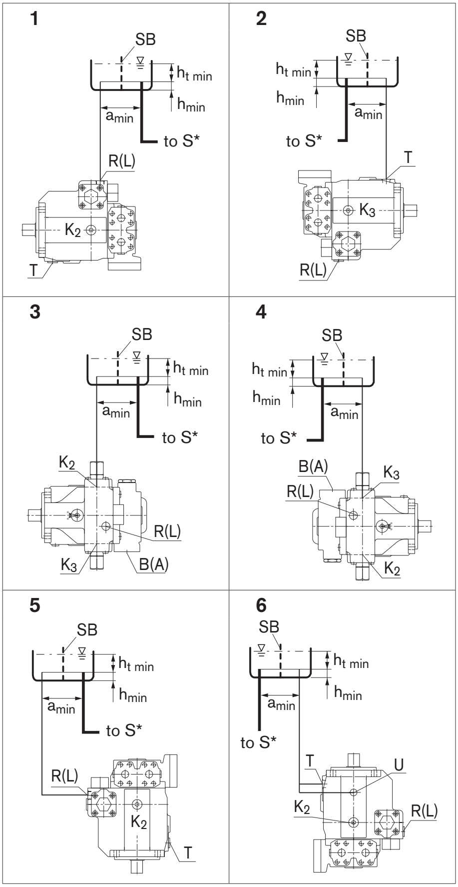
Recommended installation position: 1 and 2.

Instructions

- Before installation, fill the pump case with the pump in a horizontal position. Port T to the reservoir plugged. Filling option when mounted with shaft end upward: fill via R(L) and air bleed at T, then plug port R(L).
- To achieve an optimum control function, the stroking chambers must be bled via the highest available air bleed port R_2 to R_7 depending on the installation position for HM, HS, HS4 and EO.
- At installation positions 3, 4, 9 and 10 an influence on the control characteristics can be expected. Gravity, unit weight and case pressure can cause minor shifts in control characteristics and changes in response time.

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Installation position	Fill / air bleed case
1	R(L)
2	T; plug R(L)
3	K_2; plug R(L)
4	K_3; plug R(L)
5	R(L)
6	T; plug R(L)

* With a mounted attachment pump, please observe the details in the corresponding data sheet, see page 54

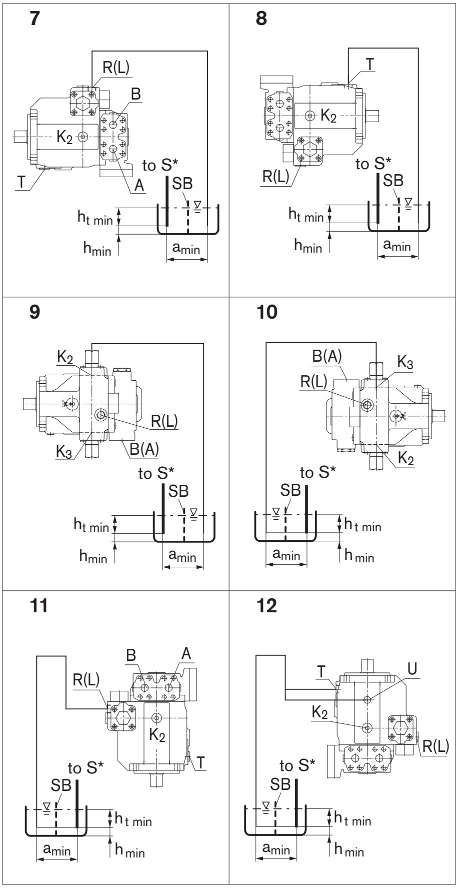
Key, see page 67.

Installation instructions

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

A check valve in the case drain line is to be avoided. Exceptions maybe permissible, please consult us first.



* With a mounted attachment pump, please observe details on suction height or minimum inlet pressure from the data sheet for the attachment pump, see page 54

Installation position	Fill / air bleed case
7	R(L)
8	T; plug R(L)
9	K_2; plug R(L)
10	K_3; plug R(L)
11	R(L)
12	T; plug R(L)

L_1	Filling / air bleeding
S	Suction port
T, K_2, K_3, R(L)	Fill + air bleed (case drain port)
A, B	Pressure port
SB	Baffle (baffle plate)
$h_{t\,min}$	Minimum permissible immersion depth (200 mm)
h_{min}	Minimum permissible spacing from suction port to reservoir bottom (100 mm)
a_{min}	When designing the reservoir, ensure adequate spacing between the suction line and the case drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

2

General instructions

– The A4VSG pump is designed to be used in closed circuits.

– Project planning, installation and commissioning of the axial piston units requires the involvement of qualified personnel.

– Before using the axial piston unit, please read the general instruction manual (RE 90300-B) completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.

– During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristics may shift.

– Service line ports (pressure ports):

  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

  - The service line ports and function ports can only be used to accommodate hydraulic lines.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the fittings used.

  - Mounting bolts:
    For mounting bolts with metric ISO thread according to DIN 13, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.

  - Female thread of the axial piston unit:
    The maximum permissible tightening torques $M_{G\,max}$ are maximum values of the female thread and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metallic threaded plugs, supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports **Standard**	**Size of thread**	**Maximum permissible tightening torque of the female threads $M_{G\,max}$**	**Required tightening torque of the threaded plugs M_V**	**WAF hexagon socket of the threaded plugs**
DIN 3852-1	M10 x 1	30 Nm	12 Nm	5 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M33 x 2	540 Nm	310 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
	M48 x 2	900 Nm	400 Nm	24 mm

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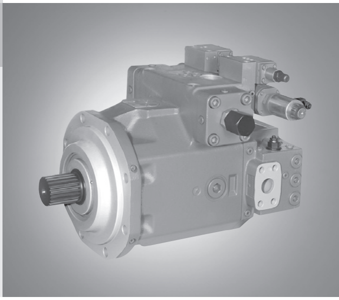
Rexroth
Bosch Group

Axial piston-compact unit A4CSG

closed loop circuit



Size 250...750
Series 3
Nominal pressure 350 bar
Peak pressure 400 bar

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Features

- Axialpiston pump-variable displacement, swashplate design for hydrostatic drives in closed circuits.
- The flow is proportional to input speed and displacement. It can be infinitely varied by adjustment of the swashplate.
- The necessary boostpump and all required controlvalves are integrated.
- One common auxiliary pump for boost and EP-control pressure
- Compact design (extremely small in length)
- Favourable power to weight ratio
- Low noise level
- Long service life
- High efficiency
- New electro-hydr. control EP with proportional solenoid and zero displacement position at power loss
- Throughdrive for multiple pumpcombinations also possible with integrated boost pump

- For further information on control- and regulating devices see separate data sheets
  RE 92 072, RE 92 076 und RE 92 080

Model code / standardprogram

Axial piston unit

Compact unit, swashplate design, variable	A4CS

Type of operation

Pump, closed circuit operation	G

Size

≙ Displacement $V_{g\,max}$ (cm³)	250	355	500	750

Control and adjustment devices

		250	355	500	750		
Manual adjustment	MA	❍	❍	❍	–	MA	see RE 92072
Electric motor adjustment	EM	❍	❍	❍	–	EM..	see RE 92072
Hydr. adjustment, control volume dependent	HM	❍	❍	❍	❍	HM..	see RE 92076
Hydr. adjustment with servo-/ proportional valve	HS	❍	❍	❍	❍	HS..	see RE 92076
Electronic control	EO	❍	❍	❍	❍	EO..	see RE 92076
Hydr.control , pilot pressure dependent	HD	●	●	●	❍	HD..	see RE 92080
Electro-hydr. control with proportional solenoid	EP	●	●	●	●	EP..	see RE 92084 in prep.

Series

	30

Direction of rotation

viewing at shaft end	clockwise	R
	counter-clockwise	L

Seals

FPM (Fluorcarbon rubber)	V

Shaft end

	250	355	500	750	
Metric keyed parallel shaft DIN 6885	●	●	●	●	P
Metric splined shaft DIN 5480	●	●	●	●	Z

Mounting flange similar to ISO 3019-2

	250	355	500	750	
4-hole	●	●	–	–	B
8-hole	–	–	●	●	H

Port connections

Ports A,B: SAE flanged opposite sides Port S: SAE on side 90° offset	metric threaded bolt holes	35

Boost pump

	250	355	500	750	
with integrated boost pump	●	●	●	●	F
without integrated boost pump	❍	❍	●	❍	K

▭ = Preferred program

● = available ❍ = in preparation – = not available

Model code / standardprogram

A4CS	G			/	30		–	V			35				

Axial piston unit

Type of operation

Size

Control and adjustment device

Series

Direction of rotation

Seals

Shaft end

Mounting flange

Port connections

Boost pump

Through drive

			250	355	500	750	
with through drive shaft, without coupler, without adapter flange, closed with cover			●	●	●	●	**99**
with through drive for mounting of second pump(for further options see page 18)							
Flange ISO 3019-2 (metr.)	coupler for shaft end DIN 5480	to mount					
125, 4-hole	W 32x2x30x14x9g	A4VSO/H/G 40	❍	❍	❍	❍	**31**
140, 4-hole	W 40x2x30x18x9g	A4VSO/H/G 71	❍	❍	❍	❍	**33**
160, 4-hole	W 50x2x30x24x9g	A4VSO/H/G 125, 180	●	●	❍	❍	**34**
224, 4-hole	W 60x2x30x28x9g	A4CSG, A4VSO/H/G 250	●	❍	❍	❍	**35**
224, 4-hole	W 70x3x30x22x9g	A4CSG, A4VSO/G 355	–	●	❍	❍	**77**
315, 8-hole	W 80x3x30x25x9g	A4CSG, A4VSO/G 500	–	–	●	❍	**43**
400, 8-hole	W 90x3x30x28x9g	A4CSG, A4VSO/G 750	–	–	–	❍	**76**
Flange ISO 3019-2 (metr.)	coupler for shaft SAE J744	to mount					
80, 2-hole	19-4 3/4in 11T (A-B)	A10VSO 10, 18	❍	❍	❍	❍	**B2**
100, 2-hole	22-4 7/8in 13T (B)	A10VSO 28	❍	❍	❍	❍	**B3**
100, 2-hole	25-4 1in 15T (B-B)	A10VSO 45	❍	❍	❍	❍	**B4**
125, 2-hole	32-4 11/4in 14T C)	A10VSO 71	❍	❍	❍	❍	**B5**
125, 2-hole	38-4 11/2in 17T (C-C)	A10VSO 100	❍	❍	❍	❍	**B6**
180, 4-hole	44-4 13/4in 13T (D)	A10VSO 140	❍	❍	❍	❍	**B7**
Flange SAE J 744	coupler for shaft SAE J744	to mount					
82-2 (A)	16-4 5/8in 9T (A)	AZPF, PGF2	●	●	●	❍	**01**
82-2 (A)	19-4 3/4in 11T (A-B)	A10VSO 10, 18	❍	❍	❍	❍	**52**
101-2 (B)	22-4 7/8in 13T (B)	AZPN/G	●	❍	●	❍	**02**
101-2 (B)	22-4 7/8in 13T (B)	A10VO 28, PGF3	●	●	●	❍	**68**
101-2 (B)	25-4 1in 15T (B-B)	A10VO 45, PGH4	❍	❍	●	❍	**04**
127-2 (C)	32-4 11/4in 14T (C)	A10VO 71	●	●	●	❍	**07**
127-2 (C)	38-4 11/2in 17T (C-C)	A10VO 100, PGH5	❍	❍	❍	❍	**24**
152-4 (D)	44-4 13/4in 13T (D)	A10VO 140	●	●	●	❍	**17**

Valves

Boost-, control press. relief- and flushing valve integrated; direct operated mainline relief valves integrated	❍	❍	❍	❍	**3**
Boost-, control press. relief- and flushing valve integrated; pilot operated mainline relief valves integrated	●	●	●	●	**4**

Filtration

without filter	●	●	●	●	**N**
with threaded connection for filter in boost circuit	●	●	●	●	**D**
with built on filter (optical-electr. dirt indicator) in boost circuit	●	●	●	❍	**M**
with threaded connection f. filter in boost circuit (D) a. sandwichplate filter for HS-control (see RE 92076)	❍	❍	–	–	**Z**
with built on filter in boost circuit (M) and sandwichplate filter for HS-control (see RE 92076)	❍	❍	–	–	**U**

2

Technical data

Fluid

Prior to project design, please see our data sheets RE 90220 (mineral oil) and RE 90221 (environmentally acceptable fluids) for detailed information on fluids and application conditions. The variable displacement pump A4CSG is suitable for operation on mineral oil. When using environmentally acceptable fluids attention must be paid to possible limitations of the technical data. If necessary please contact us (when ordering, please state in clear text the fluid to be used).

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at oprating temperature) be selected in the range

ν_{opt} = optimum operating viscosity 16 .... 36 mm²/s

referred to circuit temperature (closed circuit)

Viscosity range for operation with 100% duty cycle

$\nu_{operating}$ = 16 .... 100 mm²/s

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 3 min.)
at max. leakage fluid temp. of 90 °C.

ν_{max} = 1000 mm²/s
for short periods on cold start (the optimum viscosity should be reached within 15 minutes)
$t_{min} \geq -25°$ C

Temperature range (see selection diagram)

t_{min} = – 25° C
t_{max} = + 90° C

Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the closed circuit in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}; see shaded section of the selection diagram). We recommend that the higher viscosity grade is selected in each case.

Example: at an ambient temperature of X°C the operating temperature in the circuit is 60 °C. In the optimum viscosity range ν_{opt} (shaded area), this corresponds to viscosity grades VG 46 or VG 68, VG 68 should be selected.

Important: The leakage oil temperature is influenced by pressure and speed and is typically higher than the circuit temperature. However max. temperature at any point in the system may not exceed 90 °C.

If the above mentioned conditions cannot be kept due to extreme operating parameters or high ambient temperatures, please consult us.

Filtration of fluid

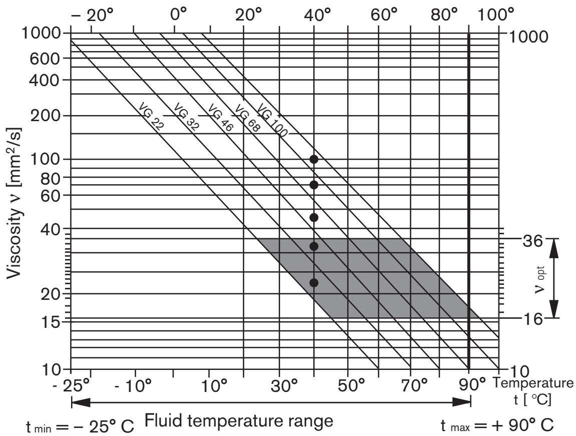
The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston unit.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness of

20/18/15 acc. to ISO 4406 is necessary.

If above conditions cannot be met, we ask you to consult with us. For notes on the types of filtration see page 25.

Selection diagram



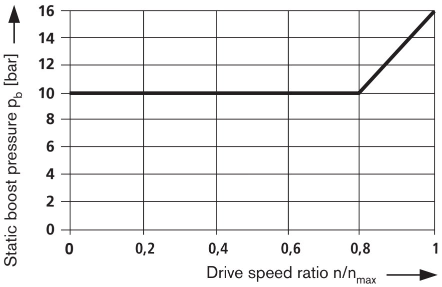
Technical Data (valid for operation on mineral oil)

Operating pressure range

Inlet

(Pressures acc. to DIN 24312)

Required static boost pressure, depending on drive speed



Required static boost pressure(at n/n_{max}=1)
$p_{b\ min}$ ______ 16 bar*

Minimum static boost pressure (short periods), relief valve setting
at $p_{b\ min}$ ______ 8 bar*

Maximum static boost pressure
$p_{b\ max}$ (for MA, EM, HM2/3, HS, EO2, HD u. EP), ______ 20 bar*
$p_{b\ max}$ (for HM1 u. EO1), ______ 30 bar*

* absolute pressure at port M_{E3} with flushingvalve spool in shifted position .

Permissible pressure spikes in boostcircuit min. ______ 4 bar abs.
max. ______ 40 bar abs.

Depending on the behaviour of the transmitted hydraulic energy in the system, boost pressure fluctuations can occur. In order to prevent damage in the system, boost pressure protection, which monitors the static boostpressure part is necessary. Ports M_{E3} or M_{K4} are suitable to monitor the boost pressure. It is recommended to check regularly the boost pressure for the permissible max. and min. spikes with suitable measuring equipment.

In order to prevent excessive boost pressure spikes, a low pressure accumulator can be connected to ports E_2, E_3 or K_4 . Accumulator sizing as well as the selection for the optimum connecting location depend on the system behaviour and the operating conditions under consideration of the available boost flow. Depending on the total systems leakage fluid flow, it may be necessary to increase the boost flow by means of a larger, or additional boost pump.

With integrated auxiliary pump - Version F..

Inlet pressure at port S

$p_{S\ min}$ ______ ≥ 0,8 bar abs.
$p_{S\ max}$ ______ 30 bar abs.

Outlet

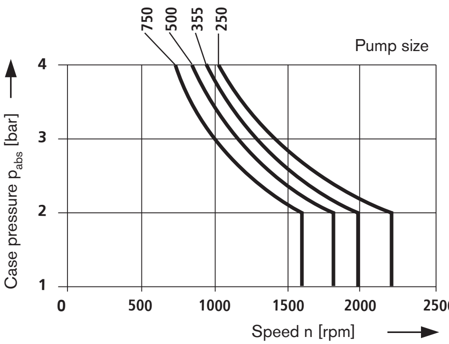
(Pressures acc. to DIN 24312)
Variable pump:
Pressure at port A or B
nominal pressure p_N ______ 350 bar
Peak pressure p_{max} ______ 400 bar

Case drain pressure

The service life of the shaft seal depends on the drive speed and case pressure. The diagram shows permissible limiting values at intermittent pressure loads on the shaft seal, which may not be exceeded.

A static case pressure, close to the max. limit will result in decreased service life of the shaft seal.

Permissible case pressure(housing pressure) depending on the drive speed



Max. case pressure (housing pressure)
$p_{L\ abs\ max}$ ______ 4 bar

Technical Data

Table of values (theoretical values, without considering η_{mh} und η_v; values rounded)

Size				250	355	500	750
Displacement	Variabe pump	$V_{g\,max}$	cm³	250	355	500	750
	integr. boost pump	$V_{g\,H}$	cm³	63	80	98	143
Drive speed	max. speed	n_{max}	rpm	2200	2000	1800	1600
	min. speed	n_{min}	rpm	800	800	800	800
Max. flow (variable pump)	at n_{max}	$q_{v\,max}$	L/min	550	710	900	1200
	at $n_E = 1500$ rpm		L/min	375	533	750	1125
Max. power	at $n_{o\,max}$	$P_{o\,max}$	kW	321	414	525	700
($\Delta p = 350$ bar)	at $n_E = 1500$ rpm		kW	219	311	438	656
Torque at $V_{g\,max}$	$\Delta p = 350$ bar	T_{max}	Nm	1391	1976	2783	4174
Variable pump (without boost pump)	$\Delta p = 100$ bar	T	Nm	398	564	795	1193
Moment of inertia about drive axis		J	kgm²	0,0959	0,19	0,3325	0,66
Max. perm. angular acceleration			rad/s²	775	600	540	400
Torsional stiffness	Shaft end P		kNm/rad	527	800	1145	1860
	Shaft end Z		kNm/rad	543	770	1209	1812
Case volume			L	10	8	14	19
Weight approx.. (Pump with EP-control a. integr. boost pump)		m	kg	214	237	350	500

Calculation of size

Flow $$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{[L/min]}$$

Drive torque $$T = \frac{1{,}59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} \quad \text{[Nm]}$$

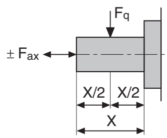
Power $$P = \frac{2\pi \cdot T \cdot n}{60\,000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

V_g = geometr. displacement per revolution in cm³
Δp = Pressure differential in bar
n = Drive speed in rpm
η_v = volumetriic efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Permissible forces on drive shaft

Size			250	355	500	750
Permissible radial force	$F_{q\,max}$	N	2000	2200	2500	3000
Permissible axial force	$\pm F_{ax\,max}$	N	1800	2000	2000	2200

Application of forces



Technical Data

Bearing flushing

For the following operating conditions bearing flushing is required for reliable continuous operation :

- Applications with special fluids (non mineral oils), due to limited lubricity and narrow operating temperature range
- Operation with critical conditions of temperature and viscosity with mineral oil
- With vertical mounting position of pump (shaft upwards) in order to ensure lubrication of front bearing and shaft seal.

Flushing is carried out via port "U", which is located in the front flange area of the pump. The flushing oil flows through the front bearing and leaves the system together with the leakage oil at the case drain port.

The following flushing flows are recommended for the various pump sizes:

Size			250	355	500	750
Flushing flow	q_{sp}	L/min	10	15	20	30

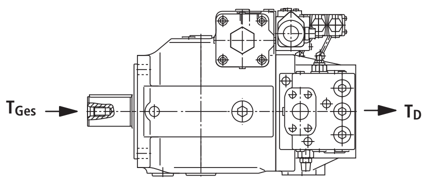
These flushing flows create a pressure drop of approx. 3 bar between port "U" and pump housing (including fitting).

2

Notes regarding bearing flushing

When using bearing flushing at port "U" the throttle screw, which can be found at port "U", has to be turned in all the way to its stop.

Maximum drive and through drive torques



The split in torque between the 1. and 2. pump is optional.

The max. permissible drive torque T_{Ges} as well as the max. permissible through drive torque T_D may not be exceeded.

Size			250	355	500	750
Max. perm. drive torque on pump 1 with shaft "**Z**"	T_{Ges}	Nm	2782	3952	5566	8348
Max. perm. through drive torque	T_D	Nm	1391	1976	2783	4174

Size			250	355	500	750
Max. perm. drive torque on pump 1 with shaft "**P**"	T_{Ges}	Nm	2300	3557	5200	7513
Max. perm. through drive torque	T_D	Nm	1391	1976	2783	4174

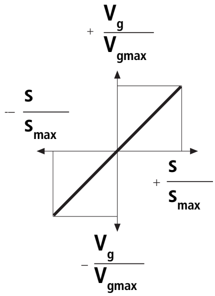
T_{Ges} = Max.permissible drive torque on pump 1

T_D = Max. permissible through drive torque

Summary of control and adjustment devices

Manuel adjustment MA

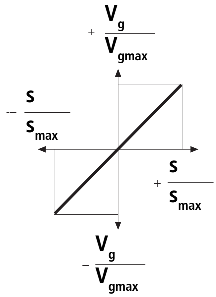
Handwheel operated stepless adjustment of displacement



see RE 92072

Electric motor adjustment EM

Stepless adjustment of displacement via an electric motor.
With a programmed sequence control, various intermediate displacements can be selected by means of built-on limit switches or a potentiometer.



see RE 92072

Hydraulic displacement control HM 1/2/3 control volume dependent

The pump displacement is infinitely variable in relation to the pilot oil volume at ports X_1 and X_2

Application: – 2-point control
– basic control device for servo- or proportional control

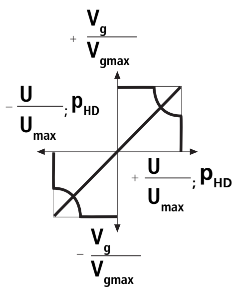
see RE 92076

Hydraulic displacement control HS, HS1, HS3 with servo- or proportional valve

The stepless displacement control is accomplished by means of a servo- or proportional valve with electrical feedback of the swivel angle.

Electronic control

Optional: servo valve (HS/HS1), proportional valve (HS3), short circuit valve (HS1K, HS3K), without valves (HSE, HS1E, HS3E) The **HS3P-** control is fitted with a built-on pressure transducer so that it can be utilised for **electrical pressure- and power control**



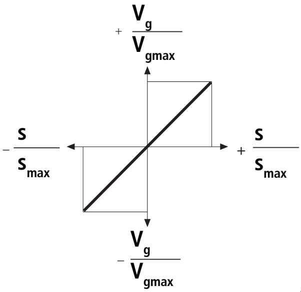
see RE 92076

Summary of control and adjusment devices

Hydraulic-electronically operated displacement control EO 1/2

The stepless adjustment of the displacement is accomplished by means of a proportional valve with electrical feedback of the swivel angle.
Electronically controlled

Optional:
Short circuit valve (EO1K, EO2K)
Without valves (EO1E, EO2E)

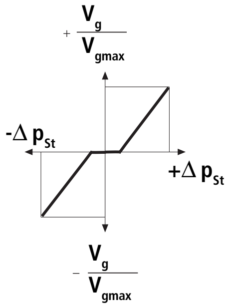


see RE 92076

Hydraulic control HD1/2/3 pilot pressure dependent

Stepless adjustment of pump displacement in relation to pilot pressure.
The displacement is proportional to the applied pilot pressure.

Optional:
Pilot pressure curves (HD1, HD2, HD3)
Pressure control (HD.A, HD.B, HD.D)
Remote pressure control (HD.GA, HD.GB, HD.G)
Power control (HD.P)
Electric control of pilot pressure (HD.T)



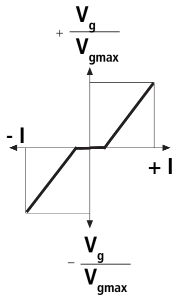
see RE 92080

Electro -hydraulic control EP with proportional solenuid

A valve with two proportional solenoids gives a pressure signal to one of the pumps pilot control chambers. The pressure signal and also the displacement is proportional to the solenoid current. Each solenoid operates one direction of flow.

Voltage 24 V
Nominal current 800 mA
Resistance at 20°C 19 Ω

Optional:
with pressure control (EPA, EPB, EPD);
with pressure control remote (EPGA, EPGB, EPG)



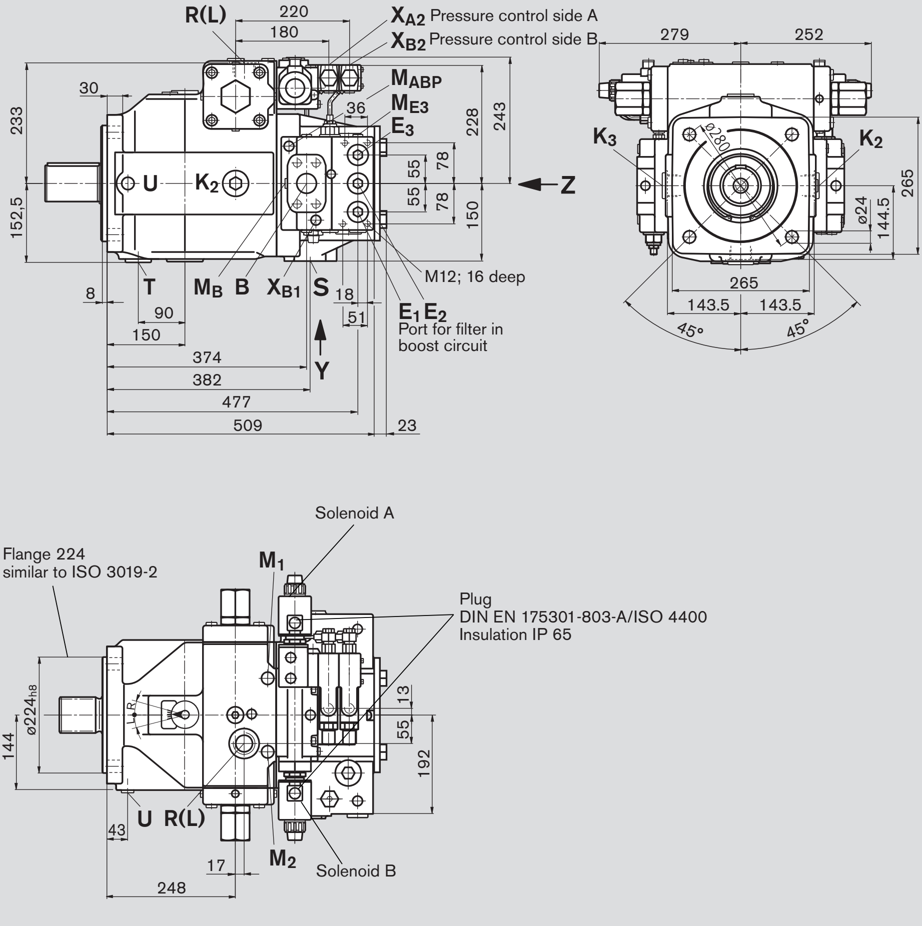
see RE 92084
(in preparation)

2

Unit dimensions size 250

Before finalising your design, please request a certified installation drawing

Example A4CSG250EPG/30R-XXB35F994N



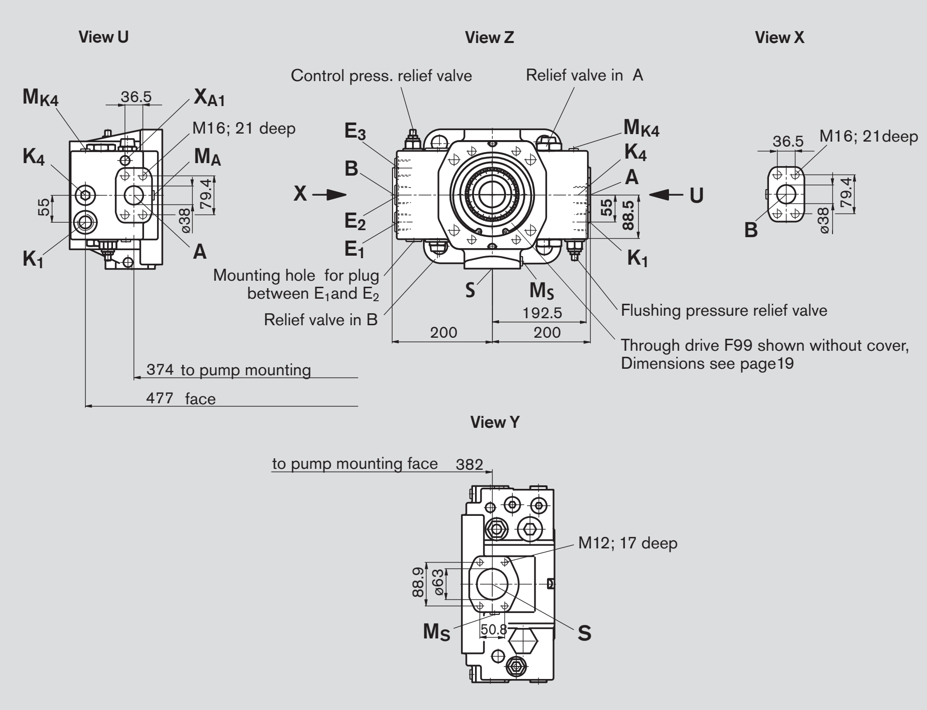
Further views and ports on page 11

Ports					Max. tightening torque [1]
A, B	Pressure port, high press. range fixing thread	SAE J518c DIN 13	1 1/2 in M16;	 21 deep	– see safety instructions
S	Inlet port, standard press. range fixing thread	SAE J518c DIN 13	2 1/2 in M12;	 17 deep	– see safety instructions
M_A,M_B,M_{ABP}	Test points press. ports	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_S	Test point inlet pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
T	Oil drain	DIN 3852	M42x2;	20 deep (closed)	720 Nm
E_1	To filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
E_2	From filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
K_1	Flushing port	DIN 3852	M33x2;	18 deep	540 Nm

[1]) Follow manufacturer's instructions of used fittings

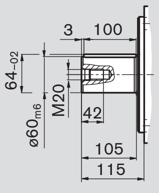
Unit dimensions size 250

Before finalising your design, please request a certified installation drawing

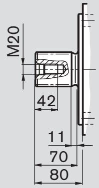


Shaft ends

P Keyed DIN 6885
AS 18x11x100



Z Splined DIN 5480
W60x2x30x28x9g



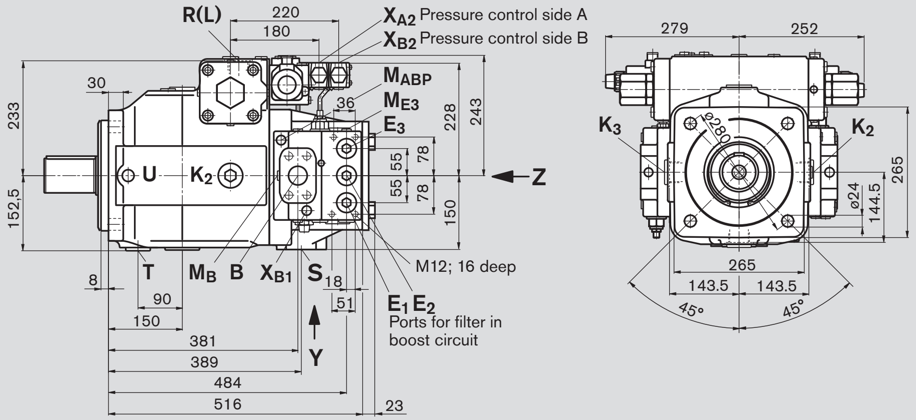
Ports				Max. tightening torque [1])
K_2, K_3	Flushing port	DIN 3852	M42x2; 20 deep (closed)	720 Nm
R(L)	Oil fill and air bleed	DIN 3852	M42x2; 20 deep	720 Nm
U	Bearing flushing port	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
E_3	External boost flow port	DIN 3852	M33x2; 18 deep (closed)	540 Nm
M_{E3}	Test point boost pressure	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
K_4	Accumulator port	DIN 3852	M33x2; 18 deep (closed)	540 Nm
M_{K4}	Test point loop flushing press.	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
M_1, M_2	Test point control pressure	DIN 3852	M18x1,5; 12 deep (closed)	140 Nm
X_{A1}	Pilot port relief valve in A	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
X_{B1}	Pilot port relief valve in B	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
X_{A2}, X_{B2}	Pilot port for pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm

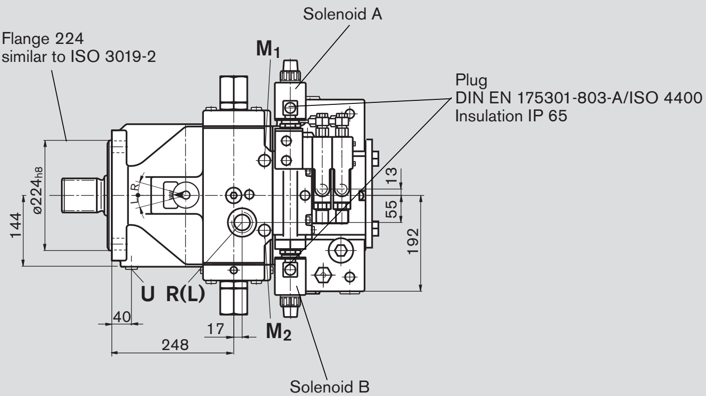
2

Unit dimensions size 355

Before finalising your design, please request a certified installation drawing

Example A4CSG355EPG/30R-XXB35F994N





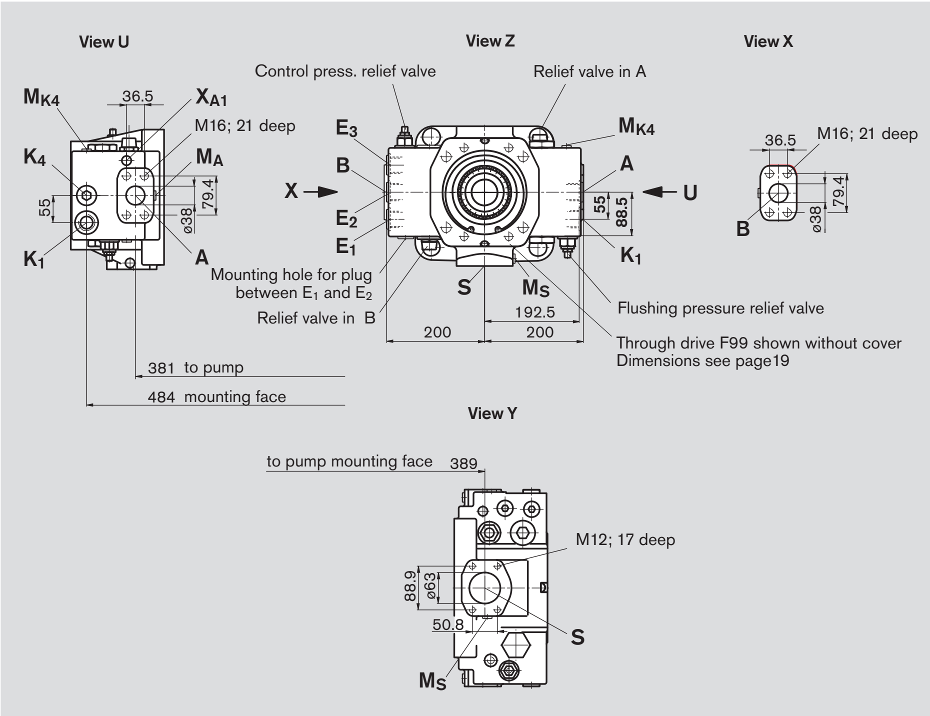
Further views and ports on page 13

Ports					**Max. tightening torque**[1])
A, B	Pressure port,high press. range	SAE J518c	1 1/2 in		–
	fixing thread	DIN 13	M16;	21 deep	see safety instructions
S	Inlet port, standard press. range	SAE J518c	2 1/2 in		–
	fixing thread	DIN 13	M12;	17 deep	see safety instructions
M_A,M_B,M_{ABP}	Test points press. ports	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_S	Test point inlet pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
T	Oil drain	DIN 3852	M42x2;	20 deep (closed)	720 Nm
E_1	To filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
E_2	From filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
K_1	Flushing port	DIN 3852	M33x2;	18 deep	540 Nm

[1]) Follow manufacturer's instructions of used fittings

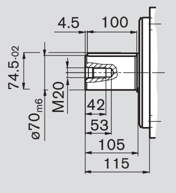
Unit dimensions size 355

Before finalising your design, please request a certified installation drawing

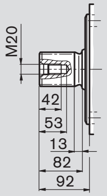


Shaft ends

P Keyed DIN 6885 AS 20x12x100



Z Splined DIN 5480 W70x3x30x22x9g

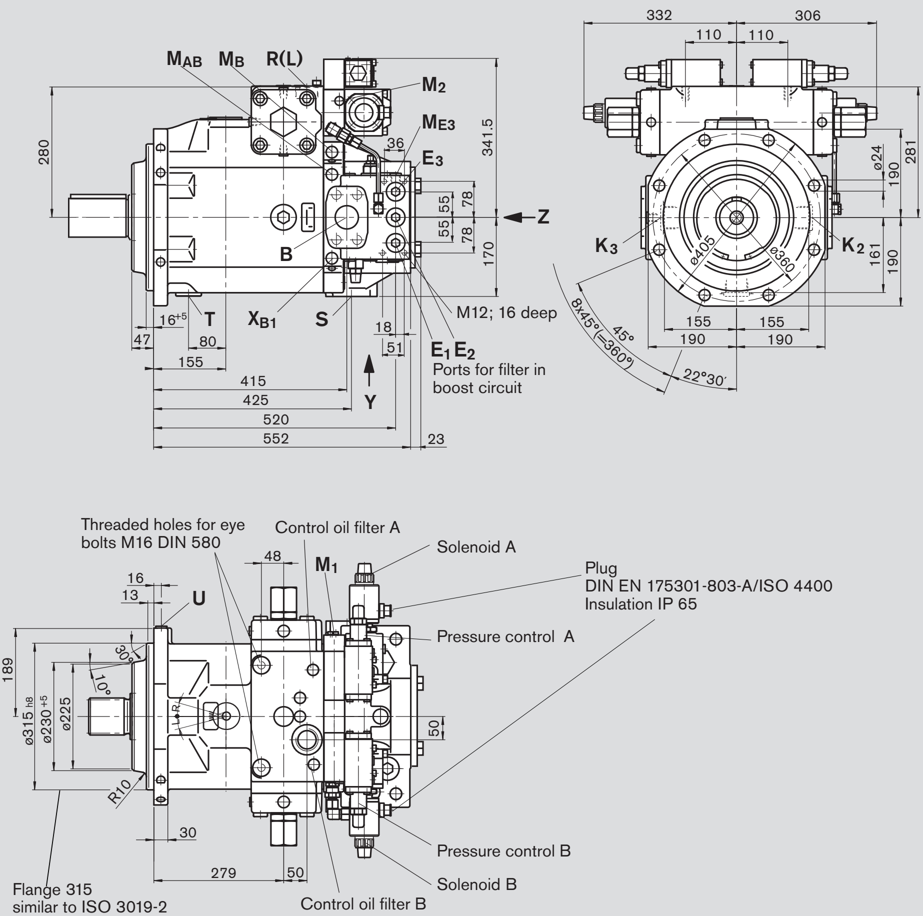


Ports					**Max. tightening torque.** [1]
K_2, K_3	Flushing port	DIN 3852	M42x2;	20 deep (closed)	720 Nm
R(L)	Oil fill +air bleed	DIN 3852	M42x2;	20 deep	720 Nm
U	Bearing flushing port	DIN 3852	M18x1,5;	12 deep (closed)	140 Nm
E_3	External boost flow port	DIN 3852	M33x2;	18 deep (closed)	540 Nm
M_{E3}	Test point boost pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
K_4	Accumulator port	DIN 3852	M33x2;	18 deep (closed)	540 Nm
M_{K4}	Test point loop flushing pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_1,M_2	Test point control pressure	DIN 3852	M18x1,5;	12 deep (closed)	140 Nm
X_{A1}	Pilot port relief valve in A	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
X_{B1}	Pilot port relief valve in B	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
X_{A2}, X_{B2}	pilot port pressure control	DIN 3852	M14x1,5;	12 deep	80 Nm

Unit dimensions size 500

Before finalising your design, please request a certified installation drawing

Example A4CSG500EPD/30R-XXH35F994N



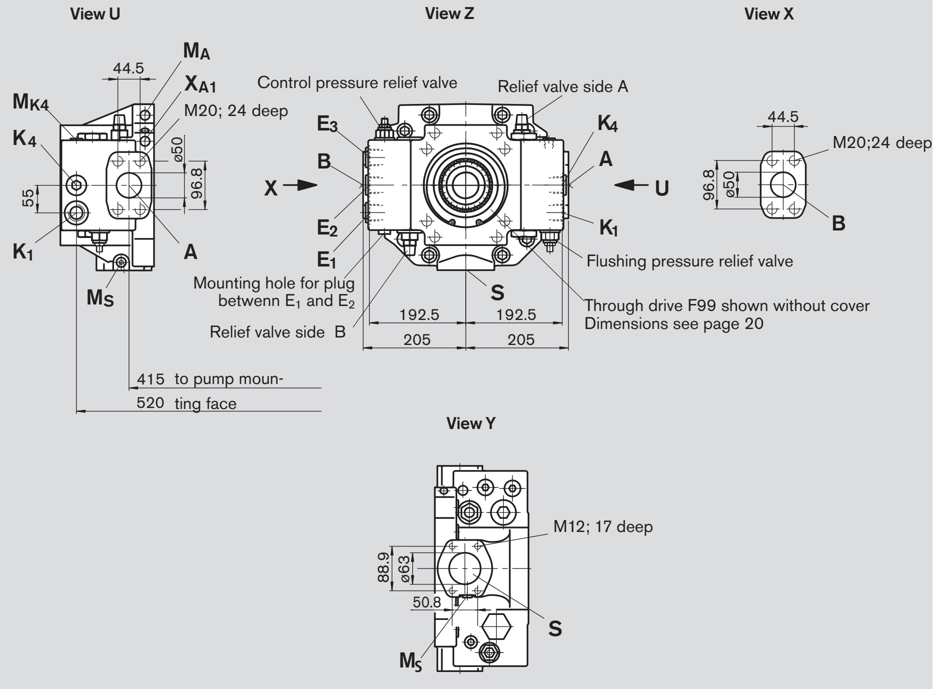
Further views and ports on page 15

Ports					Max. tightening torque [1])
A, B	Pressure port, high press. range	SAE J 518c	2 in		–
	fixing thread	DIN 13	M20;	24 deep	see safety instructions
S	Inlet port, standardpress. range	SAE J518c	2 1/2 in		–
	fixing thread	DIN 13	M12;	17 deep	see safety instructions
M_A,M_B,M_{AB}	Test points press. ports	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_S	Test point inlet pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
T	Oil drain	DIN 3852	M48x2;	22 deep (closed)	960 Nm
E_1	To filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
E_2	From filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
K_1	Flushing port	DIN 3852	M33x2;	18 deep	540 Nm

[1]) Follow manufacturer's instructions of used fittings

Unit dimensions size 500

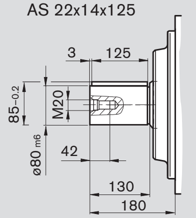
Before finalising your design, please request a certified installation drawing



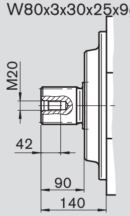
2

Shaft ends

P Keyed DIN 6885
AS 22x14x125



Z Splined DIN 5480
W80x3x30x25x9g

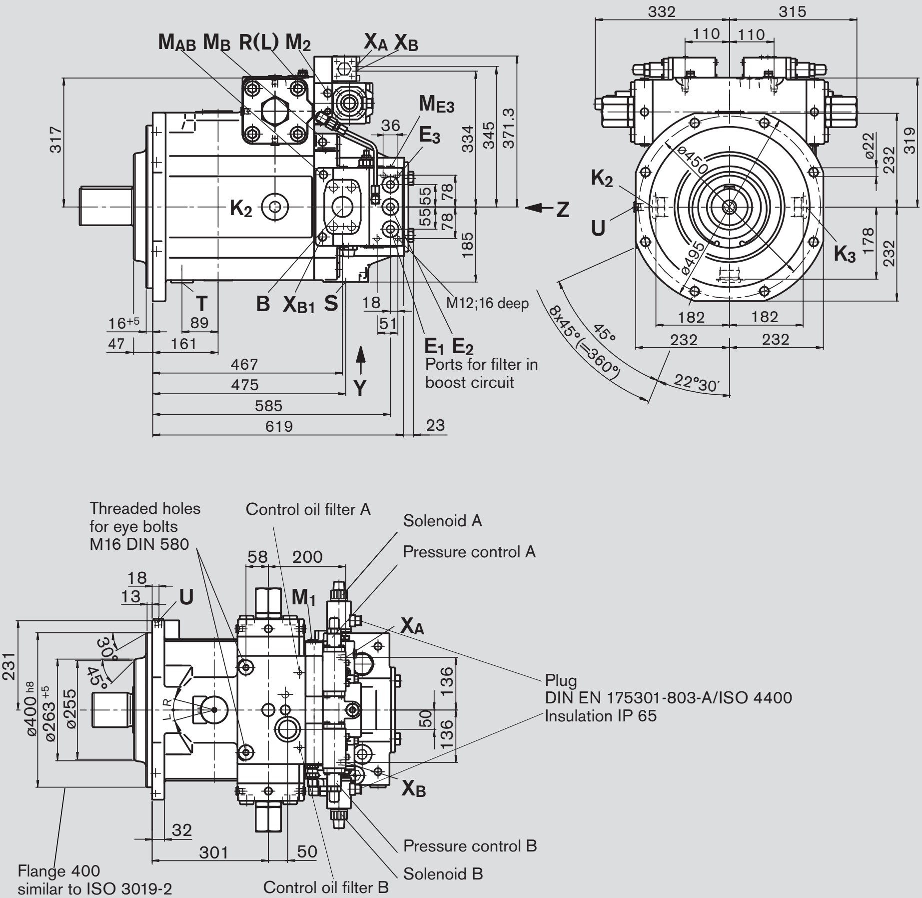


Ports				**Max. tightening torque** [1])
K_2, K_3	Flushing port	DIN 3852	M48x2; 22 deep (closed)	960 Nm
R(L)	Oil fill +air bleed	DIN 3852	M48x2; 22 deep	960 Nm
U	Bearing flushing port	DIN 3852	M18x1,5; 12 deep (closed)	140 Nm
E_3	External boost flow port	DIN 3852	M33x2; 18 deep (closed)	540 Nm
M_{E3}	Test point boost pressure	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
K_4	Accumulator port	DIN 3852	M33x2; 18 deep (closed)	540 Nm
M_{K4}	Test point loop flushing pressure	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
M_1	Test point control chamber press.	DIN 3852	M22x1,5; 14 deep (closed)	210 Nm
M_2	Test point control chamber press.	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
X_{A1}	Pilot port relief valve in A	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm
X_{B1}	Pilot port relief valve in B	DIN 3852	M14x1,5; 12 deep (closed)	80 Nm

Unit dimensions size 750

Before finalising your design, please request a certified installation drawing

Example A4CSG750EPG/30R-XXH35F994N



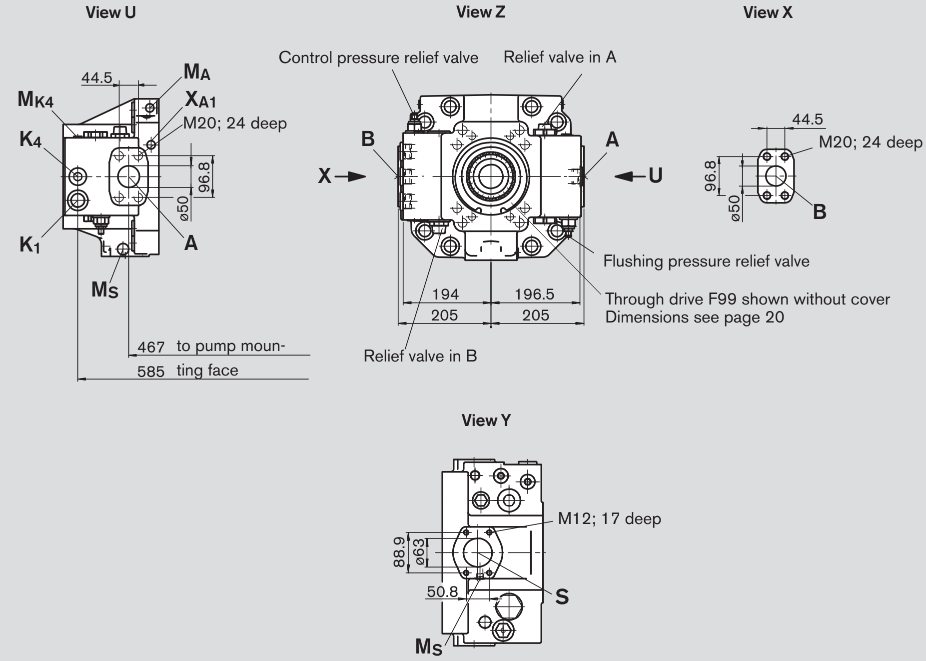
Further views and ports on page 17

Ports					**Max. tightening torque** [1])
A, B	Pressure ports, high press. range fixing thread	SAE J 518c DIN 13	2 in M20;	 24 deep	– see safety instructions
S	Inlet port, standard press. range fixing thread	SAE J518c DIN 13	2 1/2 in M12;	 17 deep	– see safety instructions
M_A,M_B,M_{AB}	Test points pressure ports	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_S	Test point inlet pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
T	Oil drain	DIN 3852	M48x2;	22 deep (closed)	960 Nm
E_1	To filter	DIN 3852	M33x2;	18 deep (closed)	540 Nm
E_2	From filter	DIN 3852	M33x2;	18deep (closed)	540 Nm
K_1	Flushing port	DIN 3852	M33x2;	18 deep	540 Nm

[1]) Follow manufacturer's instructions of used fittings

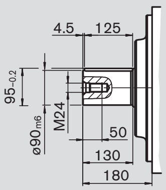
Unit dimensions size 750

Before finalising your design, please request a certified installation drawing

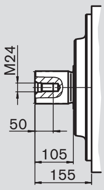


Shaft ends

P Keyed DIN 6885
AS 25x14x125



Z Splined DIN 5480
W90x3x30x28x9g



Ports					**Max. tightening torque** [1]
K_2, K_3	Flushing port	DIN 3852	M48x2;	22 deep (closed)	960 Nm
R(L)	Oil fill + air bleed	DIN 3852	M48x2;	22 deep	960 Nm
U	Bearing flushing port	DIN 3852	M18x1,5;	12 deep (closed)	140 Nm
E_3	External boost flow port	DIN 3852	M33x2;	18 deep (closed)	540 Nm
M_{E3}	Test point boost pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
K_4	Accumulator port	DIN 3852	M33x2;	18 deep (closed)	540 Nm
M_{K4}	Test point loop flushing pressure	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
M_1	Test point control chamber press.	DIN 3852	M22x1,5;	14 deep(closed)	210 Nm
M_2	Test point control chamber press.	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
X_{A1}	Pilot port relief valve A	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm
X_{B1}	Pilot port relief valve B	DIN 3852	M14x1,5;	12 deep (closed)	80 Nm

Through drive

Although the compact unit A4CSG has a built in boost pump, it can be supplied with a through drive as per the model codes on page 3.
For the various through drive versions see the codes on page 3 (codes 99 – 17).
This code designation is sufficient if no further pump has to be factory mounted.
Included in this case are:
for F/K 31 – 17:
Shaft coupler, mounting screws, seal, and if necessary an adapter flange

for F/K 99:
with through drive shaft, without shaft coupler, without adapter flange; unit closed with oiltight cover.

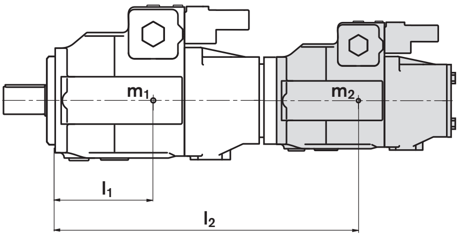
Combination pumps

Independent circuits are avilable for the user when further pumps are built on.

1. If the combination consists of **2 Rexroth axial poston pumps** and if these 2 units have to be **factory assembled together** both pump model codes should be joined by a "**+**".
   Ordering example:
   A4CSG 500 EPG/30 R–VPH35F434M **+**
   A4CSG 500 EPG/30 R–VZH35F994M
2. If a **gear** pump is to be **factory mounted**, please consult us.

Max. permissible input and through drive torques see page 7.

Permissible moment of inertia



m_1, m_2, m_3 Weight of pumps in kg
l_1, l_2, l_3 Distance to center of gravity in mm

$$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \frac{1}{102} \text{ in Nm}$$

Size			250	355	500	750
Perm. moment of inertia	T_m	Nm	9300	9300	15600	19500
Perm. moment of inertia with dyn. mass acc. of 10g ≙ 98,1 m/sec²	T_m	Nm	930	930	1560	1950
Weight	m_1	kg	214	237	350	500
Dist. to center of gravity	l_1	mm	210	220	230	260

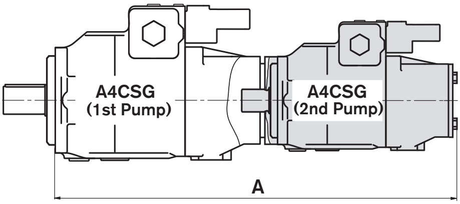
Overview mounting options onto A4CSG

Through drive - A4CSG Flange	Shaft coupler	Short code	Suitable for 2. Pumptype A4CSG Size (shaft)	A4VSO/(H)G Size (shaft)	A10V(S)O/31 Size (shaft)	A10V(S)O/52 Size (shaft)	Ext./internal gear pump	Available for pump-size
Flange ISO 3019-2 (metric)								
80, 2-hole	19-4 (3/4in, 11T) 3)	**F/KB2**	–	–	18 (S, R)	10 (S)	–	in prep.
100, 2-hole	22-4 (7/8in, 13T) 3)	**F/KB3**	–	–	28 (S, R)	–	–	in prep.
	25-4 (1in, 15T) 3)	**F/KB4**	–	–	45 (S, R)	–	–	in prep.
125, 2-hole	32-4 (1 1/4in, 14T) 3)	**F/KB5**	–	–	71 (S, R)	–	–	in prep.
	38-4 (1 1/2in, 17T) 3)	**F/KB6**	–	–	100 (S)	–	–	in prep.
125, 4-hole	W 32x2x30x14x9g 2)	**F/K31**	–	40 (Z)	–	–	–	in prep.
140, 4-hole	W 40x2x30x18x9g 2)	**F/K33**	–	71 (Z)	–	–	–	in prep.
160, 4-hole	W 50x2x30x24x9g 2)	**F/K34**	–	125, 180 (Z)	–	–	–	250, 355
180, 4-hole	44-4 (1 3/4in, 13T) 3)	**F/KB7**	–	–	140 (S)	–	–	in prep.
224, 4-hole	W 60x2x30x28x9g 2)	**F/K35**	250 (Z)	250 (Z)	–	–	–	250
	W 70x3x30x22x9g 2)	**F/K77**	355 (Z)	355 (Z)	–	–	–	355
315, 8-hole	W 80x3x30x25x9g 2)	**F/K43**	500 (Z)	500 (Z)	–	–	–	500
400, 8-hole	W 90x3x30x28x9g 2)	**F/K76**	750 (Z)	750 (Z)	–	–	–	in prep.
Flange SAE J 744 (ISO 3019-1)								
82-2 (A) 1)	16-4 (5/8in, 9T) 3)	**F/K01**	–	–	–	–	AZPF 4)/PGF2	250...500
	19-4 (3/4in, 11T) 3)	**F/K52**	–	–	18 (S, R)	10 (S)	–	in prep.
101-2 (B) 1)	22-4 (7/8in, 13T) 3)	**F/K02**	–	–	–	–	AZPN/G 4)	250, 500
		F/K68	–	–	28 (S)	28 (S)	PGF3	250...500
	25-4 (1in, 15T) 3)	**F/K04**	–	–	45 (S)	45 (S)	PGH4	500
127-2 (C) 1)	32-4 (1 1/4in, 14T) 3)	**F/K07**	–	–	71 (S)	–	–	250...500
	38-4 (1 1/2in, 17T) 3)	**F/K24**	–	–	100 (S)	85 (S)	PGH5	in prep.
152-4 (D) 1)	44-4 (1 3/4in, 13T) 3)	**F/K17**	–	–	140 (S)	–	–	250...500

1) 2 = 2-hole, 4 = 4-hole 2) to DIN 5480 3) Drive shafts acc. to SAE J744 OCT83
4) Rexroth recommends special versions for the gear pumps. Please consult us.

Dimensions pump combinations and through drive F/K99

Pump combinations A4CSG + A4CSG

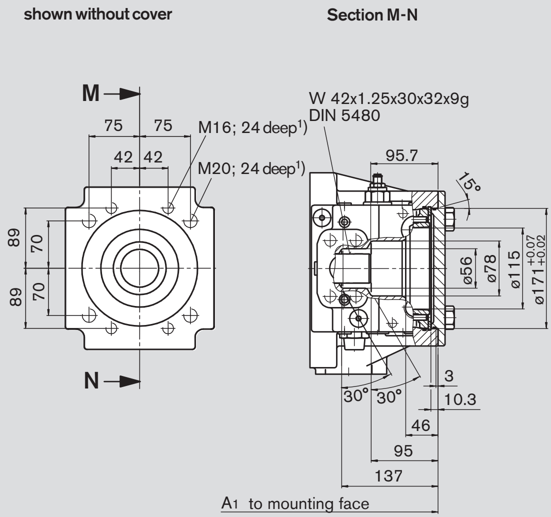


Overall lenght A

A4CSG (1st Pump)	A4CSG (2nd Pump with through drive F/K99) 250	355	500	750
250	1041	–	–	–
355	1048	1055	–	–
500	1084	1091	1127	–
750	1151	1158	1194	1261

F/K99 **with through drive shaft,** without shaft coupler, without adapter flange, closed with cover

Size 250 and 355



Size	A_1
250	509
355	516

Sizes 500 and 750 see page 20

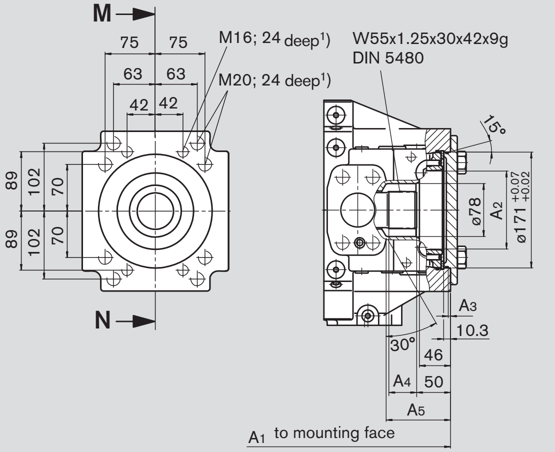
[1]) DIN 13, Tightening torque see safety instructions

Dimensions through drive F/K99 and F/K34

**F/K99 with through drive shaft,without shaft coupler,
without adapter flange, closed with cover**

Size 500 and 750

shown without cover **Section M-N**

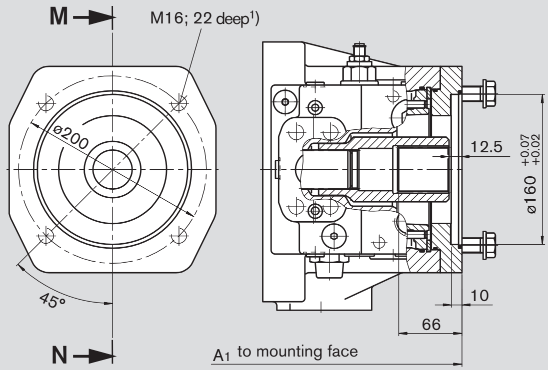


Size	A_1	A_2	A_3	A_4	A_5
500	552	ø115	3.4	41	95
750	619	ø115	3.4	45	116.6

F/K 34 Flange ISO 3019-2 160 4-hole
Shaft coupler for shaft to DIN 5480 N 50x2x30x24x8H
for mounting of A4VSO/H/G (shaft Z, see RE 92 050, 92 110 resp. 92 100)

Size 250 and 355

Section M-N



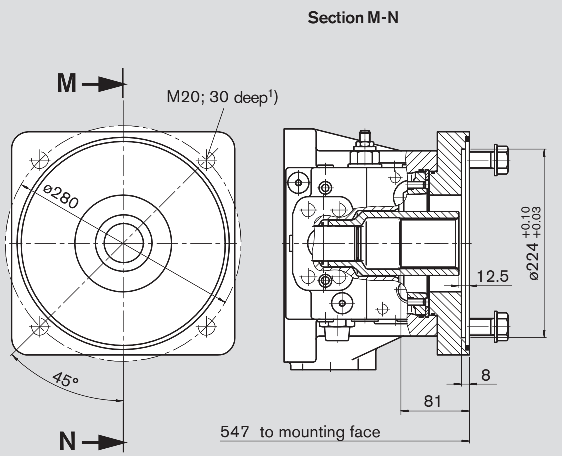
Size	A_1
250	531
355	538

[1]) DIN 13, Tightening torque see safety instructions

Dimensions through drive F/K35 and F/K77

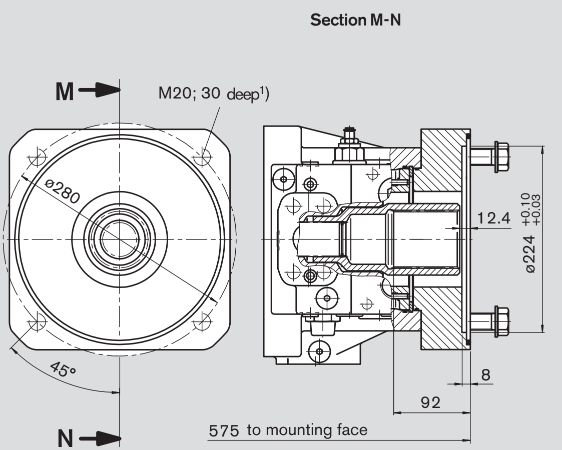
F/K35 **Flange** ISO 3019-2 224 4-hole
Shaft coupler for shaft to DIN 5480 N 60x2x30x28x8H
for mounting of A4CSG 250 or an A4VSO/H/G 250 (shaft Z, see RE 92 050, 92 110 resp. 92 100)

Size 250



F/K77 **Flange** ISO 3019-2 224 4-hole
Shaft coupler for shaft to DIN 5480 N 70x3x30x22x8H
for mounting of A4CSG 355 or an A4VSO/G 355 (shaft Z see RE 92 050 resp. 92 100)

Size 355

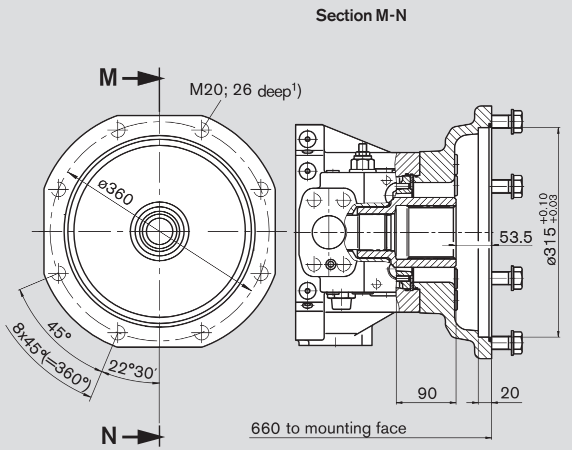


[1]) DIN 13, tightening torque see safety instructions

Dimensions through drive F/K43 and F/K01

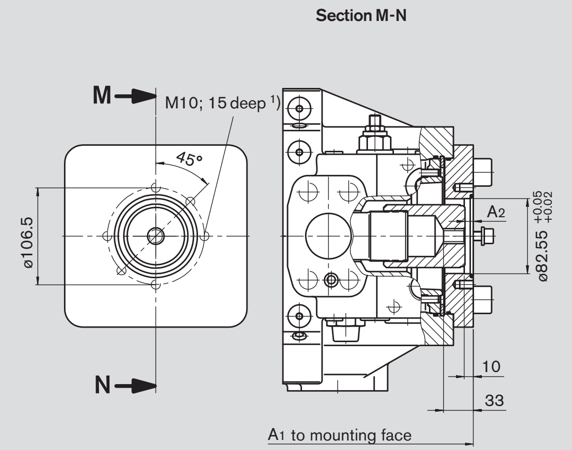
F/K43 **Flange** ISO 3019-2 315 8-hole
Shaft coupler for shaft to DIN 5480 N 80x3x30x25x8H
for mounting of A4CSG 500 or an A4VSO/G 500 (shaft Z, see RE 92 050 resp. 92 100)

Size 500



F/K01 **Flange** SAE J744 – 82-2 (SAE A-2-hole)
Shaft coupler for shaft to SAE J744 16-4 (A) 5/8in 9T 16/32 DP 2)
for mounting of AZPF or PGF2 (shaft J, flange U2, see RE10 213)

Size 250, 355 and 500



Size	A_1	A_2
250	531	10,5
355	538	10,5
500	574	9,3

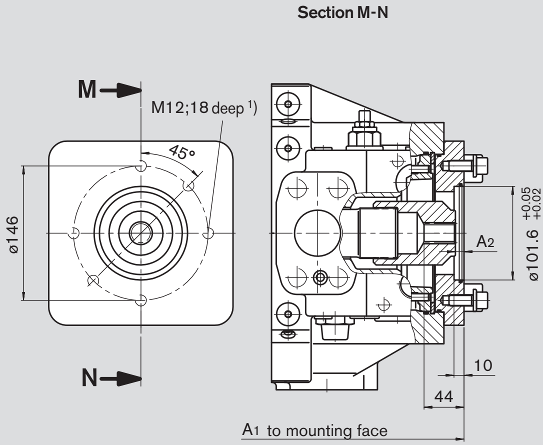
1) DIN 13, tightening torque see safety instructions

2) 30° pressure angle, flat root, side fit, class 5

Dimensions through drive F/K02 and F/K68

F/K02 **Flange** SAE J744 – 101-2 (SAE B-2-hole)
Shaft coupler for shaft to SAE J 744 22-4 (B) 7/8in 13T 16/32 DP [2])
for mounting of AZPN/G

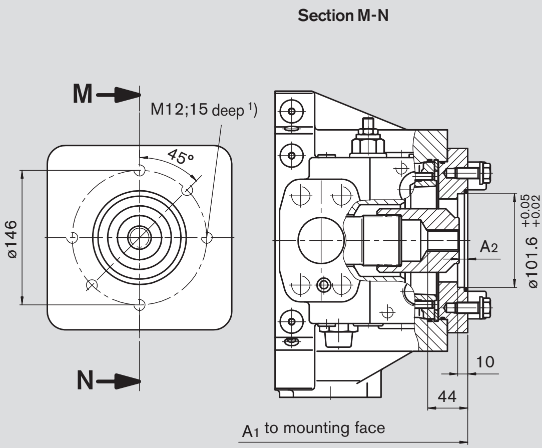
Size 250 and 500



Size	A_1	A_2
250	531	10,3
500	574	9,3

F/K68 **Flange** SAE J744 – 101-2 (SAE B-2-hole)
Shaft coupler for shaft to SAE J 744 22-4 (B) 7/8in 13T 16/32 DP [2])
for mounting of A10VO 28 (shaft S, see RE 92 701) or internal gear pump PGF3 (shaft J, flange U2, see RE 10 213)

Size 250, 355 and 500



Size	A_1	A_2
250	531	10,3
355	538	10,3
500	574	9,3

[1]) DIN 13, tightening torque see safety instructions

[2]) 30° pressure angle, flat root, side fit, class 5

2

Dimensions through drive F/K04 and F/K07

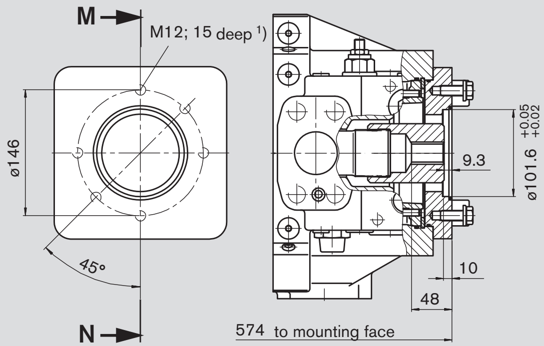
F/K04 **Flange** SAE J744 – 101-2 (SAE B-2-hole)

Shaft coupler for shaft to SAE J 744 25-4 (C) 1 in 15T 16/32 DP [2])

for mounting of A10VO 45 (shaft S, see RE 92 701) or of an internal gear pump PGH4 (shaft R, flange U2, see RE 10 223)

Size NG 500

Section M-N



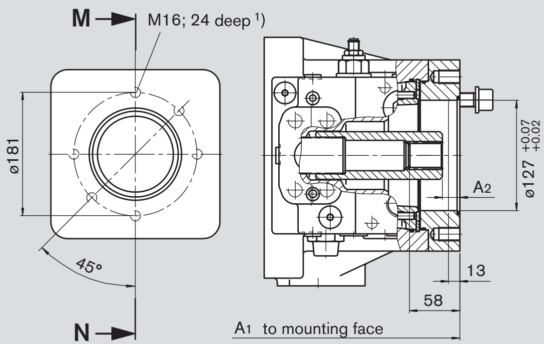
F/K07 **Flange** SAE J744 – 127-2 (SAE C-2-hole)

Shaft coupler for shaft to SAE J 744 32-4 (C) 1 1/4in 14T 12/24 DP [2])

for mounting of A10VO 71 (shaft S, see RE 92 701)

Size 250, 355 and 500

Section M-N



Size	A_1	A_2
250	545	19,9
355	552	19,9
500	588	10,3

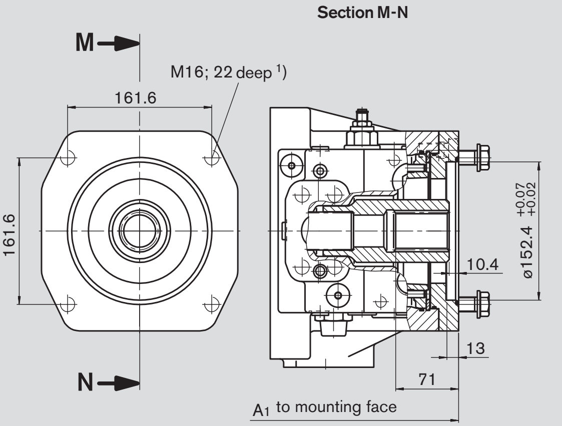
[1]) DIN 13, tightening torque see safety instructions

[2]) 30° pressure angle, flat root, side fit, class 5.

Dimensions through drive F/K17

F/K17 **Flange** SAE J744 – 152-4 (SAE D-4-hole)
Shaft coupler for shaft to SAE J 744 – 44-4 (D) 1 3/4in 13T 8/16 DP [2])
for mounting of A10VO 140 (shaft S, see RE 92 701)

Size 250, 355 and 500



Size	A_1
250	531
355	538
500	600

[1]) DIN 13, tightening torque see safety instructions

[2]) 30° pressure angle, flat root, side fit, class 5

Types of filtration

Version N - without filter in boost circuit

The ports E_1 and E_2 are closed with a pressure tight cover and internally connected (see circuit drawing page 26).

If needed, a boost line filter can still be mounted later on at these ports.

In this case, the internal connection between E_1 and E_2 must be plugged (please consult us).

Version M - with built on filter in the boost circuit

In this case a filter is factory mounted into the boostpump pressure line.

Filter version: with bypass and electrical-optical dirt indicator

Filtermodel for pump sizes 250...500:

DFBN/HC330QE10D1.X/V-L24

For further information see pages 28 and 29.

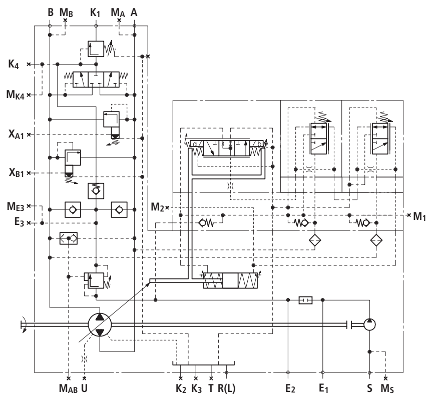
Version D - Threaded ports for external mounting of filter in boost pump outlet

Ports E_1 and E_2 are provided to mount a filter externally .

These ports are open, and only temporarily closed with plastic plugs for transport.

The internal passage between E_1 and E_2 is plugged.

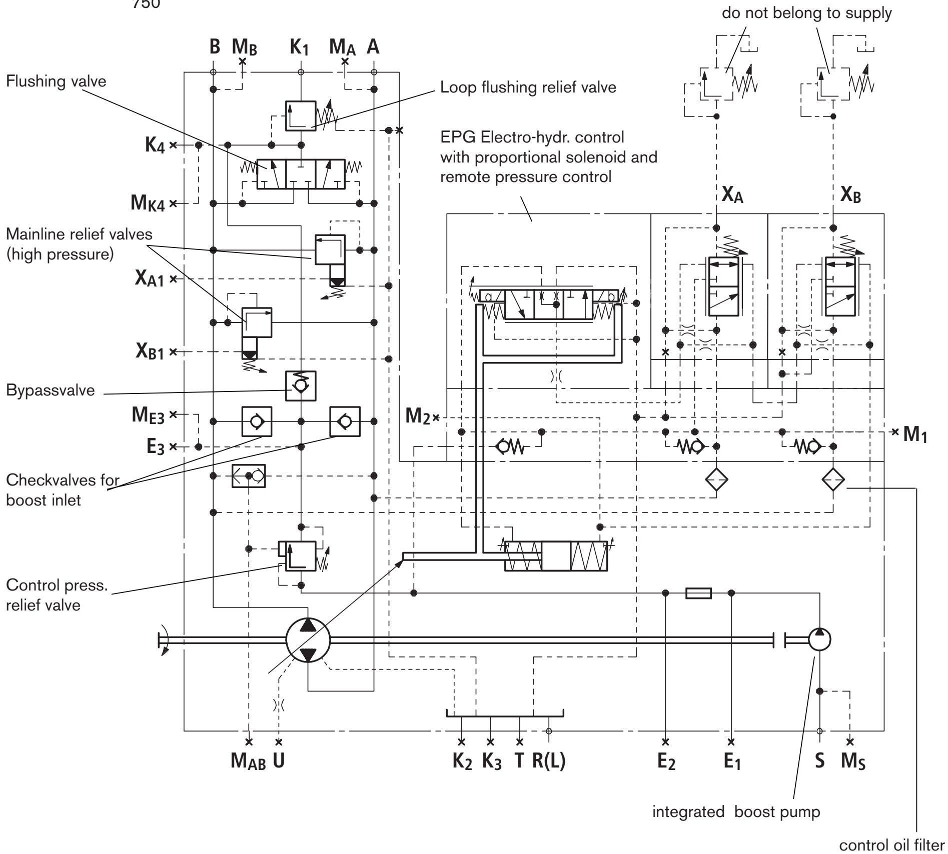
Circuit drawing version D (example size 500/750)



Integrated boost pump and control valves (Version F..)

Circuit drawing

Example A4CSG $^{500}_{750}$ EPG/30R-XXB35**F**994N



Circuit drawing NG 500/750 with EPD-control and filter see page 29; without integrated boostpump see page 30.

Ports

A, B	Pressure ports	
S	Inlet port	
M_A,M_B,M_{AB}	Test points pressure port	(closed)
M_S	Test point inlet port	(closed)
T	Oil drain	(closed)
E1	To filter	(closed)
E2	From filter	(closed)
K_1	Flushing port	
K_2, K_3	Flushing port	(closed)
R(L)	Oil fill + air bleed	

U	Bearing flushing port	(closed)
E_3	External boost flow port	(closed)
M_{E3}	Test point boost pressure	(closed)
K_4	Accumulator port	(closed)
M_{K4}	Test point loop flushing pressure	(closed)
M_1,M_2	Test point control pressure	(closed)
X_{A1}	Pilot port relief valve in A	(closed)
X_{B1}	Pilot port relief valve in B	(closed)
X_A, X_B	Pilot port for remote pressure control	

Integrated boost pump and -control valves (Version F..)

High press. mainline reliefs (crossover relief valves)

The 2 pilot operated crossover reliefs have pilot ports for remote control.

The valves limit the max. pressure spikes to an acceptable safe level, and prevent damage to the main pump.

Each pressure side has its own relief valve, which is vented to the low pressure side of the loop.

The valves can be hooked up to pilot reliefs for remote setting of pressure at ports XA1, XB1.

The valves are normally set to a pressure level of 350 bar.

If another setting is required, please state that in clear text.

Flushing pressure relief valve

direct operated

Adjustment range Δp_{Sp} 10...20 bar

Standard setting: 16 bar absolute

Integrated boost pump

Standard sizes

Size	250	355	500	750
cm^3	63	80	98	143

Control pressure filter

Controls HD and EP in the size 500 and 750 with internal supply of control pressure out of one of the high pressure sides have always a 0,2 mm filter insert for coarse particles (regardless of the model code for filtration).

Control pressure relief valve (for EP and HD)

Direct operated, piloted open by circuit operating pressure.

Adjustment range Δp_{St} 10 - 20 bar

Standard setting: $\Delta p_{Sp} + \Delta p_{St} = 32$ bar

At low operating pressure (i.e. main pump in center position) the auxiliary pump pressure is limited to 32 bar. This pressure level is required to make sure that the pump will stroke when using an HD or EP control. This feature eliminates the use of another pump for control pressure.

As soon as the pressure level in one of the circuit pressure sides exceeds the 32 bar, the control pressure is taken from this source via the check valves.At the same time, the relief valve is piloted open.

This brings the boost pump pressure to the level set at the flushing relief valve, i.e. 16 bar.

This function enables saving of energy, and improves the overall efficiency of the system.

With the controls EO1 and HM1 the necessary control enrgy can always be taken out of the boost circuit (Port M_{E3}).

Recommended setting: 25 bar

With all other control options, the control pressure relief valve is not mounted, and the valve cavity is plugged.

2

Subplate mounted filter in boost circuit (Version M..)

The filter is mounted in the auxiliary pump's pressure line directly onto the pump

Filter model DFBN/HC330QE10D1.X/V–L24

Filter with bypass and electrical-optical dirt indicator.

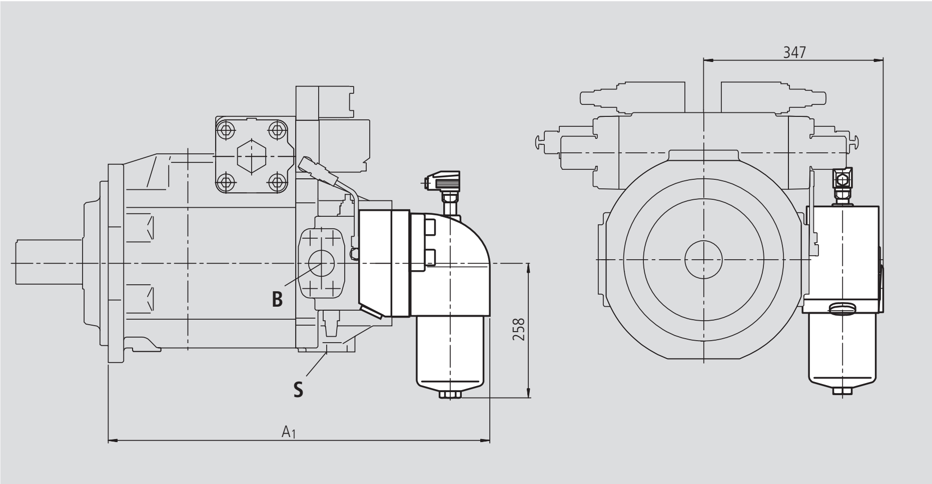
Pickup pressure of dirt indicator

$\Delta p_a = 5 \text{ bar}_{\,-\,0{,}5 \text{ bar}}$

Opening pressure of bypass valve

$\Delta p_ö = 6 \text{ bar}^{\,+0{,}6 \text{ bar}}$

Dimensions size 250...500

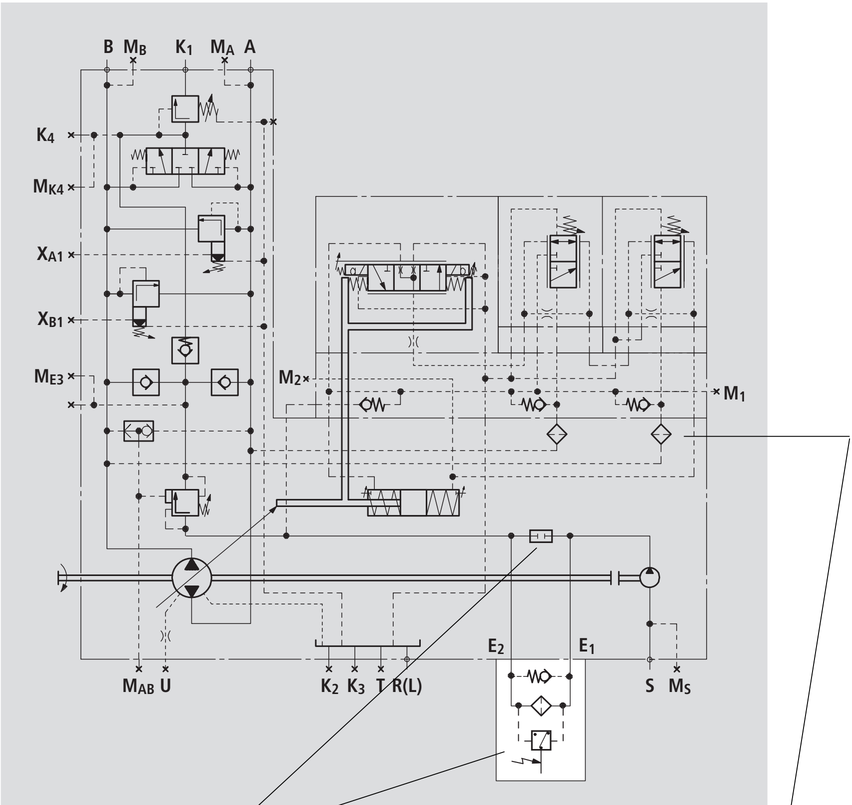


Size	A1
250	699,5
355	706,5
500	742,5

Subplate mounted filter in boost circuit (Version M..)

Circuit diagram

Example A4CSG$\frac{500}{750}$ EPD/30R-XXH35F994**M**



Mounting of filter onto size 250...500
DFBN/HC330QE10D1.X/V-L24
with electrical-optical dirt indicator
internal connection between E_1 and E_2 plugged
model code M

Control oil filter
Controls HD and EP in the size 500 and 750 with internal supply of control pressure out of one of the high pressure sides have always a 0,2 mm filter insert for coarse particles (regardless of the model code for filtration).

Ports

A, B	Pressure port		U	Bearing flushing port	(closed)
S	Inlet port		M_{E3}	Test point boost pressure	(closed)
M_A,M_B,M_{AB}	Test points pressure port	(closed)	K_4	Accumulator port	(closed)
M_S	Test point inlet pressure	(closed)	M_{K4}	Test point loop flushing pressure	(closed)
T	Oil drain	(closed)	M_1,M_2	Test point control pressure	(closed)
K_1	Flushing port		X_{A1}	Pilot port relief valve in A	(closed)
K_2, K_3	Flushing port	(closed)	X_{B1}	Pilot port relief valve in B	(closed)
R(L)	Oil fill + air bleed				

External supply of boost flow - without integrated boostpump (Version K..)

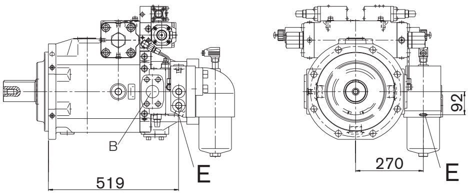
This variation is used without the integrated boost pump.

Port E* is used for the connection of the external boost.

In order to guarantee a reliable function it is necessary to maintain a boost flow with a cleanliness class as described on page 4

*** resp. E_2 for version K...N/D without filter**

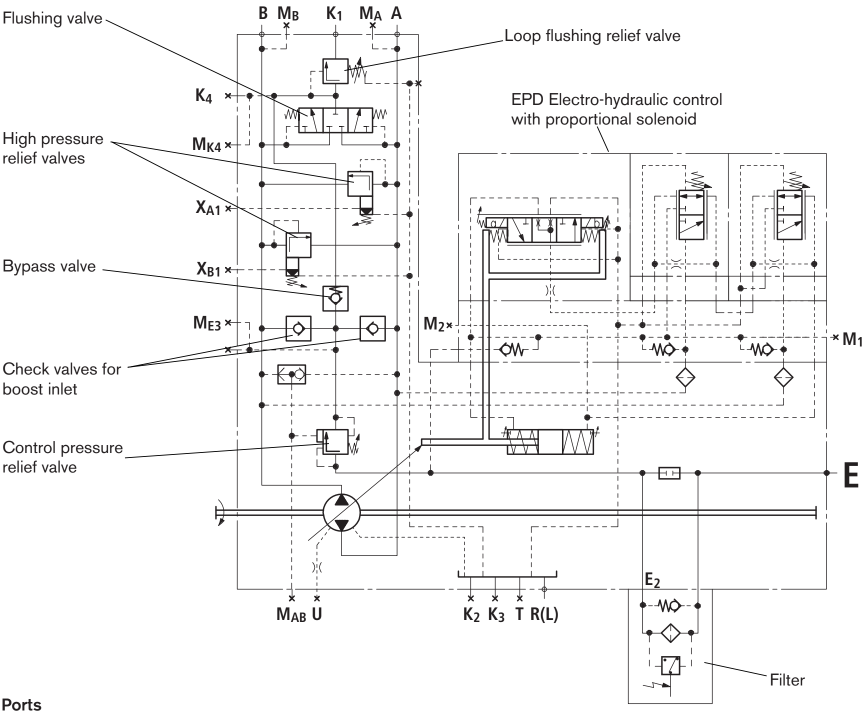
Size 500



Position of port E_2 see page 14

Circuit diagram

Example A4CSG $\frac{500}{750}$ EPD/30R-XXB35**K**174M



Ports

E resp. E_2	**Boost inlet** DIN 3852 M33x2; 18 deep 540 Nm max. tightening torque
E_2	Boost inlet for version without filter
A, B	Pressure port
M_A,M_B,M_{AB}	Test points pressure ports
T	Oil drain
K_1	Flushing port
K_2, K_3	Flushing port

R(L)	Oil fill + air bleed
U	Port for bearing flushing
K_4	Accumulator port
M_{E3}	Test point for boost pressure
M_{K4}	Test point loop flushing pressure
M_1,M_2	Test point control pressure
X_{A1}	Pilot port relief valve in A
X_{B1}	Pilot port relief valve in B

Installation and commissioning instructions

During commissioning and during operation the pump housing must be filled with oil. The commissioning must be carried out with low speeds, and without load, until the system is completely deairated

During prolonged periods of standstill the housing can loose its oil via the service lines. At renewed start up, the pump housing must be refilled.

The inlet pressure at the suction port S may not fall below 0,8 bar absolute

Mounting position:

Optional.

In order to achieve a low noise level, all hydraulic lines (suction, pressure, and drain lines)should be connected via flexible members to the reservoir

A check valve in the pump drain line should be avoided. If desirable, please contact us.

1. Vertical installation

With vertical installation and the shaft pointing upwards (fig. 1 and 2) bearing flushing is necessary, in order to provide lubrication for the front bearing and the shaft seal, see page 7.

1.1 Mounting below the reservoir - flooded suction

Prior to mounting fill pump housing (pump in horizontal position). Connect port T to reservoir , R/L closed.

Option for filling in installed condition with shaft pointing upwards: fill through port R and bleed via port T, afterwards close port R.

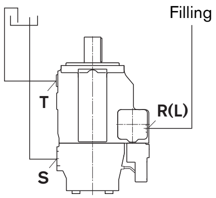


Fig. 1

1.2 Mounting above reservoir - tanktop mounted

Prior to mounting fill pump housing(pump in horizontal position. Connect port T to reservoir, R/L closed.
Option for filling in installed condition with shaft pointing upwards: fill through R/L and bleed viaT, afterwards close R(L) .

Important: Suction(inlet) pressure at port S may never fall below 0,8 bar absolute

Avoid mounting above reservoir if low noise levels are important.

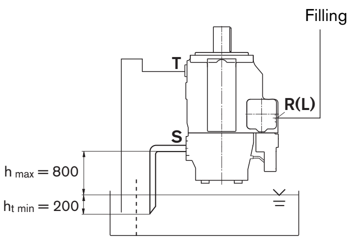


Fig. 2

2. Horizontal mounting

The highest of the ports T, K1, K2 , K3 resp.R/L must be used to fill/bleed the pump and afterwards be piped as case drain.

Prior to start up fill the pump housing.

2.1 Mounting below the reservoir - flooded suction

Case drain and inlet port S to be piped acc. to fig. 3 or4.

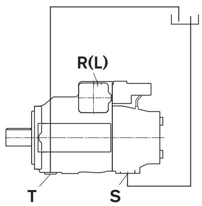


Fig. 3

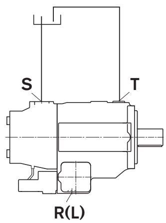


Fig. 4

2.2Mounting above reservoir - tanktop mounted

Case drain and inlet port S to be piped acc. to fig. 5 .

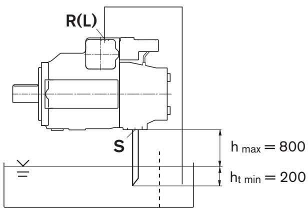


Fig. 5

Safety instructions

– The pump A4CSG was designed for operation in closed circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines .

– Tightening torques: please comply with the manufacturer’s information regarding the max. permissible tightening torques for the used fittings.
For fastening screws to DIN 13 we recommend to check the permissible tightening torques in each individual case acc. to VDI 2230 dated 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned!

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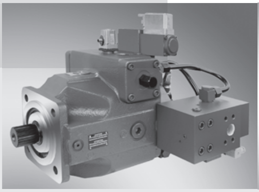
Rexroth
Bosch Group

Secondary control with A4VSO axial piston units

Type A4VSO...DS2

Size 40...1000
Component series 1X, 3X
Nominal pressure 315 bar
Peak pressure 400 bar



Secondary unit
type A4VSO125DS2R

Digital controller assembly
SYHNC100-SEK...3X
(not included in the scope of delivery)

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Features	1
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Anti-cavitation valve S...A	29
Digital controller assembly SYHNC100-SEK-...-3X	30

Features

- Highly dynamic rotor drive
- Motor and generator operation for both directions of rotation
- With energy recovery and energy storage
- With closed-loop speed, position or torque control with high control quality and dynamics
- Throttle-free coupling and energy transfer from any number of independently working axial piston units (motor or generator operation) to one joint supply line with constant operating pressure
- Compact digital control electronics

Ordering code

	A4VSO				/		W	–				25			
01	02	03	04	05		06	07		08	09	10	11	12	13	14

Hydraulic fluid

01	Mineral oil	

Axial piston unit

02	Swash plate design, adjustable, p_N = 315 bar, p_{max} = 400 bar	**A4VSO**

	Size	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**
03	Displacement $V_{g\ max}$ [cm^3]	40	71	125	180	250	355	500	750	1000

Control and adjustment device

04	Closed-loop speed control, secondary controlled, with attached high-response valve	**DS2R**
	Closed-loop speed control, secondary controlled, with attached servo valve [1)]	**DS2S**
	Closed-loop speed control, secondary controlled, without valve	**DS2E**

Load holding function

05	With load holding valve LS 1363 [1)]	**L**
	Without load holding valve	**0**

Component series

06	Size 40 and size 71	**1X**
	Size 125 to size 1000	**3X**

Direction of rotation

07	Changing	**W**

Seals

08	NBR (nitrile rubber according to ISO 1629) with shaft seal ring made of FKM	**P**
	FKM (fluorocarbon rubber according to ISO 1629)	**V**

Shaft end

09	Cylindrical with fitting key, DIN 6886	**P**
	Splined shaft profile, DIN 5480	**Z**

	Mounting flange	40	71	125	180	250	355	500	750	1000	
10	ISO 4-hole	●	●	●	●	●	●	–	–	–	**B**
	ISO 8-hole	–	–	–	–	–	–	●	●	●	**H**

Connection for working lines

11	Ports B and S: SAE, laterally displaced by 90°, metric mounting thread, the additional pressure port B1 vis-à-vis B is closed upon delivery by means of a flange plate.	**25**

● = Available

– = Not available

1) No standard, please contact us at the following email address: application-centre@boschrexroth.de

	A4VSO				/		W	–				25			
01	02	03	04	05		06	07		08	09	10	11	12	13	14

Through-drive

				40	71	125	180	250	355	500	750	1000	
12	Without boost pump, without through-drive			●	●	●	●	●	●	●	●	●	**N00**
	Through-drive K or U for attaching an axial piston unit			●	●	–	–	–	–	●	●	●	**K...**
				–	–	●	●	●	●	–	–	–	**U...**
	Flange	Splined shaft	For attaching										
	ISO 125, 4-hole	32x2x14x9g	A4VSO40	●	●	●	●	●	●	●	●	●	**...31**
	ISO 140, 4-hole	40x2x18x9g	A4VSO71	–	●	●	●	●	●	●	●	●	**...33**
	ISO 160, 4-hole	50x2x24x9g	A4VSO125	–	–	●	●	●	●	●	●	●	**...34**
	ISO 160, 4-hole	50x2x24x9g	A4VSO180	–	–	–	●	●	●	●	●	●	**...34**
	ISO 224, 4-hole	60x2x28x9g	A4VSO250	–	–	–	–	●	●	●	●	●	**...35**
	ISO 224, 4-hole	70x3x22x9g	A4VSO355	–	–	–	–	–	●	●	●	●	**...77**
	ISO 315, 8-hole	80x2x38x9g	A4VSO500	–	–	–	–	–	–	●	●	●	**...43**
	ISO 400, 8-hole	90x3x28x9g	A4VSO750	–	–	–	–	–	–	–	●	●	**...76**
	ISO 250, 8-hole	90x3x28x9g	A4VSO1000	–	–	–	–	–	–	–	–	●	**...88**
	With attached incremental encoder 1000 imp/r			●	●	●	●	●	●	●	●	●	**T03**
	With attached incremental encoder 2500 imp/r			●	●	●	●	●	●	●	●	●	**T04**
	Incremental encoder can be attached, through-drive closed with cover			●	●	●	●	●	●	●	●	●	**T10**
	Special speedometer attachment			●	●	●	●	●	●	●	●	●	**T99**
	Euro flange, through-drive closed			●	●	●	●	●	●	●	●	●	**T00**

Valves

13	Without valve block	**0**
	Electrically releasable check valve RVE attached	**1**
	Electrically releasable shut-off block for combination with load holding valve LS1363 (ordering code 05 = "L") [1)]	**2**

Filtration

14	Without filter	**N**
	With attached sandwich plate filter (Only in connection with ordering code 04 = "DS2S")	**Z**

● = Available

– = Not available

1) No standard, please contact us at the following email address: application-centre@boschrexroth.de

Related electronics (separate order)

See page 30

2

Function

The secondary control is an energy-saving drive concept with high dynamics for setting up closed-loop speed, position or torque controls with energy recovery.

The secondary controlled hydrostatic axial piston units work at one supply network with constant pressure.

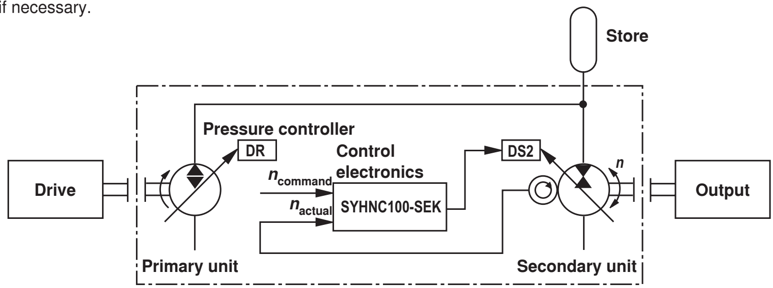
The power removal or return from or to the supply network is throttle-free and in line with the demand by adjusting the stroke volume of the axial piston units to the relevant load case.

To this end, any number of units working as motor or pump can be connected in parallel. Four-quadrant operation is possible whereas the units for speed or torque reversal are swiveled via "zero". This also reverts the direction of flow.

Between primary and secondary units, an energy store can be arranged, if necessary.

The store is used to cover flow peaks. It is moreover used to store the energy which is fed back by the secondary unit into the hydraulic network in case of pump operation if there are no more actuators. Together with the pressure-controlled primary unit and the operating state of the secondary unit, the charging state of the store and its preload pressure determine the constant high pressure of the system.

The specific properties of the secondary control such as the reduction of the number of devices needed in the primary area, the possibilities to recover energy and store braking energy and the almost load-independent speed and positioning accuracy open up a broad range of application.



Parts of the secondary unit

1 Axial piston unit A4VSO

1.1 4-way high-response valve (see data sheet 29026)

Size of the A4VS	**Type**
40, 71	4WRPH 6 C3 B24L-2X/G24K0/M-750
125 to 1000	4WRPH 10 C3 B50L-2X/G24K0/M-750

1.2 Swivel angle sensor AWXF (see page 28)

1.3 Incremental encoder GEL 293 (ordering code 12 = "T03" and/or "T04") (see page 27)

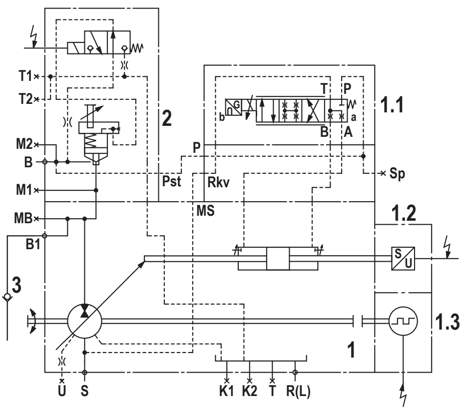
2 Electrically releasable check valve RVE (ordering code 13 = "1") (see page 29)

3 Anti-cavitation valve, separate order (see page 29)

Related electronics (for more information refer to page 30):

– Digital controller assembly SYHNC100-SEK-...-3X
– Amplifier VT-VRRA 1-527-20/V0 (for A4VS sizes 40 and 71)
  Amplifier VT-VRRA 1-537-20/V0 (for A4VS sizes 125 to 1000)
– Card holder VT3002-1-2X/32F

Hydraulic circuit diagram for standard configuration A4VSO....DS2R/..W–...25T0...1N



Technical data: Axial piston unit A4VSO (applies to mineral oil)

Pressures

Operating pressure range (pressure specification according to DIN 24312)

Pressure at port B	
Nominal pressure p_N [1]	315 bar
Peak pressure p_{max}	400 bar
Absolute pressure at port S (suction opening) $p_{abs\ min}$ At port S, feed-in is possible by means of a boost pump.	≥ 1 bar

Boost pressure range

Maximum boost pressure $p_{E\ max}$	30 bar
Recommended boost pressure p_E	16 bar
Boost pump inlet pressure Suction pressure $p_{S\ abs\ min}$ (v = 10 to 300 mm²/s)	≥ 0.7 bar

Pilot pressure range

Maximum admissible pilot pressure [1] p_{max}	315 bar
Minimum pilot pressure required p_{min}	Operating pressure and/or 150 bar (see diagram)

Leakage pressure

Max. leakage pressure (housing pressure) $p_{L\ abs\ max}$	4 bar

Installation position

Any. During commissioning and during operation, the housing must be filled with hydraulic fluid.

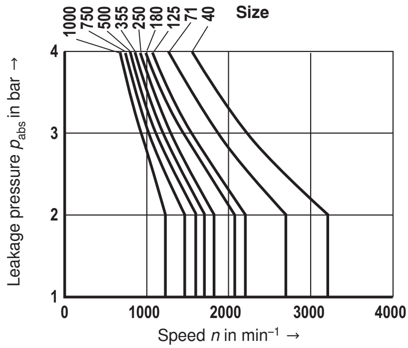
Notice:

The values in the table are guidelines. With special operating conditions, please contact us at the following email address: application-centre@boschrexroth.de.

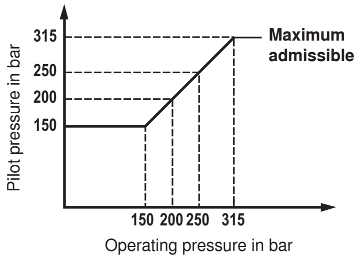
[1] Due to the admissible data of the high-response valve and other system components

Leakage pressure

The admissible leakage pressure (housing pressure) depends on the speed.



Required pilot pressure depending on the operating pressure



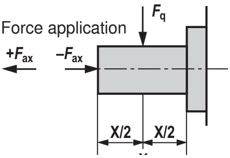
Technical data

Value table (theoretical values, without consideration of η_{mh} and η_v; values rounded)

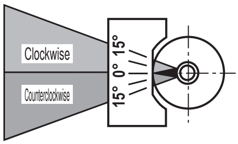
For a highly dynamic, exact drive system, a play-free minimum mass moment of inertia direct at the shaft of the secondary unit is required. The related information can be found in the line "Required minimum total moment of inertia". Higher moments of inertia improve the control behavior.

Size		Size	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**
Displacement	$V_{g\,max}$	cm^3	40	71	125	180	250	355	500	750	1000
Max. speed $V_g \le 1.0\ V_{g\,max}$, $p_E \ge 15$ bar	n_{max}	min^{-1}	3700	3200	2600	2400	2000	2000	1800	1600	1600
$V_g \le 0.8\ V_{g\,max}$, $p_E \ge 15$ bar	n_{max}	min^{-1}	4900	4100	3400	2900	2600	2200	2000	1800	1600
$V_g \le 0.8\ V_{g\,max}$, $p_E \ge 1$ bar	$n_{o\,max}$	min^{-1}	3200	2700	2200	2100	1800	1700	1600	1450	1000
$V_g \le 1.0\ V_{g\,max}$, $p_E \ge 1$ bar	$n_{o\,max}$	min^{-1}	2600	2200	1800	1800	1500	1500	1320	1200	1000
Torque with $V_{g\,max}$ and Δp = 300 bar	T	Nm	191	339	597	859	1194	1695	2387	3581	4775
Power with $V_{g\,max}$, n_{max} and Δp = 300 bar	P	kW	74	114	163	216	250	355	450	600	800
Adjustment volume (from 0 to $V_{g\,max}$)	$V_{S\,max}$	cm^3	5.9	10.5	26.0	26.0	50.9	50.9	63.8	105	129
Actuating time (from 0 to $V_{g\,max}$)	t_S	s	0.030	0.040	0.050	0.050	0.060	0.060	0.080	0.090	0.1
Moment of inertia		kgm^2	0.0049	0.0121	0.0300	0.055	0.0959	0.19	0.3325	0.66	1.20
Required minimum total moment of inertia		kgm^2	0.025	0.06	0.15	0.27	0.48	0.95	1.66	3.33	6
Weight approx. (with RVE and incremental encoder) A4VSO...DS2	m	kg	65	79	122	136	218	241	373	513	642
Adm. axial force with housing pressure p_{max} 1 bar abs.	$\pm F_{ax\,max}$	N	1000	1400	1900	2250	3000	3600	4000	5450	8000
Adm. axial force with housing pressure p_{max} 4 bar abs.	$+ F_{ax\,max}$	N	620	810	1050	1400	1850	2100	2500	3150	4700
	$- F_{ax\,max}$	N	1380	1950	2750	3050	4150	5050	5500	7800	11000
Admissible radial force	$F_{q\,max}$	N	1200	1700	2500	3100	4000	4400	5000	6000	10000

Force application



Flow direction



Swivel range [1]	Direction of rotation [2]		Pressure in	Operating mode
	Clockwise	Counterclockwise		
Clockwise Clockwise	B → S –	– S → B	BB	Motor Pump
Counterclockwise Counterclockwise	– S → B	B → S –	BB	Motor Pump

[1] Cf. swivel angle display

[2] Looking at the shaft

Technical parameters

Motor operation	Pump operation
Displacement	**Flow**
$q_V = \dfrac{V_g \cdot n}{1000 \cdot \eta_v}$ [l/min]	$q_V = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$ [l/min]
Output torque (load torque)	**Drive torque**
$T = \dfrac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$ [Nm]	$T = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]
Output power	**Drive power**
$P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{T \cdot n}{9549} = \dfrac{q_V \cdot \Delta p \cdot \eta_t}{600}$ [kW]	$P = \dfrac{2\pi \cdot T \cdot n}{60000} = \dfrac{T \cdot n}{9549} = \dfrac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Geometric displacement in cm^3 per rotation

Δp = Pressure differential in bar

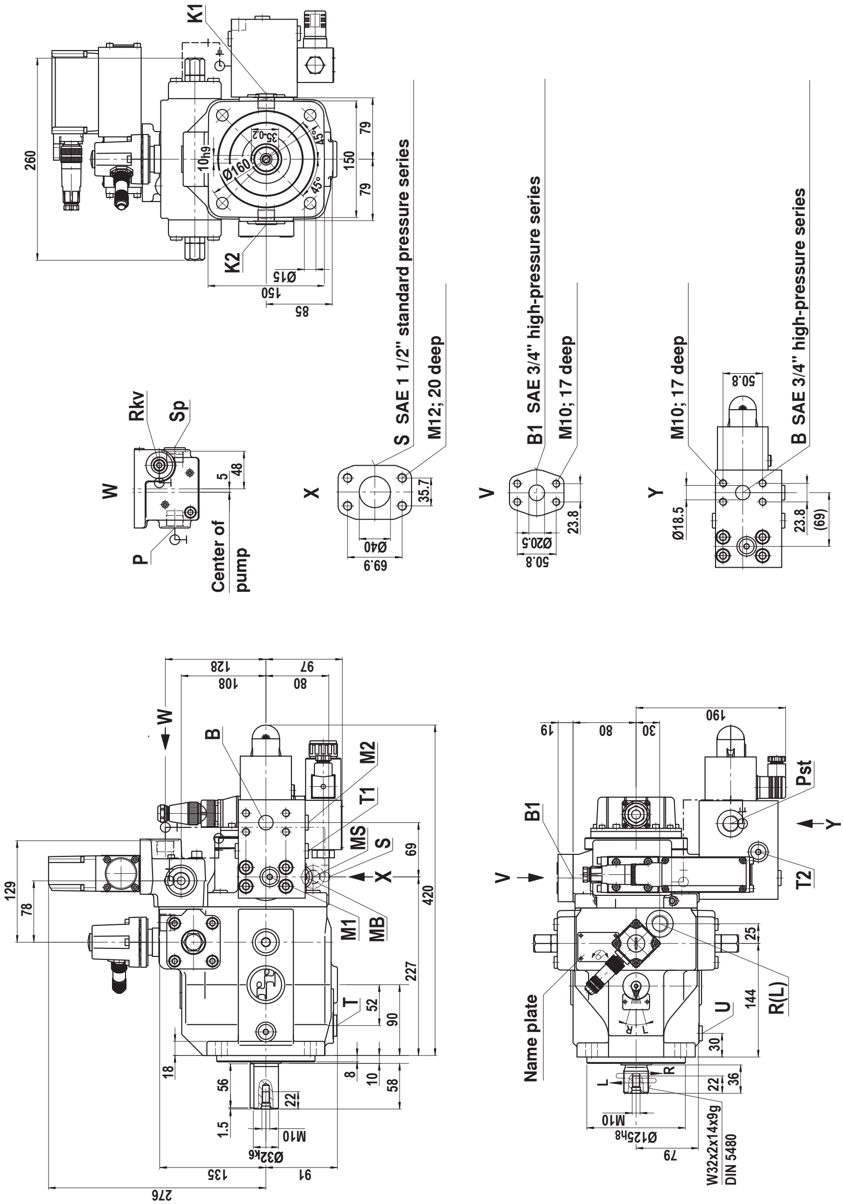
n = Speed in min^{-1}

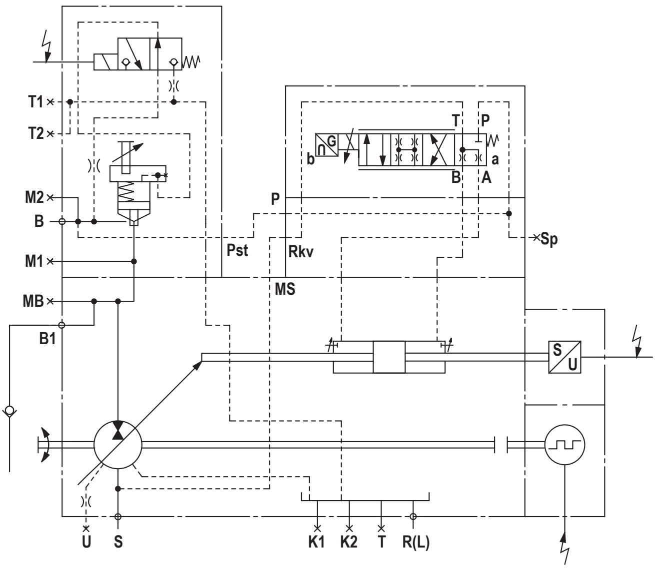
η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Device dimensions / circuit diagram: A4VSO40DS2R0/1XW–..B25T031N (in mm)

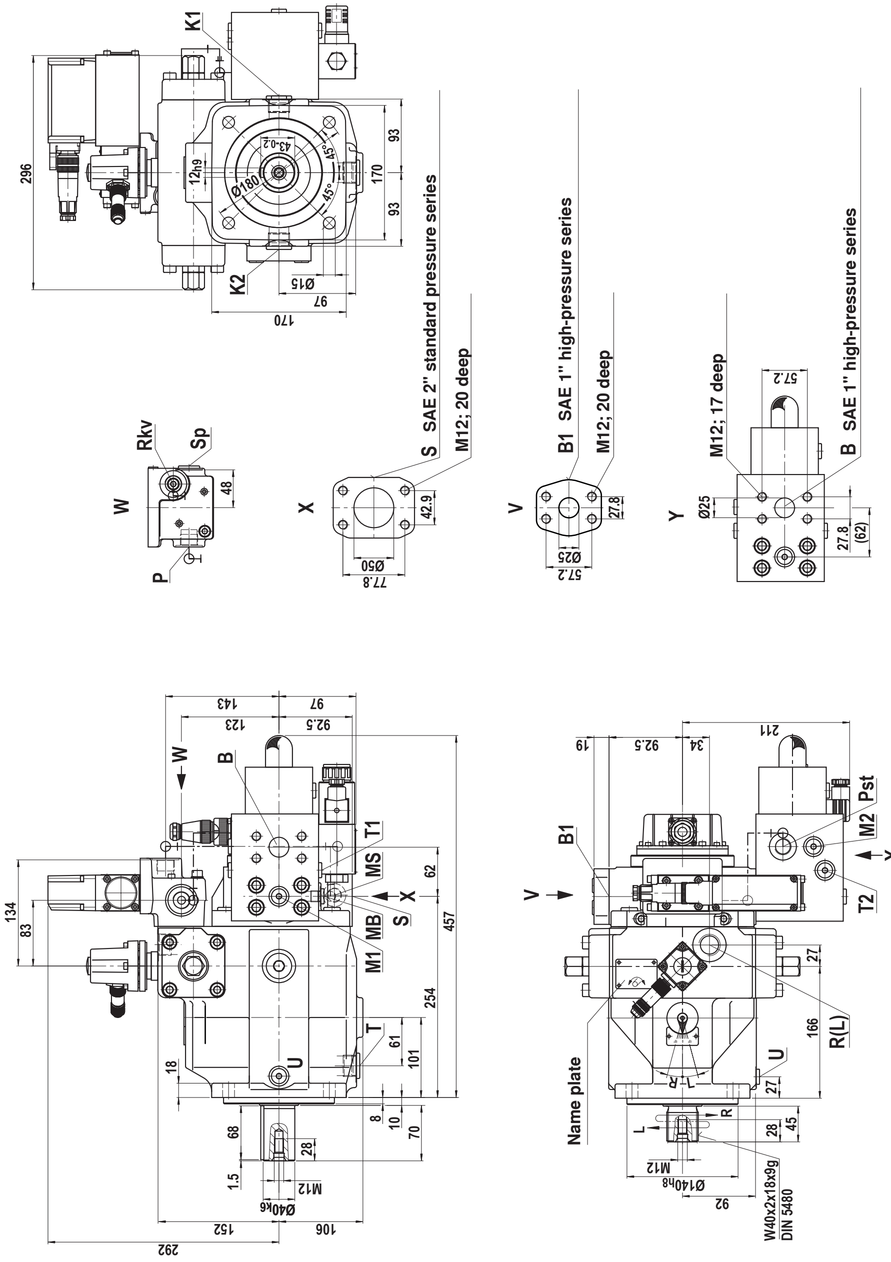


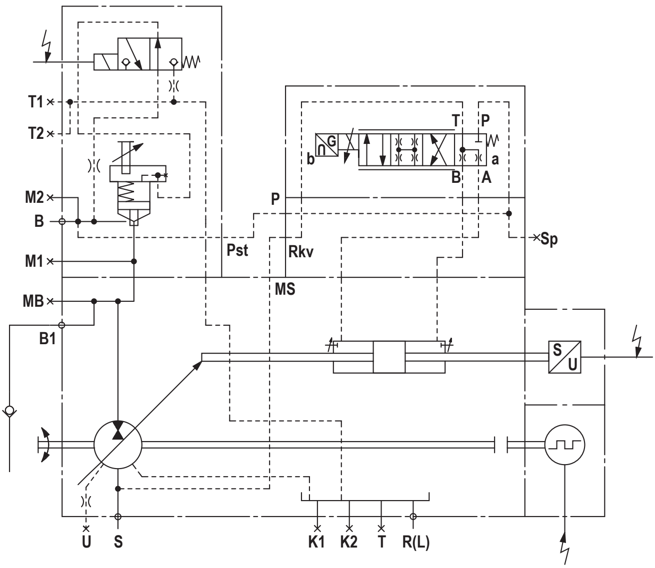


Designation of the ports

B	Pressure port	SAE 3/4"
B1	Additional pressure port	SAE 3/4"
S	Suction port	SAE 1 1/2"
K1, K2	Flushing port	M22x1.5
MB	Measuring port operating pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M22x1.5
T	Fluid drain	M22x1.5
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M14x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS	Pilot fluid return (piped)	M18x1.5
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO71DS2R0/1XW–..B25T031N (in mm)

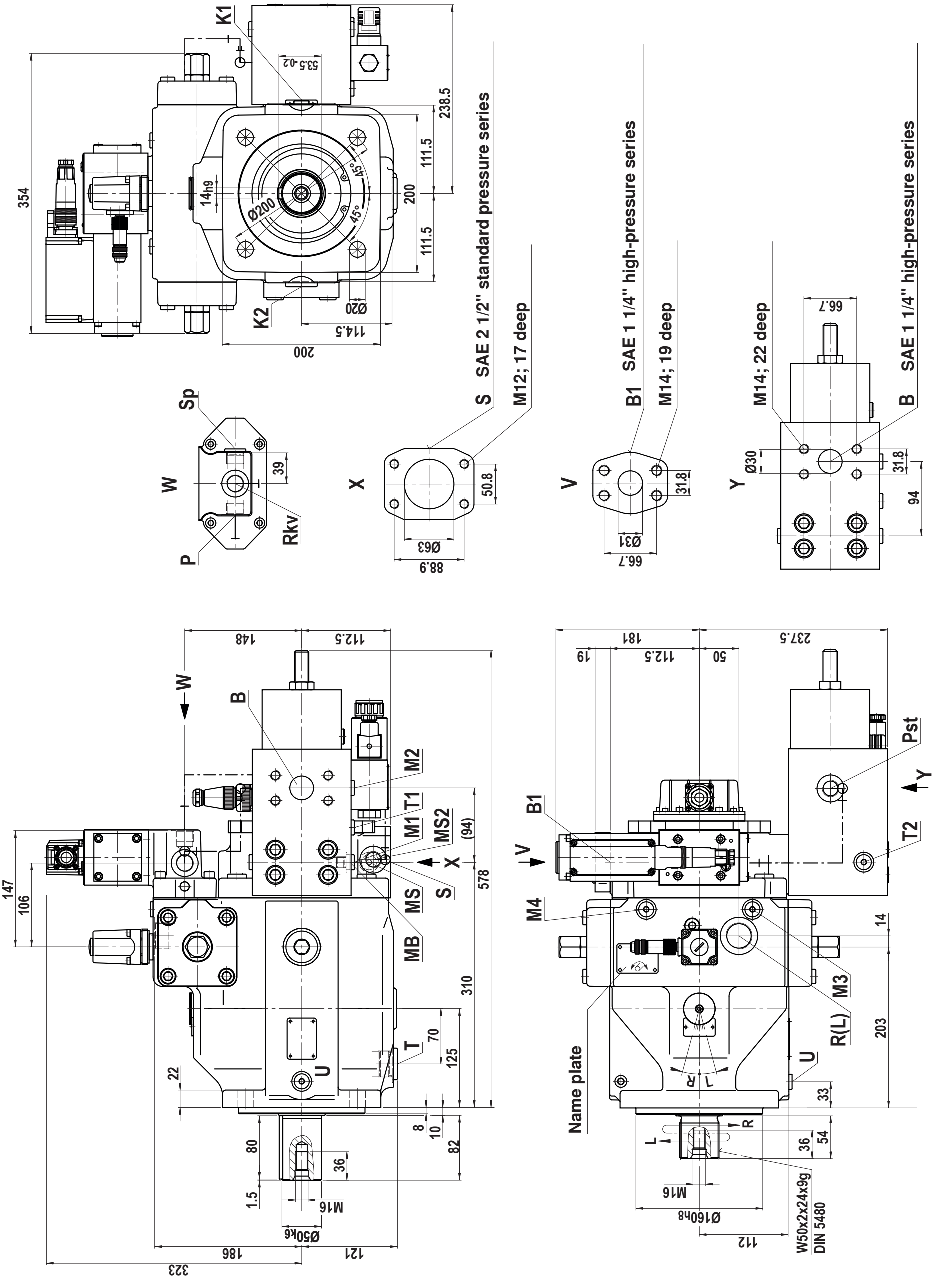


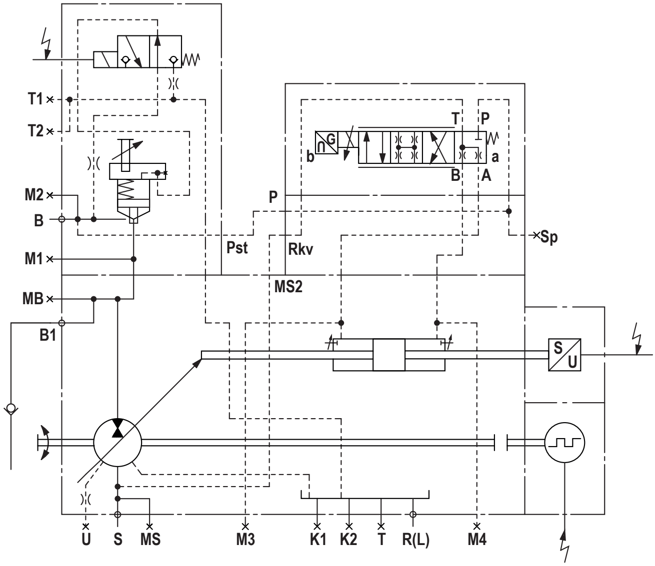


Designation of the ports

B	Pressure port	SAE 1"
B1	Additional pressure port	SAE 1"
S	Suction port	SAE 2"
K1, K2	Flushing port	M27x2
MB	Measuring port operating pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M27x2
T	Fluid drain	M27x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M14x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS	Pilot fluid return (piped)	M18x1.5
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO125DS2R/3XW–..B25T031N (in mm)

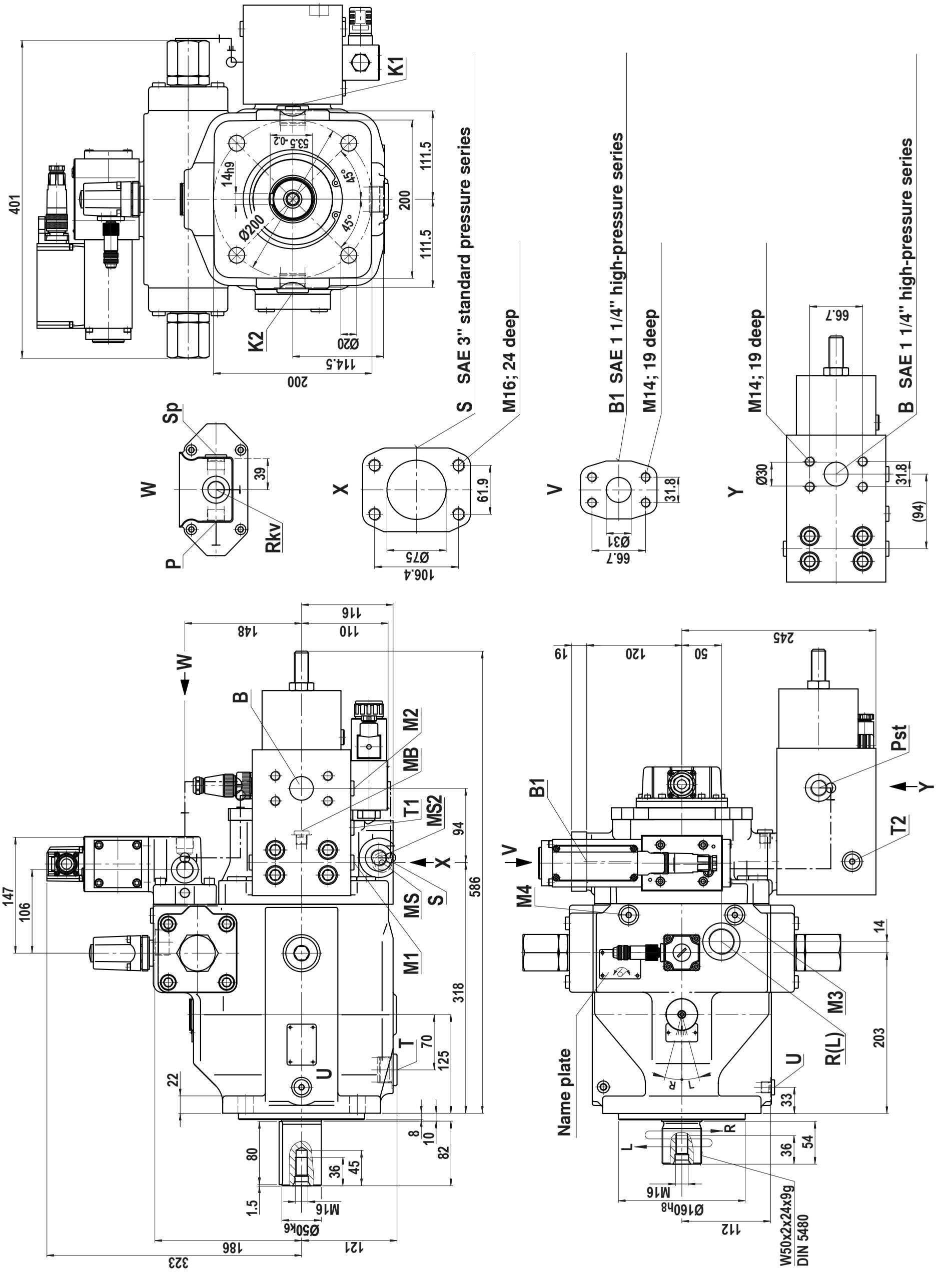


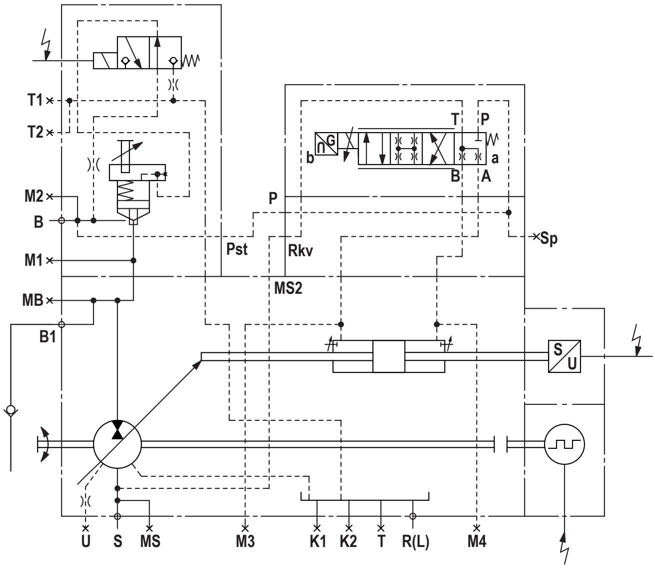


Designation of the ports

B	Pressure port	SAE 1 1/4"
B1	Additional pressure port	SAE 1 1/4"
S	Suction port	SAE 2 1/2"
K1, K2	Flushing port	M33x2
MB	Measuring port operating pressure	M14x1.5
MS	Measuring port suction pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
M3, M4	Measuring port actuating pressure	M14x1.5
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M33x2
T	Fluid drain	M33x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M14x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS2	Pilot fluid return (piped)	G 1/2
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO180DS2R/3XW–..B25T031N (in mm)

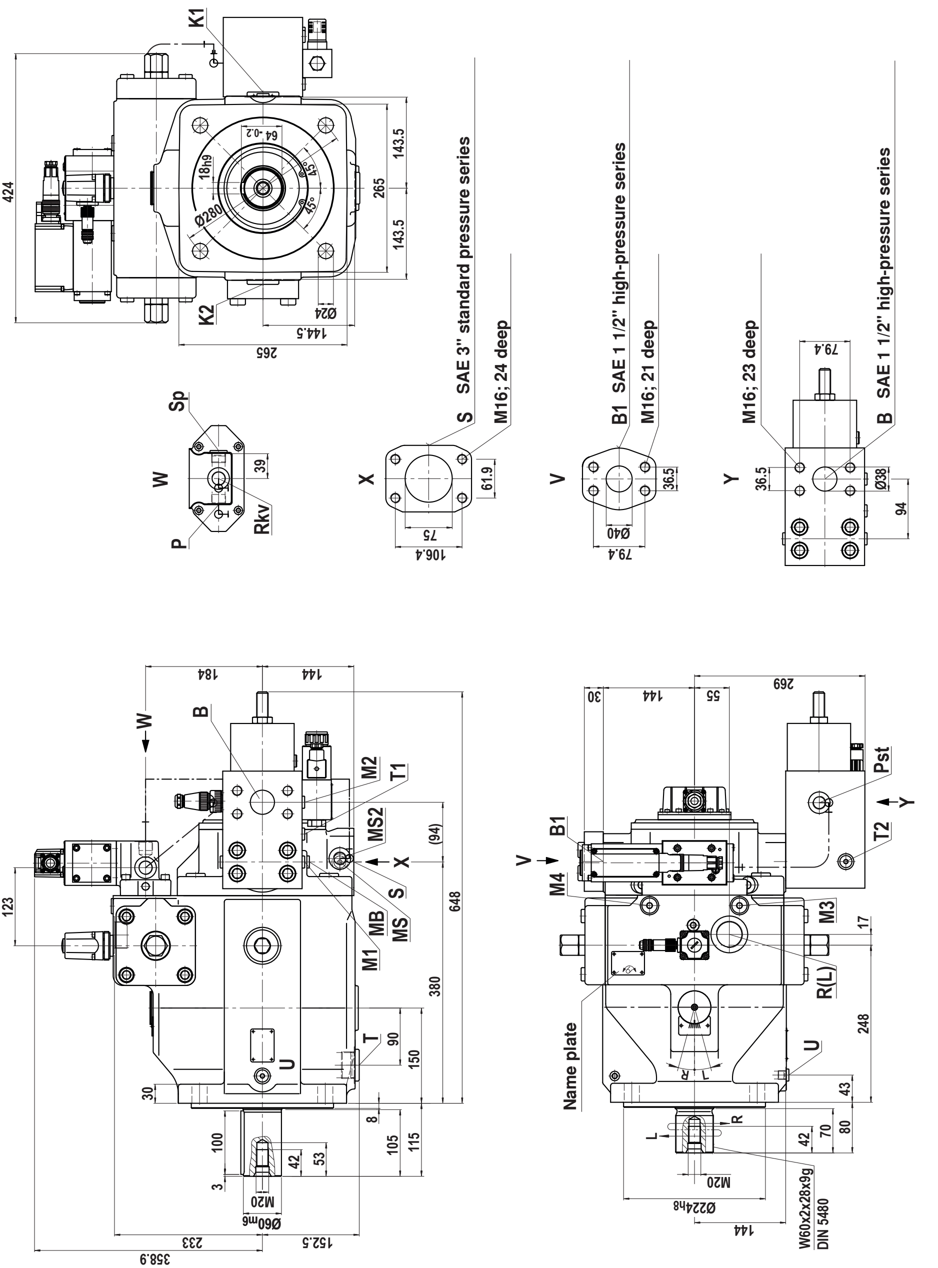


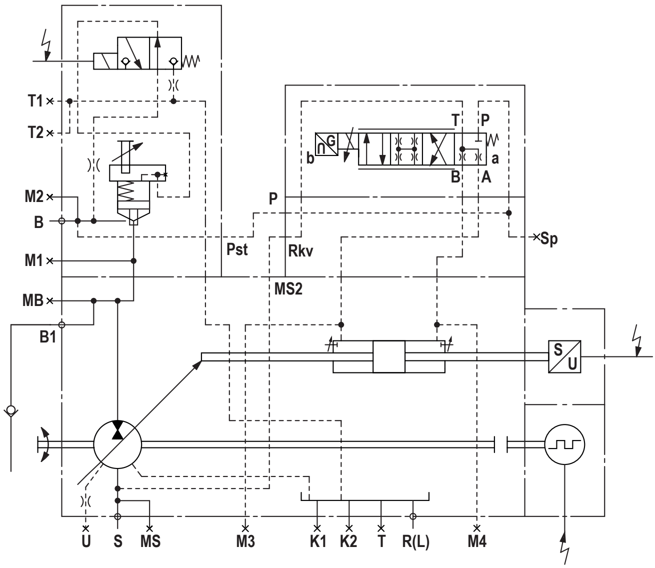


Designation of the ports

B	Pressure port	SAE 1 1/4"
B1	Additional pressure port	SAE 1 1/4"
S	Suction port	SAE 3"
K1, K2	Flushing port	M33x2
MB	Measuring port operating pressure	M14x1.5
MS	Measuring port suction pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
M3, M4	Measuring port actuating pressure	M14x1.5
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M33x2
T	Fluid drain	M33x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M14x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS2	Pilot fluid return (piped)	G 1/2
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO250DS2R/3XW–..B25T031N (in mm)

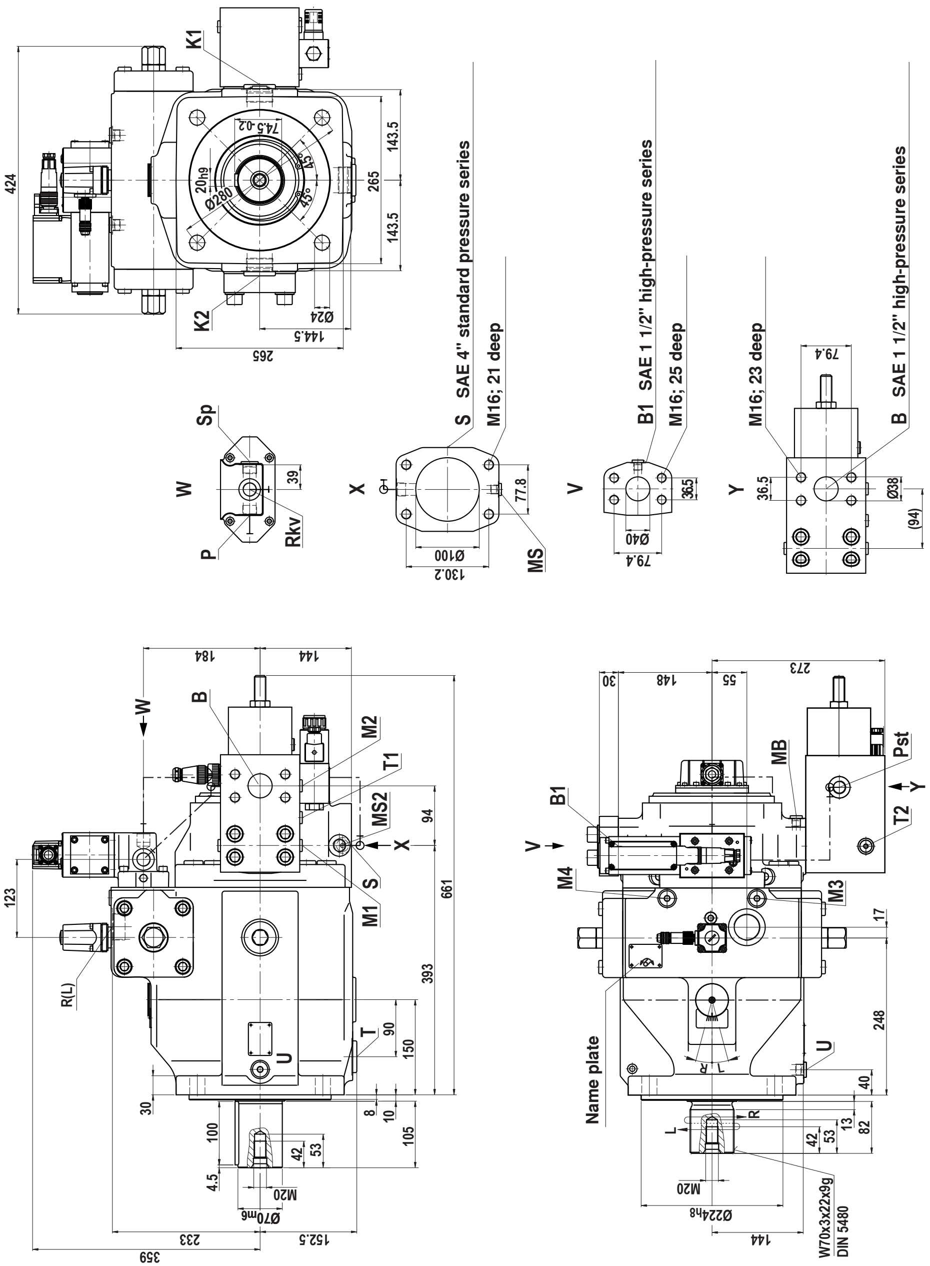


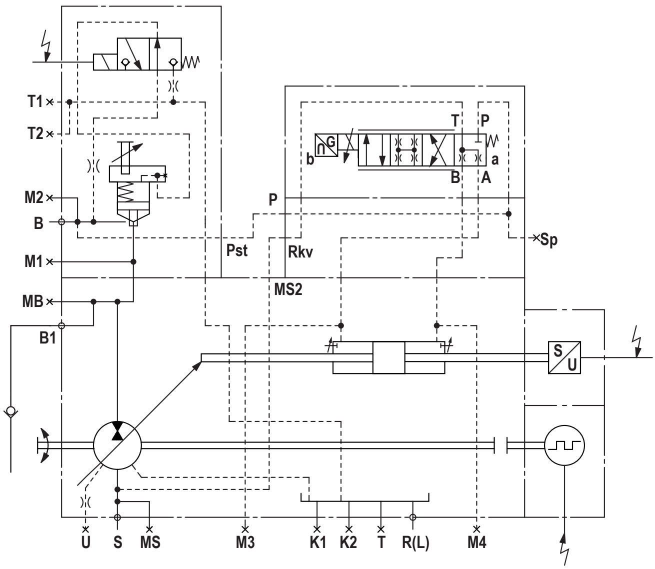


Designation of the ports

B	Pressure port	SAE 1 1/2"
B1	Additional pressure port	SAE 1 1/2"
S	Suction port	SAE 3"
K1, K2	Flushing port	M42x2
MB	Measuring port operating pressure	M14x1.5
MS	Measuring port suction pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
M3, M4	Measuring port actuating pressure	M18x1.5
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M42x2
T	Fluid drain	M42x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M14x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS2	Pilot fluid return (piped)	G 1/2
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO355DS2/3XW–..B13T031Z (in mm)

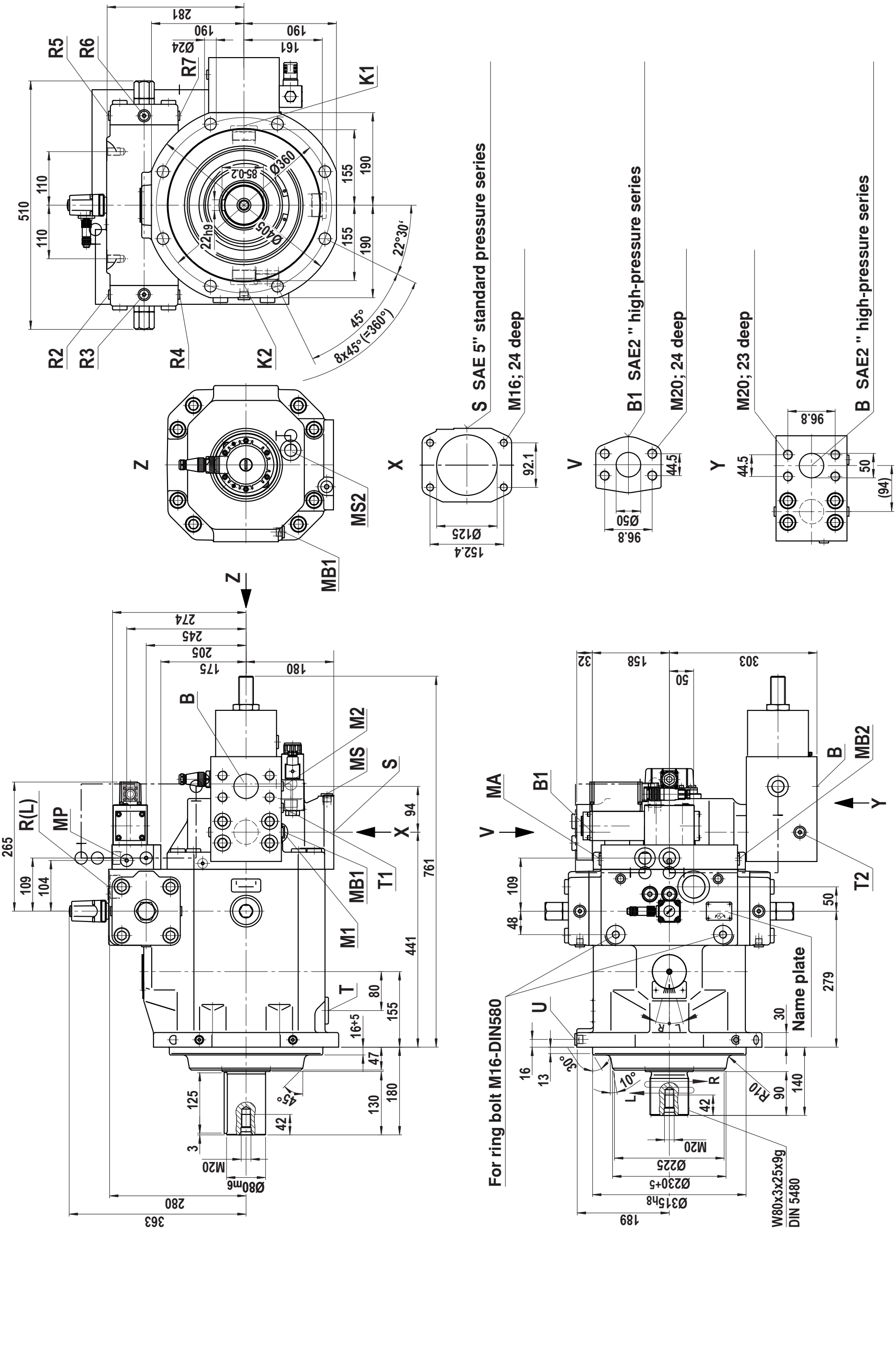


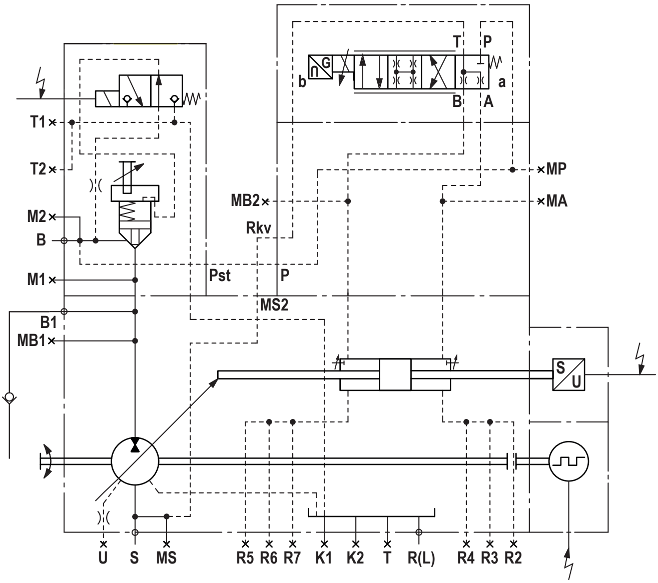


Designation of the ports

B	Pressure port	SAE 1 1/2"
B1	Additional pressure port	SAE 1 1/2"
S	Suction port	SAE 4"
K1, K2	Flushing port	M42x2
MB	Measuring port operating pressure	M14x1.5
MS	Measuring port suction pressure	M14x1.5
M1, M2	Measuring port operating pressure	G 1/4
M3, M4	Measuring port actuating pressure	M18x1.5
Sp	External control pressure port	M22x1.5
R(L)	Fluid filling and bleeding	M42x2
T	Fluid drain	M42x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M18x1.5
RKV	Pilot fluid return (piped)	M22x1.5
MS2	Pilot fluid return (piped)	G 1/2
P	Control pressure port (piped)	M22x1.5
Pst	Control pressure port (piped)	G 1/2

Device dimensions / circuit diagram: A4VSO500DS2R/3XW–..H25T031N (in mm)



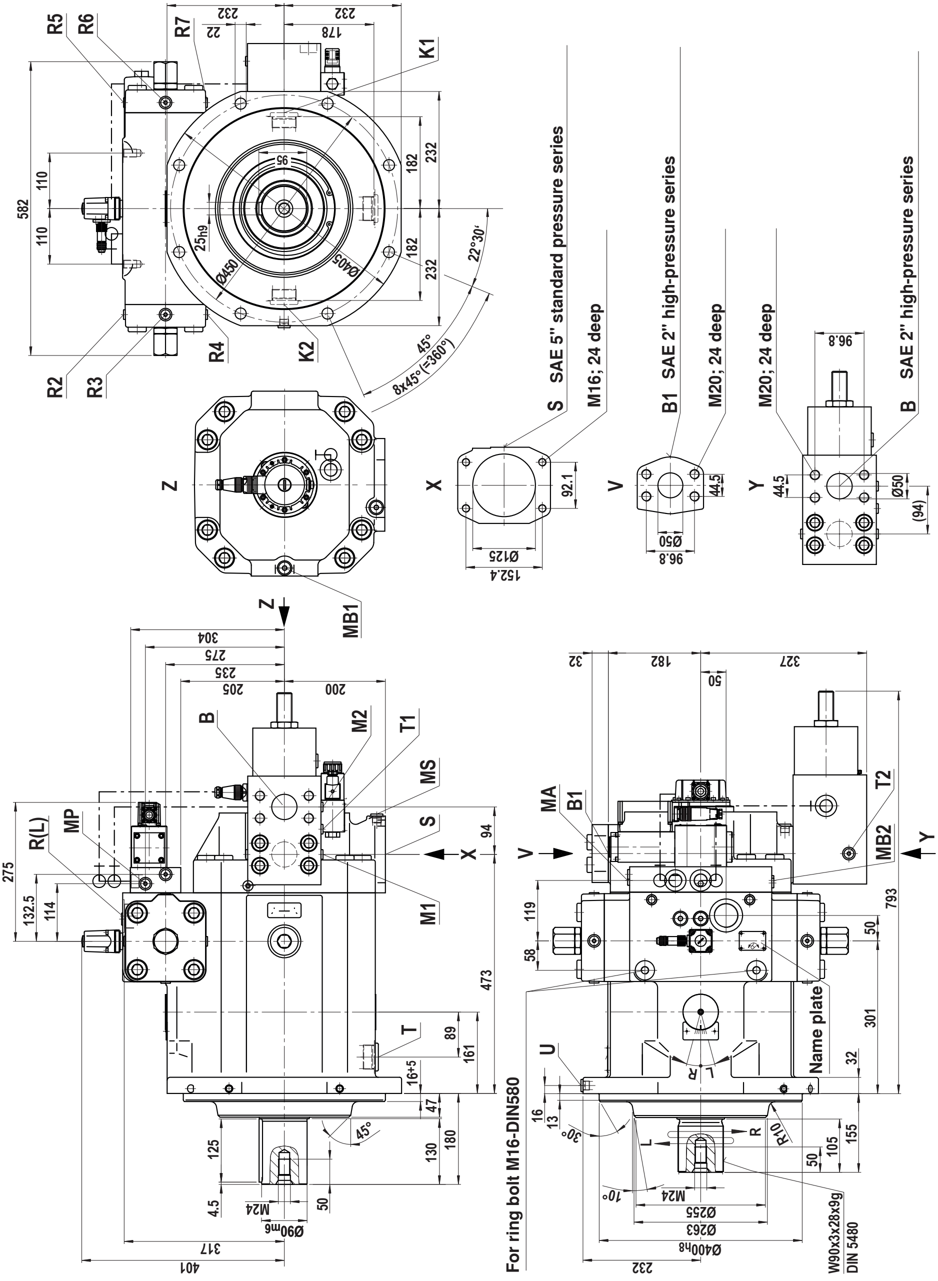


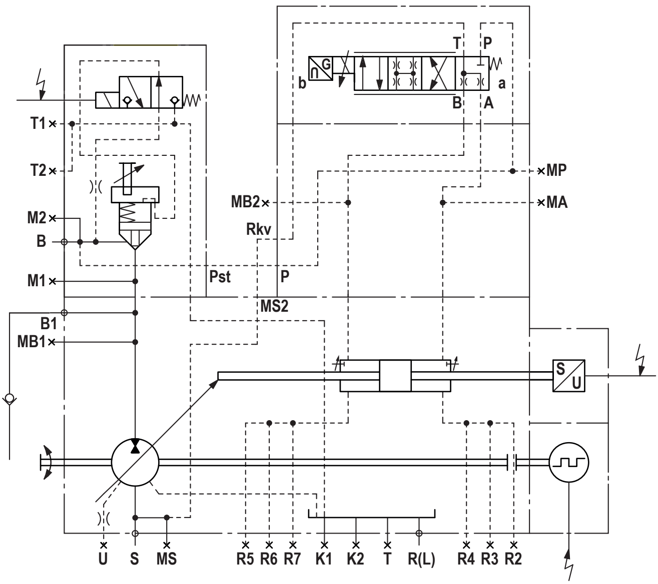
2

Designation of the ports

B	Pressure port	SAE 2"
B1	Additional pressure port	SAE 2"
S	Suction port	SAE 5"
K1, K2	Flushing port	M48x2
MB1	Measuring port operating pressure	M18x1.5
MA, MB2	Measuring port actuating pressure	M14x1.5
MS	Measuring port suction pressure	M18x1.5
M1, M2	Measuring port operating pressure	G 1/4
MP	External control pressure port	M14x1.5
R(L)	Fluid filling and bleeding	M48x2
R2-R7	Bleeding adjustment	M4x1.5
T	Fluid drain	M48x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M18x1.5
RKV	Pilot fluid return (piped)	M27x2
MS2	Pilot fluid return (piped)	M27x2
P	Control pressure port (piped)	M27x2
Pst	Control pressure port (piped)	G 3/4

Device dimensions / circuit diagram: A4VSO750DS2/3XW–..H13T031Z (in mm)



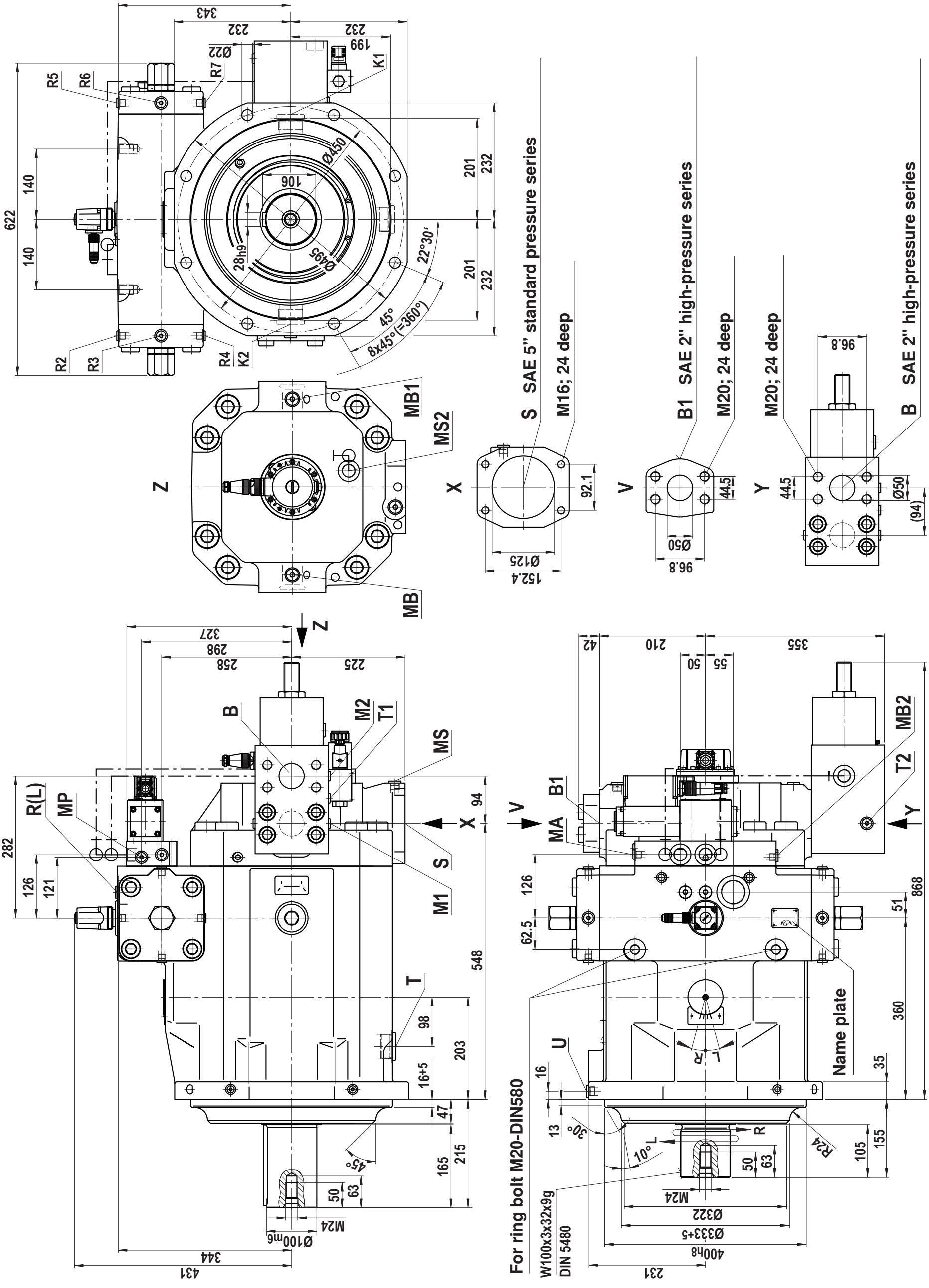


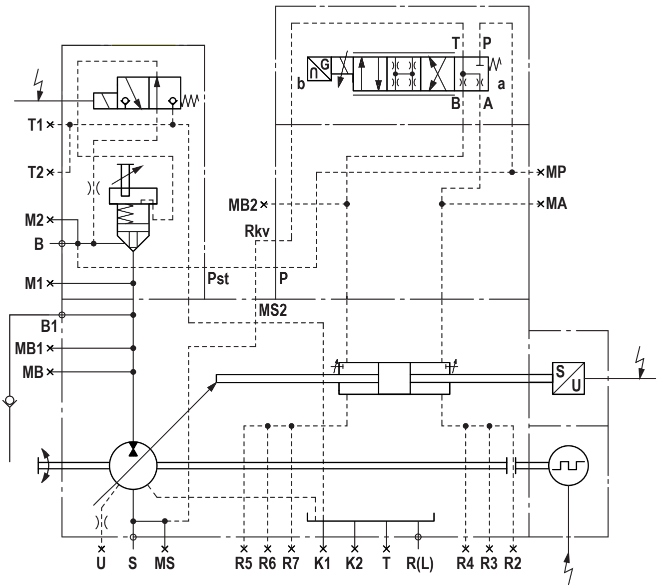
2

Designation of the ports

B	Pressure port	SAE 2"
B1	Additional pressure port	SAE 2"
S	Suction port	SAE 5"
K1, K2	Flushing port	M48x2
MB1	Measuring port operating pressure	M18x1.5
MA, MB2	Measuring port actuating pressure	M14x1.5
MS	Measuring port suction pressure	M18x1.5
M1, M2	Measuring port operating pressure	G 1/4
MP	External control pressure port	M14x1.5
R(L)	Fluid filling and bleeding	M48x2
R2-R7	Bleeding adjustment	M4x1.5
T	Fluid drain	M48x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M18x1.5
RKV	Pilot fluid return (piped)	M27x2
MS2	Pilot fluid return (piped)	M27x2
P	Control pressure port (piped)	M27x2
Pst	Control pressure port (piped)	G 3/4

Device dimensions / circuit diagram: A4VSO1000DS2R/3XW–..H25T031N (in mm)





Designation of the ports

B	Pressure port	SAE 2"
B1	Additional pressure port	SAE 2"
S	Suction port	SAE 5"
K1, K2	Flushing port	M48x2
MB, MB1	Measuring port operating pressure	M18x1.5
MA, MB2	Measuring port actuating pressure	M14x1.5
MS	Measuring port suction pressure	M18x1.5
M1, M2	Measuring port operating pressure	G 1/4
MP	External control pressure port	M14x1.5
R(L)	Fluid filling and bleeding	M48x2
R2-R7	Bleeding adjustment	M4x1.5
T	Fluid drain	M48x2
T1, T2	Leaking fluid/bleeding	G 1/4
U	Flushing port (bearing flushing)	M18x1.5
RKV	Pilot fluid return (piped)	M27x2
MS2	Pilot fluid return (piped)	M27x2
P	Control pressure port (piped)	M27x2
Pst	Control pressure port (piped)	G 3/4

2

Closed-loop speed control DS2R

With closed-loop speed control, the swivel angle and thus the stroke volume of the axial piston unit are changed with constant operating pressure using the DS2 adjustment device until the torque required to maintain the specified speed has been built up.

In a supply network with constant operating pressure, the torque is proportional to the swivel angle and/or to the stroke volume of the axial piston unit. The stroke volume is recorded by an inductive position transducer, the speed by an incremental rotary encoder.

The stroke volume is adjusted by means of a high-response valve. With higher requirements on the dynamics of the drive system, the high-response valve can be replaced by a servo valve.

In case of emergency shut-off, the electrically releasable check valve RVE (hydraulic connector) at the pressure port is brought into blocked position. This interrupts the energy supply to the secondary unit; only generator-based braking with energy recovery to the hydraulic network is then possible.

So that in case of an emergency stop signal, the coastdown or rundown of the axial piston unit does not cause cavitation damage, anti-cavitation valves are to be provided which have to be freely piped at port B1. These check valves without spring are to be installed vertically and have to be ordered separately.

The following pages describe the following:

- Incremental encoder GEL 293 to record the speed
- Inductive position transducer AWXF to record the swivel angle
- Electrically releasable check valve RVE A4VS
- Anti-cavitation valve S...A
- Digital controller assembly SYHNC100-SEK

Incremental encoder GEL 293

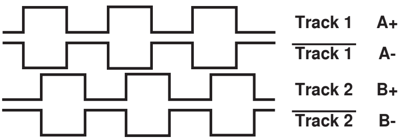
Ordering code 12 = "T03" or "T04"

Technical data

Resolution	Ordering code 12 = "T03"		1000 increments/rotation
	Ordering code 12 = "T04"		2500 increments/rotation
Protection class according to EN 60529			IP 66 with mating connector mounted and locked
Power consumption: $R_L = \infty$; $U_B = 5$ V		W	≤ 1.0
Ambient temperature range		°C	–20 to +80

Signal pattern T

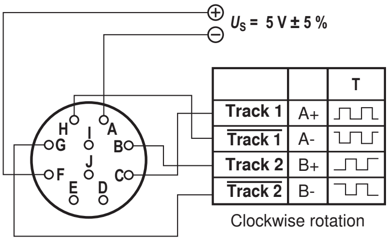
Supply voltage U_S = 5 V ± 5 %; signal voltage U_{Si} = 5 V



Signal pattern rotating clockwise when looking at the shaft

2

Electrical connection



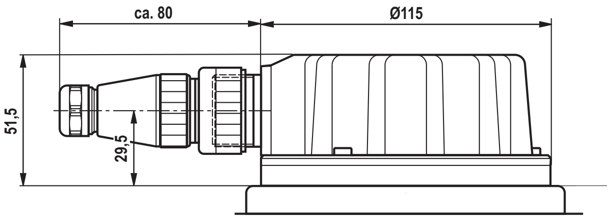
Maximum cable lengths

Between incremental encoder and downstream electronics:
Ground the cable shield on one side at the receiver. The specified data are guidelines and refer to the cable type LiYCY 6 (10) x 0.25 mm^2.

f [kHz]	5	10	20	50	100	200
l_{max} [m]	200	200	200	200	145	72

Device dimensions (in mm)

The mating connector is included in the scope of delivery.



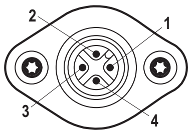
Use of other speed recording systems is not possible. In this case, please contact us at the following email address: application-centre@boschrexroth.de

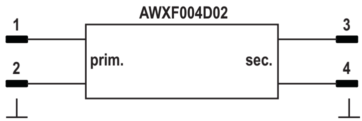
Swivel angle sensor AWXF

Technical data

Measurement system			Differential transformer
Control stroke			±4.5 mm
Linearity tolerance		%	≤ 1.0
Carrier frequency		kHz	5
Coil resistance (at 20 °C)	Primary coil	Ω	120
	Per secondary coil	Ω	280
Electrical connection			Plug-in connection M12 x 1, 4-pin
Protection class of the plug-in connection according to EN 60529			IP 67 with mating connector mounted and locked
Ambient temperature range		°C	–20 to +80

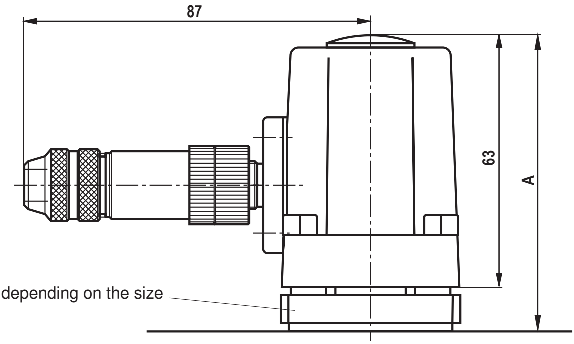
Electrical connection





Device dimensions (in mm)

The mating connector is included in the scope of delivery.



Adapter ring, depending on the size

	Size 40	Size 71	Size 125	Size 180	Size 250	Size 355	Size 500	Size 750	Size 1000
A	86	90	86	86	81	81	81	81	81

Electrically releasable check valve RVE A4VS

Ordering code 13 = "1"

Technical data

electrical (confer directional seat valve M–3SED6, data sheet 22049)

Direct voltage	V	24
Power consumption	W	30
Duty cycle		Continuous operation
Protection class according to EN 60529		IP 67 with mating connector mounted and locked

hydraulic (confer cartridge valves type LC.., data sheet 21010)

Size	Logic element	Installed in the housing	Max. flow q_{Vmax} in l/min with a pressure drop of 5 bar
40	LC16B40D-7X/	AGEV4-05701-AB/46	200
71	LC25B40D-7X/	AGEV4-05702-AB/46	400
125	LC32B40D-7X/	AGEV4-05703-AB/46	700
180	LC32B40D-7X/	AGEV4-05703-AB/46	700
250	LC32B40D-7X/	AGEV4-05704-AB/46	700
355	LC32B40D-7X/	AGEV4-05704-AB/46	700
500	LC40B40D-7X/	AGEV4-05705-AB/46	1200
750	LC40B40D-7X/	AGEV4-05705-AB/46	1200
1000	LC40B40D-7X/	AGEV4-05705-AB/46	1200

Anti-cavitation valve S...A

Separate order (selection according to the following table)

Ordering code

	Anti-cavitation valve	
For A4VSO, size	without feed-in	with feed-in
40	S10A0.0	S10A1.0
71	S15A0.0	S15A1.0
125	S20A0.0	S20A1.0
180	S20A0.0	S20A1.0
250	S25A0.0	S25A1.0
355	S25A0.0	S25A1.0
500	S30A0.0	S30A1.0
750	S30A0.0	S30A1.0
1000	S30A0.0	S30A1.0

Notice: These anti-cavitation valves are piped at port B1.
For details on the anti-cavitation valves refer to data sheet 20375.

2

Digital controller assembly SYHNC100-SEK-...-3X

Separate order (selection according to data sheet 30162)

Features

The SYHNC100-SEK-...-3X digital controller assembly is suitable for the closed-loop speed control, the closed-loop torque control as well as the open-loop torque control of secondary controlled axial piston units type A4VS..DS2(E).

It comprises interfaces for recording the swivel angle position of individual or tandem units as well as for the speed feedback with incremental encoders. The software contains closed-loop control, open-loop control and monitoring functions especially designed for the secondary control.

Other features:

- Up to 2 modules for the analysis of the signals of up to 4 LVDT swivel angle sensors
- Up to 2 incremental encoder inputs with monitoring function for the speed recording
- Up to 8 analog inputs (voltage or current) for command value specification
- Up to 6 analog outputs to control downstream valve amplifiers
- Digital inputs and outputs for communication with a superior control system
- Profibus DP or CANopen for the communication with a superior control system
- Set-up of master/slave applications via internal CAN interface
- Assembly on top hat rail 35 mm

Software functionality

Basically, the software contains the closed-loop control types closed-loop speed control, closed-loop torque control and open-loop torque control. It is possible to switch between the closed-loop control types during operation in a shock-free form.

Configuration, parameterization and diagnosis of the SYHNC100-SEK-...-3X by means of the WIN-PED PC program. Only the "WIN-PED 6.6" version is used. It can be downloaded free of charge on the Internet at www.boschrexroth.com/hnc100.

System-specific software extensions can be prepared upon request.

Monitoring functions

- Cable break monitoring for incremental and SSI encoder
- Cable break monitoring for swivel angle sensors
- Acceleration too high
- Overspeed (max. speed)
- Speed difference command / actual
- Swivel angle difference command / actual

More information

Data sheet 30162 "Digital controller assembly HNC100-SEK for the secondary control of axial piston units, type SYHNC100-SEK

Information on the system set-up

For the secondary unit with ordering code 04 = "DS2R" (with high-response valve), the following is required in addition and not included in the scope of delivery:

- Digital controller assembly SYHNC100-SEK-...-3X according to data sheet 30162
- Amplifier VT-VRRA 1-527-20/V0 according to data sheet 30041(for A4VS sizes 40 and 71)
  or
  Amplifier VT-VRRA 1-537-20/V0 according to data sheet 30041(for A4VS sizes 125 to 1000)
- Card holder VT3002-1-2X/32F,
  Material number 1834486001, according to data sheet 29928

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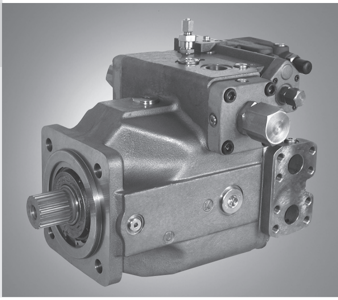
Rexroth
Bosch Group

Hydraulic control, pilot pressure dependent HD

RE 92 080/01.06 **1**/52
Replaces: 08.93

Technical data sheet



for the variable pumps
A4VSO and A4VSG series 1 and 3
A4CSG series 3
open and closed circuits

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Features

- Displacement control for the variable pumps A4VSO, A4VSG and A4CSG
- Control is pilot pressure dependent
- Different pilot pressure ranges available
- Optional pressure control
- Optional hydraulic power control
- Optional electrical control of pilot pressure
- Mechanical limitation of $V_{g\,min}$ and $V_{g\,max}$
- Standard spring centering of control cylinder
- Loss of pilot pressure signal causes swivel back to center
- Mooring operation: enables swiveling over center and de-compression via the pump

Further information:

Variable pump A4VSO	Size 40...1000	RE 92050
Variable pump A4VSG	Size 40...1000	RE 92100
Variable pump A4CSG	Size 250...750	RE 92105

Ordering code / Standard program

	A4 . . .		HD .			/			–							
01	02	03	04	05	06		07	08		09	10	11	12	13	14	15

01	**Hydraulic fluid** (for detailed information see RE 92050, RE 92100 or RE 92105)

Axial piston unit / type of operation

02	Swash plate design, variable / pump, open circuit (see RE 92050)	**A4VSO**
	Swash plate design, variable / pump, closed circuit (see RE 92100)	**A4VSG**
	Compact unit swash plate design, variable / pump, closed circuit (see RE 92105)	**A4CSG**

	Size	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**
03	Displacement $V_{g\,max}$ [cm³]	40	71	125	180	250	355	500	750	1000

Control and regulating devices

		40	71	125	180	250	355	500	750	1000	
04	**Hydraulic control, pilot pressure dependent**										**HD**
	Pilot pressure characteristic										
	10...45 bar	●	●	●	●	●	●	●	●	●	**1**
	10...28 bar	●	●	●	●	●	●	●	●	●	**2**
	5,5...19 bar	●	●	●	●	●	●	●	●	●	**3**
05	**Pressure control**										
	without pressure control (no code)										
	with pressure control in A	●	●	●	●	●	●	●	●	●	**A**[1) 2)]
	with remote pressure control in A	●	●	●	●	●	●	●	●	●	**GA**[1) 2)]
	with pressure control in B	●	●	●	●	●	●	●	●	●	**B**[2)]
	with remote pressure control in B	●	●	●	●	●	●	●	●	●	**GB**[2)]
	with pressure control in both ports	●	●	●	●	●	●	●	●	●	**D**[1) 2)]
	with remote pressure control in both ports	●	●	●	●	●	●	●	●	●	**G**[1) 2)]
06	**Power control and/or electrical control of pilot pressure for HD1**										
	without power control or electrical control of pilot pressure (no code)										
	Power control with power control valve LV 06	●	●	●	●	●	●	●	●	●	**P**
	Electrical control of pilot pressure	●	●	●	●	●	●	●	●	●	**T**[3)]
	Power control and electrical control of pilot pressure	●	●	●	●	●	●	●	●	●	**U**[3)]

Series

		40	71	125	180	250	355	500	750	1000	
07	for A4VSO	●	●	–	–	–	–	–	–	–	**11**
		–	–	●	●	●	●	●	●	●	**30**
	for A4VSG	●	●	–	–	–	–	–	–	–	**11**
		–	–	●	●	●	●	●	●	●	**30**
	for A4CSG	–	–	–	–	●	●	●	●	–	**30**

1) not available on A4VSO

2) not possible for bi-directional rotation

3) for operation with HF-fluids please observe data sheet RE 29164 (Prop. pressure relief valve type DBEP); for A4CSG please consult us

● available – not available

A4 . . .		HD .			/			–							
01	02	03	04	05	06		07	08		09	10	11	12	13	14	15

08	Direction of rotation	
09	Seals	
10	Shaft end	for detailed data see: RE 92050 – A4VSO RE 92100 – A4VSG RE 92105 – A4CSG
11	Mounting flange	
12	Connecting options for service ports	
13	Through drive	
14	Valves	
15	Filter options	

2

HD1/2/3 – Hydraulic control, pilot pressure dependent

The HD1/2/3 control sets the pump displacement dependent on a pilot pressure signal.

One control chamber is permanently pressurized by control pressure. The pilot piston is shifted through the pilot pressure differential X_1–X_2 and controls the oil supply to the opposite control chamber. The resulting control stroke gives a spring pressure feedback signal to the pilot pressure piston. This enables a proportional control stroke movement, dependent on the pressure differential (X_2–X_1).

When determining the pilot pressure requirements, it must be considered, that on the A4VSO the effective pilot pressure command signal is equal to the difference between actual pilot pressure and housing pressure, in case of the A4VSG and A4CSG it is the pressure differential between X_1 and X_2.

– Upon loss of pilot pressure signal the pump control system will swivel **back to center through the built in spring centering**.

– When loosing control pressure, **the spring centering of the control piston will support the reset to center position**. Both features are standard.

Note

The spring centering in the pilot control unit is not a safety device

Through contamination in the control unit – eg. in hydraulic fluid, wear particles, or particles out of a system – the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore.

- Make sure that a proper emergency shut down function can bring the driven machine movements to a safe position immediately (eg. stop).
- Adhere to the specified cleanliness level 20/18/15 (< 90 °C) or 19/17/14 (> 90 °C) to ISO 4406.

The mechanical swivel angle limitation can be set at both sides of center in the range of $V_{g\,max}$ to 50 % of $V_{g\,max}$, on size 500 $V_{g\,max}$ to 70% of $V_{g\,max}$.

The sizes 500...1000 offer the possibility to adjust the control time at the pilot unit. As standard the units are set at the long control times (for times see table on page 5). This is necessary for the power control valve LV06 on HD1P and HD1U.

3 executions are available:
HD1 pilot pressure range 10...45 bar
HD2 pilot pressure range 10...28 bar
HD3 pilot pressure range 5,5...19 bar

An execution with inductive displacement transducer is available on request.

Supply of control and pilot pressure

On A4VSO and A4VSG the minimum required control pressure must be connected externally to P. This enables a control out of center position without sufficient control pressure from the pump itself. The pump internal pressure output supplies the control pressure as soon as $p_A, p_B > p$.
On **A4CSG** in standard execution (boost pump „F“) the control pressure comes internally out of the boost circuit. This eliminates the need for a separate control pressure pump, that means port P is already hooked up internally.
Recommended setting on control pressure relief valve: double the boost pressure

Recommended:as separate control/pilot press. pump for the sizes 40...250 an auxiliary pump with 8 cm^3
for the sizes 355...1000 an auxiliary pump with 11 cm^3
Direct mounting at the through drive on A4VSO/G or A4CSG is possible, see the technical data sheet of the relevant pump.

HD1/2/3 – Technical data

Size				40	71	125	180	250	355	500	750	1000
Pilot pressure [1] (in X_1, X_2)	HD1	p_{St}	bar	10 [2] – 45 [3]								
	HD2	p_{St}	bar	10 [2] – 28 [3]								
	HD3	p_{St}	bar	5,5 [2] – 19 [3]								
Control pressure (in P)		p_{min} [5] [6]	bar	2x boost press. but at least 32 bar								
		p_{max} [4] [5]	bar	350								
Control stroke		s_{max}	mm	14,2	17,1	20,7	20,7	25,9	25,9	32,6	37	41,41
Control area		A	cm^2	3,9	6,4	9	9	14,4	14,4	18,8	28,5	32,4
Control volume		$V_{S\ max}$	cm^3	5,5	11	18,7	18,7	37,3	37,3	61,4	105	134,1
Control time (at 200 bar pressure output)		t	s	0,08	0,09	0,10	0,10	0,15	0,15	0,75	1,0	1,5
Setting range control time (at 200 bar pressure output)		t	s	–	–	–	–	–	–	0,15... 0,75	0,2... 1,0	0,3... 1,5
Boost pressure	A4VSG	$p_{Sp\ min}$	bar	16	16	16	16	16	16	16	16	16
		$p_{Sp\ max}$ [6]	bar	30	30	30	30	30	30	30	30	30
	A4CSG	$p_{Sp\ min}$	bar	–	–	–	–	16	16	16	16	–
		$p_{Sp\ max}$	bar	–	–	–	–	20	20	20	20	–
Weight approx. (A4VSO...HD. ...N00)			kg	42	59	98	112	200	220	333	476	606
Hysteresis				± 3 % von $V_{g\ max}$								
Repeatability				1 % von $V_{g\ max}$								

1) Pilot pressure characteristics see page 6.

2) ± 0,5 bar at open circuit; ± 1,5 bar at closed circuit

3) ± 1,5 bar at open citcuit; ± 2 bar at closed circuit

4) with pressure control, the max. control pressure at port P must be below the pressure control setting

5) with built on valve DBEP6 (HD1T and HD1U) max. pressure at port P for all sizes must be limited from min. 50 bar to max. 100 bar; with built on power control valve (HD1P und HD1U) the max. pressure at port P must be below the beginning of control on the power curve

6) on execution H06 the boost pressure must be limited to max. 25 bar, since the control pressure is set at 50 bar.

Characteristics

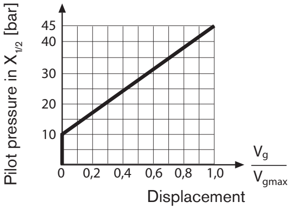
A4VSO - open circuit

Please note: on the A4VSO for open circuit (swivel to one side of center only) the $V_{g\ min}$-stop is set so that pump pressure reaches 20 bar when port B is closed.

Mooring or over center operation available on request.

Characteristic

Example: **HD1** pilot pressure 10...45 bar

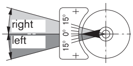


Relation between

Direction of rotation – Pilot pressure – Direction of flow

Direction of rotation	Pilot pressure	Swivel range[1]	Direction of flow	Pressure output port
clockwise	in X_2	left	S to B	B
counter clockwise	in X_1	right	S to B	B

[1] compare swivel angle indicator

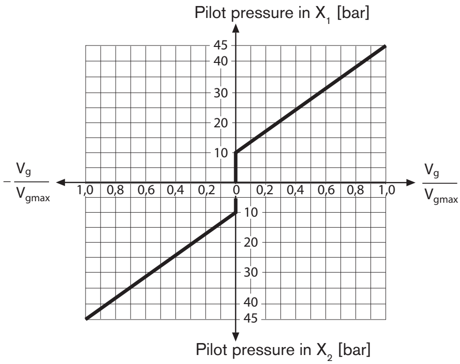


A4VSG and A4CSG - closed circuit

On the standard execution of the **A4CSG** (boostpump „F“) with HD, control fluid is taken internally out of the boost circuit. This eliminates the need for a separate control pressure pump.

Characteristic

HD1 pilot pressure 10...45 bar

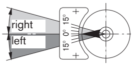


Relation between

Direction of rotation – Pilot pressure – Direction of flow

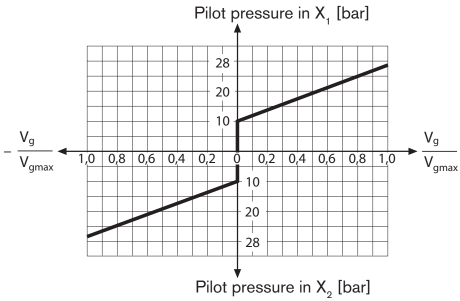
Direction of rotation	Pilot pressure	Swivel range[1]	Direction of flow	Pressure outlet port
clockwise	in X_1	right	B to A	A
	in X_2	left	A to B	B
counter clockwise	in X_1	right	A to B	B
	in X_2	left	B to A	A

[1] compare swivel angle indicator



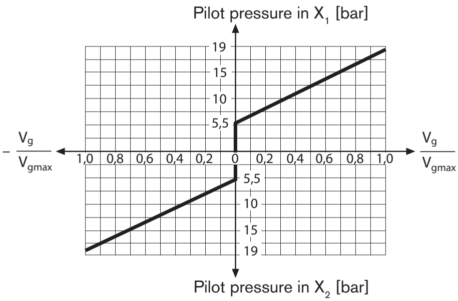
Characteristic

HD2 pilot pressure10...28 bar



Characteristic

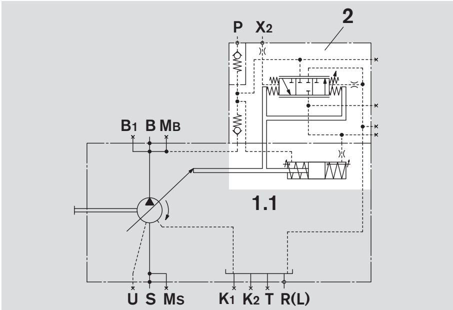
HD3 pilot pressure 5,5...19 bar



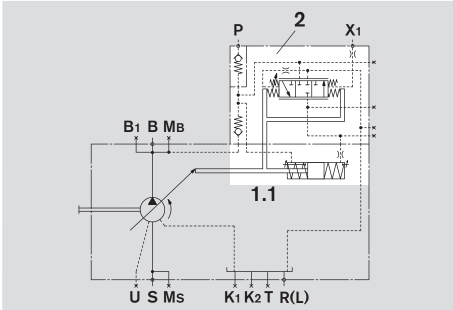
Schematics A4VSO HD1/2/3

Size 40 and 71

Direction of rotation clockwise

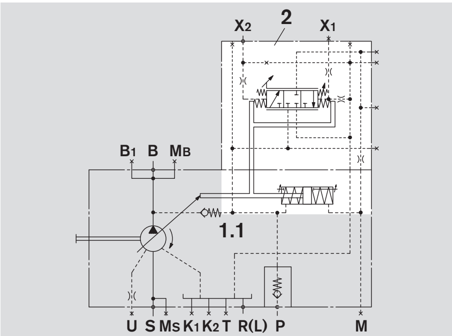


Direction of rotation counter clockwise

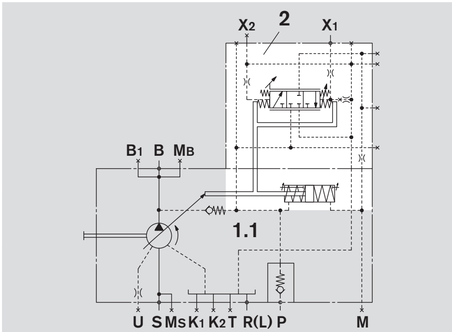


Size 125...355

Direction of rotation clockwise

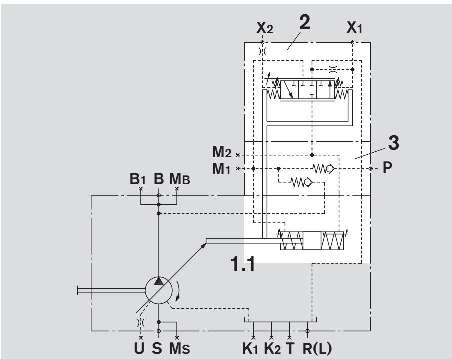


Direction of rotation counter clockwise

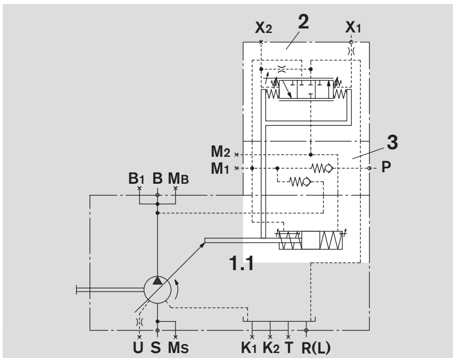


Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



2

Ports

X_1; X_2 Pilot pressure ports

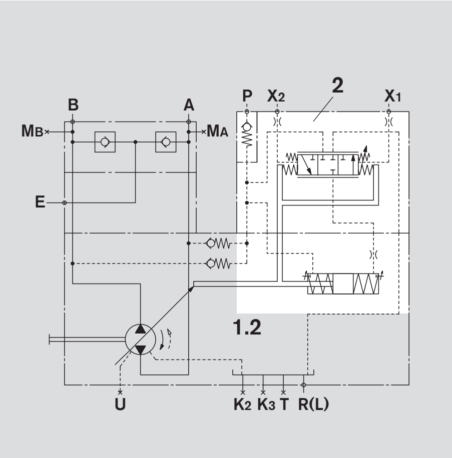
P Control pressure port

M; M_1; M_2 Gauging ports control chamber pressure

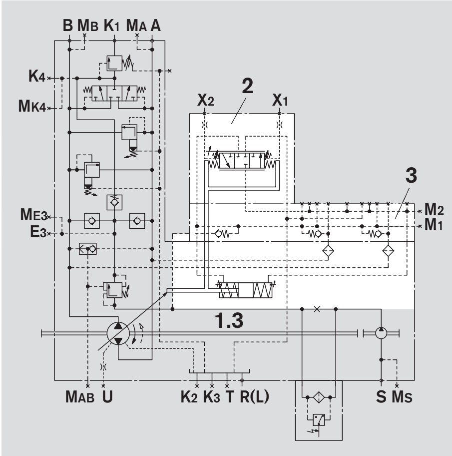
Sub-assemblies see page 8.

Schematics A4VSG and A4CSG HD1/2/3

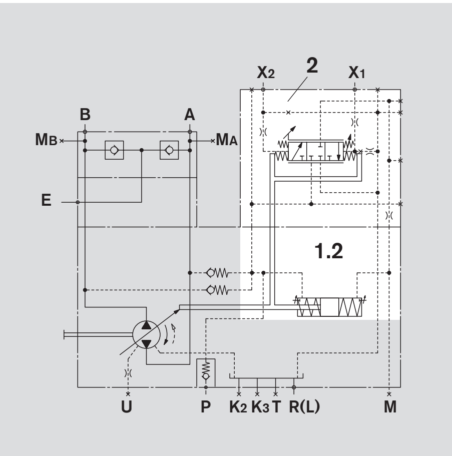
Size 40 and 71
Example: A4VSG



Size 500...1000
Example: A4CSG



Size 125...355
Example: A4VSG



Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
1.3	A4CSG (see RE 92105)
2	Pilot control unit
3	Sandwich plate

Ports

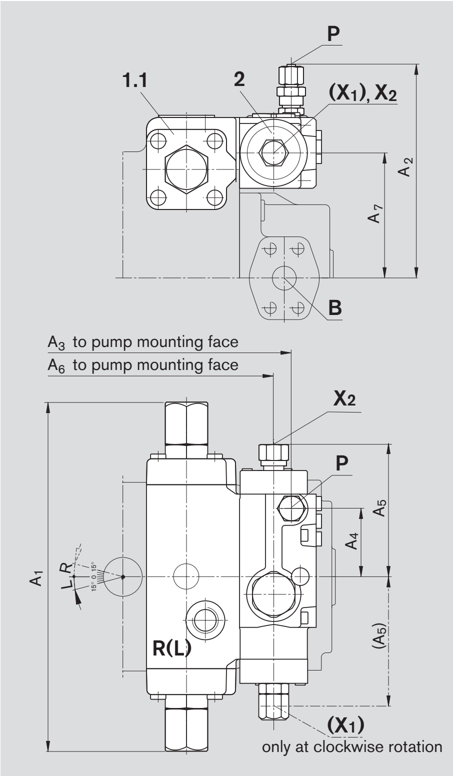
X_1; X_2	Pilot pressure ports
P	Control pressure port (at A4VSG)
M	Gauging port control chamber pressure (Size 125...355)
M_1	Gauging port small control chamber (Size 500...1000)
M_2	Gauging port large control chamber (Size 500...1000)

Unit dimensions HD1/2/3

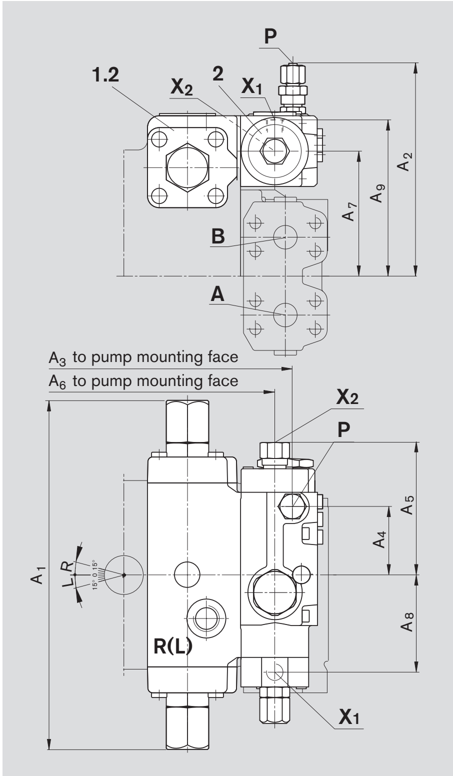
Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSO – open circuit



A4VSG – closed circuit



Sub-assemblies see page 8.

Ports

				max. tightening torques [1]
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3853	S8 Form W	50 Nm

A4VSO in clockwise rotation shows only X_2, A4VSO in counter clockwise rotation has only X_1

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9
40	296	193	233	58	113	218	106	82,5	132,5
71	332	209	260	58	113	245	122	82,5	148,5

For detailed unit dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

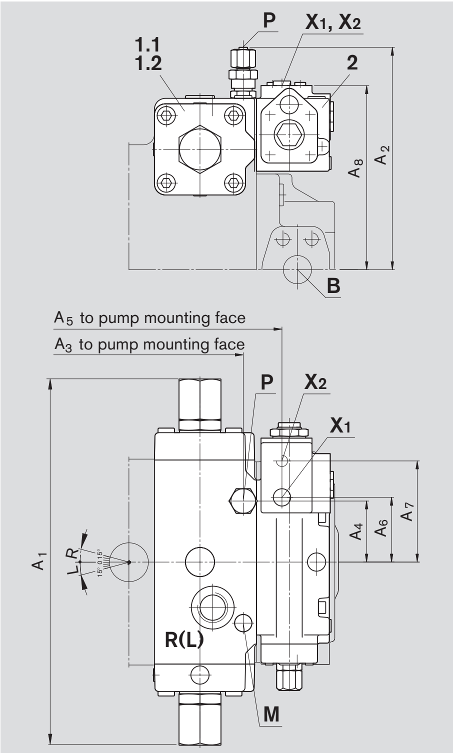
[1] see general notes

Unit dimensions HD1/2/3

Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSO and A4VSG



A4CSG in preparation, dimensions on request

Sub-assemblies

1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pilot control unit

3 Sandwich plate (size 500...1000)

Ports

				max. tightening torques [1]
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
on A4VSO in clockwise rotation X_1 is plugged, on A4VSO in counter clockwise rotation X_2 is plugged				
P	Control pressure port	DIN 3853	S8 Form W (size 125 and 180) S12 Form W (size 250 and 355)	50 Nm 90 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (size 125 a. 180) M18x1,5; 12 deep; plugged (size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
125	402	245	251	67	293	71	111	202
180	402	245	251	67	293	71	111	202
250	485	297,5	311	71	355	71	111	238
355	485	297,5	311	71	355	71	111	238

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105

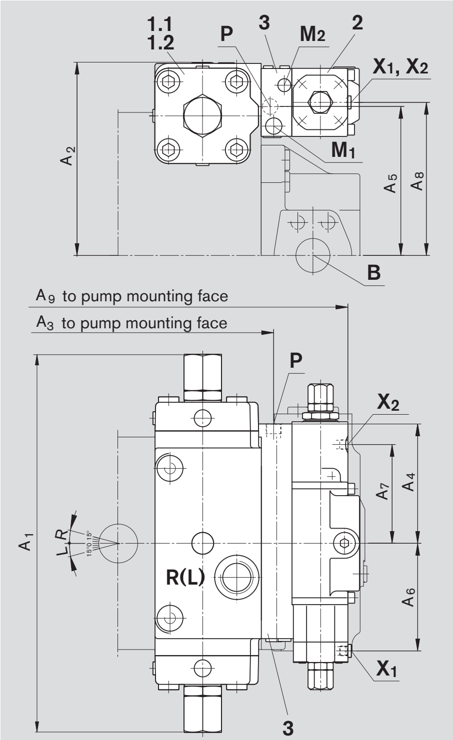
[1] see general notes

Unit dimensions HD1/2/3

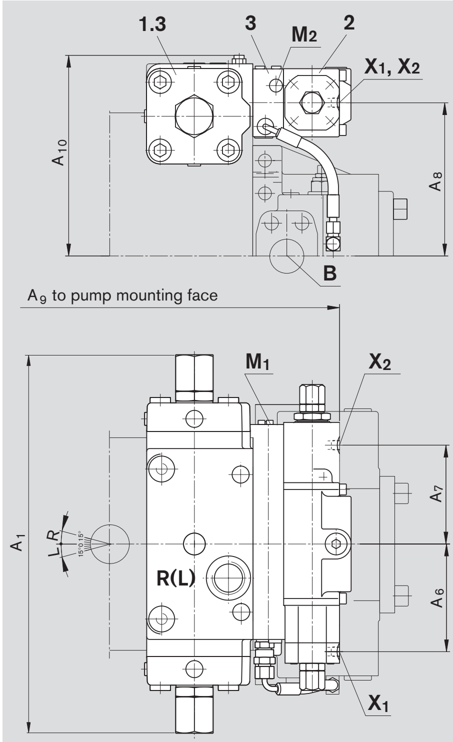
Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSO and A4VSG



A4CSG



Sub-assemblies see page 10.

Ports A4VSO and A4VSG

				max. tightening torques [1]
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm

on A4VSO in clockwise rotation X_1 is plugged, on A4VSO in counter clockwise rotation X_2 is plugged

P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Ports A4CSG

				max. tightening torques [1]
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
M_1	Gauging port small control chamber	DIN 3852	M22x1,5; 14 deep; plugged	210 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
500	555	283	383	175	200	158	145	225	492	297	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
750	630	322	415	175	230	158	145	280	524	355	
1000	670	347	482	175	253	158	145	278	590	–	

[1] see general notes

Pressure control

The pressure control is an additional function, which controls pump displacement as soon as a certain preset pressure level is reached. When this preset pressure level is exceeded, the pressure control valve opens and destrokes the pump till this set pressure level is reached again. With control on both sides of center, this pressure control feature enables swiveling over center (pump „swallows“ fluid) an thereby a fast decompression of the pressure line.

On rotary drives with inert, large rotating masses, the pressure control enables a smooth, controlled deceleration.

The pressure control is optionally available as: HD.A one side in port A (schematics see page 13 and 14)
HD.B one side in port B (schematics see page 20 and 21)
HD.D both sides in ports A and B (schematics see page 27 and 28)

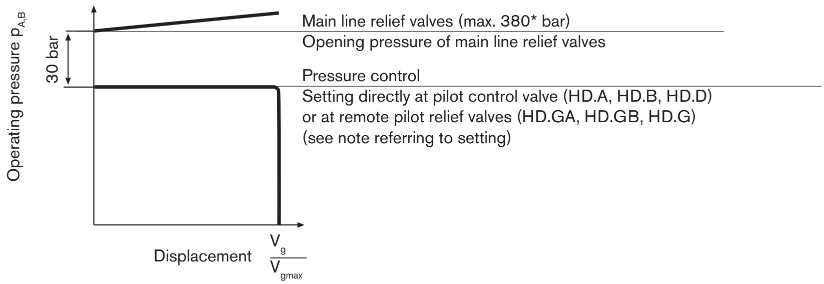
Setting range 50...350 bar

Standard setting 350 bar. Other settings please state in clear text when ordering.

The settings must be 30 bar below the setting of the main line relief valves (A4CSG), since the system induced pressure spikes should be limited through these relief valves.

Moreover, the setting must be **higher** than **the control pressure level at port P**.

Characteristic



Pressure rise $\Delta p \leq 5$ bar

Hysteresis $\leq \pm 5$ bar

* only valid in combination with pressure control – without pressure control, max. main line relief settings 350 bar

Remote pressure control

Remote control is carried out via ports X_A or X_B.

The external pilot pressure relief valves are not included in the supply.

Recommended: DBD 6 (RE 25 402)

The max. line lenght should not exceed 2m.

The standard setting of the differential pressure at the pumps control valve is 30 bar. With this setting the pilot oil consumption amounts to approx. 2 L/min. If another setting is required (range 14...50 bar) please state in clear text.

Notes about the setting of the remote pressure control level:

The setting on the remote pilot relief valves plus the value of the differential pressure on the pumps control valve constitutes the overall pressure control level.

Example: external pilot relief valve setting 320 bar

differential pressure at control valve 30 bar

equals pressure control level of 320 + 30 = 350 bar

Remote pressure control available as : HD.GA one side in port A (schematics see page 15 and 16)
HD.GB one side in port B (schematics see page 22 and 23)
HD.G both sides in ports A and B (schematics see page 29 and 30)

HD.A with pressure control on one side for port A

The pressure control valve controls the pressure in port A. Description see page 12.

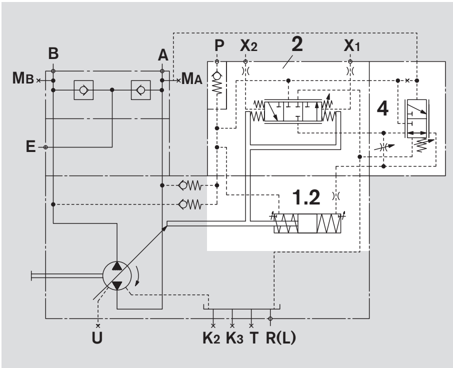
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

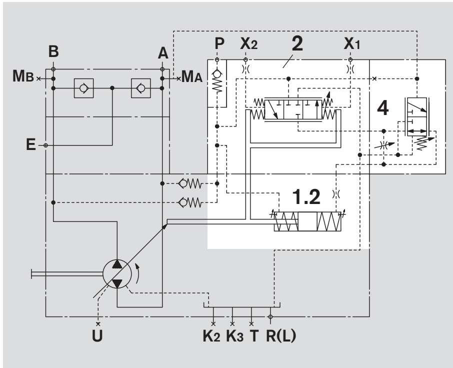
Schematics example A4VSG

Size 40 and 71

Direction of rotation clockwise

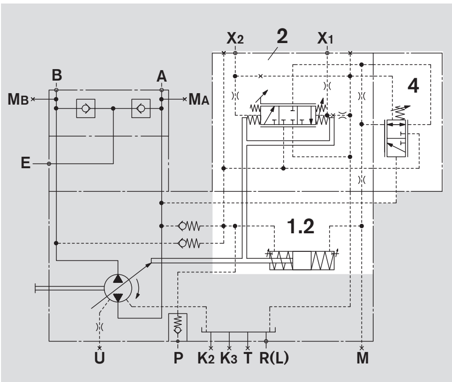


Direction of rotation counter clockwise

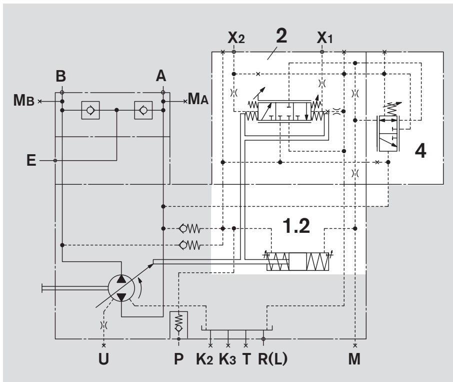


Size 125...355

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_1; X_2 Pilot pressure ports

P Control pressure port

M Gauging port control chamber pressure (Size 125...355)

Sub-assemblies

1 Pump with hydraulic control device
1.2 A4VSG (see RE 92100)

2 Pilot control unit

4 Pressure control valve for port A

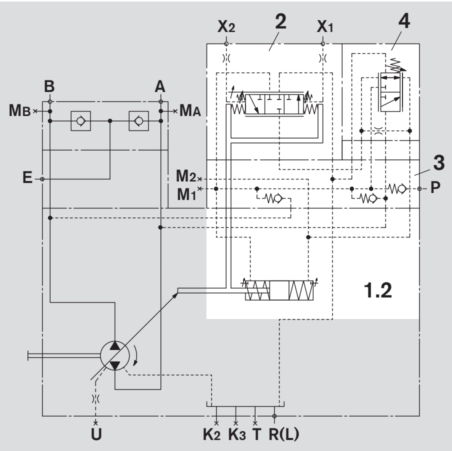
Size 500...1000 see page 14

HD.A with pressure control on one side for port A

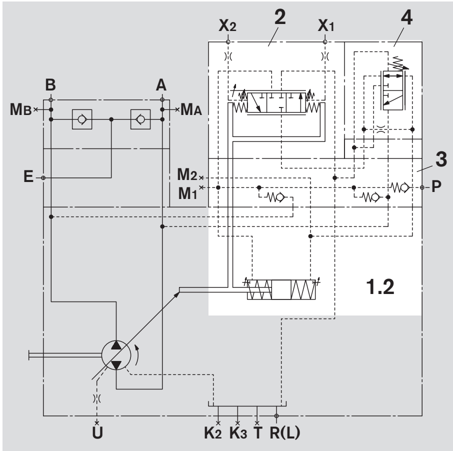
Schematics example A4VSG

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control unit
3	Sandwich plate
4	Pressure control valve for port A

Size 40...355 see page 13

HD.GA with remote pressure control for port A

The remote control is carried out via port X_A. The external pilot relief valve (item 5) is not included in the supply. Description on page 12.

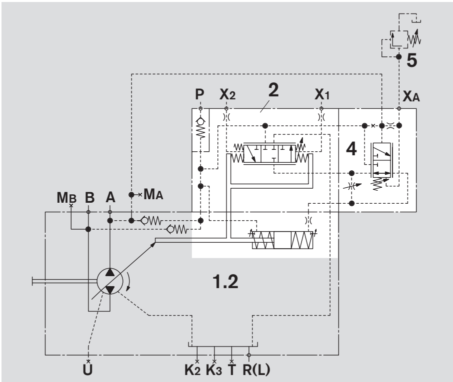
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

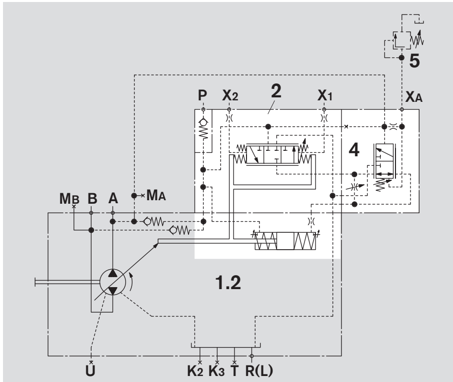
Schematics example A4VSG

Size 40 and 71

Direction of rotation clockwise

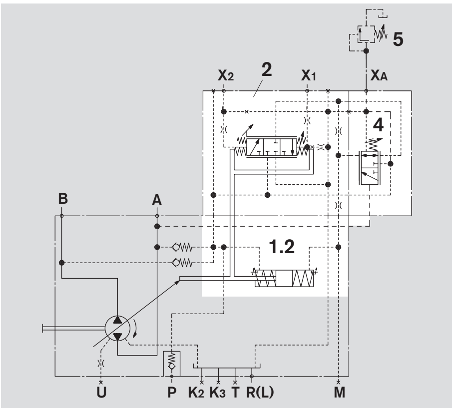


Direction of rotation counter clockwise

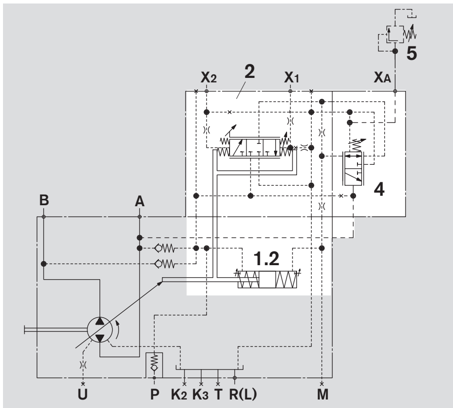


Size 125...355

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_A	Pilot pressure port for remote pressure control in A
X_1; X_2	Pilot pressure ports
P	Control pressure port
M	Gauging port control chamber press. (Size 125...355)

Size 500...1000 see page 16

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control valve
4	Pressure control valve for port A
5	External pilot relief valve (not included in supply)

HD.GA with remote pressure control on one side for port A

The remote pressure control is carried out via port X_A. The external pilot relief valve (item 5) is not included in the supply. Description see page 12.

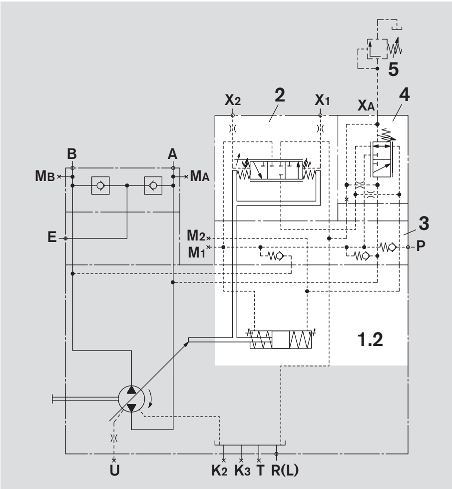
Not available on A4VSO.

Not possible for bi-directional rotation.

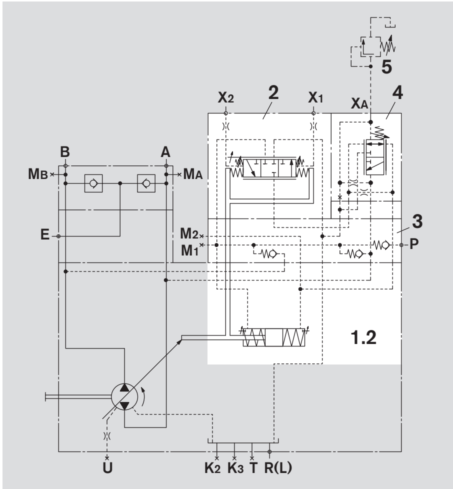
Schematics example A4VSG

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_A	Pilot pressure port for remote pressure control in A
X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control unit
3	Sandwich plate
4	Pressure control valve for port A
5	External pilot relief valve (not included in supply)

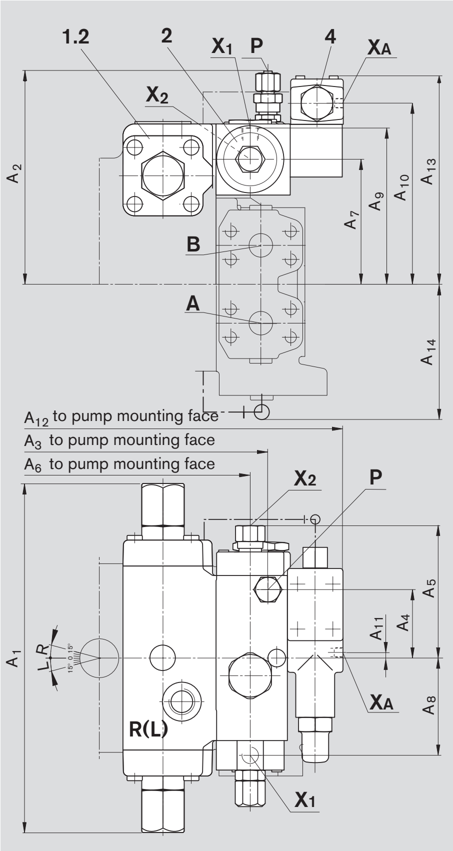
Size 40...355 see page 15

Unit dimensions HD.A / HD.GA

Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSG



2

Sub-assemblies

1 Pump with hydraulic control device
1.2 A4VSG (see RE 92100)
2 Pilot control unit
4 Pressure control valve for port A

Ports

				max. tightening torques [1]
X_A	Pilot pressure port for remote pressure control in A	DIN 3852	M14x1,5; 12 deep; plugged on HDA	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3853	S8 Form W	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	
40	296	193	233	58	113	218	106	82,5	132,5	163	4	299	189	136	For detailed unit dimensions and technical data on the variable pump see the technical data sheet A4VSG RE 92100
71	332	209	260	58	113	245	122	82,5	148,5	179	4	326	205	139	

[1] see general notes

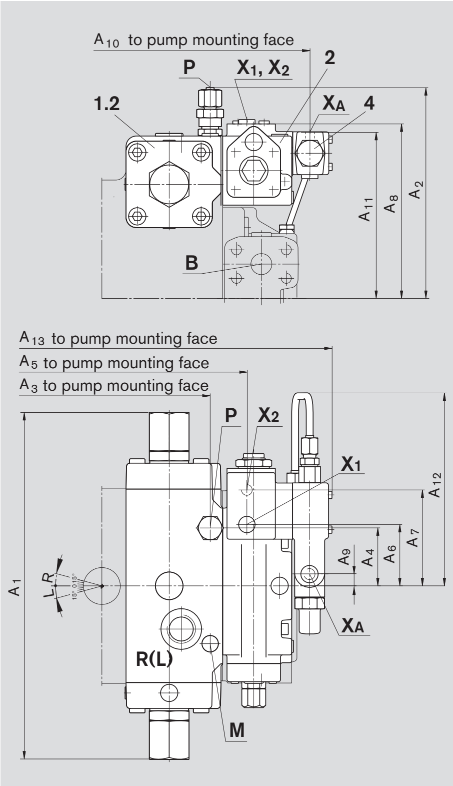
Unit dimensions HD.A / HD.GA

Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSG

A4CSG in preparation, dimensions on request



Sub-assemblies

- **1** Pump with hydraulic control device
- **1.2** A4VSG (see RE 92100)
- **2** Pilot control unit
- **3** Sandwich plate (Size 500...1000)
- **4** Pressure control valve for port A

Ports

				max. tightening torques [1]
X_A	Pilot pressure port for remote pressure control in A	DIN 3852	M14x1,5; 12 deep; plugged on HDA	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3853	S8 Form W (Size 125 and 180) S12 Form W (Size 250 and 355)	50 Nm 90 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	
125	402	245	251	67	293	71	111	202	13	366	192	224	392	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSG RE 92100 or A4CSG RE 92105
180	402	245	251	67	293	71	111	202	13	366	192	224	394	
250	485	297,5	311	71	355	71	111	238	13	428	228	224	454	
355	485	297,5	311	71	355	71	111	238	13	428	228	224	454	

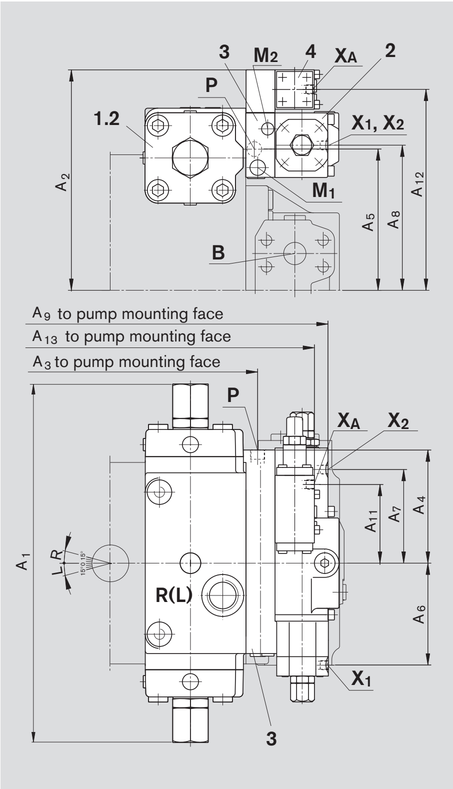
[1] see general notes

Unit dimensions HD.A / HD.GA

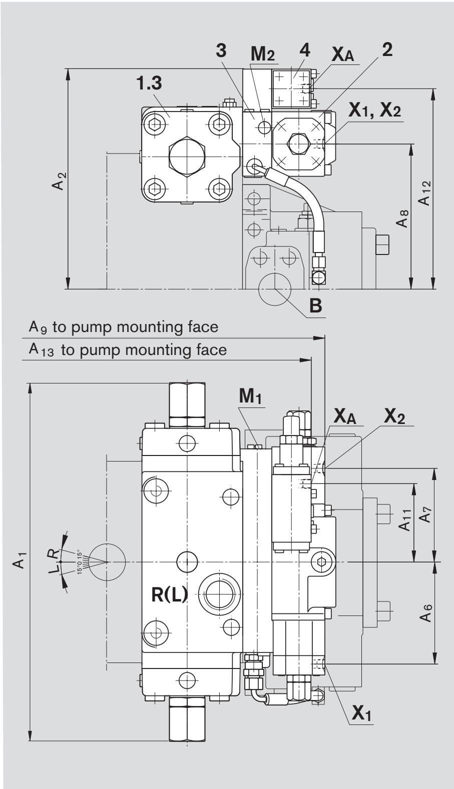
Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSG



A4CSG



2

Sub-assemblies see page 18.

Ports

				max. tightening torques [1]
X_A	Pilot pressure port for remote pressure control in A	DIN 3852	M14x1,5; 12 deep; plugged on HDA	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M22x1,5; 14 deep (only on A4VSG)	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged (A4VSG)	140 Nm
			M22x1,5; 14 deep; plugged (A4CSG)	210 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{11}	A_{12}	A_{13}
500	555	342	383	175	200	158	145	225	492	136	315	469
750	630	371	415	175	230	158	145	280	524	136	345	501
1000	670	394	481	175	253	158	145	278	590	136	368	567

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSG RE 92100 or A4CSG RE 92105

[1] see general notes

HD.B with pressure control on one side for port B

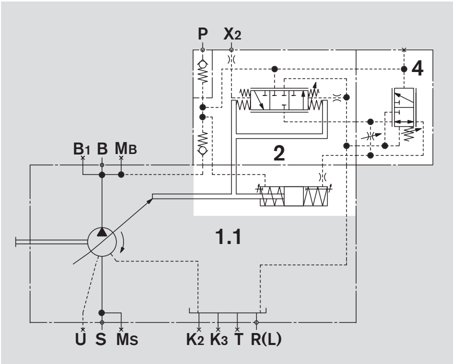
The pressure control valve controls the pressure in port B. Description see page 12.

Not possible on pumps for bi-directional rotation.

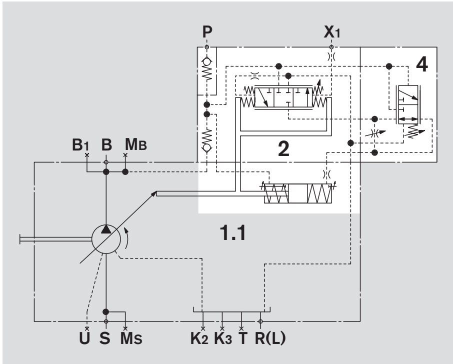
Schematics

Size 40 and 71

Direction of rotation clockwise
(Example A4VSO)

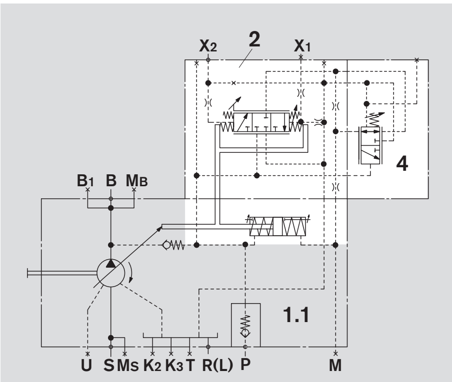


Direction of rotation counter clockwise
(Example A4VSO)

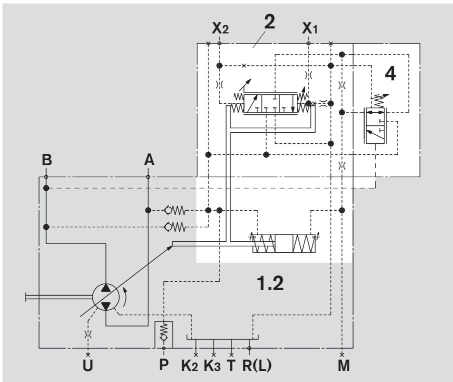


Size 125...355

Direction of rotation clockwise
(Example A4VSO)



Direction of rotation counter clockwise
(Example A4VSG)



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M	Gauging port control chamber pressure (Size 125...355)

Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
2	Pilot control unit
4	Pressure control valve for port B

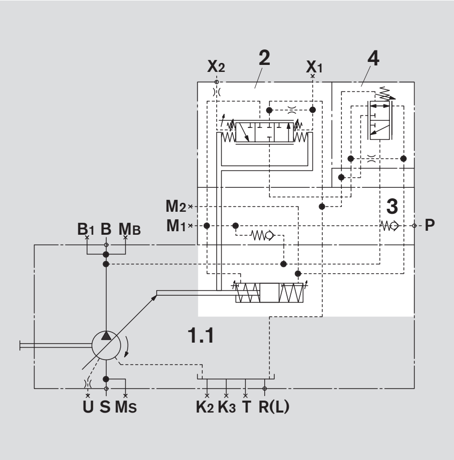
Size 500...1000 see page 21

HD.B with pressure control on one side for port B

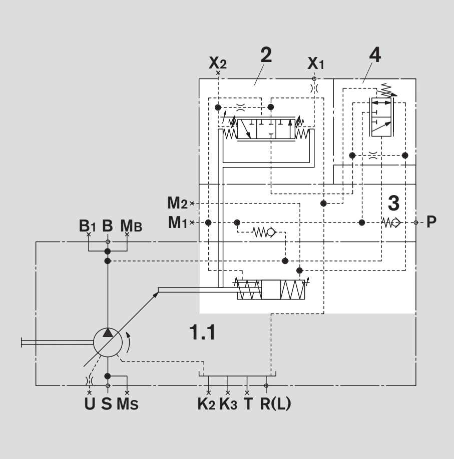
Schematics example A4VSO

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Pilot control unit
3	Sandwich plate
4	Pressure control valve for port B

Size 40...355 see page 20

HD.GB with remote pressure control for port B

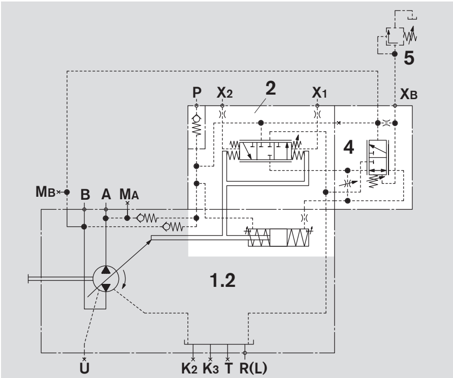
The remote pressure control is carried out via port X_B . The external pilot relief valve (item 5) is not included in the supply. Description see page 12.

Not possible on pumps for bi-directional rotation.

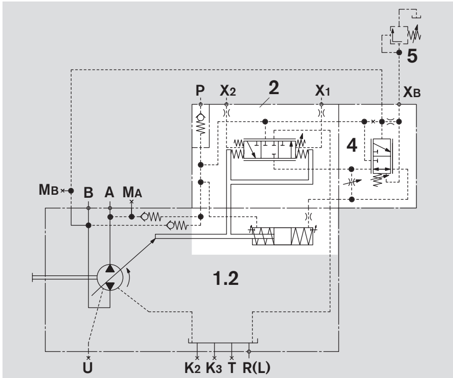
Schematics example A4VSG

Size 40 and 71

Direction of rotation clockwise

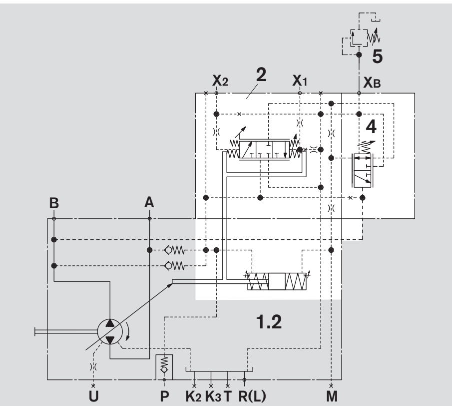


Direction of rotation counter clockwise

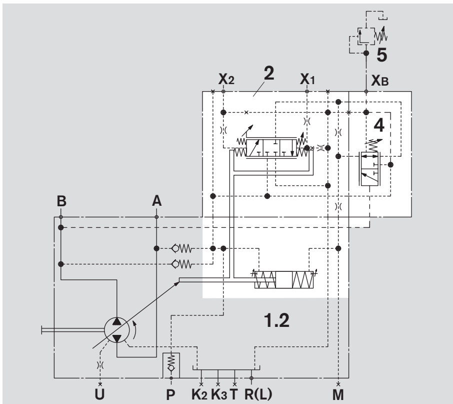


Size 125...355

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_B	Pilot pressure port for remote pressure control in B
X_1; X_2	Pilot pressure ports
P	Control pressure port
M	Gauging port control chamber pressure (Size 125...355)

Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
2	Pilot control unit
4	Pressure control valve for port B
5	External pilot relief valve (not included in supply)

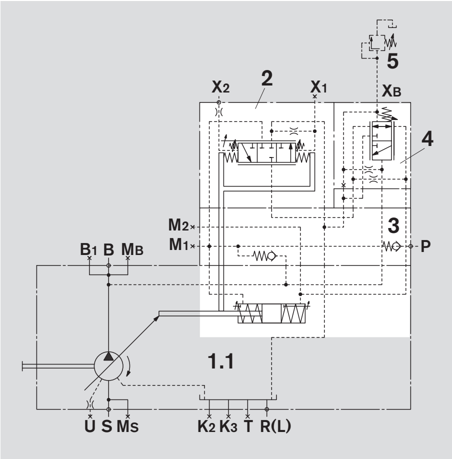
Size 500...1000 see page 23

HD.GB with remote pressure control for port B

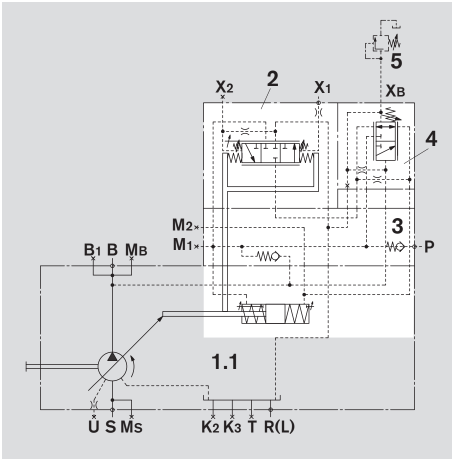
Schematics example A4VSO

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_B	Pilot pressure port for remote pressure control in B
X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Pilot control valve
3	Sandwich plate
4	Pressure control valve for port B
5	External pilot relief valve (not included in supply)

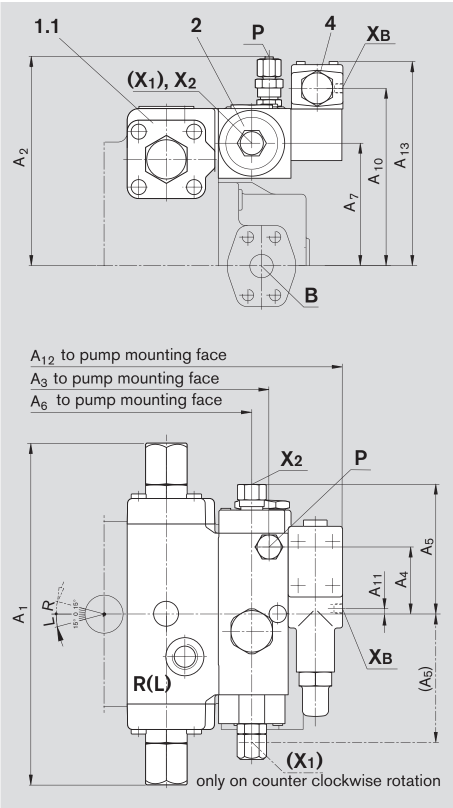
Size 40...355 see page 22

Unit dimensions HD.B / HD.GB

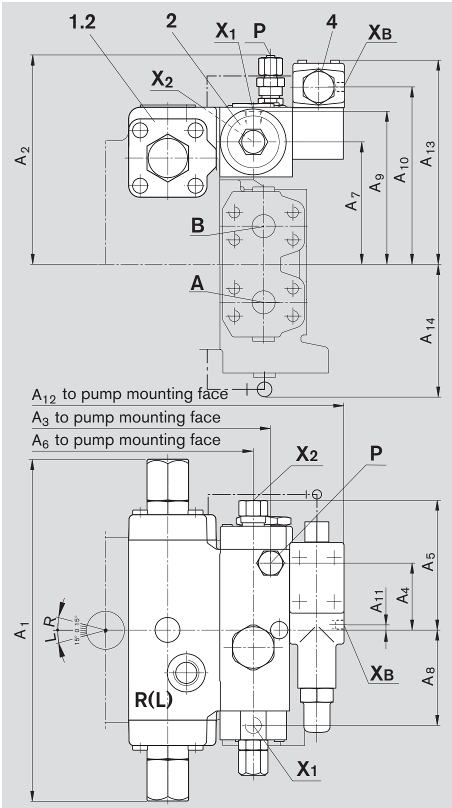
Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSO



A4VSG



Sub-assemblies see page 25

Ports

max. tightening torques [1]

X_B	Pilot pressure port for remote pressure control in B	DIN 3852	M14x1,5; 12 deep; plugged on HDB	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm

on A4VSO clockwise rotation only X_2 exists, on A4VSO counter clockwise rotation only X_1 exists

P	Control pressure port	DIN 3853	S8 Form W	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	
40	296	193	233	58	113	218	106	82,5	132,5	163	4	299	189	136	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	332	209	260	58	113	245	122	82,5	148,5	179	4	326	205	139	

[1] see general notes

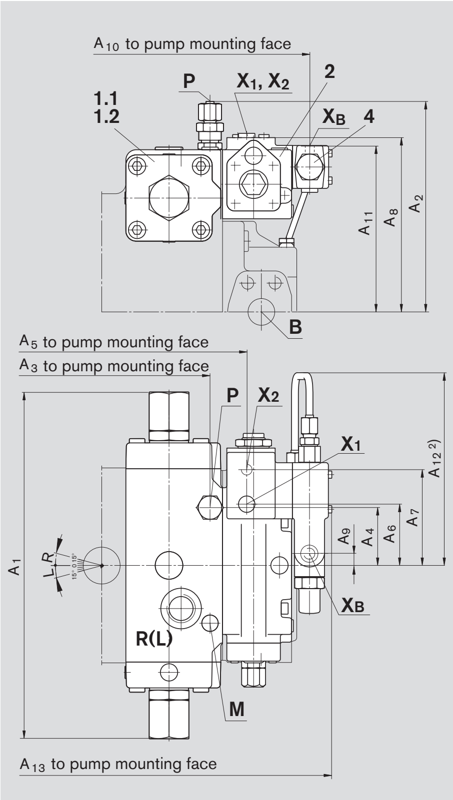
Unit dimensions HD.B / HD.GB

Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSO and A4VSG

A4CSG in preparation, dimensions on request



Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
1.3	A4CSG (see RE 92105)
2	Pilot control unit
3	Sandwich plate (Size 500...1000)
4	Pressure control valve for port B

Ports

				max. tightening torques [1]
X_B	Pilot pressure port for remote pressure control in B	DIN 3852	M14x1,5; 12 deep; plugged on HDB	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm

on A4VSO in clockwise rotation X_1 is plugged, on A4VSO in counter clockwise rotation X_2 is plugged

P	Control pressure port	DIN 3853	S8 Form W (Size 125 and180) S12 Form W (Size 250 and 355)	50 Nm 90 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12} [2]	A_{13}
125	402	245	251	67	293	71	111	202	13	366	192	224	392
180	402	245	251	67	293	71	111	202	13	366	192	224	392
250	485	297,5	311	71	355	71	111	238	13	428	228	224	454
355	485	297,5	311	71	355	71	111	238	13	428	228	224	454

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105

[1] see general notes

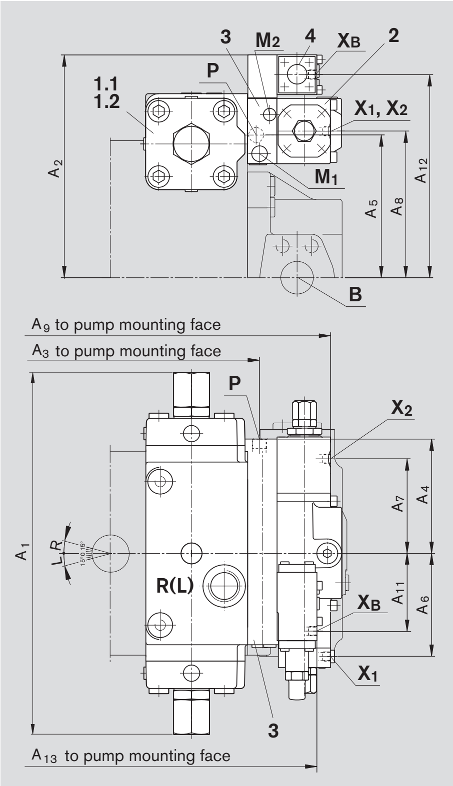
[2] Piping exists only on A4VSO

Unit dimensions HD.B / HD.GB

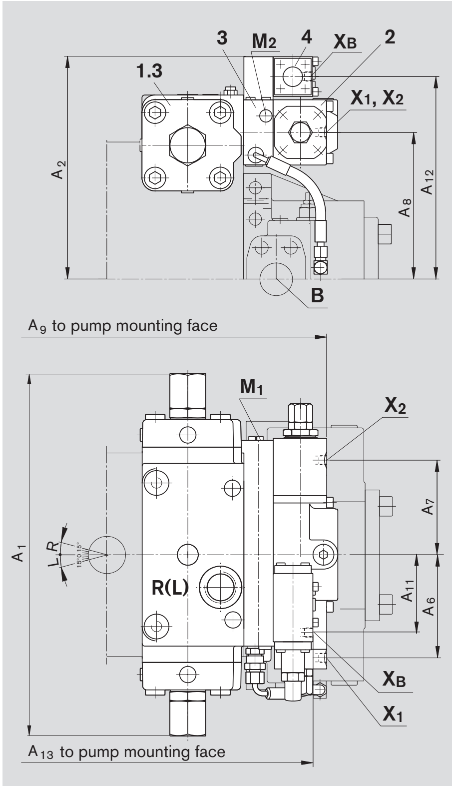
Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSO and A4VSG



A4CSG



Sub-assemblies see page 25.

Ports

				max. tightening torques [1]
X_B	Pilot pressure port for remote pressure control in B	DIN 3852	M14x1,5; 12 deep; plugged on HDB	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm

on A4VSO in clockwise rotation X_1 is plugged, on A4VSO in counter clockwise rotation X_2 is plugged

P	Control pressure port	DIN 3852	M22x1,5; 14 deep (only on A4VSG)	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged (A4VSG) M22x1,5; 14 deep; plugged (A4CSG)	140 Nm 210 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{11}	A_{12}	A_{13}	
500	555	342	383	175	200	158	145	225	492	136	304	469	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
750	630	371	415	175	230	158	145	280	524	136	334	501	
1000	670	394	481	175	253	158	145	278	590	136	357	567	

[1] see general notes

HD.D with pressure control on both sides for ports A and B

Two pressure control valves enable a control of max. pressure in ports A or B independent of each other. Description see page 12.

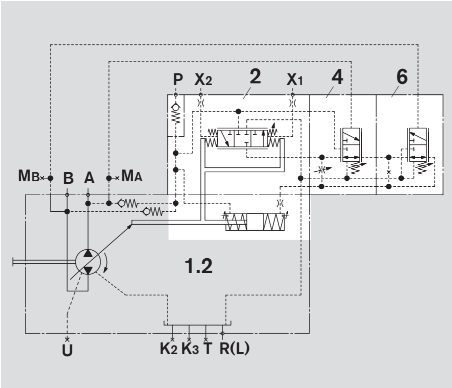
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

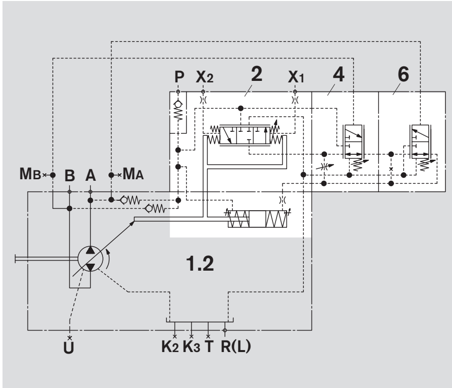
Schematics example A4VSG

Size 40 and 71

Direction of rotation clockwise

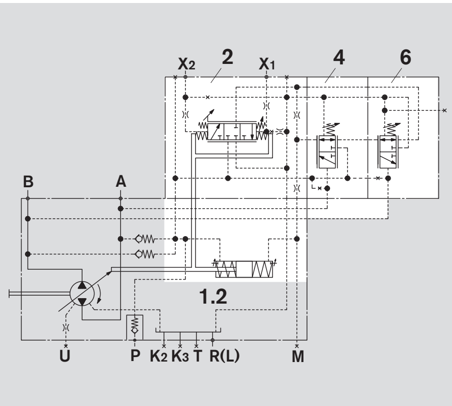


Direction of rotation counter clockwise

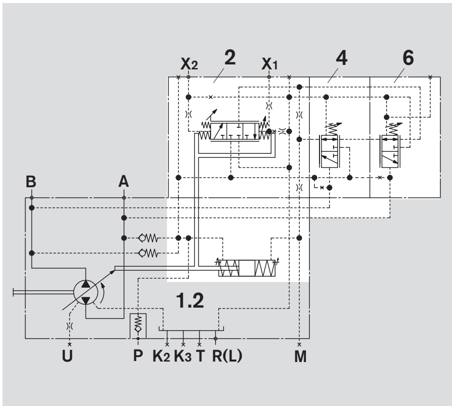


Size 125...355

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M	Gauging port control chamber pressure (Size 125...355)

Size 500...1000 see page 28

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control unit
4	Pressure control valve for port A (for port B on counter clockwise rotation)
6	Pressure control valve for port B (for port A on counter clockwise rotation)

HD.D with pressure control on both sides for ports A and B

Two pressure control valves enable a control of max. pressure in ports A or B independent of each other. Description see page 12.

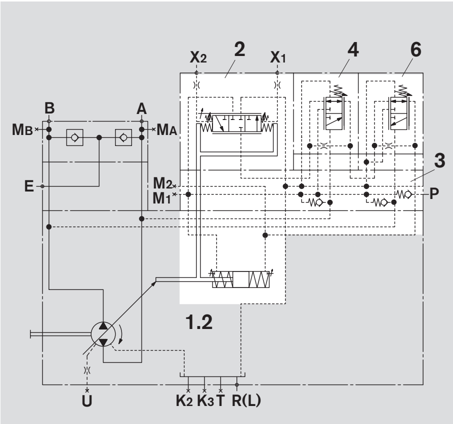
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

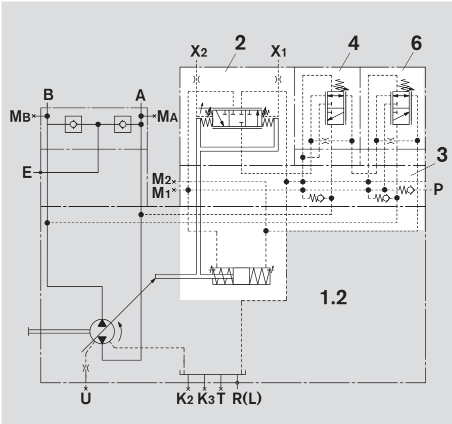
Schematics example A4VSG

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control valve
4	Pressure control valve for port A
6	Pressure control valve for port B

Size 40...355 see page 27

HD.G with remote pressure control on both sides for A and B

The remote pressure control is carried out via the ports X_A and X_B. The external pilot relief valves (item 5 and item 7) are not included in the supply. Description see page 12.

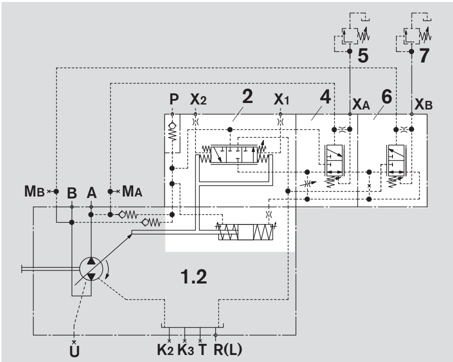
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

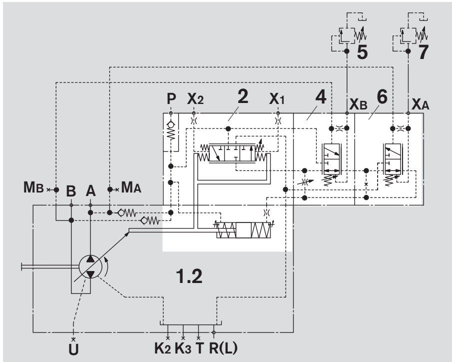
Schematics example A4VSG

Size 40 and 71

Direction of rotation clockwise

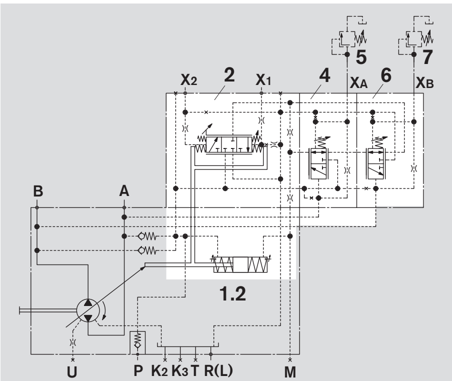


Direction of rotation counter clockwise

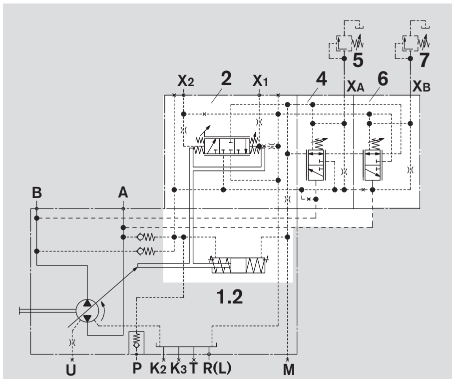


Size 125...355

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_A; X_B	Pilot pressure ports for remote pressure control
X_1; X_2	Pilot pressure ports
P	Control pressure port
M	Gauging port control chamber pressure (size 125...355)

Size 500...1000 see page 30

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control unit
4	Pressure control valve for port A (for port B on counter clockwise rotation)
5; 7	External pilot relief valves (not included in supply)
6	Pressure control valve for port B (for port A on counter clockwise rotation)

2

HD.G with remote pressure control on both side for A and B

The remote pressure control is carried out via the ports X_A and X_B. The external pilot relief valves (item 5 and 7) are not included in the supply. Description see page 12.

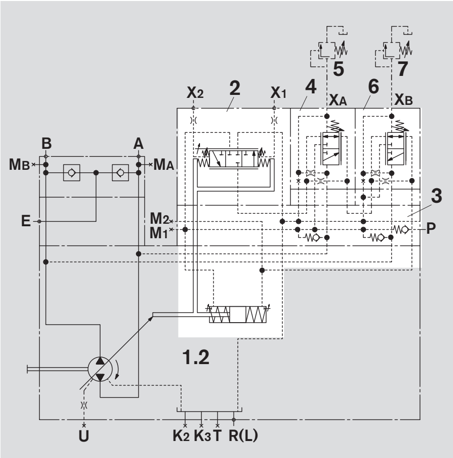
Not available on A4VSO.

Not possible on pumps for bi-directional rotation.

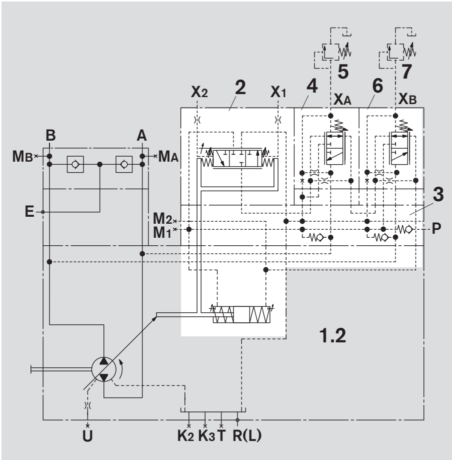
Schematics example A4VSG

Size 500...1000

Direction of rotation clockwise



Direction of rotation counter clockwise



Ports

X_A	Pilot pressure port for remote pressure control in A
X_B	Pilot pressure port for remote pressure control in B
X_1; X_2	Pilot pressure ports
P	Control pressure port
M_1	Gauging port small control chamber
M_2	Gauging port large control chamber

Sub-assemblies

1	Pump with hydraulic control device
1.2	A4VSG (see RE 92100)
2	Pilot control unit
3	Sandwich plate
4	Pressure control valve for port A
5; 7	External pilot relief valves (not included in supply)
6	Pressure control valve for port B

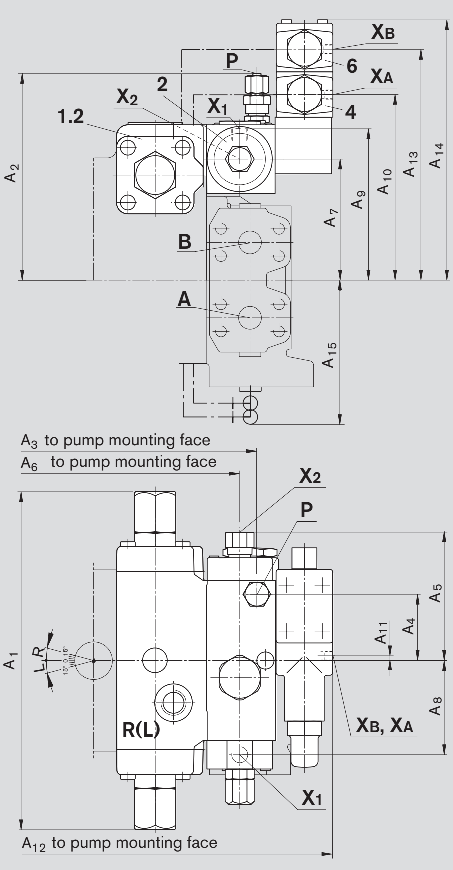
Size 40...355 see page 29

Unit dimensions HD.D / HD.G

Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSG



Sub-assemblies

1 Pump with hydraulic control device
1.2 A4VSG (see RE 92100)
1.3 A4CSG (see RE 92105)

2 Pilot control unit

3 Sandwich plate (Size 500...1000)

4 Pressure control valve for port A
(for port B on counter clockwise rotation size 40...355)

6 Pressure control valve for port B
(for port A on counter clockwise rotation size 40...355)

Ports

				max. tightening torques [1]
X_A; X_B	Pilot pressure ports for remote pressure control	DIN 3852	M14x1,5; 12 deep; plugged on HDD	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3853	S8 Form W	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	
40	296	193	233	58	113	218	106	82,5	132,5	163	4	299	203	229	165	For detailed dimensions and technical data on the variable pump see the technical data sheet A4VSG RE 92100
71	332	209	260	58	113	246	122	82,5	148,5	179	4	326	219	245	168	

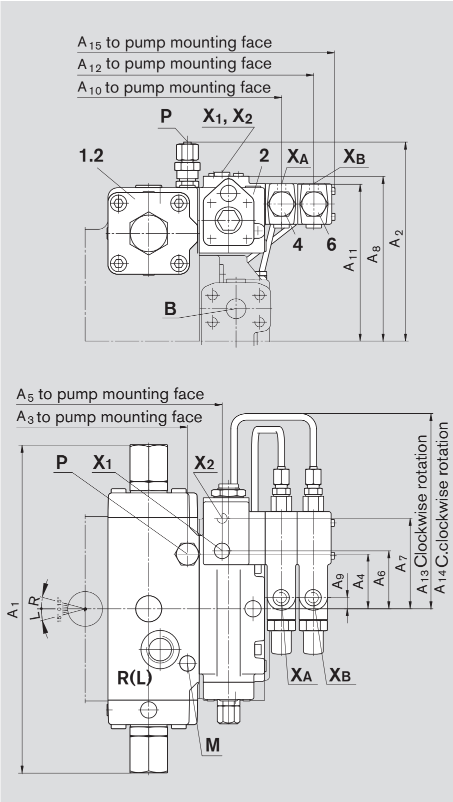
[1] see general notes

Unit dimensions HD.D / HD.G

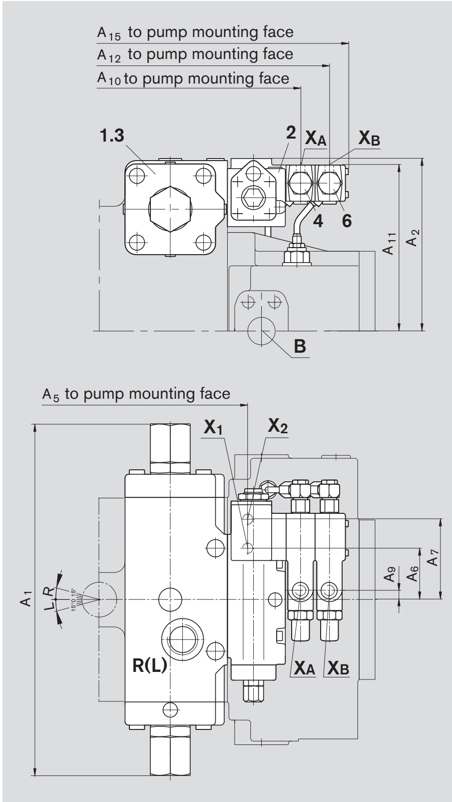
Before finalising your design please request a certified installation drawing.

Size125...355

A4VSG



A4CSG



Sub-assemblies see page 31

Ports

max. tightening torques [1)]

X_A; X_B	Pilot pressure ports for remote pressure control	DIN 3852	M14x1,5; 12 deep; plugged on HDD	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port only on A4VSG	DIN 3853	S8 Form W (Size 125 and 180) S12 Form W (Size 250 and 355)	50 Nm 90 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged(Size 125a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}
125	402	245	251	67	293	71	111	202	13	366	192	406	239	224	432
180	402	245	251	67	293	71	111	202	13	366	192	406	239	224	432
250	485	297,5	311	71	355	71	111	238	13	428	228	468	239	224	494
355	485	297,5	311	71	355	71	111	238	13	428	228	468	239	224	494

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSG RE 92100 or A4CSG RE 92105

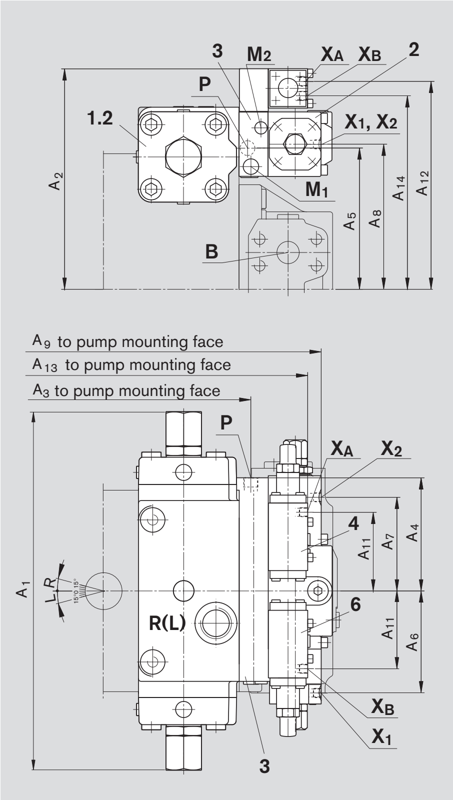
[1)] see general notes

Unit dimensions HD.D / HD.G

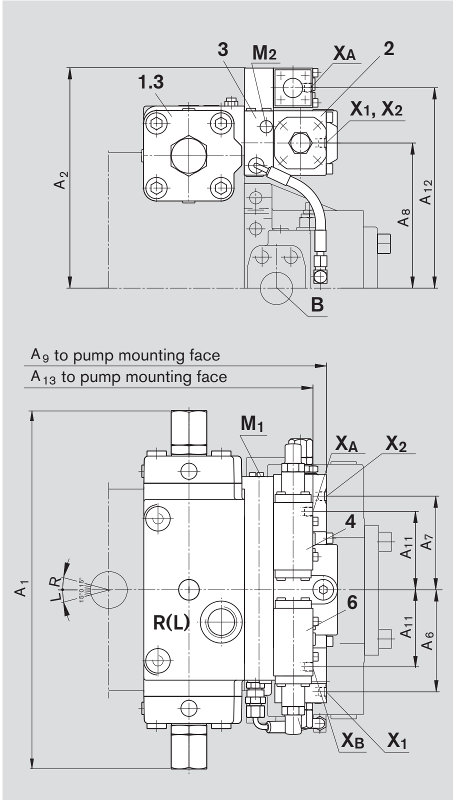
Before finaliaing your design please request a certified installation drawing.

Size 500...1000

A4VSG



A4CSG



2

Sub-assemblies see page 31.

Ports

max. tightening torques [1)]

X_A; X_B	Pilot pressure ports for remote pressure control	DIN 3852	M14x1,5; 12 deep plugged on HDD	80 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M22x1,5; 14deep (only on A4VSG)	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged (A4VSG) M22x1,5; 14 deep; plugged (A4CSG)	140 Nm 210 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{11}	A_{12}	A_{13}	A_{14}	
500	555	342	383	175	200	158	145	225	492	136	315	469	304	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSG RE 92100 or A4CSG RE 92105
750	630	371	415	175	230	158	145	280	524	136	345	501	334	
1000	670	394	481	175	253	158	145	278	590	136	368	567	357	

1) see general notes

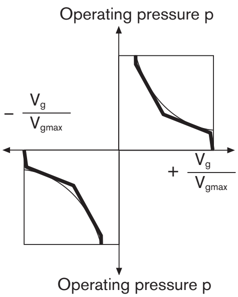
HD1P with power control

As the operating pressure rises, the pilot pressure (i.e. the command value for HD) is reduced by the power limiting valve LV 06, thereby reducing the pump displacement in such a manner, that a certain preset drive torque cannot be exceeded.

On some pump combinations **A4 + A4 dimensional restrictions** can limit the mounting of the power limiting valve.
In the folowing cases we recommend the mounting of the power valve on the rear pump, or consult us for more information:

Size 40	+	Size 40
Size 71 with pressure control	+	Size 71

Characteristic



Technical data

Min. beginning of control for pump operating pressure must be higher than the set control pressure at P or at the control pressure relief valve on the A4CSG.

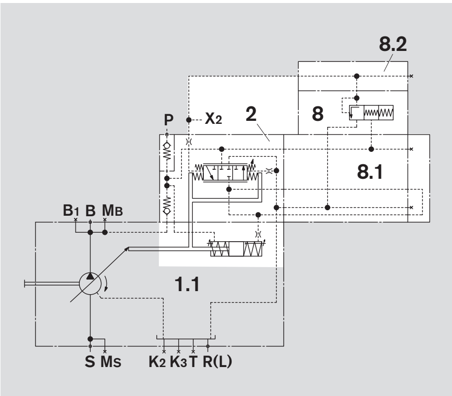
The power control curve is factory set

Please state in clear text when ordering
e.g. 55 kW at 1500 rpm.

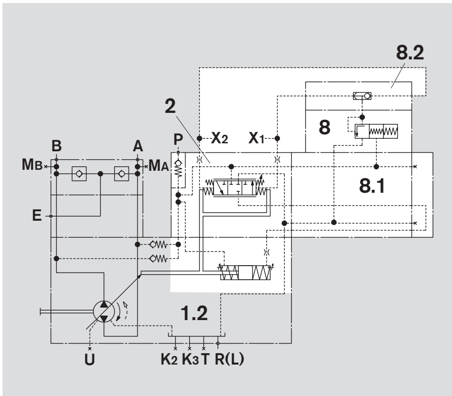
Examples of power control curves see RE 95546

Schematics

Size 40 and 71
(Example A4VSO in clockwise rotation; in counter clockwise rotation only X_1 exists and is connected to the power valve)



(Example A4VSG)



Ports

X_1; X_2 Pilot pressure ports

P Control pressure port

Sub-assemblies

1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pilot control unit

8 Power limiting valve (see RE 95546)
LV 06 405 (on size 40 and 71)

8.1 Sandwich plate for mounting of power valve (size 40 and 71)

8.2 Shuttle valve (on A4VSG)

Schematics size **125...1000** see page 35

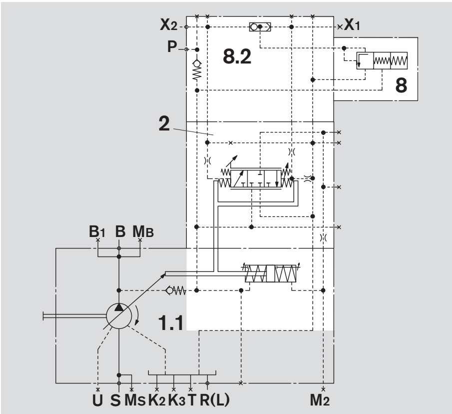
HD1P with power control

Schematics

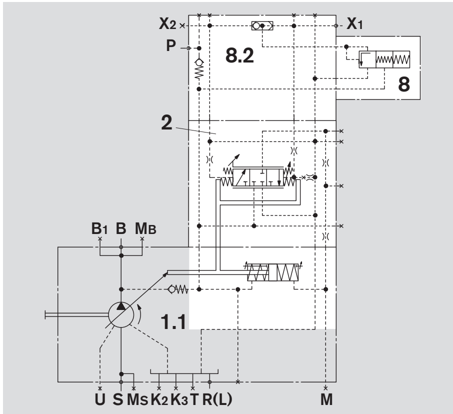
On the **A4VSG** and **A4CSG both ports X_1 and X_2** are connected to the shuttle valve (either internally or via a T–joint) and **open.** On the **A4VSO in clockwise rotation** only port **X_2, and in counter clockwise rotation only port X_1,** is connected to the power valve and **open.**

Size 125...355

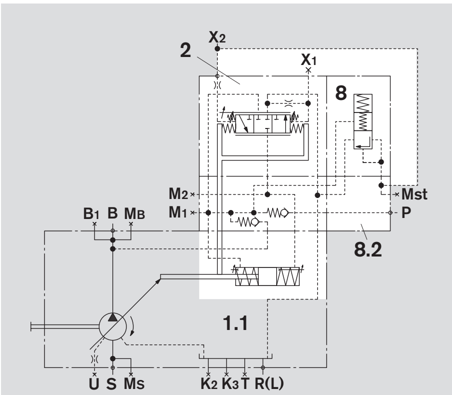
Example A4VSO clockwise rotation



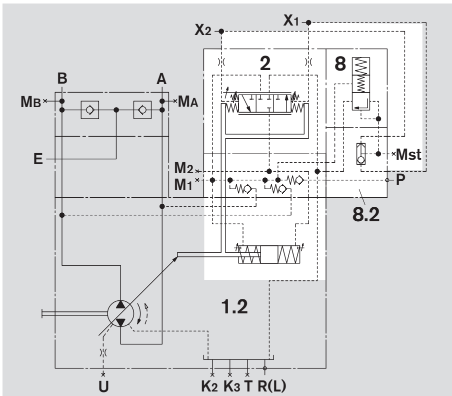
Example A4VSO counter clockwise rotation



Size 500...1000
Example A4VSO clockwise rotation



Example A4VSG



Ports

X_1; X_2	Pilot pressure ports
P	Control pressure port
M_{st}	Gauging port pilot pressure (Size 500...1000)
M	Gauging port control chamber pressure (Size 125...355)
M_1	Gauging port small control chamber (Size 500....1000)
M_2	Gauging port large control chamber (Size 500...1000)

Size 40 and 71 see page 34

Sub-assemblies

1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pilot control unit

8 Power valve (see RE 95546)
LV 06 205 (on size 125...1000)

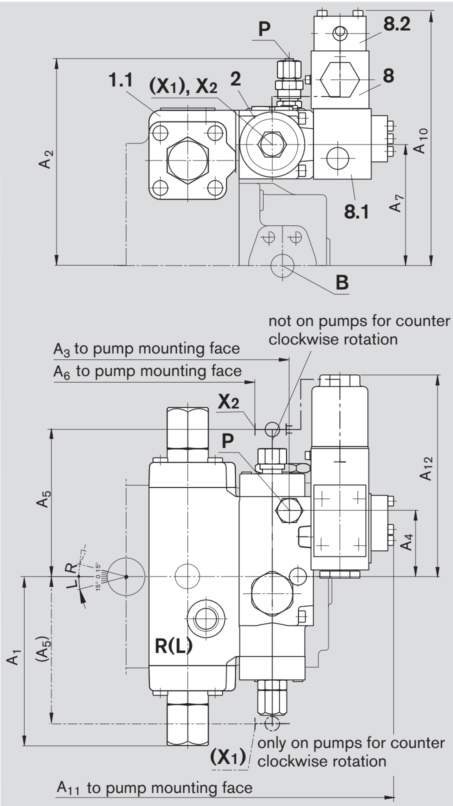
8.2 Shuttle valve assembly (on A4VSG and A4CSG)

Unit dimensions HD1P

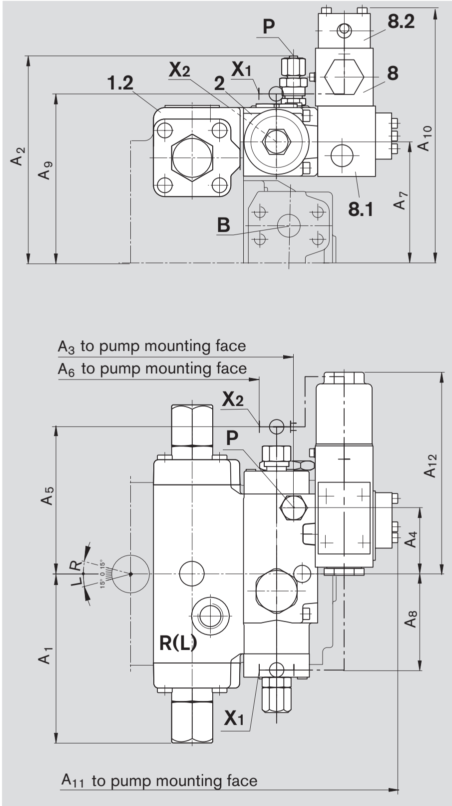
Before finalising your desigh please request a certified installation drawing.

Size 40 and 71

A4VSO



A4VSG



Sub-assemblies see page 37

Ports

				max. tightening torques [1]
X_1; X_2	Pilot pressure ports	DIN 3853	S8 Form W	50 Nm
P	Control pressure port	DIN 3853	S8 Form W	50 Nm

on A4VSO clockwise rotation only X_2 exists, on A4VSO counter clockwise rotation only X_1 exists

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	
40	148	222	233	58	128	203	106	82,5	147,5	222	323	175	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	166	240	260	58	128	203	122	82,5	147,5	238	350	175	

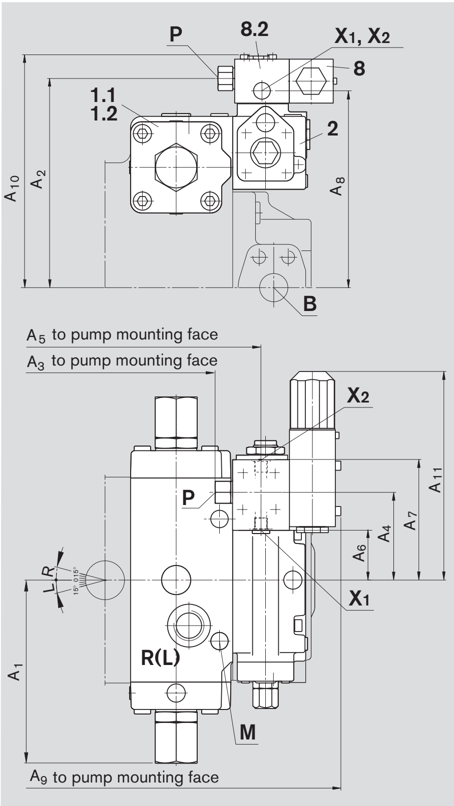
[1] see general notes

Unit dimensions HD1P

Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSO and A4VSG



A4CSG in preparation, dimensions on request

Sub-assemblies

1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pilot control unit

8 Power valve (see RE 95546)
LV 06 405 (on size 40 and 71)
LV 06 205 (on size 125...1000)

8.1 Adapter plate for power valve (Size 40 and 71)

8.2 Shuttle valve assembly
(on A4VSG and A4CSG)

Ports

				max. tightening torques [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
X_1; X_2	Pilot pressure ports	DIN 3852	M14x1,5; 12 deep	80 Nm

on A4VSO clockwise rotation X_1 is plugged, on A4VSO counter clockwise rotation X_2 is plugged

M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (size 125...180)	80 Nm
			M18x1,5; 12 deep; plugged (size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	
125	201	230	247	95,5	297	55,5	129,5	216	384	257	227	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
180	201	230	247	95,5	297	55,5	129,5	216	384	257	227	
250	243	266	309	95,5	359	55,5	129,5	252	446	293	227	
355	243	266	309	95,5	359	55,5	129,5	252	446	293	227	

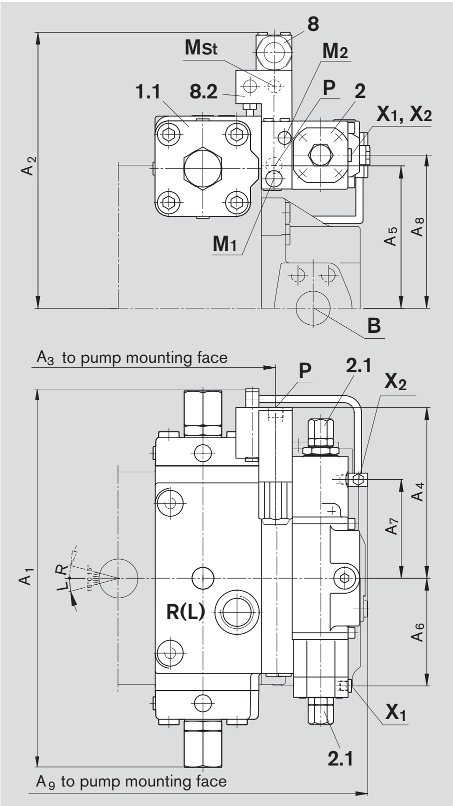
[1] see general notes

Unit dimensions HD1P

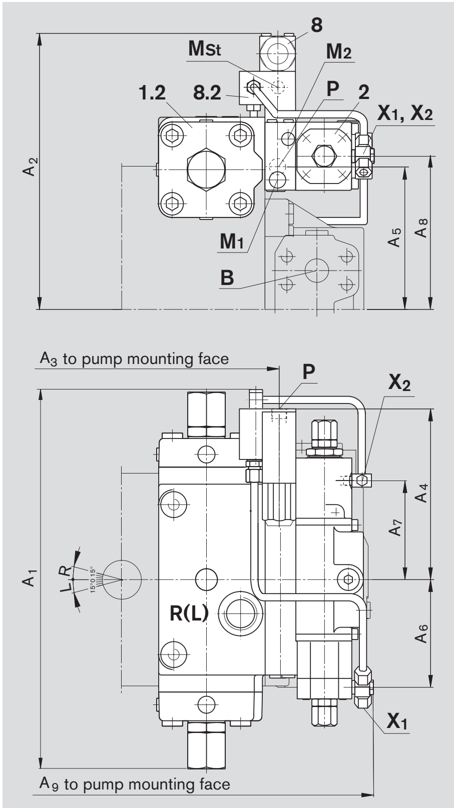
Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSO



A4VSG (A4CSG on request)



Sub-assemblies see page 37

Ports

				max. tightening torques [1]
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
X_1; X_2	Pilot pressure ports	DIN 3853	S8 Form W	50 Nm

on A4VSO clockwise rotation X_1, on A4VSO counter clockwise rotation X_2 M14x1,5 plugged

M_{st}	Gauging port pilot pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9
500	555	406	383	251	206	158	145	225	521
750	630	430	415	251	236	158	145	280	553
1000	670	459	481	251	259	140	140	278	619

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

[1] see general notes

HD1T with electrical control of pilot pressure

The pilot pressure level in the X_1 or X_2 pilot channel is generated by means of a proportional current signal to to one of the solenoids a or b at the proportional valve DBEP6 (acc. to RE 29164).

The pilot pressure is limited by the current signal.

In pumps for closed circuit operation each direction of swivel is controlled by its own proportional solenoid. In open circuit pumps (one side of center) there is only one solenoid.

Control through an electrical command value. Current control through pulsewidth modulation.

Analog or digital amplifiers can be used for control of the solenoids e.g. proportional amplifier VT 3000 with 170 Hz (see RE 29935). Please order separately.

For more information on the selection of available control electronics and hydraulic fluid, functional discription and manual emergency override and further technical data please consult RE 29164.

Technical data – electrical

Operating voltage	24 V
Nominal solenoid current	700 mA
Control current	
Beginning of control at V_{g0} and 10 bar pilot pressure	300 mA
End of control at V_{gmax} and 45 bar pilot pressure	700 mA
Nominal resistance at 20°C (R_{20})	19,5 Ω
Max. duty cycle	100 % (S1)
Type of plug	DIN EN 175 301-803/ISO 4400 with wiring screw joint M16x1,5 for cable dia. 4,5...10 mm
Type of protection DIN/EN 60529	IP 65
Manual emergency override	exists, see RE 29164
Coil operating temperature	up to 150 °C

Caution! Avoid being burned:
The pump and especially the solenoids are during and shortly after operation very hot!
Wear always suitable protective clothing.

Calculation formula for the resistance

at T > 20 °C

$$R_W = \frac{R_{20} \text{ x } (235 + T)}{255}$$

Technical data – hydraulic

Control pressure (in P)	p_{min}	bar	50
	p_{max}	bar	100
Hysteresis			± 4 % of V_{gmax}
Repeatability			2% of V_{gmax}

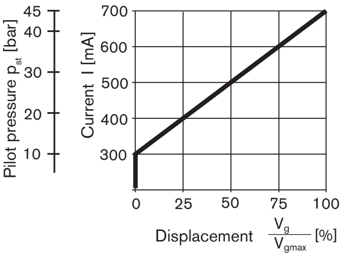
Because of the restrictions in RE 29164 the control pressure in P is limited to 50...100 bar on the controls HD1T and HD1U. The flow losses in the proportional valve (e.g. 4 L/min per de-energized solenoid at p = 50 bar) must be compensated for in the calculation of the required control oil flow in P.

HD1T with electrical control of pilot pressure

A4VSO - open circuit

DBEP 6, Execution B resp. A

Characteristic

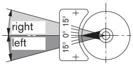


Relation between

Direction of rotation – Direction of flow at actuation of solenoid

Direction of rotation	Swivel range[1]	Direction of flow	Pressure outlet port
clockwise	left	S to B	B
counter clockwise	right	S to B	B

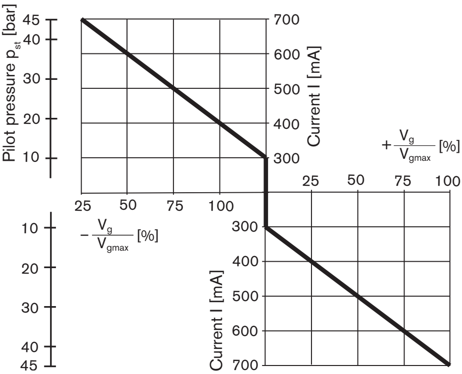
[1] compare swivel angle indicator



A4VSG - closed circuit

DBEP 6, Execution C

Characteristic

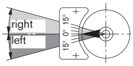


Relation between

Direction of rotation – Actuation of solenoid – Direction of flow

Direction of rotation	Actuation of solenoid	Swivel range[1]	Direction of flow	Pressure outlet port
clockwise	b	right	B to A	A
	a	left	A to B	B
counter clockwise	b	right	A to B	B
	a	left	B to A	A

[1] compare swivel angle indicator



A4CSG with HD1T

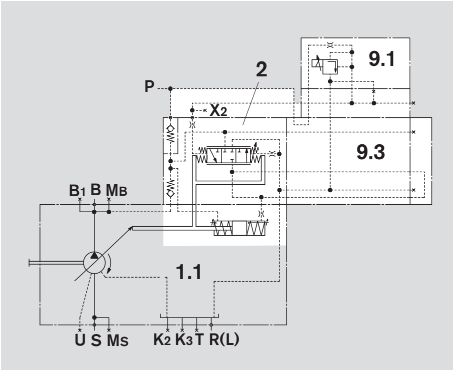
is in preparation and can be supplied on request.

HD1T with electrical control of pilot pressure

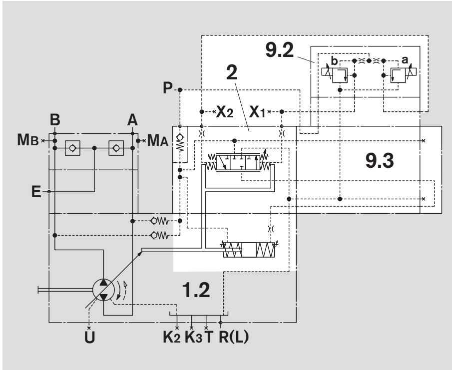
Schematics

Size 40 and 71

Example A4VSO in clockwise rotation, in counter clockwise rotation X_1 connected to the prop. valve and X_2 deleted

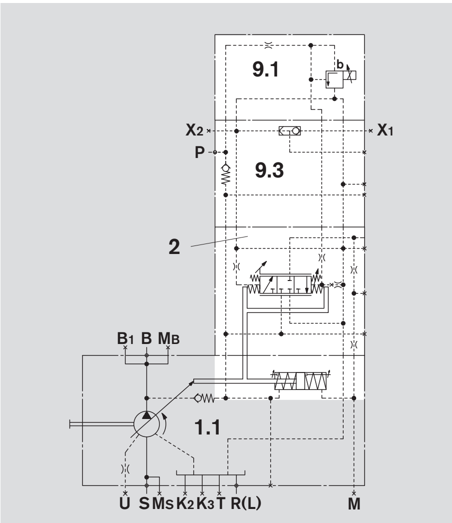


Example A4VSG

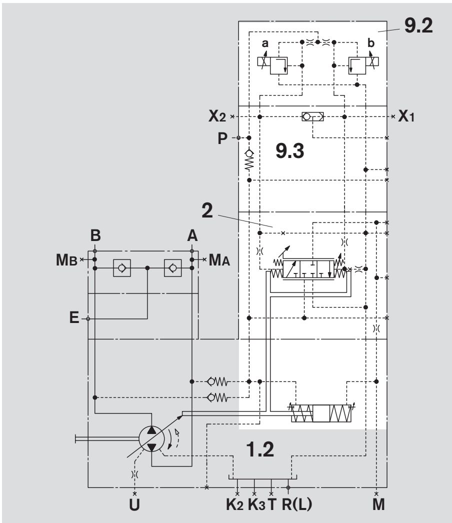


Size 125...355

Example A4VSO in counter clockwise rotation



Example A4VSG



Ports

P	Control pressure port
X_1; X_2	Gauging ports pilot pressure
M	Gauging port control chamber pressure (Size 125...355)

Sub-assemblies see page 42

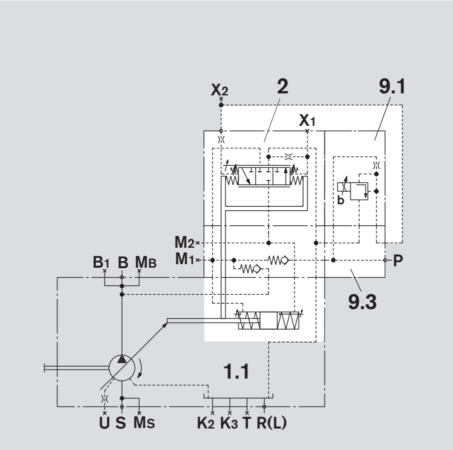
Size 500...1000 see page 42

HD1T with electrical control of pilot pressure

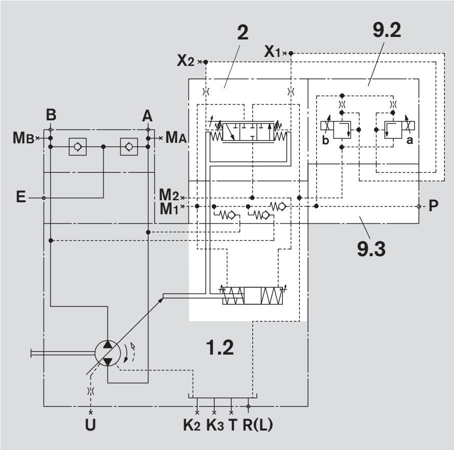
Schematics

Size 500...1000

Example A4VSO in clockwise rotation, in counter clockwise rotation X_1 connected to the proportional valve



Example A4VSG



Ports

P	Control pressure port
X_1; X_2	Gauging ports pilot pressure
M_1	Gauging port small control chamber (size 500...1000)
M_2	Gauging port large control chamber (size 500...1000)

Subassemblies

1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pilot control unit

9.1 Proportional-pressure relief valve
(open circuit)
DBEP6 B06-1X/45AG24NZ4M-382 with inlet orifice dia. 1,0 mm
DBEP6 A06-1X/45AG24NZ4M-382 on size 125...355 clockwise rotation

9.2 Proportional-pressure relief valve
(closed circuit)
DBEP6 C06-1X/45AG24NZ4M-382 with inlet orifice dia.1,0 mm

Solenoids with plugs
to DIN EN 175 301-803 / ISO 4400
Type of protection IP 65
and wiring screw joint M16x1,5 for
cable dia. 4,5...10mm

9.3 Sandwich plate to mount proportional valve

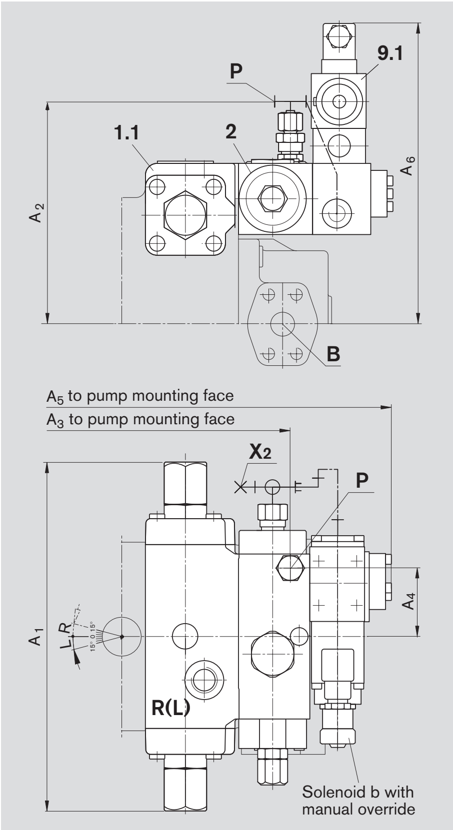
Size 40...355 see page 41

Unit dimensions HD1T

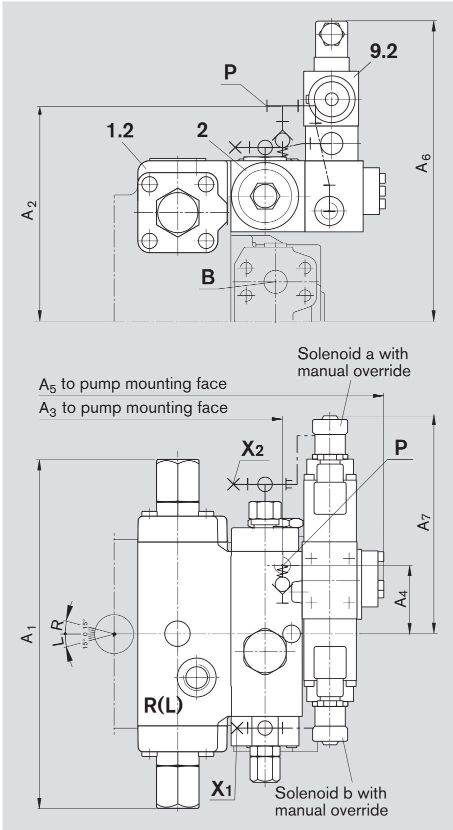
Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSO in clockwise rotation
(Counter clockwise rotation on request)



A4VSG



Sub-assemblies see page 42

Ports

max. tightening torques [1)]

P	Control pressure port	DIN 3853	S8 Form W	50 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3853	S8 Form W plugged	50 Nm

on A4VSO clockwise rotation only X_2 exists, on A4VSO counter clockwise rotation only X_1 exists (dimensions on request)

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	
40	296	193	233	58	323	257	189	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	332	209	260	58	350	273	189	

[1)] see general notes

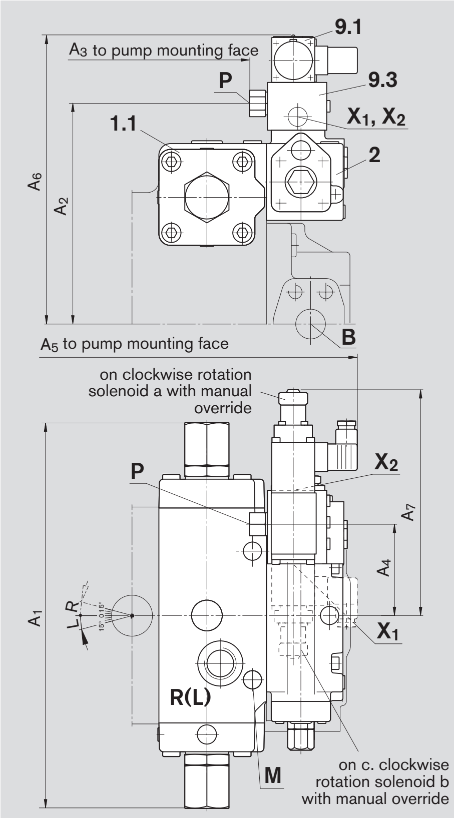
2

Unit dimensions HD1T

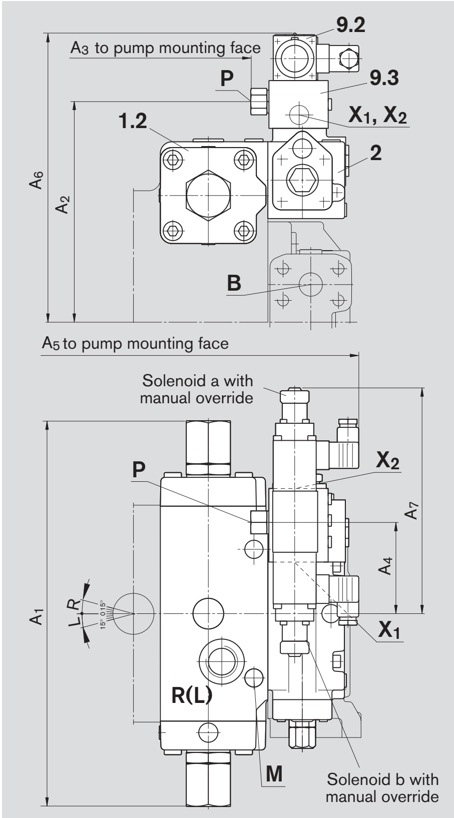
Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSO



A4VSG (A4CSG in preparation, dimensions on request)



Sub-assemblies see page 42

Ports

				max. tightening torques [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (size 125 a. 180) M18x1,5; 12 deep; plugged (NG 250 a. 355)	80 Nm 140 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7
125	402	230	247	96	360	302	236
180	402	230	247	96	360	302	236
250	485	266	309	96	422	338	236
355	485	266	309	96	422	338	236

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

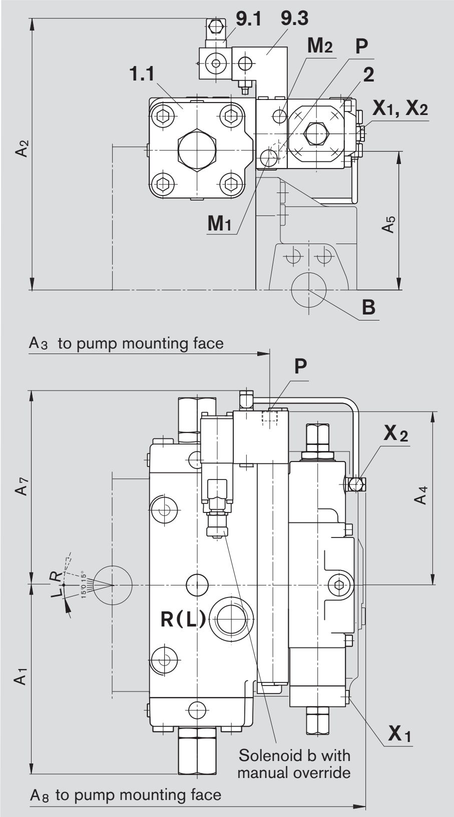
[1] see general notes

Unit dimensions HD1T

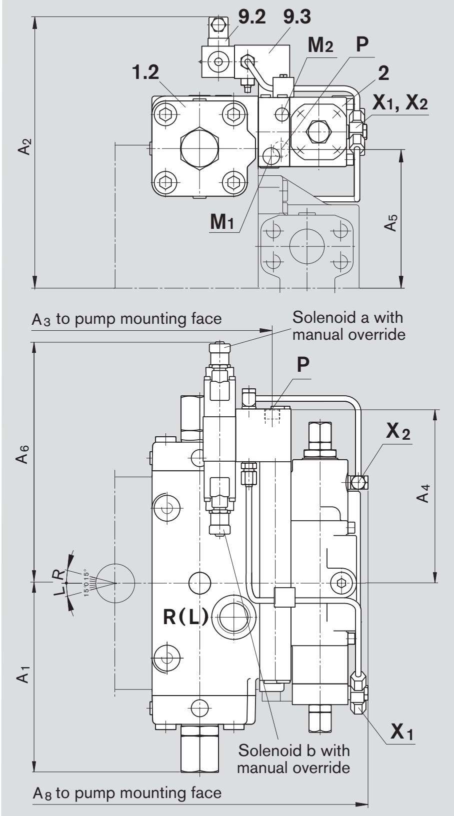
Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSO



A4VSG (A4CSG in preparation, dimensions on request)



Sub-assemblies see page 42

Ports

				max. tightening torques [1]
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged	80 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3853	S8 Form W; plugged	50 Nm
on A4VSO clockwise rotation X_1, c.clockwwise X_2		DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
500	278	391	383	251	206	348	278	521
750	315	423	415	251	236	348	278	553
1000	335	444	481	251	259	348	278	619

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

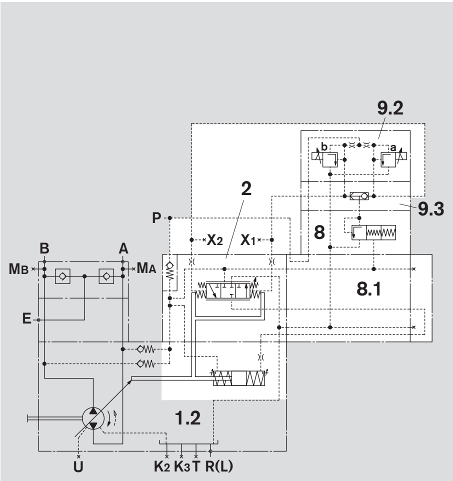
[1] see general notes

HD1U with power control and electr. control of pilot pressure

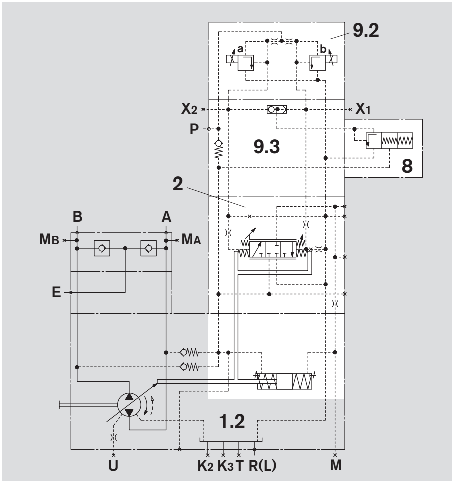
This version is a combination of HD1P (see page 34) and HD1T (see page 39)

Schematics

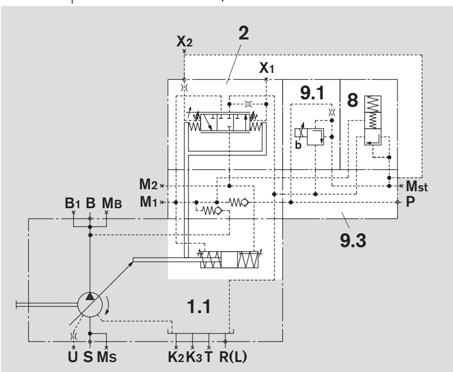
Size 40 and 71
Example A4VSG; on A4VSO clockwise rotation only X_2, on A4VSO counter clockwise rotation only X_1 exists



Size 125...355
Example A4VSG



Size 500...1000
Example A4VSO clockwise rotation; on counter clockwise rotation X_1 is connected to the power valve



Ports

P	Control pressure port
X_1; X_2	Gauging ports pilot pressure
M	Gauging port control chamber pressure (size 125...355)
M_1	Gauging port small control chamber (size 500...1000)
M_2	Gauging port large control chamber (size 500...1000)
M_{st}	Gauging port pilot pressure (size 500...1000)

Sub-assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
2	Pilot control unit
8	Power valve (see RE 95546) LV 06 405 (on size 40 and 71) LV 06 205 (on size 125...1000)
8.1	Sandwich plate for mounting of power valve (size 40 a. 71)
9.1*	Proportional-pressure relief valve (on A4VSO) DBEP6 B06 DBEP6 A06 (on size 125...355 clockwise rotation)
9.2*	Proportional-pressure relief valve DBEP6 C06 (on A4VSG and A4CSG)
9.3	Sandwich plate for mounting of proportional valve

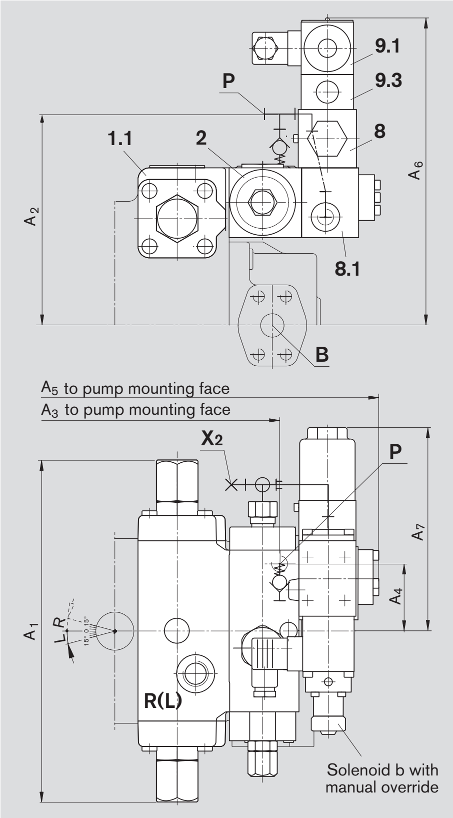
* detailed information see page 42

Unit dimensions HD1U

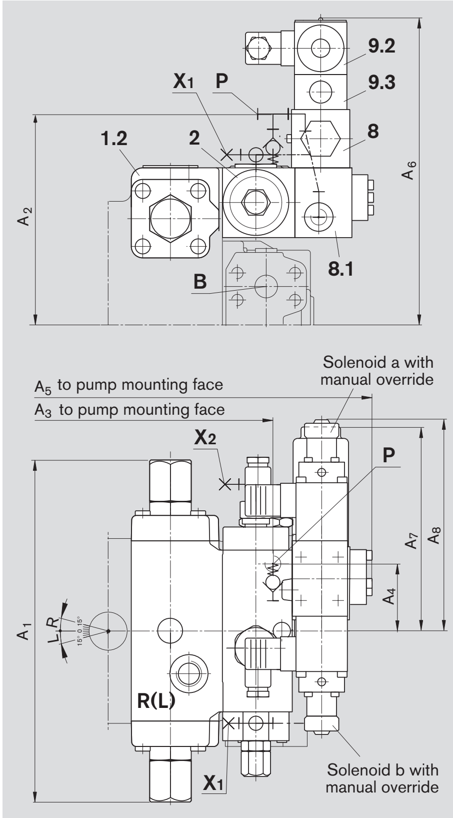
Before finalising your design please request a certified installation drawing.

Size 40 and 71

A4VSO clockwise rotation
(Counter clockwise rotation on request)



A4VSG



Sub-assemblies see page 46

Ports

max. tightening torques [1)]

P	Control pressure port	DIN 3853	S8 Form W	50 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3853	S8 Form W plugged	50 Nm

on A4VSO clockwise rotation only X_2 exists, on A4VSO counter clockwise rotation only X_1 exists (dimensions on request)

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	
40	296	193	233	58	323	266	175	189	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	332	209	260	58	350	282	175	189	

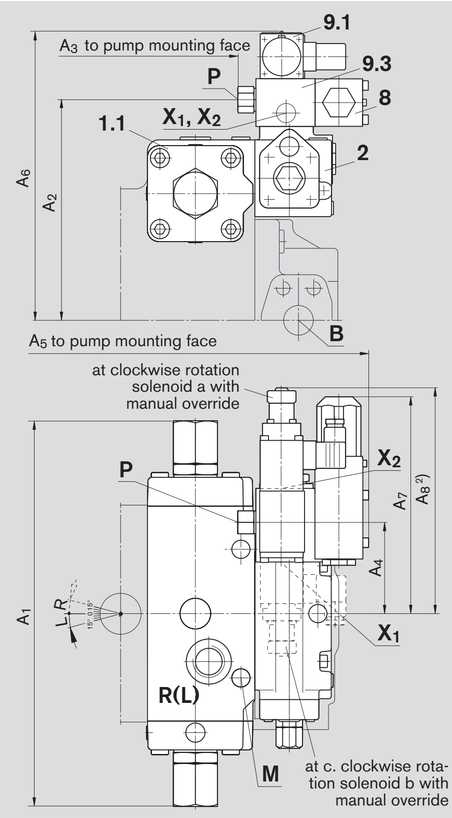
1) see general notes

Unit dimensions HD1U

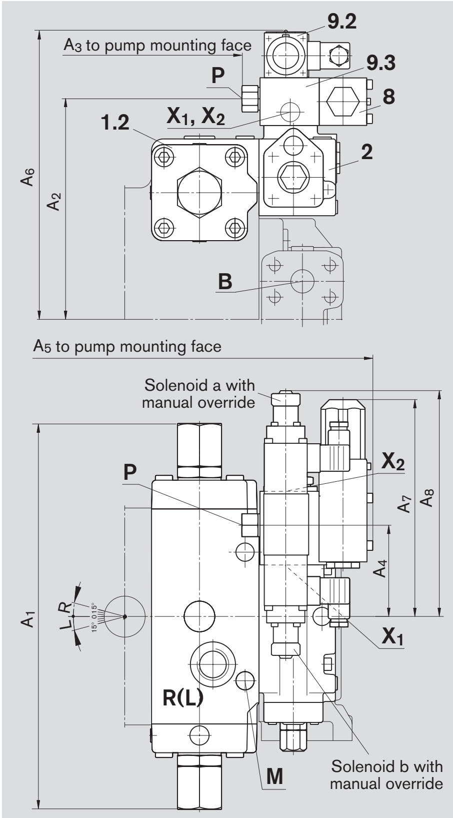
Before finalising your design please request a certified installation drawing.

Size 125...355

A4VSO



A4VSG (A4CSG in preparation, dimensions on request)



Sub-assemblies see page 49

Ports

				max. tightening torques [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
M	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (size 125 a. 180) M18x1,5; 12 deep; plugged (size 250 a. 355)	80 Nm 140 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8 [2]
125	402	230	247	96	384	302	227	236
180	402	230	247	96	384	302	227	236
250	485	266	309	96	446	338	227	236
355	485	266	309	96	446	338	227	236

For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

[1] see general notes [2] deleted on counter clockwise rotation, since only solenoid b exists

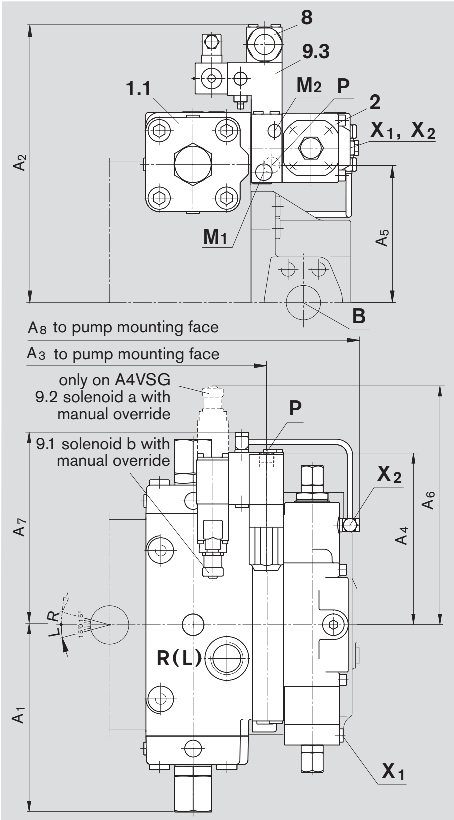
Unit dimensions HD1U

Before finalising your design please request a certified installation drawing.

Size 500...1000

A4VSO

A4VSG has additional solenoid a (see dimension A_6)
A4CSG in preparation, dimensions on request



2

Sub-assemblies

- **1** Pump with hydraulic control device
- **1.1** A4VSO (see RE 92050)
- **1.2** A4VSG (see RE 92100)
- **2** Pilot control unit
- **8** Power valve (see RE 95546)
  LV 06 405 (on size 40 and 71)
  LV 06 205 (on size 125...1000)
- **8.1** Sandwich plate for mounting of power valve
- **9.1** Proportional-pressure relief valve (on A4VSO)
  DBEP6 B06
  DBEP6 A06 (on size 125...355 clockwise rotation)
- **9.2** Proportional-pressure relief valve DBEP6 C06
  (on A4VSG and A4CSG)
- **9.3** Sandwich plate for mounting of proportional valve

Ports

Ports				max. tightening torques [1]
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
M_1	Gauging port small control chamber	DIN 3852	M18x1,5; 12 deep; plugged	80 Nm
M_2	Gauging port large control chamber	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
X_1; X_2	Gauging ports pilot pressure	DIN 3853	S8 Form W; plugged	50 Nm
on A4VSO clockwise rotation X_1, c. clockw. rot. X_2		DIN 3852	M14x1,5; 12 deep; plugged	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	
500	278	406	383	251	206	352	278	521	For detailed dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
750	315	430	415	251	236	348	278	553	
1000	335	459	481	251	259	348	278	619	

[1] see general notes

General notes

– The hydraulic control HD is, depending on the type of operation, suitable for open circuit (A4VSO) or closed circuit operation (A4VSG, A4CSG).

– Project planning, assembly, and startup of the motor require the involvement of trained personnel.

– The working and functional ports are only designed to accommodate hydraulic piping.

– Tightening torques: The tightening torques specified in this data sheet are maximum values and may not be exceeded (maximum value for screw thread). Manufacturer specifications for the max. permissible tightening torques of the used fittings must be observed!
For DIN 13 fastening screws we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– The housing temperature rises during and shortly after operation. Take suitable safety precautions (e.g. wear protective clothing).

– The data and information contained herein must be adhered to.

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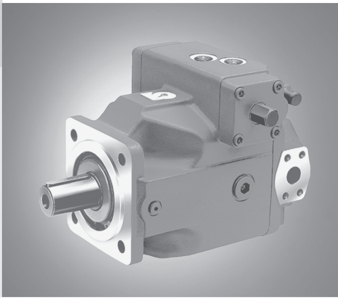
Control devices DR, DP, FR and DFR

RE 92 060/10.06 1/32
Replaces: 03.95

Technical data sheet



for the variable pumps
A4VSO and A4VSG Series 1 and 3
open and closed circuits

Contents

Ordering code – Standard program A4VSO	2
Ordering code – Standard program A4VSG	3
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Features

- Control devices for the variable pumps A4VSO and A4VSG
- Control of pressure and flow
- Optional remote control
- Optional control for parallel operation
- Mechanical limitation of $V_{g\ min}$ and $V_{g\ max}$
- Special versions for mooring, over center operation and decompression via the pump are possible

Further information:

Variable pump A4VSO	Size 40...1000	RE 92050
Variable pump A4VSG	Size 40...1000	RE 92100

Ordering code – Standard program A4VSO

	A4VS	O			/				–					
01	02	03	04	05		06	07	08		09	10	11	12	13

01	**Fluid** (for details see RE 92050)	

Axial piston unit

02	Swash plate design, variable	**A4VS**

Type of operation

03	Pump, open circuit operation (see RE 92050)	**O**

	Size				40	71	125	180	250	355	500	750	1000	
04	Displacement $V_{g\ max}$ [cm³]				40	71	125	180	250	355	500	750	1000	
	Control and regulating devices													
05	**Pressure control**	DR			●	●	●	●	●	●	●	●	●	**DR**
	remotely controlled	DR	G		●	●	●	●	●	●	●	●	●	**DRG**
	Press. control for parallel operation	DP			●	●	●	●	●	●	●	●	●	**DP**
	with flow control	DP	F		–	–	●	●	●	●	–	–	–	**DPF**
	Flow control	FR			●	●	●	●	●	●	–	–	–	**FR**
	with remote pressure control	FR	G		●	●	●	●	●	●	–	–	–	**FRG**
	FR no connection betw. X_F to tank	FR		1	●	●	●	●	●	●	–	–	–	**FR1**
	FRG no connection betw. X_F to tank	FRG		1	●	●	●	●	●	●	–	–	–	**FRG1**
	Pressure and flow control	DFR			●	●	●	●	●	●	–	–	–	**DFR**
	no connection between X_F to tank	DFR		1	●	●	●	●	●	●	–	–	–	**DFR1**
	Series													
06					●	●	–	–	–	–	–	–	–	**10**
					–	–	●	●	●	●	●	●	●	**30**

07	**Direction of rotation**	
08	**Seals**	
09	**Shaft end**	
10	**Mounting flange**	For detailed information see: RE 92050 – A4VSO
11	**Service port connections**	
12	**Through drive**	
13	**Filtration**	

● available – not available

Ordering code – standard program of A4VSG see page 3

Ordering code – Standard program A4VSG

	A4VS	G			/				–						
01	02	03	04	05		06	07	08		09	10	11	12	13	14

01	Fluid (for details see RE 92100)	

Axial piston unit

02	Swash plate design, variable	**A4VS**

Type of operation

03	Pump closed circuit operation (see RE 92100)	**G**

	Size				40	71	125	180	250	355	500	750	1000	
04	Displacement $V_{g\,max}$ [cm³]				40	71	125	180	250	355	500	750	1000	
	Control and regulating devices													
05	**Pressure control for one side of center**	DR			●	●	●	●	●	●	●	●	●	**DR**
	remotely controlled	DR	G		●	●	●	●	●	●	●	●	●	**DRG**
	Pressure control for parallel operation for one side of center	DP			●	●	●	●	●	●	●	●	●	**DP**
	Series													
06					●	●	–	–	–	–	–	–	–	**10**
					–	–	●	●	●	●	●	o	●	**30**

Direction of rotation

07	with view on shaft end	clockwise	**R**
	(no bi-directional rotation possible)	counter clockwise	**L**

08	Seals	For detailed information see: RE 92100 – A4VSG
09	Shaft end	
10	Mounting flange	
11	Service port connections	
12	Through drive	
13	Valves	
14	Filtration	

● available o in preparation – not available

Ordering code – standard program of A4VSO see page 2

2

DR pressure control, swivel on one side

The pressure control keeps the pressure in the pumps pressure outlet constant within the control range of the pump. Therefore, the pump only delivers as much fluid, as required by the actuators. The pressure can be steplessly set at the control valve.

Recommended setting range 50...350 bar
Standard setting 350 bar. If another setting is required, please state in clear text when ordering.

Home position in pressureless condition: $\mathbf{V_{g\,max}}$

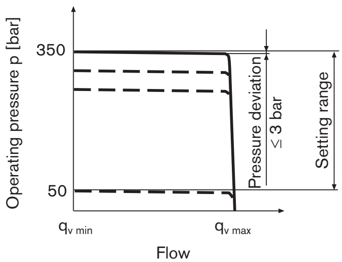
Min. and max. **swivel angle limitation** mechanically adjustable to 50 % of $V_{g\,max}$.
The $V_{g\,min}$-stop is set so that a pressure level of 15...20 bar is reached in a closed pressure port B.
The $V_{g\,max}$-stop is set to the nominal $V_{g\,max}$ value. If another setting is required, please state in clear text when ordering.

The pressure control is available in A4VSO and A4VSG however only for swivel on one side of center.
On request also versions for **mooring or over center operation** are available.
For fast decompression of the pressurized outlet, the pump can swivel momentarily over center and swallow some fluid.

Remote adjustment of pressure control DRG see page 7, pressure control for parallel operation DP see page.12.

A4VSO - open circuit

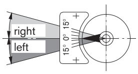
Static characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

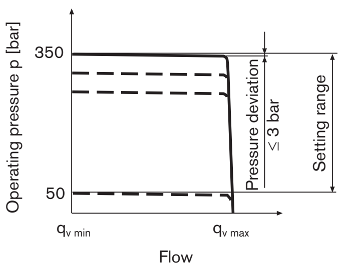
[1] compare swivel angle indicator



A4VSG - closed circuit

Pressure control DR only for swivel on one side.
No bi-directional rotation possible.

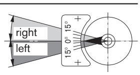
Static characteristic



Direction of flow A to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

[1] compare swivel angle indicator



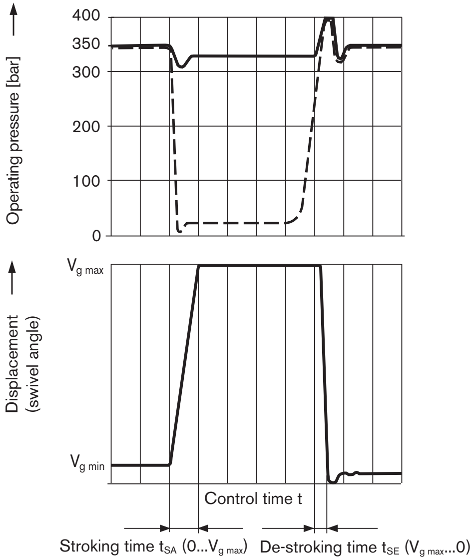
DR pressure control, swivel on one side

Dynamic characteristics

The curves show measured average values.

Conditions: n = 1500/1800 rpm
t_{oil} = 50° C
Main line relief set at 400 bar

Load jump accomlished through sudden opening and closing of the pressure outlet with a relief valve as load valve, situated 1 m downstream of the pressure port on the axial piston unit.



Size	t_{SA} [s] at 20 bar	t_{SA} [s] at 330 bar	t_{SE} [s] Standby at 350 bar
40	approx. 0,12	approx. 0,08	0,02
71	approx. 0,20	approx. 0,10	0,03
125	approx. 0,30	approx. 0,20	0,04
180	approx. 0,30	approx. 0,20	0,05
250	approx. 0,40	approx. 0,30	0,06
355	approx. 0,40	approx. 0,30	0,08
500	approx. 0,50	approx. 0,30	0,10
750	approx. 1,00	approx. 0,60	0,15
1000	approx. 1,50	approx. 0,90	0,20

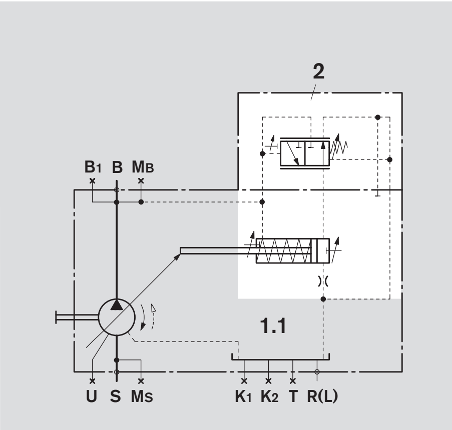
The **stroking time** t_{SA} ($V_{g\,min} \rightarrow V_{g\,max}$) can be steplessly adjusted, without influencing the de-stroking time t_{SE}.
Standard setting see table. If needed, these values can be reduced by a factor of 2...3 (please consult us).

Schematics DR

Control device (shown in area with white background) valid for A4VSO and A4VSG

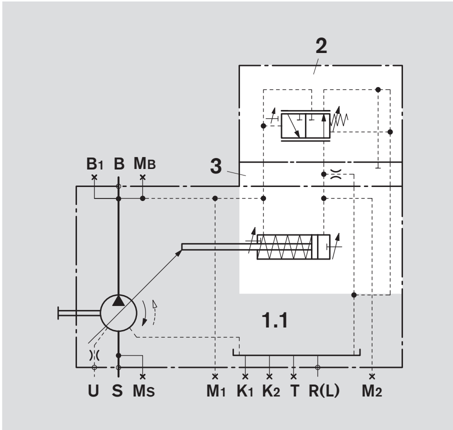
Size 40 and 71

Example: A4VSO



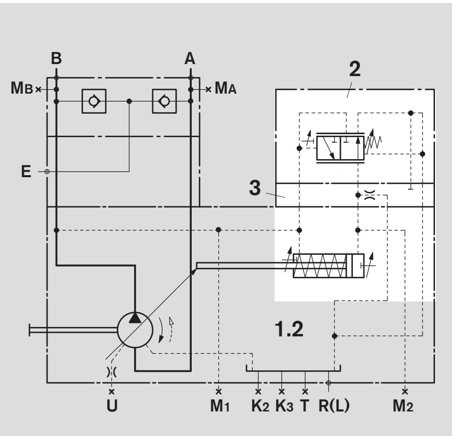
Size 125...355

Example: A4VSO



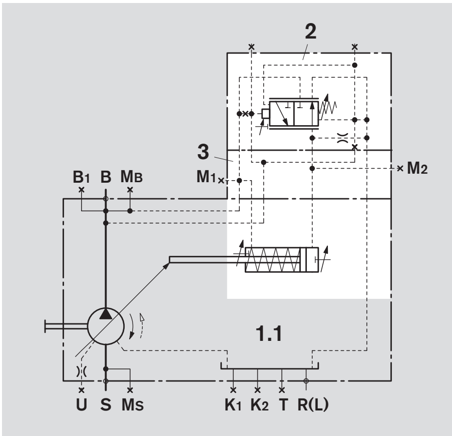
Size 125...355

Example: A4VSG



Size 500...1000

Example: A4VSO



Ports

M_1, M_2 Gauging port control chamber pressure (Size 125...1000)

Sub assemblies

1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pressure control valve

3 Sandwich plate (Size 125...1000)

DRG remotely controlled pressure control

Function and execution as DR.

A pressure relief valve (item 4) can be piped externally to port X_D, but it is not included in the supply of the DRG control.
A special version with a built on pressure relief valve is available upon request.

The differential pressure at the pressure control valve (item 2) is set as standard to 20 bar, which results in a pilot flow out of X_D of approx. 1,5 L/min. If a different setting (recommended range 20...50 bar) is required, please state in clear text when ordering.

As a separate pressure relief valve we recommend :
- DBD 6 (hydraulic) to RE 25402.
- DBETR-SO 437 (electric) to RE 29166

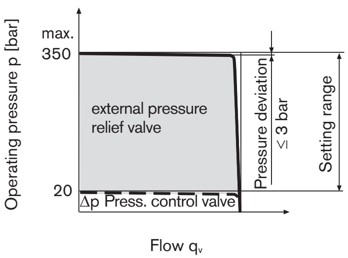
The maximum line lenght should not exceed 2 m.

2

Notes to the setting of the remote pressure control:

The overall output pressure level is the result of the setting of the separate pressure relief valve plus the value of the control valve´s differential pressure.

Example: setting external pressure relief valve 330 bar
differential pressure at control valve 20 bar
results in control pressure level of 330 + 20 = 350 bar



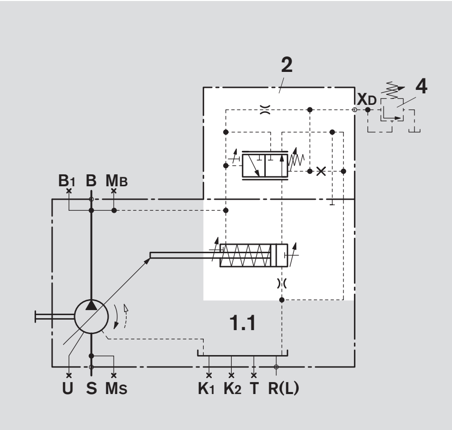
Function, description and stroking times of pressure control DR see page 4 and 5.

Schematics DRG

Control device (shown in area with white background) valid for A4VSO and A4VSG

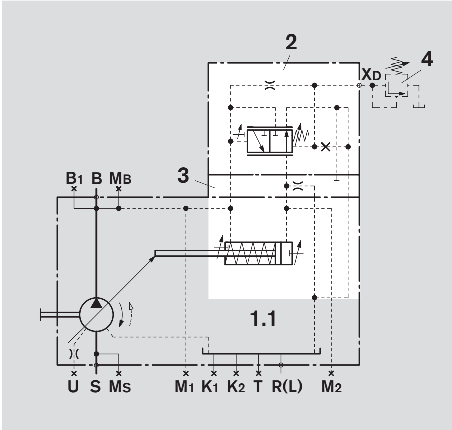
Size 40 and 71

Example: A4VSO



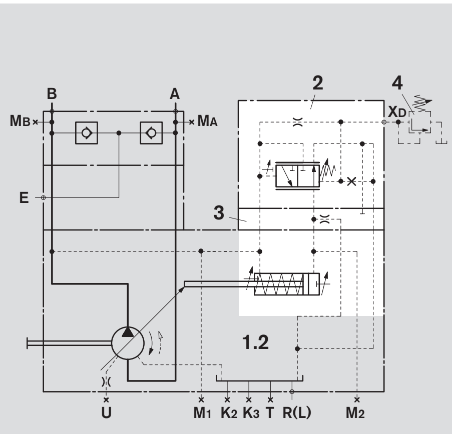
Size 125...355

Example: A4VSO



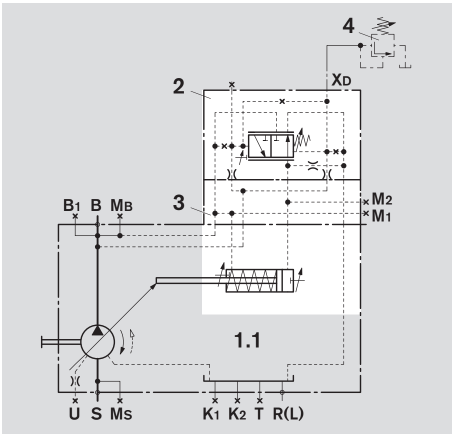
Size 125...355

Example: A4VSG



Size 500...1000

Example: A4VSO



Ports

X_D Pilot pressure port for remote pressure relief valve

M_1, M_2 Gauging port control chamber pressure (Size125...1000)

Sub assemblies

1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
1.2 A4VSG (see RE 92100)

2 Pressure control valvel

3 Sandwich plate (Size 125...1000)

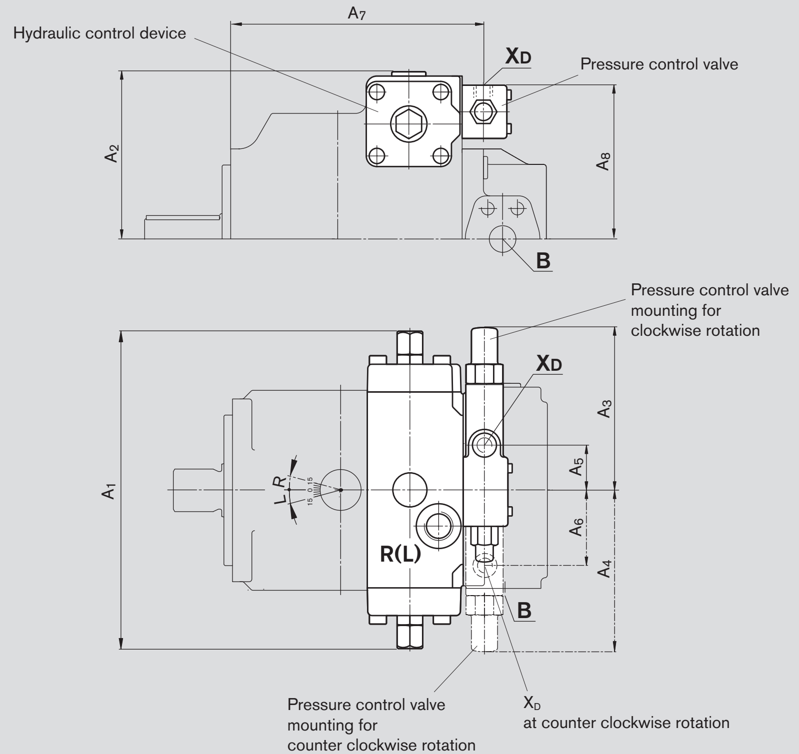
4 External pressure relief valve (not included in supply)

Unit dimensions DR / DRG

Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO and A4VSG

Size 40 and 71



Ports

max. tightening torque [1)]

X_D	Pilot pressure port for remote pressure relief valve	DIN 3852 M14x1,5; 12 deep; plugged at DR control	80 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	
40	260	140	147	137	47	67	209	128	For detailed unit dimensions and technical data on the variable pumps see the technical data sheets A4VSO RE 92050 and A4VSG RE 92100
71	298	157	142	142	42	72	236	144	

[1)] see general notes

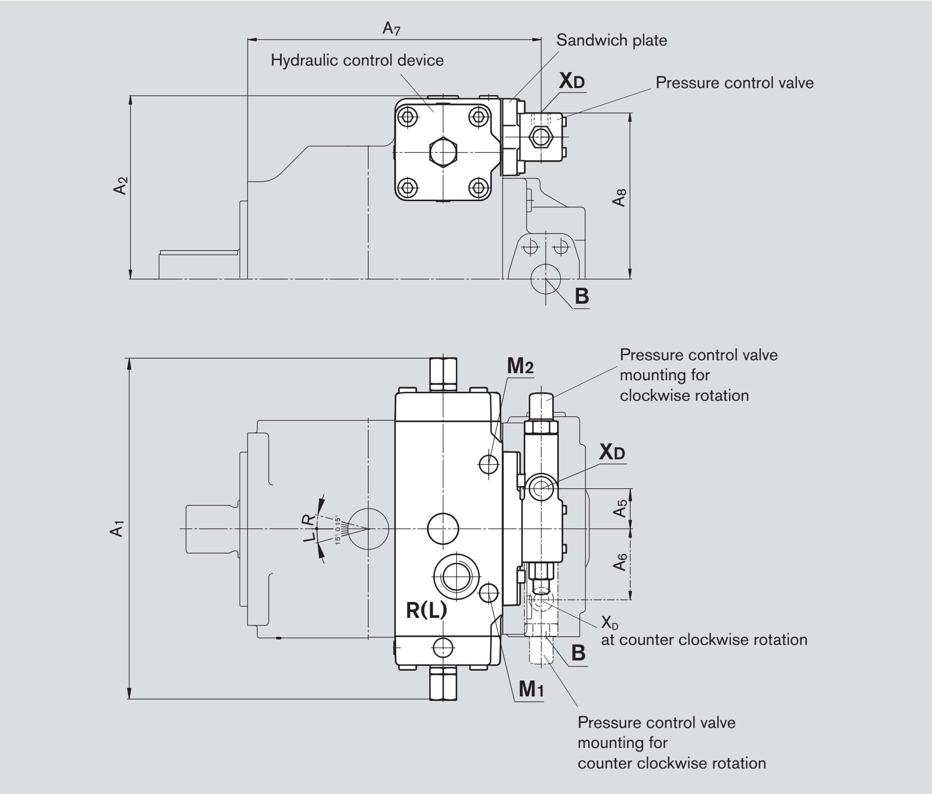
Size 125...1000 see page 10 and 11

Unit dimensions DR / DRG

Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO and A4VSG

Size 125...355



Ports

				max. tightening torque [1]
X_D	Pilot pressure port for remote pressure relief valve	DIN 3852	M14x1,5; 12 deep; plugged at DR control	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125...180) M18x1,5; 12 deep; plugged (Size 250...355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_5	A_6	A_7	A_8	
125/180	354	191	41	71	305	172	For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 and A4VSG RE 92100
250/355	424	238	41	71	367	208	

[1] see general notes

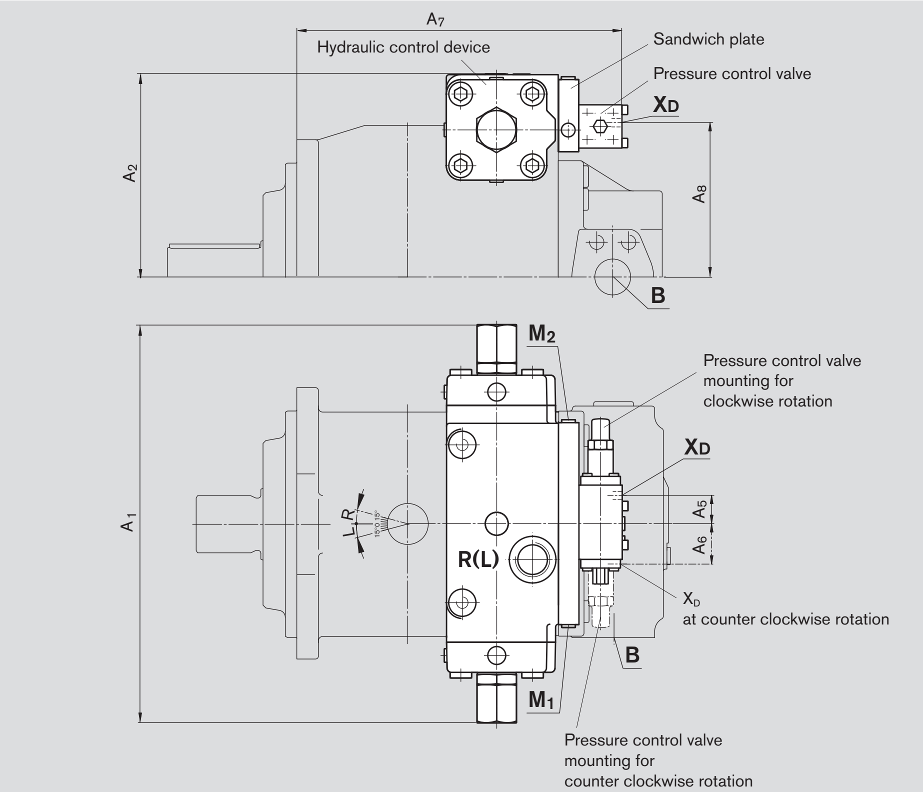
Size 40 and 71 see page 9; size 500...1000 see page 11

Unit dimensions DR / DRG

Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO and A4VSG

Size 500...1000



Ports

				max. tightening torque [1]
X_D	Pilot pressure port for remote pressure relief valver	DIN 3852	M14x1,5; 12 deep; plugged at DR control	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_5	A_6	A_7	A_8
500	510	283	41	51	452	216
750	582	322	41	51	484	235
1000	622	350	41	51	550	269

For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 and A4VSG RE 92100

[1] see general notes

Size 40 and 71 see page 9; size 125...355 see page 10

DP pressure control for parallel operation

Suitable for pressure control of several axial piston units A4VS in parallel operation (feeding into one common pressure header).

An external pressure relief valve (item 4) is used to control several axial piston units simultaneously via their X-ports. The relevant throttle valve (item 5) ensures control of the required pressure increase, which is proportional to the actual pump displacement.

Home position in pressureless condition: $\mathbf{V_{g\,max}}$

Setting of differential pressure for DP-control
The standard setting of the differential pressure over control valve (item 2) plus throttle valve (item 5) amounts to 33 bar, with port X_D unloaded to tank. The pilot oil flow out of port X_D amounts to approx. 1,5 L/min.

The pressure setting of the external relief valve plus the overall differential pressure over item 2 and 5 determine the total pressure control level. The pressure rise during the de-stroking of the pump is independent of the pressure relief valve setting and causes a slight swivel angle deviation of all commonly controlled pumps.

Make sure that the lines between the ports X_D and the pressure relief valve are as much as possible of the same lenght.

Min. and max. **swivel angle limitation** mechanically adjustable to 50 % of $V_{g\,max}$.
The $V_{g\,min}$-stop is set so that a pressure level of 15...20 bar is reached in a closed pressure port B.
The $V_{g\,max}$-stop is set to the nominal $V_{g\,max}$ value. If another setting is required, please state in clear text when ordering.

The pressure relief valve (item 4) is not included in the supply of the DP control - please order separately.
We recommend: DBD 6 (hydraulic) RE 25402

The max. number of commonly controlled pumps is limited by the flow capacity of the used pilot valve.

If needed, it is possible to unload individual pumps to the differential pressure level through an unloading valve (item 6). In this case an additional check valve is necessary in the pump outlet (item 7) Both valves are not included in the supply of the DP control.

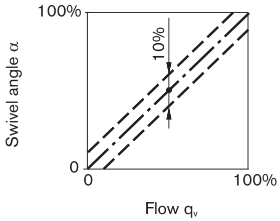
On request it is possible to mount the unloading valve (item 6) directly onto the pump.

This pressure control is available on the A4VSO and A4VSG, however only for swivel on one side of center.

On request, it is also available for **Mooring-or over center operation**.
For fast decompression of the pressurized outlet, the pump can then swivel momentarily over center and swallow some fluid.

Stroking times like DR see page 5.

Flow control is optionally available – DPF see page 19

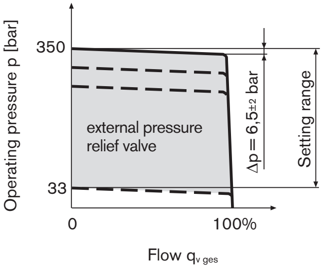


Swivel angle deviation ± 10% of ideal curve

DP pressure control for parallel operation

A4VSO - open circuit

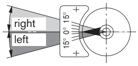
Static characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

[1] compare swivel angle indicator

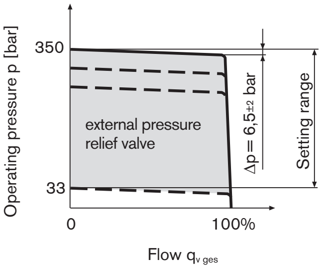


A4VSG - closed circuit

Pressure control DP can swivel on one side of center only.

No bi-directional rotation possible.

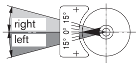
Static characteristic



Direction of flow A to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

[1] compare swivel angle indicator



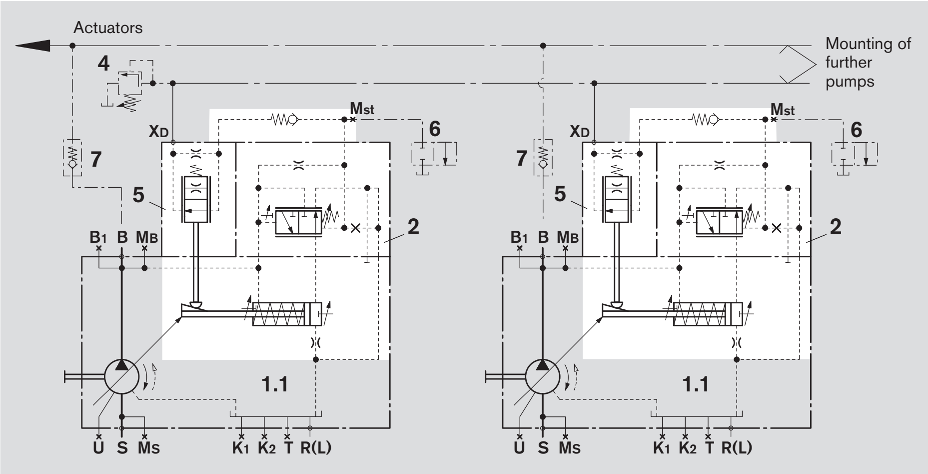
Dynamic characteristic see DR control page 5

Schematics DP

Control device (shown in area with white background) valid for A4VSO and A4VSG

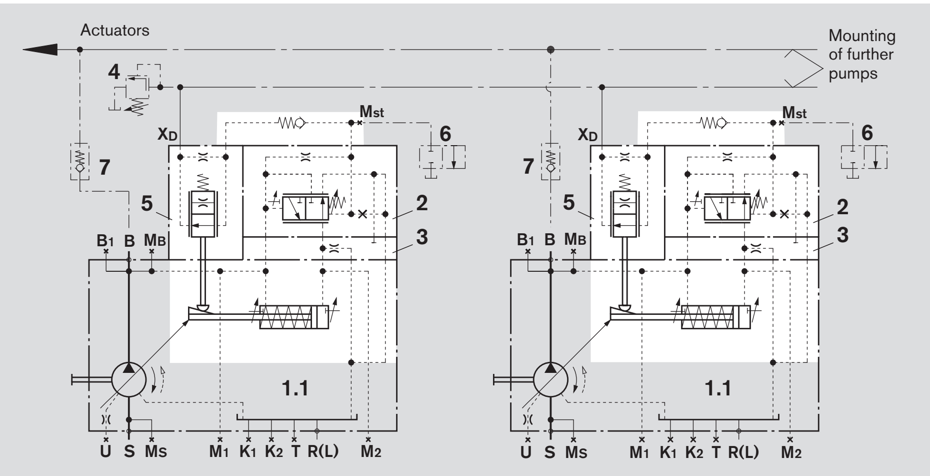
Size 40 and 71

Example: A4VSO



Size 125...355

Example: A4VSO



Ports

X_D	Pilot pressure port DP control
M_{St}	Gauging port pilot pressure
M_1, M_2	Gauging port control chamber pressure (Size 125...355)

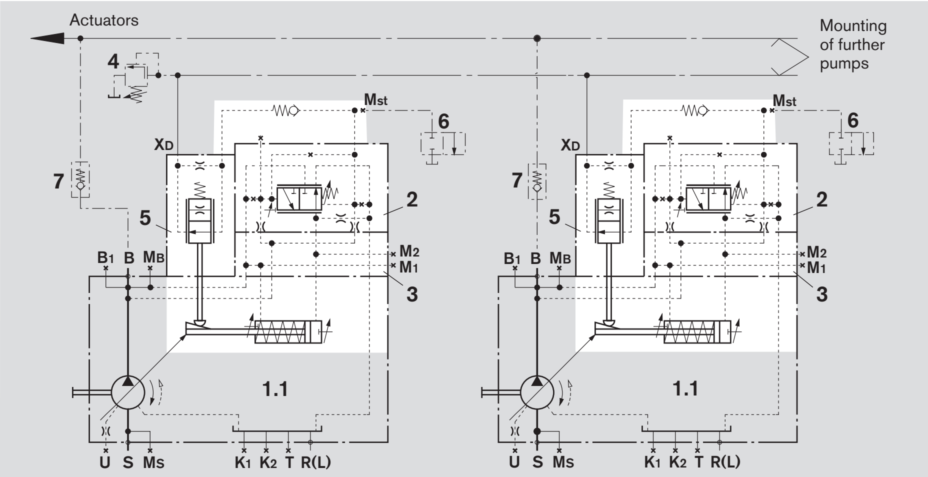
Sub assemblies see page 15

Schematics DP

Control device (shown in area with white background) valid for A4VSO and A4VSG

Size 500...1000

Example: A4VSO



Ports

X_D	Pilot pressure port DP control
M_{St}	Gauging port pilot pressure
M_1, M_2	Gauging port control chamber pressure

Sub assemblies

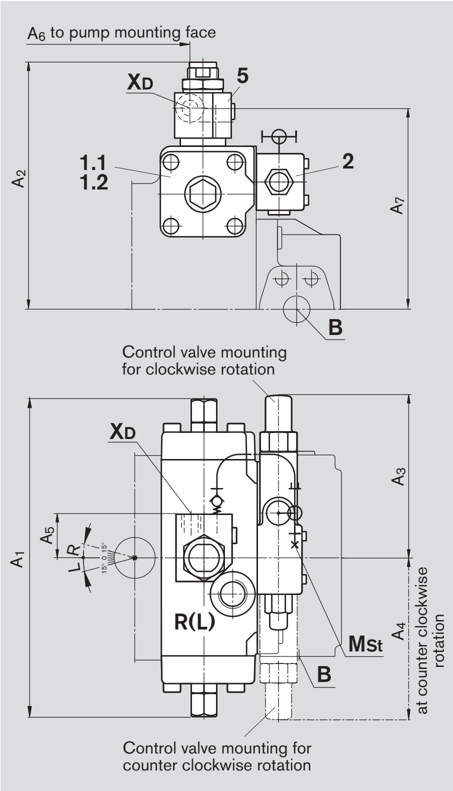
1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
2	Control valve with pressure compensator
3	Sandwich plate (Size 125...1000)
4	Pressure relief valve (not included in supply)
5	Throttle valve
6	Unloading valve (not included in supply)
7	Check valve (not included in supply) required only in conjunction with unloading valve

Unit dimensions DP

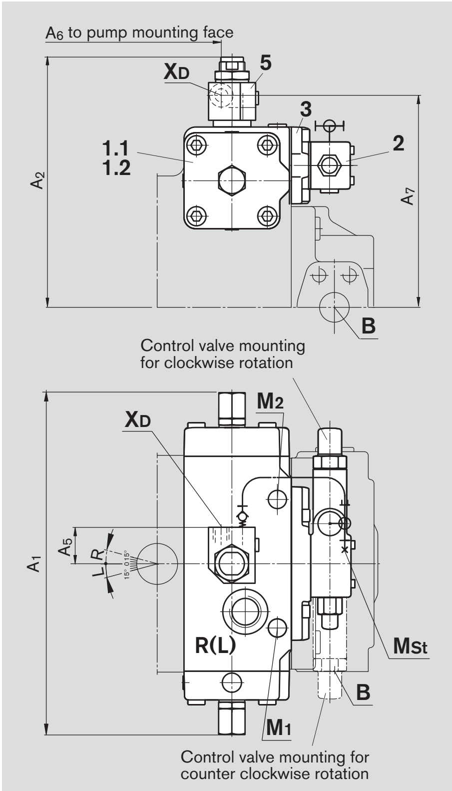
Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO and A4VSG

Size 40 and 71



Size 125...355



Sub assemblies see page 17

Ports

				max. tightening torque [1]
X_D	Pilot pressure port DP control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot pressure	DIN 3853	S8 Form W closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7
40	260	210	147	137	39	133	170
71	296	225	142	142	39	155	187
125/180	354	261	–	–	39	192	221
250/355	424	306	–	–	39	237	268

For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 and A4VSG RE 92100

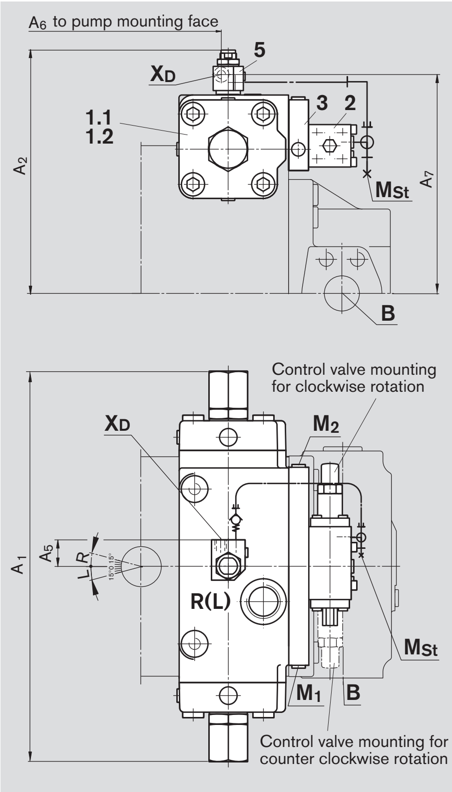
[1] see general notes

Unit dimensions DP

Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO and A4VSG

Size 500...1000



2

Sub assemblies

1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
1.2	A4VSG (see RE 92100)
2	Control valve with pressure compensator
3	Sandwich plate (Size 125...1000)
5	Throttle valve

Ports

				max. tightening torque [1]
X_D	Pilot pressure port DP control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot pressure	DIN 3853	S8 Form W closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_5	A_6	A_7	
500	510	353	39	268	313	For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 and A4VSG RE 92100
750	582	392	39	290	352	
1000	622	419	39	349	379	

[1] see general notes

Notes

DPF with flow control

In addition to the pressure control function the flow from pumps to actuators may be varied via a differential pressure e.g. over an orifice. The pumps supply only the amount of flow as required by the actuator.

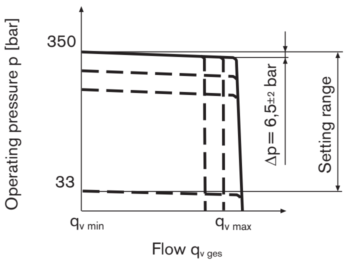
The flow depends only on the size of cross section in the control orifice (item 9) mounted between pumps and actuator. Below the setting of the pressure control and within the control range of the pumps, the flow is virtually independent of the actual operating pressure.

Description of the flow control see FR page 22.

Function and technical data of the pressure control for parallel operation DP see page 12.

A4VSO - open circuit

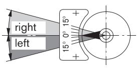
Static characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

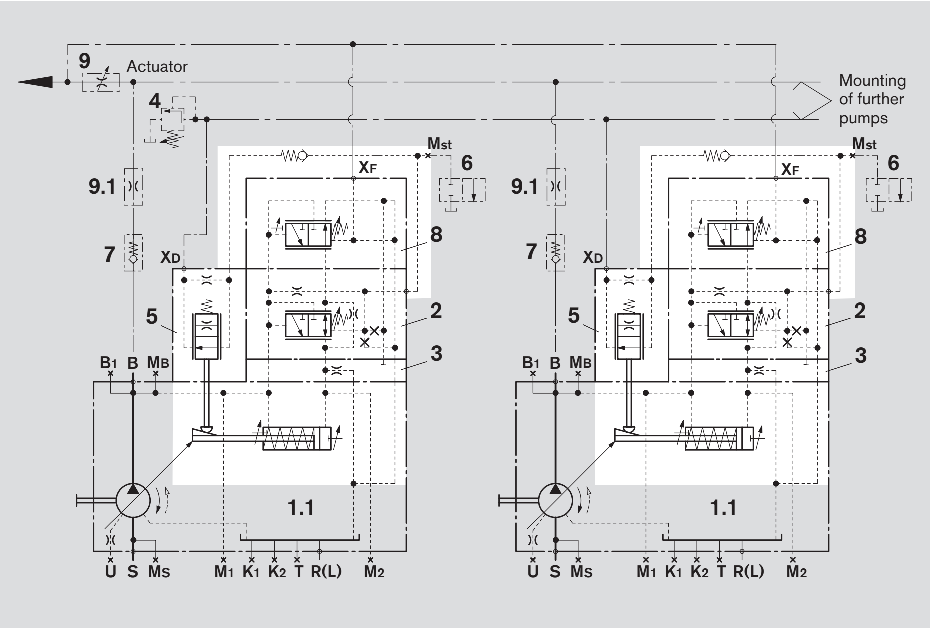
[1] compare swivel angle indicator



Schematics DPF

Size 125...355

A4VSO



Ports

X_D	Pilot pressure port DP control
X_F	Pilot pressure port flow control
M_{St}	Gauging port pilot pressure DP control
M_1, M_2	Gauging port control chamber pressure (Size 125...355)

Sub assemblies

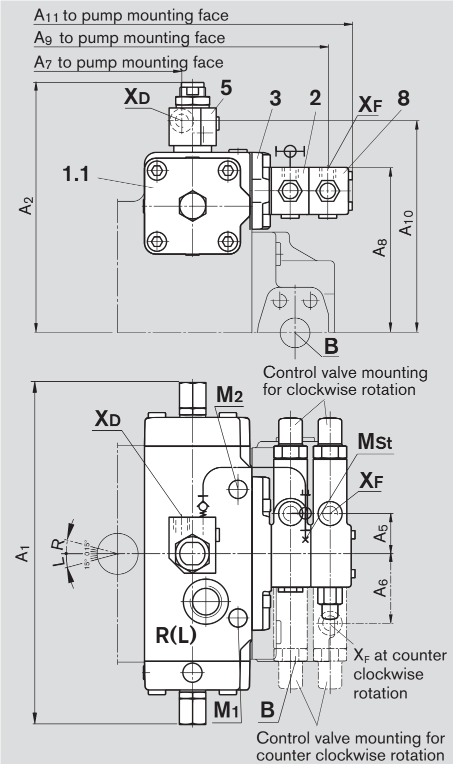
1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Control valve with pressure compensator
3	Sandwich plate
4	Pressure relief valve (not included in supply)
5	Throttle valve
6	Unloading valve (not included in supply)
7	Check valve (not included in supply) only required in conjunction with unloading valve
8	Flow control valve
9	External orifice (not included in supply)
9.1	is needed, when parallel stroking for flow control function is necessary (not included in supply)

Unit dimensions DPF

Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO

Size 125...355



Sub assemblies see page 20

Ports

				max. tightening torque [1]
X_D	Pilot pressure port DP control	DIN 3852	M14x1,5; 12 deep	80 Nm
X_F	Pilot pressure port flow control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot pressure DP control	DIN 3853	S8 Form W closed	50 Nm
M_1, M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	
125	354	261	41	71	191,5	172	345	220,5	371	For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
180	354	261	41	71	191,5	172	345	220,5	371	
250	424	306	41	51	236,5	208	407	267,5	433	
355	424	306	41	51	236,5	208	407	267,5	433	

[1] see general notes

FR/FR1 flow control

The flow control matches the pump displacement with the actual flow requirements of the actuators.

The pump flow depends only on the size of cross section in the orifice (item 4), mounted between pump and actuators. Within the control range of the pump, the flow is virtually independent of the actual load pressure (see max. flow deviation below).

The cross section in the orifice determines the pump flow.

The flow controller compares the pressure upstream of the orifice with the pressure after the orifice and keeps the pressure drop (differential pressure Δp) over the orifice constant, thereby controlling the flow.

An increase of differential pressure Δp causes the pump to de-stroke (direction to $V_{g\,min}$), and a decrease in differential pressure Δp results in a larger pump swivel angle (direction to $V_{g\,max}$), till the flow control valvespool is in balance again.

$\Delta p_{orifice} = p_{pump} - p_{actuator}$

The standard Δp setting at the flow control spool (item 2) amounts to 14 bar. If another setting (recommended range 14...25 bar) is required, please state in clear text when ordering. Higher values on request.

The stand by pressure at low pressure standby (orifice closed and pilot port X_F pressureless) is slightly higher than the Δp-setting.

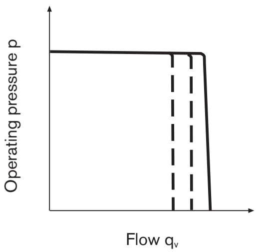
With the control version FR1 there is no connection from X_F to tank.

Home position in pressureless condition: $\mathbf{V_{g\,max}}$

Min. and max. **swivel angle limitation** mechanically adjustable to 50 % of $V_{g\,max}$.
The $V_{g\,min}$-stop is set so that a pressure level of 15...20 bar is reached in a closed pressure port B.
The $V_{g\,max}$-stop is set to the nominal $V_{g\,max}$ value. If another setting is required, please state in clear text when ordering.

A4VSO - open circuit

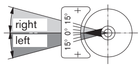
Static characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

[1] compare swivel angle indicator

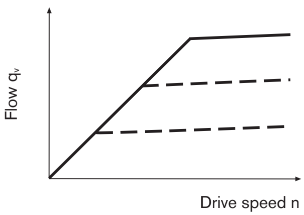


Max. flow deviation

measured at drive speed of n = 1500 rpm

Size	40	71	125	180	250	355
Δq_v [L/min]	2	3	5	6	8	10

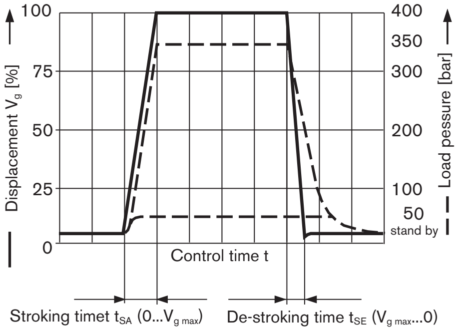
Static characteristic at variable drive speed



FR/FR1 flow control

Dynamic characteristics

The curves are measured average values.
Flow jump stand by / $q_{v\,max}$ through unloading of X-port to tank.



Size	t_{SA} [s] stand by...350 bar	t_{SE} [s] 350 bar...stand by	t_{SE} [s] 50 bar...stand by
40	approx. 0,1	0,02	0,050
71	approx. 0,2	0,03	0,075
125	approx. 0,3	0,04	0,100
180	approx. 0,4	0,05	0,120
250	approx. 0,4	0,06	0,150
355	approx. 0,5	0,07	0,180

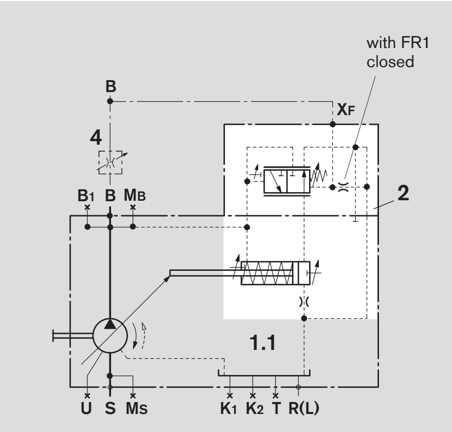
The **stroking time** t_{SA} ($V_{g\,min} \rightarrow V_{g\,max}$) can be steplessly adjusted, without influencing the de-stroking time t_{SE}.
Standard setting see table. If needed, these values can be reduced by a factor of 2...3 (please consult us).

2

Schematics FR/FR1

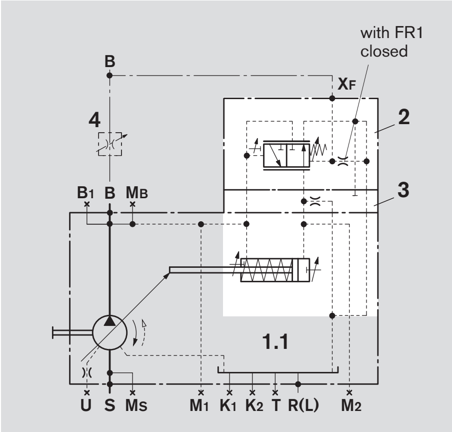
Size 40 and 71

A4VSO



Size 125...355

A4VSO



Ports

X_F	Pilot pressure port flow control
M_1, M_2	Gauging port control chamber pressure (Size 125...355)

Sub assemblies

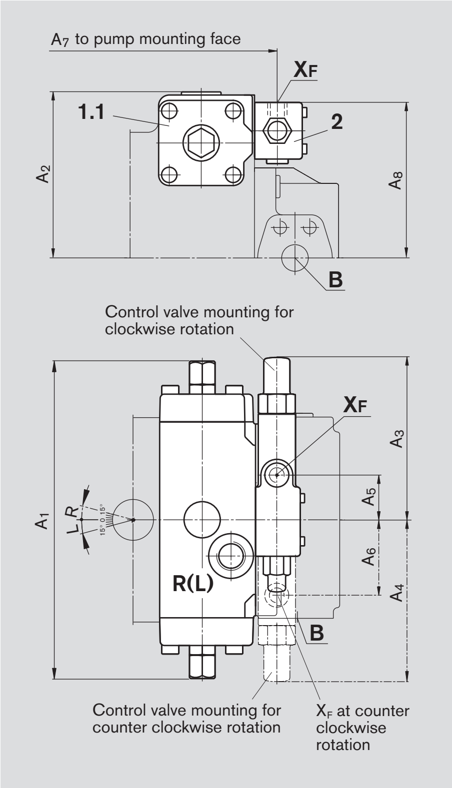
1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Flow control valve
3	Sandwich plate (Size 125...355)
4	External orifice (not included in supply)

Unit dimensions FR/FR1

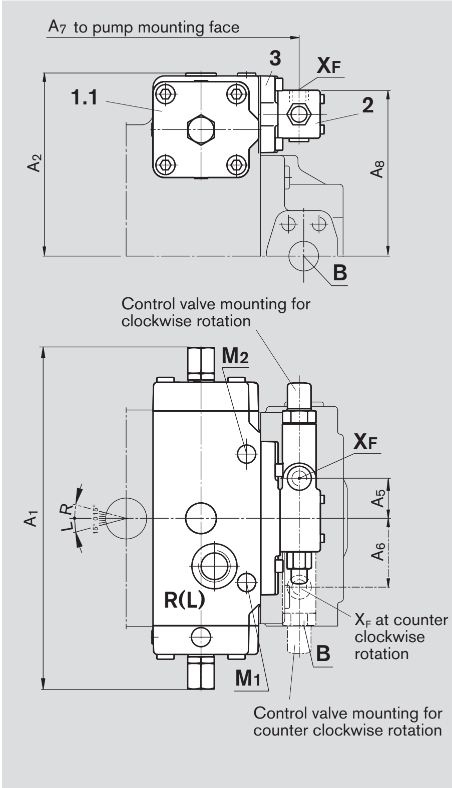
Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO

Size 40 and 71



Size125...355



2

Sub assemblies see page 24

Ports

				max. tightening torque [1]
X_F	Pilot pressure port flow control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_1, M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
40	260	140	147	137	47	67	209	128
71	298	157	142	142	42	72	236	144
125/180	354	191	–	–	41	71	305	172
250/355	424	238	–	–	41	71	367	208

For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100

[1] see general notes

FRG/FRG1 with remote pressure control

The pressure/flow control FRG is a combination of FR (FR1) and DRG.
The pressure control overrides the flow control. The pressure control level can be remotely set with a separate pressure relief valve (item 4).

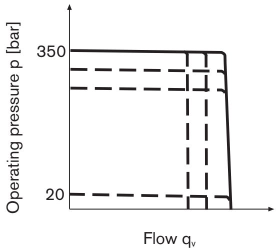
Function and technical data of the remotely adjustable pressure control see page 7.

Function and technical data of flow control FR see page 22 and 23.

With the control version FRG1 there is no connection from X_F to tank.

A4VSO - open circuit

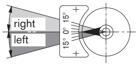
Characteristic



Direction of flow **S** to **B**

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

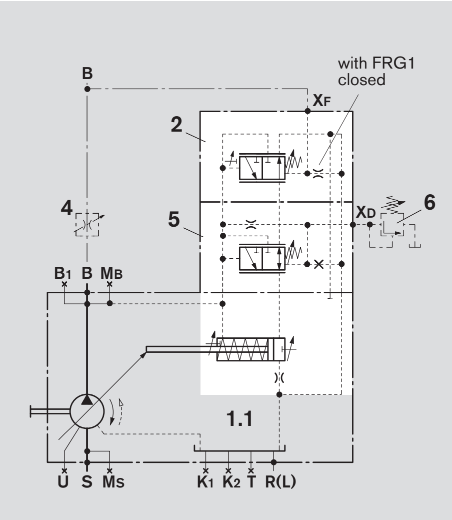
[1] compare swivel angle indicator



Schematics FRG/FRG1

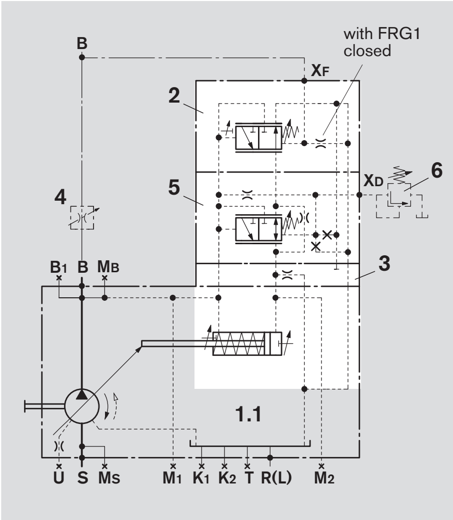
Size 40 and 71

A4VSO



Size 125...355

A4VSO



Ports

X_D	Pilot pressure port remote pressure control
X_F	Pilot pressure port flow control
M_1, M_2	Gauging port control chamber pressure (Size 125...355)

Sub assemblies

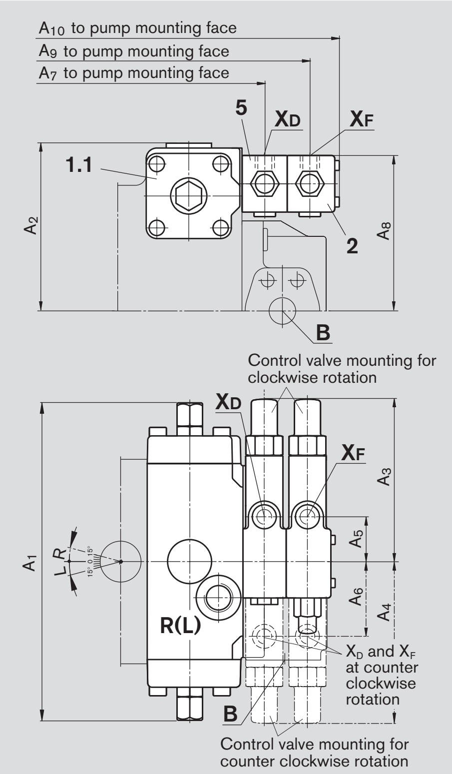
1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Flow control valve
3	Sandwich plate (Size 125...1000)
4	External orifice (not included in supply)
5	Pressure control valve
6	External pressure relief valve (not included in supply)

Unit dimensions FRG/FRG1

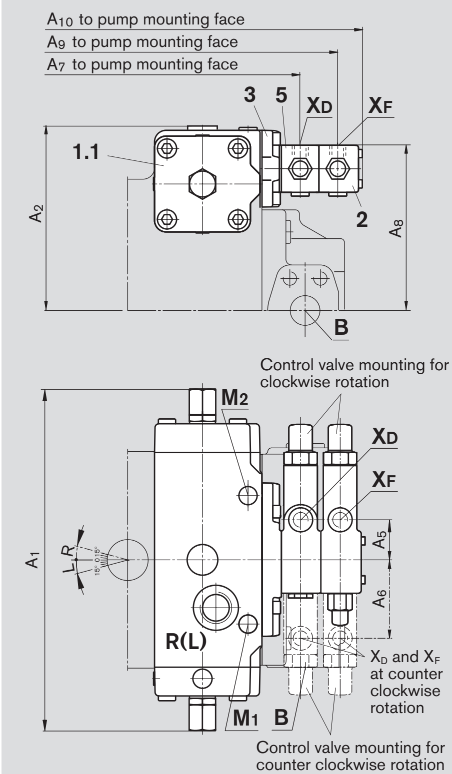
Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO

Size 40 and 71



Size 125...355



Sub assemblies see page 27

Ports

				max. tightening torque [1]
X_D	Pilot pressure port remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
X_F	Pilot pressure port flow control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_1, M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	260	140	147	137	47	67	209	128	249	275	For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	298	157	142	142	42	72	236	144	276	302	
125/180	354	191	–	–	41	71	305	172	345	371	
250/355	424	238	–	–	41	71	367	208	407	433	

[1] see general notes

DFR/DFR1 pressure and flow control

Pressure and flow control DFR is a combination of pressure control DR and flow control FR.

Function and technical data see DR (page 4) and FR (page 22).

With the control version DFR1 there is no connection from X_F to tank.

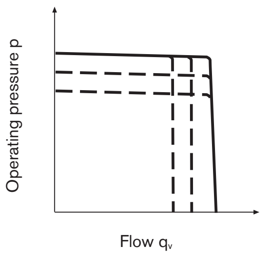
Min. and max. swivel angle limitation mechanically adjustable to 50 % of $V_{g\,max}$.

Home position in pressureless condition: $V_{g\,max}$

Min. and max. **swivel angle limitation** mechanically adjustable to 50 % of $V_{g\,max}$.
The $V_{g\,min}$-stop is set so that a pressure level of 15...20 bar is reached in a closed pressure port B
The $V_{g\,max}$-stop is set to the nominal $V_{g\,max}$ value. If another setting is required, please state in clear text when ordering.

A4VSO - open circuit

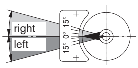
Static characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
clockwise	left hand	B
counter clockwise	right hand	B

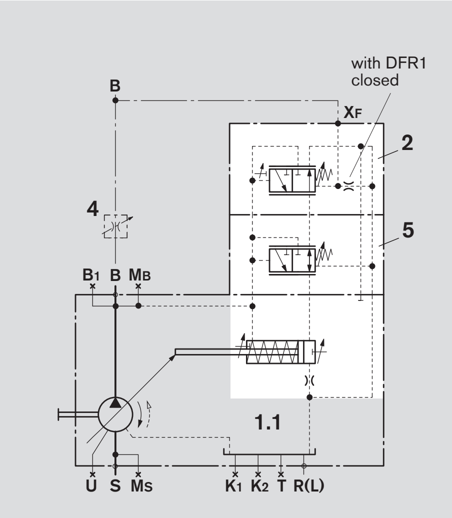
[1] compare swivel angle indicator



Schematics DFR/DFR1

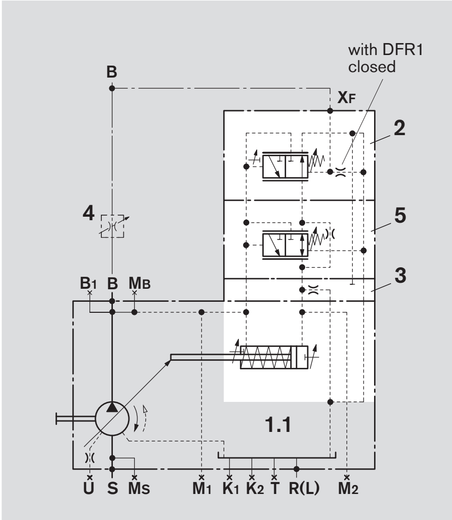
Size 40 and 71

A4VSO



Size 125...355

A4VSO



Ports

X_F	Pilot pressure port flow control
M_1, M_2	Gauging port control chamber pressure (Size 125...355)

Sub assemblies

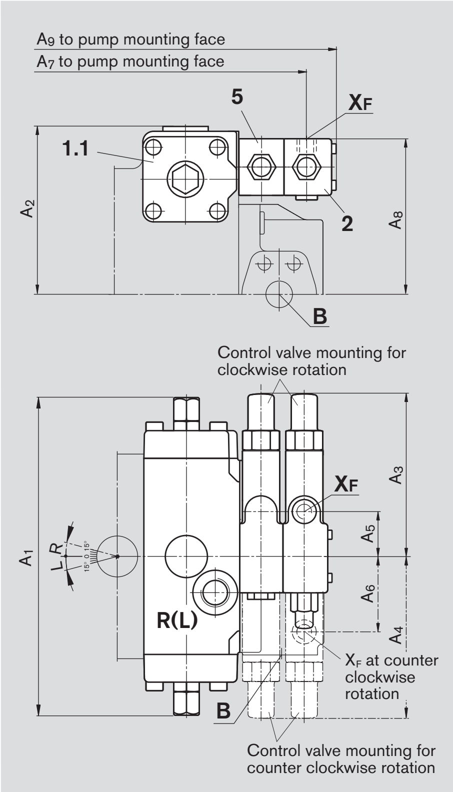
1	Pump with hydraulic control device
1.1	A4VSO (see RE 92050)
2	Flow control valve
3	Sandwich plate (Size 125...1000)
4	External orifice (not included in supply)
5	Pressure control valve

Unit dimensions DFR/DFR1

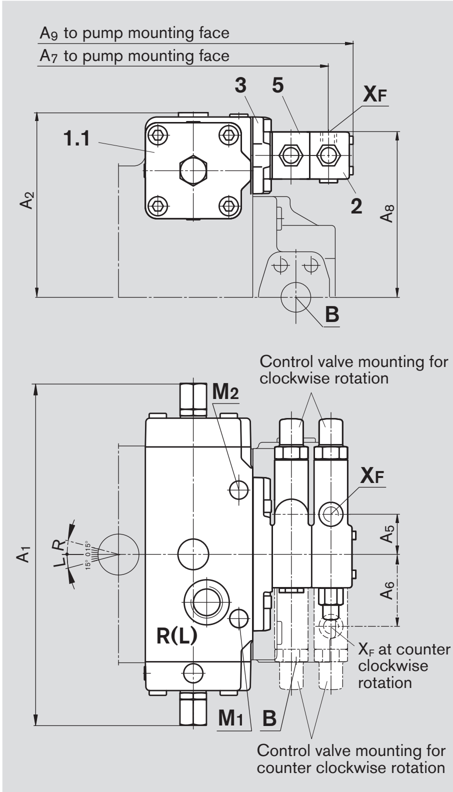
Before finalising your design, please request a certified installation drawing

Dimensions valid for A4VSO

Size 40 and 71



Size 125...355



Sub assemblies see page 30

Ports

				max. tightening torque [1]
X_F	Pilot pressure port flow control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_1, M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	
40	260	140	147	137	47	67	249	128	275	For detailed unit dimensions and technical data of the variable pumps see the technical data sheets A4VSO RE 92050 or A4VSG RE 92100
71	296	157	142	142	42	72	276	144	302	
125/180	354	191	–	–	41	71	345	172	371	
250/355	424	238	–	–	41	71	407	208	433	

[1] See general notes

2

General notes

– The control devices DR, DP, FR and DFR are intended to be used together with the pump A4VSO in open circuit applications, and the control devices DR and DP together with the pump A4VSG in closed circuit applications.

– Project planning, assembly, and commissioning of the pump require the involvement of qualified personnel.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– Tightening torques: The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread). Manufacturer´s instruction for the max. permissible tightening torques of the used fittings must be observed!
For DIN 13 fixing screws we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– During and shortly after operation of a pump the housing can be extremly hot, avoid being burned! Take suitable safety precautions, e.g. wear protective clothing.

– The data and information contained herein must be adhered to.

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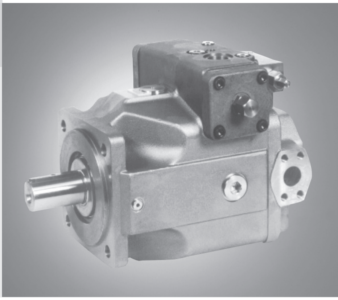
Rexroth
Bosch Group

Power control LR2, LR3, LR2N and LR3N

Data sheet



for variable pump A4VSO
Series 1 and 3
Size 40 to 1000
Nominal pressure 350 bar
Peak pressure 400 bar
open circuit operation

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Features

- Power control with hyperbolic characteristic
- The power control varies the pump displacement, dependent on output pressure in such a manner, that a specified drive power at constant speed cannot be exceeded
- Power settings from min. to max. with one spring
- Supplementary functions in a modular system, eg.:
  - hydraulic remote control
  - pressure control
  - flow control
  - hydraulic stroke limiter
  - mechanical stroke limiter
  - hydraulic two-point control
  - electric control of pilot pressure

Further information:

Variable pump A4VSO Size 40 to 1000 RE 92 050

Ordering code – Standard program A4VSO LR2 and LR3

	A4VS	O		LR					/				–				
01	02	03	04	05	06	07	08	09		10	11	12		13	14	15	16

01	**Fluid** (Details see RE 92050)	

Axial piston unit

02	Swash plate design, variable	**A4VS**

Type of operation

03	Pump, open circuit (see RE 92050)	**O**

	Size	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**
04	Displacement $V_{g\,max}$ [cm³]	40	71	125	180	250	355	500	750	1000

Control devices

						40	71	125	180	250	355	500	750	1000	
05	**Power control with hyperbolic characteristic, initial position V_{gmax}**														**LR**
06	**Setting of power characteristic**														
	mechanically adjustable	2				●	●	●	●	●	●	●	●	●	**2**
	hydraulic remote control	3				●	●	●	●	●	●	●	●	●	**3**
07	**Pressure control**														
	without pressure control (no code letter)					●	●	●	●	●	●	●	●	●	
	with pressure control		D			●	●	●	●	●	●	●	●	●	**D**
	with remote pressure control		G			●	●	●	●	●	●	●	●	●	**G**
08	**Flow control /stroke limiter**														
	without flow control /stroke limiter (no code letter)					●	●	●	●	●	●	●	●	●	
	with flow control			F		●	●	●	●	●	●	–	–	–	**F**[1]**)**
	with hydraulic stroke limiter, inverse proportional			H		●	●	●	●	●	●	●	●	●	**H**
	with hydraulic two-point control			Z		●	●	●	●	●	●	●	●	○	**Z**
	with electr. unloading valve for easy start			Y		●	●	●	●	●	●	○	○	○	**Y**
	with load sensing a. rem. press. control.		–	S		●	●	●	●	●	●	–	–	–	**S**[2]**)**
09	**Mechanical stroke limiter**														
	without mechanical stroke limiter (no code letter)					●	●	●	●	●	●	●	●	●	
	with mechanical stroke limiter				M	●	●	●	●	●	●	–	–	–	**M**

[1]**)** for a dynamic control we recommend to use the LR.S option

[2]**)** cannot be combined with pressure control D or G

● available ○ in preparation – not available ▭ preferred program

Ordering code – Standard program A4VSO LR2N and LR3N

	A4VS	O		LR			N		/				–				
01	02	03	04	05	06	07	08	09		10	11	12		13	14	15	16

Control devices

						40	71	125	180	250	355	500	750	1000	
05	**Power control with hyperbolic characteristic, initial position V_{gmin}, pilot pressure dependent**														**LR**
06	**Setting of power characteristic**					40	71	125	180	250	355	500	750	1000	
	mechanically adjustable	2		N		●	●	●	●	●	●	●	●	●	**2**
	hydraulic remote control	3		N		●	●	●	●	●	●	●	●	●	**3**
07	**Pressure control**														
	without press. control (no code letter)					●	●	●	●	●	●	●	●	●	
	with pressure control		D	N		●	●	●	●	●	●	●	●	●	**D**
	with remote pressure control		G	N		●	●	●	●	●	●	●	●	●	**G**
08	**Hydraulic stroke limiter, proportional**														**N**
09	**Electric control of pilot pressure**														
	without electr. control of pilot press. (no code letter)			N		●	●	●	●	●	●	●	●	●	
	with electr. control. (DBEP 6)			N	T	o	●	●	●	●	●	●	o	o	**T[3])**

[3]) only available for clockwise rotation;
for operation on HF-fluid please observe RE 29164 (Proportional pressure relief valve type DBEP)

	Series	40	71	125	180	250	355	500	750	1000	
10	of A4VSO	●	●	–	–	–	–	–	–	–	**10**
		–	–	●	●	●	●	●	●	●	**30**

11	Direction of rotation	
12	Seals	
13	Shaft end	For details see: RE92050 – A4VSO
14	Mounting flange	
15	Port for service lines	
16	Through drive	

● available o in preparation – not available ▭ preferred program

LR2 Power control, with hyperbolic characteristic

Initial position in pressureless condition: $V_{g\,max}$

The power control LR2 changes the pump displacement with varying output pressures in such a manner, that a specified drive power at constant drive speed cannot be exceeded.

$p \cdot V_g = \text{constant}$	p = Operating pressure V_g = Displacement

An exact control with a hyperbolic control characteristic enables an optimum utilisation of drive power.

The operating pressure acts together with a spring on the pump control piston towards $V_{g\,max}$. This force actuates via a lever arm the valve spool in the power control assembly against the adjustment spring. As soon as the pressure force against the control piston exceeds the set spring force at the valve spool, this spool shifts and fluid enters the large control chamber, forcing the pump towards $V_{g\,min}$. At the same time the leverage of the lever arm is being reduced and increasing output pressure results in a proportional decrease of displacement ($p \cdot V_g = \text{constant}$).

The beginning of control is set mechanically.
With one spring and one adjustment screw it is possible to set the beginning of control within the whole control range.

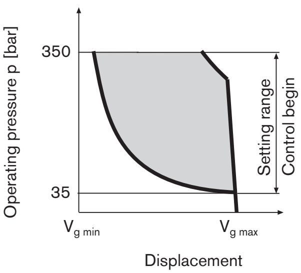
Setting range of control begin: 35...350 bar
The power curve is factory set.

When ordering please state in clear text:

- Drive power P in kW
- Drive speed n in rpm
- Max. flow $q_{v\,max}$ in L/min (50...100 % $V_{g\,max}$)

The min. and max. swivel angle limitation (up to 50% $V_{g\,max}$) is factory set at a fixed value. When ordering please state in clear text the desired value.

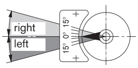
Characteristic



Direction of flow S to B

Direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

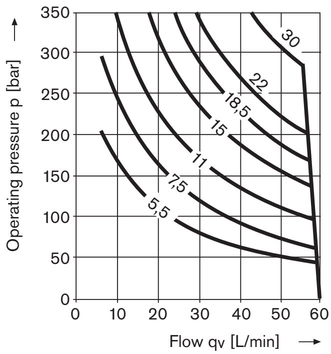
[1]) compare swivel angle indicator



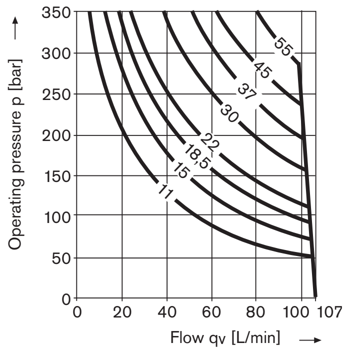
LR2 Power control, with hyperbolic characteristic

Power characteristics in kW

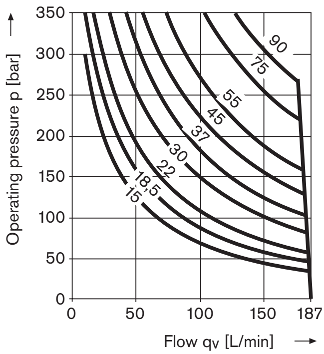
Size 40
at 1500 rpm[1]



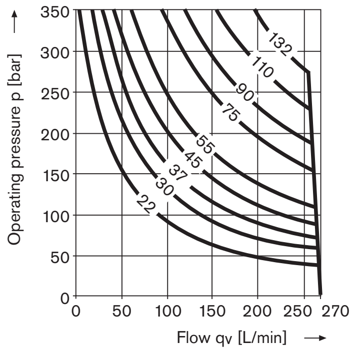
Size 71
at 1500 rpm



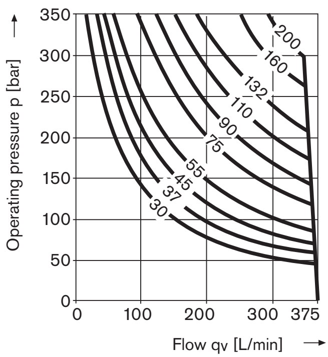
Size 125
at 1500 rpm



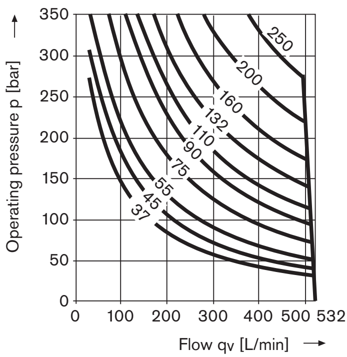
Size 180
at 1500 rpm



Size 250
at 1500 rpm



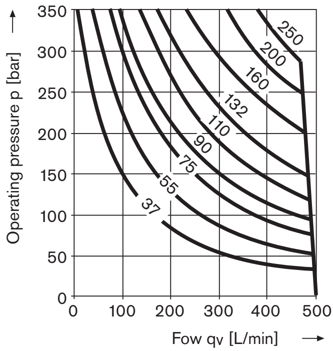
Size 355
at 1500 rpm



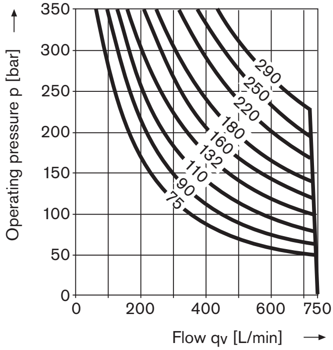
LR2 Power control, with hyperbolic characteristic

Power characteristics in kW

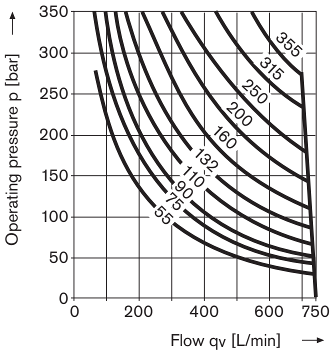
Size 500
at 1000 rpm



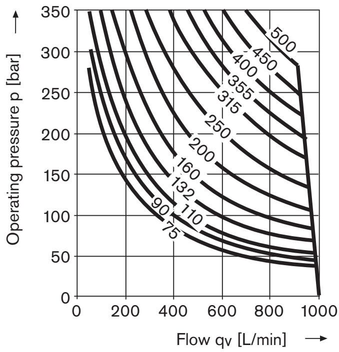
Size 500 High-Speed-Version HA4VSO
at 1500 rpm



Size 750
at 1000 rpm



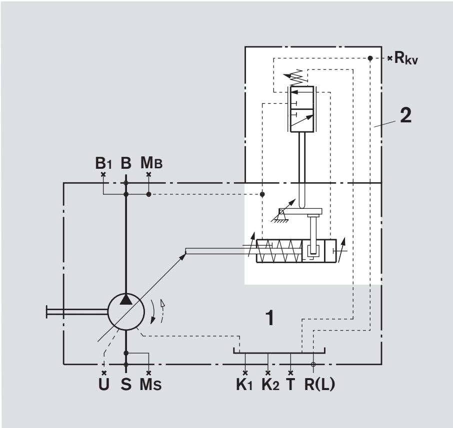
Size 1000
at 1000 rpm



Schematics LR2

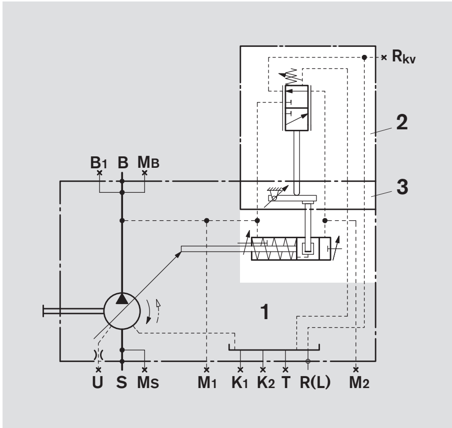
Size 40 and 71

A4VSO LR2, Series 1



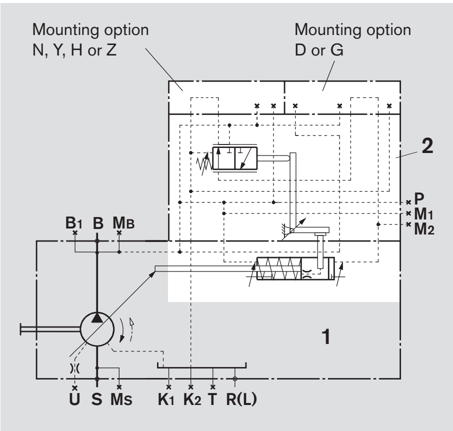
Size 125 to 355

A4VSO LR2, Series 3



Size 500 to 1000

A4VSO LR2, Series 3



Ports

R_{kv}	External control fluid return (Size 40 to 355)
M_1, M_2	Gauging ports control chamber press. (Size 125 to 1000)
P	Control pressure port (Size 500 to 1000)

Subassemblies

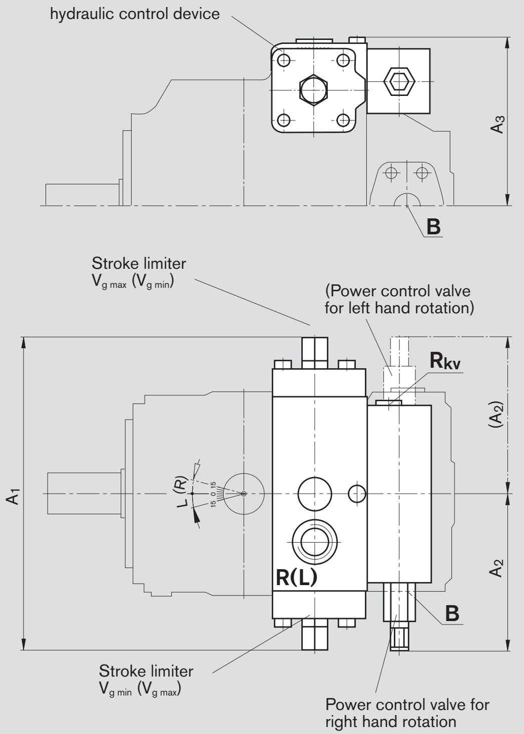
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valvel
3	Sandwich plate (Size 125 to 355)

Unit dimensions LR2

Before finalising your design please request a certified installation drawing. Dimensions in mm

Size 40 and 71, Series 1

Presentation right hand direction of rotation (left hand rotation)



Ports

				max. tightening torque [1]
R_{kv}	External control fluid return	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	
40	260	132	148	For detailed dimensions and technical data on the variable pump see the technical data sheet A4VSO RE 92050
71	296	132	165	

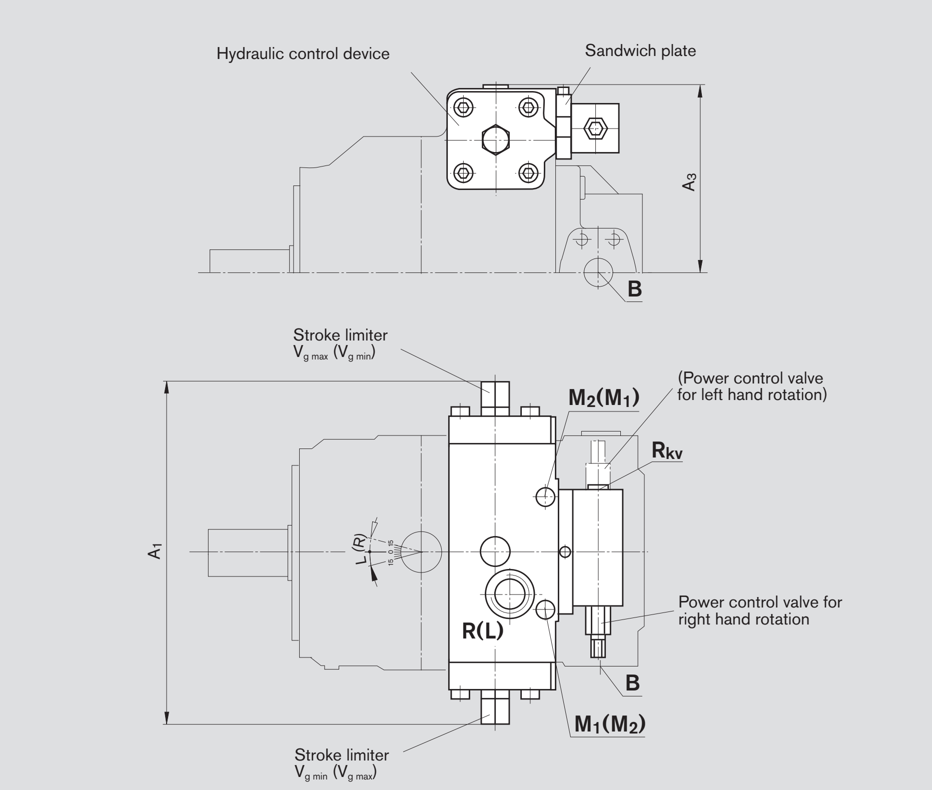
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR2

Before finalising your design please request a certified installation drawing. Dimensions in mm

Size 125 to 355, Series 3

Presentation right hand direction of rotation (left hand rotation)



Ports

				max.tightening torque [1])
R_{kv}	external control fluid return	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 u. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_3
125	354	195
180	354	195
250	424	238
355	424	238

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

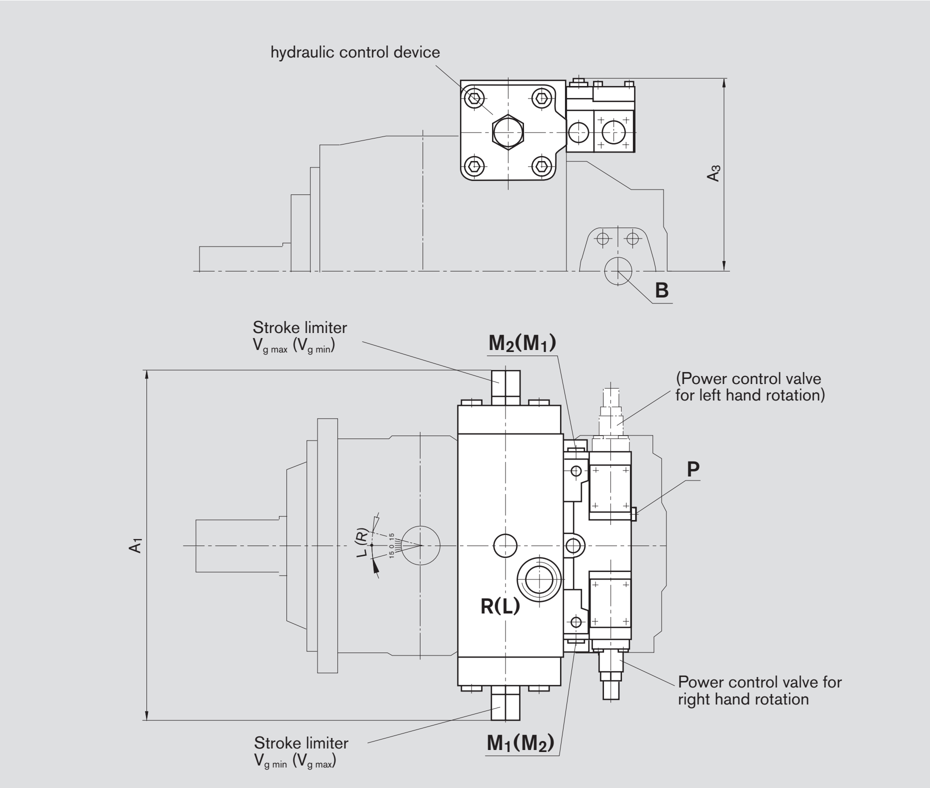
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR2

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000, Series 3

Presentation right hand direction of rotation (left hand rotation)



Ports

				max. tightening torque [1])
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm
P	Control pressure port	DIN 3852	M22x1,5; 14 deep; plugged	210 Nm

Unit dimensions

Size	A_1	A_3	
500	510	285	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
750	582	322	
1000	622	350	

[1]) please observe the general notes for the max. tightening torques on page 68

LR3 with remote control of power characteristic

Initial position in pressureless condition: $V_{g\,max}$

The power control LR3 can be remotely adjusted by applying an external pilot pressure (p_p) at port X_{LR} to the spring chamber of the power control valve.

The beginning of control can be changed in proportion to the applied pilot pressure.

The pilot pressure port X_{LR} may not be plugged.

Maximum external pilot pressure 100 bar

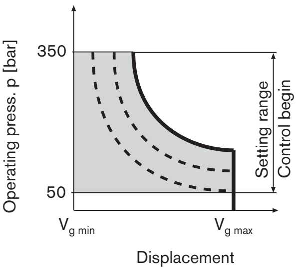
Total range for beginning of control setting: 50... 350 bar

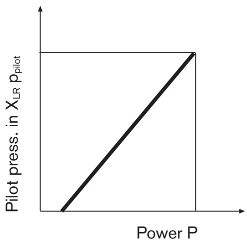
The basic power control curve is factory set, with a pilot pressure signal p_p in $X_{LR} = 0$ bar.

When ordering please state in clear text:
– Drive speed n in rpm
– Drive power P in kW with pilot pressure p_p in $X_{LR} = 0$ bar
  Max. flow $q_{v\,max}$ in L/min (50...100 % $V_{g\,max}$)

Otherwise the LR3 and the LR2 controls feature the same properties.
The min. and max. swivel angle limitations (up to 50% $V_{g\,max}$) are factory set. When ordering please state the required values in clear text.

Characteristic

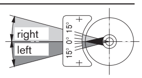




Direction of flow S to B

Direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

[1]) Compare swivel angle indicator



Power increase through pilot pressure in port X_{LR}

Power increase / pilot pressure (kW/bar)

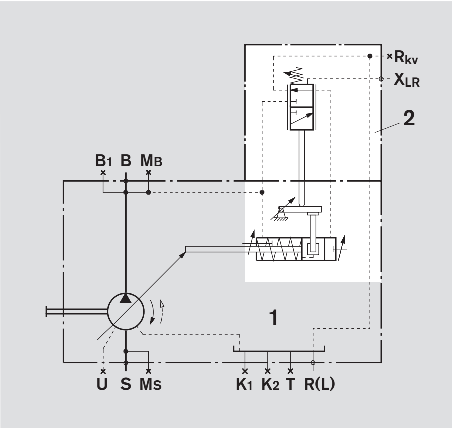
Size	40	71	125	180	250	355	500	750	1000
n*=1000rpm	0,53	0,78	1,15	1,66	1,83	2,46	5,30	7,5	9,2
n*=1200rpm	0,64	0,94	1,38	1,99	2,19	2,95	6,40	9,0	11,0
n*=1500rpm	0,80	1,18	1,72	2,47	2,74	3,69	8,00	11,25	–
n*=1800rpm	0,96	1,41	2,07	2,98	3,29	4,42	9,60	–	–

* Please observe speed limits and perm. flows acc. to RE 92050

Schematics LR3

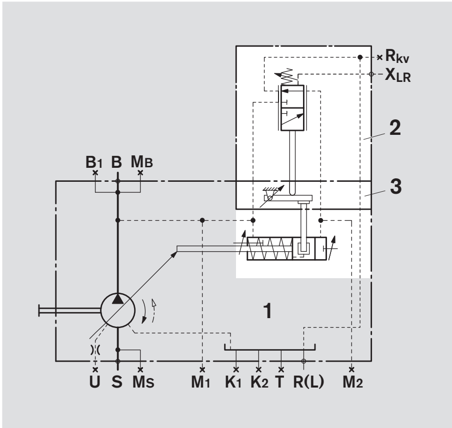
Size 40 and 71

A4VSO LR3, Series 1



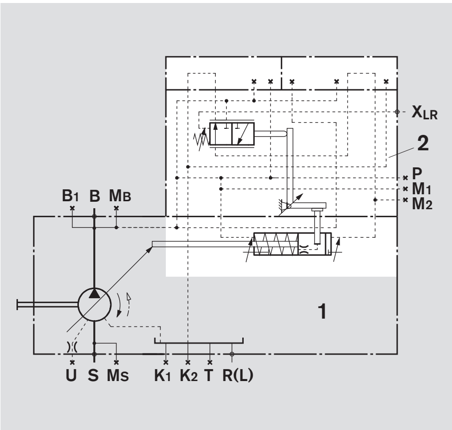
Size 125 to 355

A4VSO LR3, Series 3



Size 500 to 1000

A4VSO LR3, Series 3



Ports

X_{LR}	Pilot pressure port for remote power control
R_{kv}	External control fluid return (Size 40 to 355)
P	Control pressure port (Size 500 to 1000)
M_1, M_2	Gauging port control chamber pressure (Size 125 to 1000)

Subassemblies

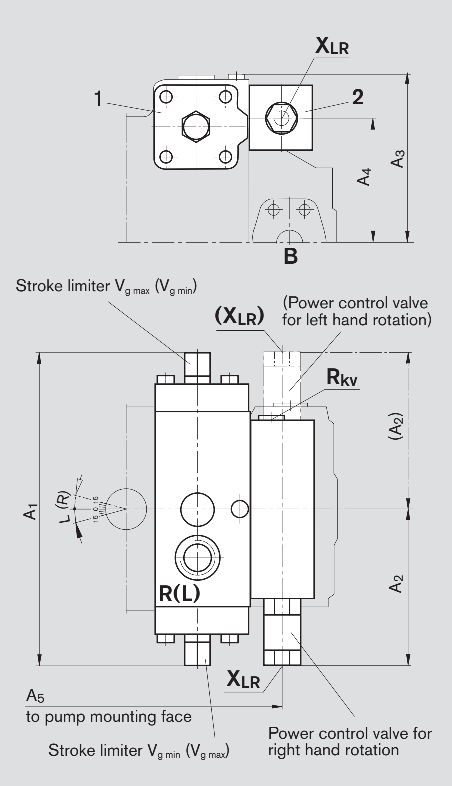
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)

Unit dimensions LR3

Before finalising your design please request a certified installation drawing. Dimensions in mm.

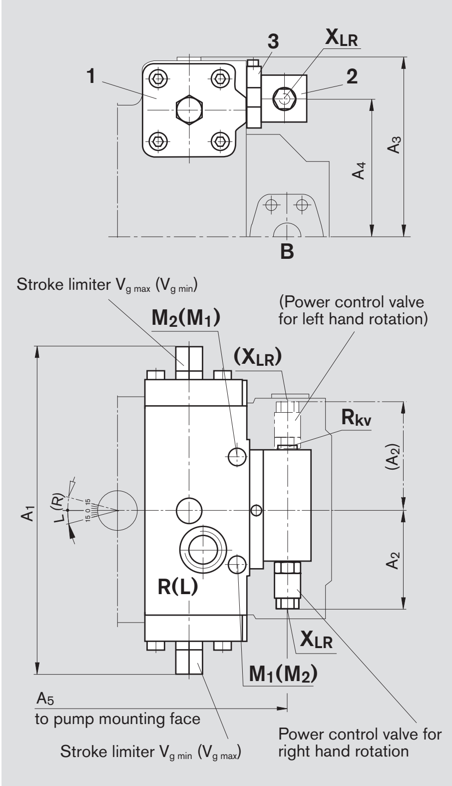
Size 40 and 71, Series 1

Right hand direction of rotation (left hand)



Size 125 to 355, Series 3

Right hand direction of rotation (left hand)



Subassemblies see page12

Ports

				max. tightening torque [1]
X_{LR}	Pilot pressure port for remote power control	DIN 3852	M14x1,5; 12 deep	80 Nm
R_{kv}	External control fluid return	DIN 3852	M18x1,5; 12 deep; plugged	40 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 40 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5
40	260	133	148	106	219
71	296	133	165	117	246
125/180	354	133	195	147	315
250/355	424	133	238	183	377

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

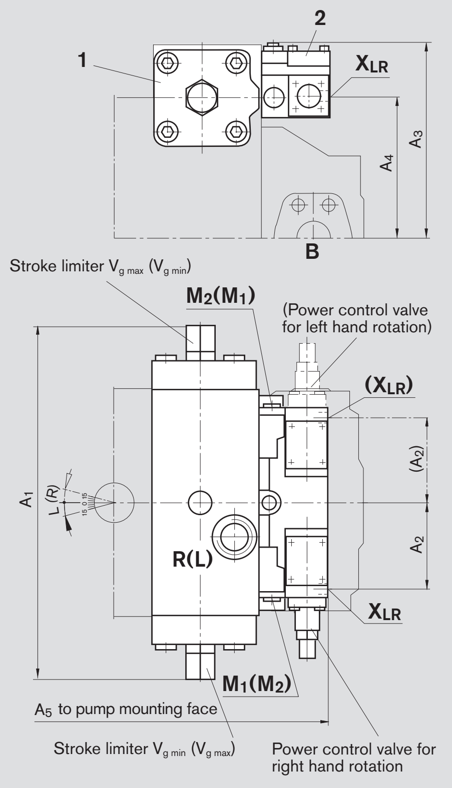
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR3

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000, Series 3

Right hand direction of rotation (left hand)



Subassemblies

1 A4VSO with hydraulic control device (see RE 92050)

2 Power control valve

3 Sandwich plate (Size 125 to 355)

Ports

				max. tightening torque [1])
X_{LR}	Pilot pressure port for remote power control	DIN 3852	M14x1,5; 12 deep	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	
500	510	125	285	207	468	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
750	582	125	322	237	502	
1000	622	125	350	260	566	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.D with pressure control

Initial position in pressureless condition: $V_{g\,max}$

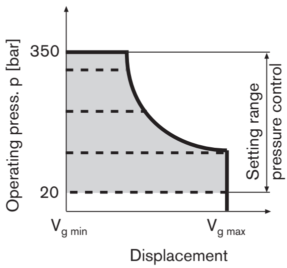
The pressure control overrides the power control, i.e. below the set pressure control level the unit follows the power control function.

As soon as the pump output pressure reaches the pressure control level, the pump turns into the pressure control mode and delivers only the amount of fluid as required to maintain this pressure.

Setting range of the pressure control 20...350 bar
This pressure is set as standard to 350 bar.

If another setting is required please state in clear text when ordering.

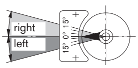
Characteristic



Direction of flow S to B

Direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

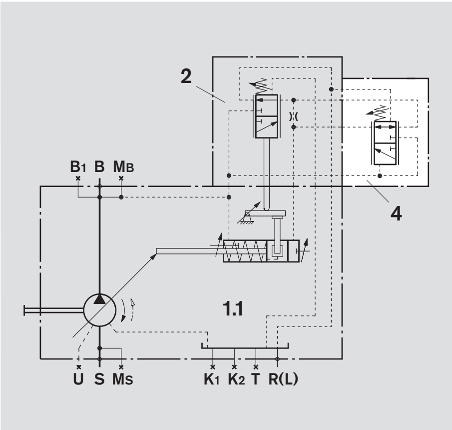
[1]) Compare swivel angle indicator



Schematics LR.D

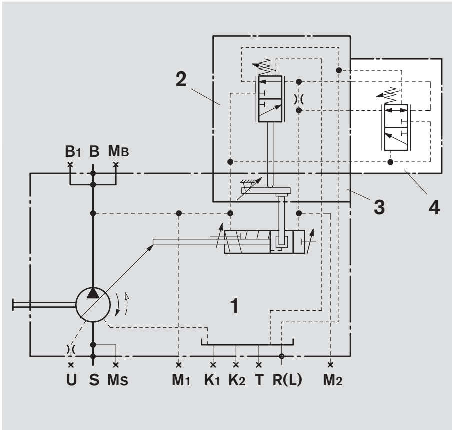
Size 40 and 71

Example: A4VSO LR2D



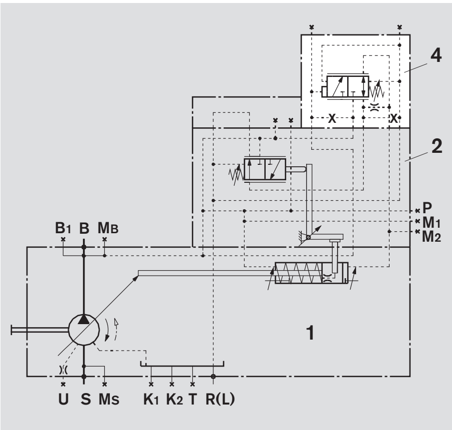
Size 125 to 355

Example: A4VSO LR2D



Size 500 to 1000

Example: A4VSO LR2D



Unit dimensions LR.D see page 19

Ports

M_1, M_2	Gauging port control chamber pressure (Size 125 to 1000)
P	Control pressure port (Size 500 to 1000)

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
4	Pressure control valve

LR.G with remote pressure control

Initial position in pressureless condition: $V_{g\,max}$

In order to enable a remote setting of the pressure control an external relief valve (item 5) can be piped to port X_D. This relief valve does not belong to the standard supply of the LR2G- or LR3G-control, if desired however it can be mounted depending on the pump version.
As soon as the pressure control level (relief valve setting plus pressure differential over the pressure control valve spool) is reached the pump turns into the pressure control mode.

The pressure differential over the pressure control valve spool (item 4) is set as standard to 20 bar, this results in a pilot oil flow of approx. 1.5 L/min. out of port X_D
If another setting is desired (recommended range 20...50 bar), please state the desired value in clear text.

As separate pressure relief valve we recommend:
– DBD 6 (hydraulic) to RE 25402.
– DBETR–SO 437 (electric) to RE 29166

The max. line lenght should not exceed 2 m.

Notes for the remote pressure control settings :

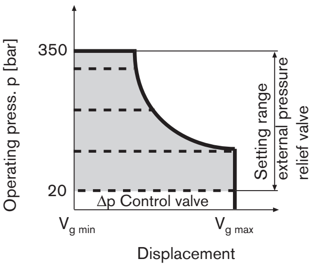
The overall level of the pressure control setting is a result of the separate relief valve setting plus the differential pressure Δp at the pressure control valve spool-

Example:	external pressure relief valve	330 bar
	Differential pressure at pressure control valve	20 bar
	results in pressure control of	330 + 20 = 350 bar

Please observe the following in control combinations with hydraulic stroke limiting (LR.GH or LR.GN):

With a pressure control setting below the pressure level of the external control pressure supply $p_{contr.}$ all pumps up to size 355 will remain against the $V_{g\,min}$-mechanical stroke limiter and the sizes 500 to 1000 may experience oscillations

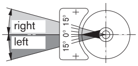
Characteristic



Direction of flow S to B

Direction of rotation	Swivel range [1)]	Pressure port
right hand	left	B
left hand	right	B

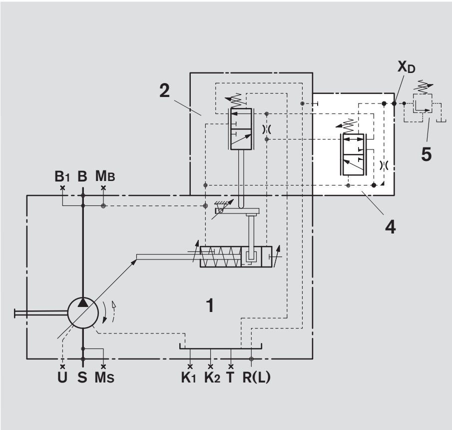
[1)] compare swivel angle indicator



Schematics LR.G

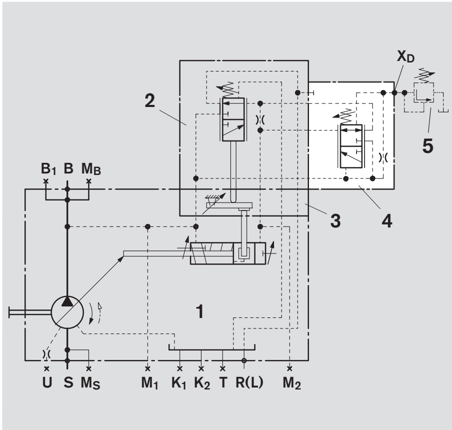
Size 40 and 71

Example: A4VSO LR2G



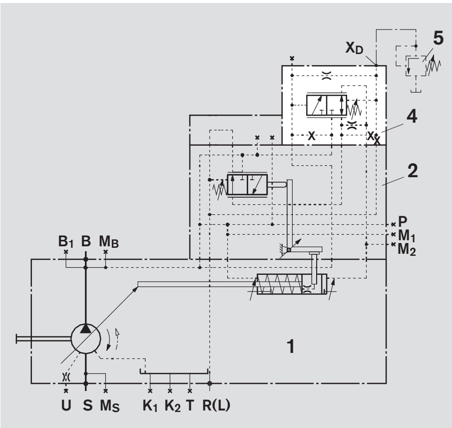
Size 125 to 355

Example: A4VSO LR2G



Size 500 to 1000

Example: A4VSO LR2G



Ports

X_D	Pilot pressure port remote pressure control
M_1, M_2	Gauging port control chamber pressure (Size 125 to 1000)
P	Control pressure port (Size 500 to 1000)

Subassemblies

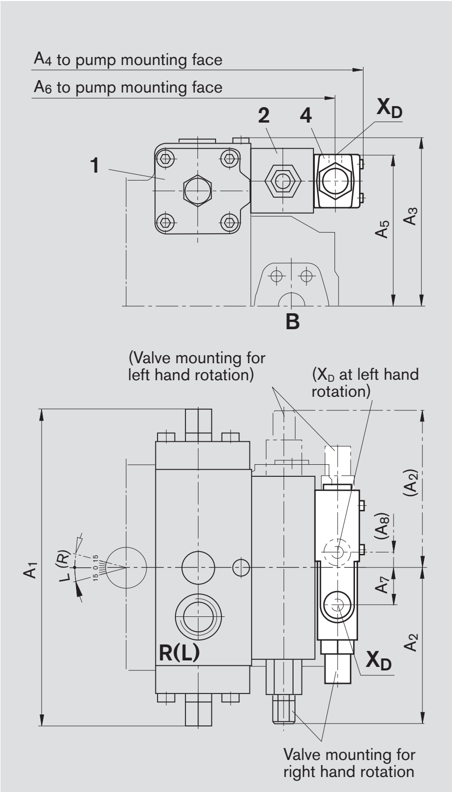
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
4	Pressure control valve
5	Pressure relief valve (not in scope of supply)

Unit dimensions LR.D and LR.G

Before finalising your design please request a certified installation drawing. Dimensions in mm.

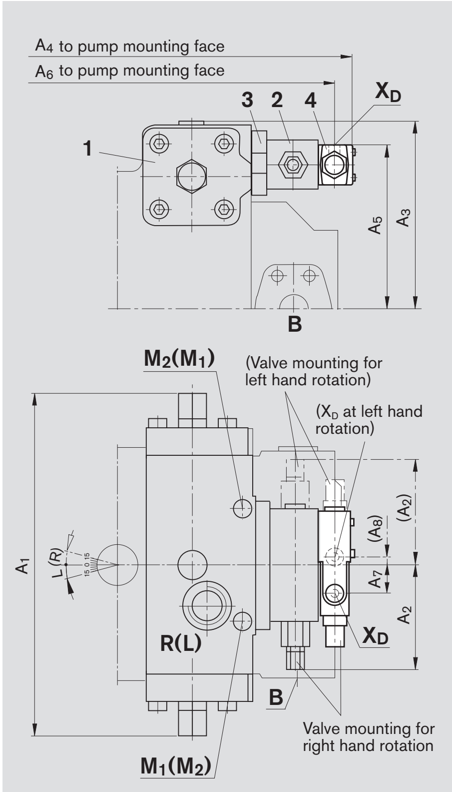
Size 40 and 71

Right hand rotation (left hand)



Size 125 to 355

Right hand rotation (left hand)



Subassemblies see page 18

Ports

				max. tightening torque [1]
X_D	Pilot pressure port remote pressure control	DIN 3852	M14x1,5; 12 deep; plugged at LR.D	80 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
40	260	132	148	295	130	269	37	7
71	296	132	159	322	141	296	37	7
125/180	354	132	195	391	171	365	37	7
250/355	424	132	238	453	207	427	37	7

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

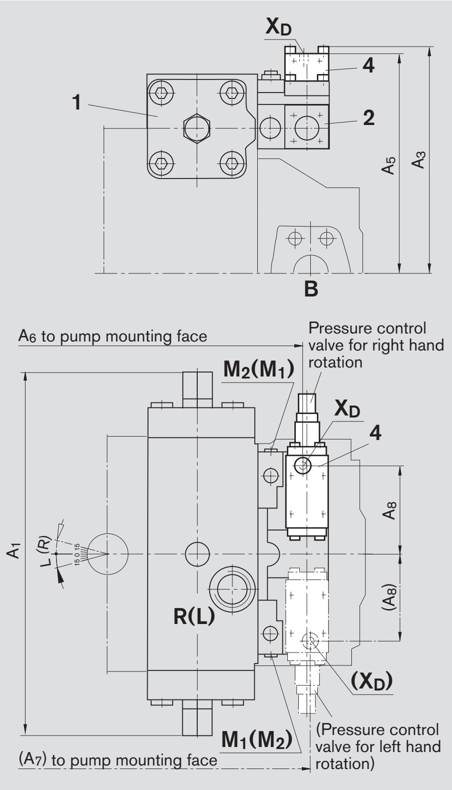
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.D and LR.G

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation (left hand rotation)



Subassemblies

1 A4VSO with hydraulic control device (see RE 92050)

2 Power control valve

4 Pressure control valve

5 Pressure relief valve (not in scope of supply)

Ports

				max. tightening torque [1])
X_D	Pilot pressure port remote pressure control	DIN 3852	M14x1,5	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_5	A_6	A_7	A_8	
500	510	320	311	430	441	125	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
750	582	350	342	462	473	125	
1000	622	373	364	528	539	125	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.F with flow control

Initial position in pressureless condition: $V_{g\,max}$

In addition to the power control function it is also possible to control the pump output flow by means of a differential pressure i.e. over an orifice or valve opening between pump and actuator. The pump delivers only the amount of fluid as required by the actuator.

The pump flow depends on the cross section of the orifice (item. 7), mounted between pump and actuator. Below the power control and within the pump's control range the output flow is virtually independent of the actual load pressure.

The size of the orifice cross section determines the pump flow.

The flow controller measures the pressure before and after the orifice and keeps the pressure drop (differential pressure Δp) constant and can thus control the flow.

With an increasing differential pressure Δp the pump swivels back (towards $V_{g\,min}$), and vice versa, if the Δp drops the pump increases the swivel angle (towards $V_{g\,max}$), till the valve spool is in balance again.

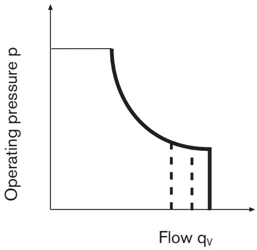
$\Delta p_{orifice} = p_{pump} - p_{actuator}$

The standard **Δp** setting at the flow control valve (item 6) amounts to 14 bar. If another setting is desired (recommended range14...25 bar), please state in clear text. Higher values on request.

Note:

For dynamic control requirements we recommend to use the LR.**S** with Load-Sensing and remote pressure control (see page42).

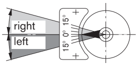
Characteristic



Direction of flow S to B

Direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

[1]) compare swivel angle indicator

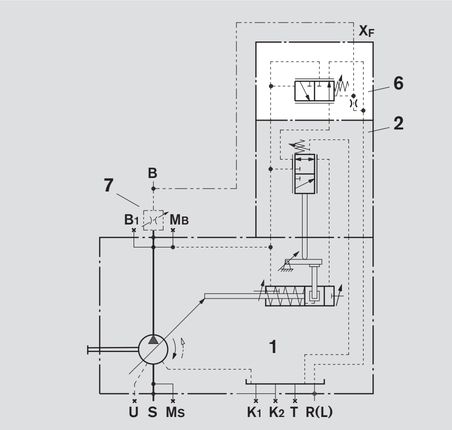


2

Schematics LR.F

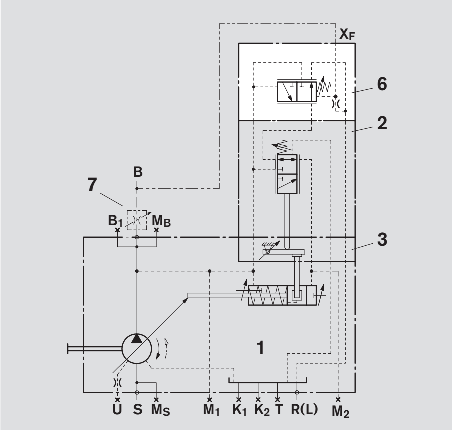
Size 40 and 71

Example: A4VSO LR2F



Size 125 to 355

Example A4VSO LR2F



Ports

X_F	Pilot pressure port flow control
M_1, M_2	Gauging port control chamber pressure (Size 125 to 355)

Subassemblies

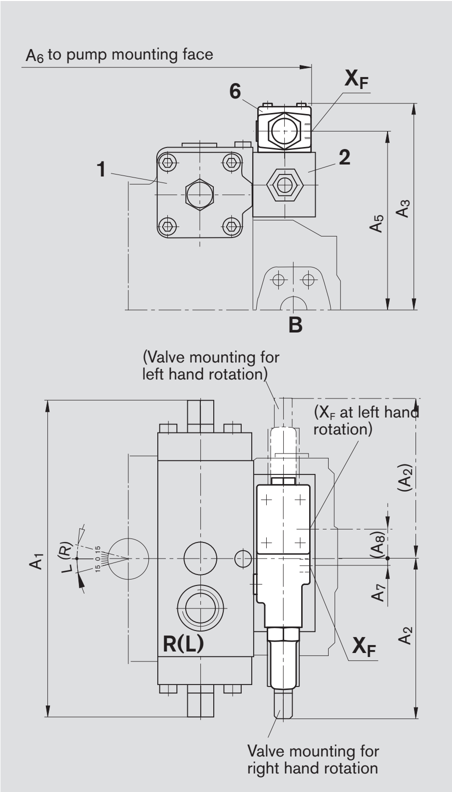
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valvel
3	Sandwich plate (Size 125 to 355)
6	Flow control valve
7	External orifice (not in scope of supply)

Unit dimensions LR.F

Before finalising your design please request a certified installation drawing. Dimensions in mm.

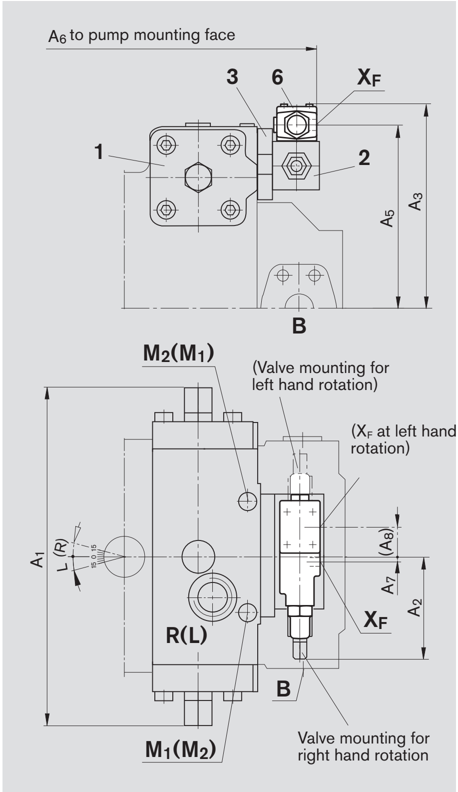
Size 40 and 71

Right hand rotation (left hand)



Size 125 to 355

Right hand rotation (lefthand)



Subassemblies see page 22

Ports

				max. tightening torque [1]
X_F	Pilot pressure port	DIN 3852	M14x1,5	80 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep; plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_5	A_6	A_7	A_8	
40	260	132	182	156	243	7	37	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	193	167	270	7	37	
125/180	354	132	223	197	339	7	37	
250/355	424	132	259	233	401	7	37	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.H with hydraulic stroke limiter

Initial position in pressureless condition: $V_{g\,max}$

This control needs an external control pressure supply to port P.

The displacement is reduced in proportion to a pilot pressure in port P_{St}.

The hyperbolic power control is overriding the pilot pressure signal and keeps the max. drive power constant.

$p \cdot V_g = \text{constant}$ p = Operating pressure
V_g = Displacement

Limitation of displacement is possible via:

– Direct swivel angle limitation at the control piston (item 1) - **mechanical**
– Additional stroke limitation at the pilot valve (item 6.1) - **hydraulic**

Setting range

mechanical swivel angle limitation at the control piston:

$V_{g\,min}$ 0...50 % of $V_{g\,max}$ $V_{g\,max}$ 100...50 % of $V_{g\,max}$

hydraulic stroke limitation at the pilot valve:

$V_{g\,min}$ 0...100 % of $V_{g\,max}$ $V_{g\,max}$ 100...0 % of $V_{g\,max}$

The min. and max. mechanical swivel angle limitations are factory set to a fixed value. Please state the desired value in clear text when ordering.

The standard setting of the hydraulic stroke limitation is done in such a manner, that the above mentioned mechanical $V_{g\,min}$- and $V_{g\,max}$ settings can be achieved. Different settings please state in clear text.

Technical data

Min. required pilot pressure in P	$p_{contr\,min}$	bar	35
Max. permissible control pressure in P	$p_{contr\,max}$	bar	100
Control fluid consumption in P (at p = 50 bar)		L/min	max. 4
Pilot pressure range in P_{St}	p_{pilot}	bar	10...45
Max. pressure in P_{St}	$p_{pilot\,max}$	bar	100
Control begin of power curve, however above control press. p_{contr} in P	p	bar	50...350
Hysteresis			≤ ± 2% von $V_{g\,max}$

Please observe the following in control combinations with remote pressure control (LR2GH and LR3GH) :

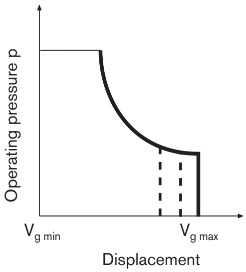
With a pressure control setting below the pressure level of the external control pressure supply p_{contr} all pumps up to size 355 will remain against the mechanical stroke limiter $V_{g\,min}$ and the sizes 500 to 1000 may experience oscillations.

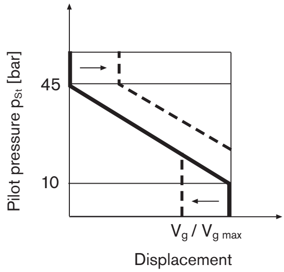
Table of values LR.H

Size			40	71	125	180	250	355	500	750	1000
Control volume	V_{1max}	cm³	11,4	21,5	37,5	37,5	73,2	73,2	125,0	210,0	263,3
Control volume	V_{2max}	cm³	2,9	5,4	9,4	9,4	18,3	18,3	31,4	51,3	65,8
Differential volume	V_1–V_2	cm³	8,5	16,1	28,1	28,1	54,9	54,9	94,1	158,7	197,5

LR.H with hydraulic stroke limiter

Characteristic

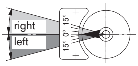




Direction of flow S to B

Direction of rotation	Swivel range [1])	Pressure port
right hand	left	B
left hand	right	B

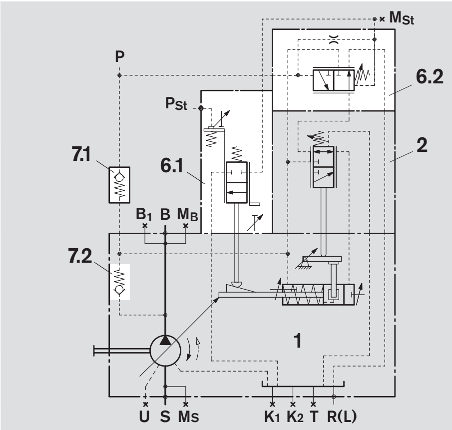
[1]) Compare swivel angle indicator



Schematics LR.H

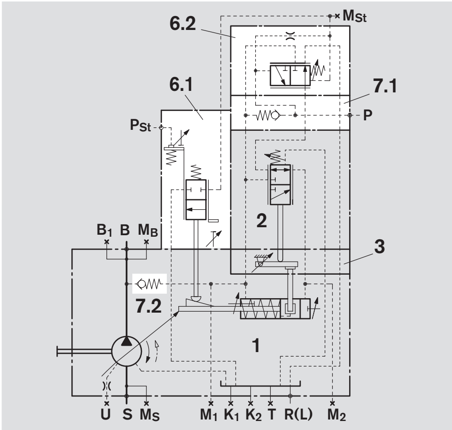
Size 40 and 71

Example: A4VSO LR2H



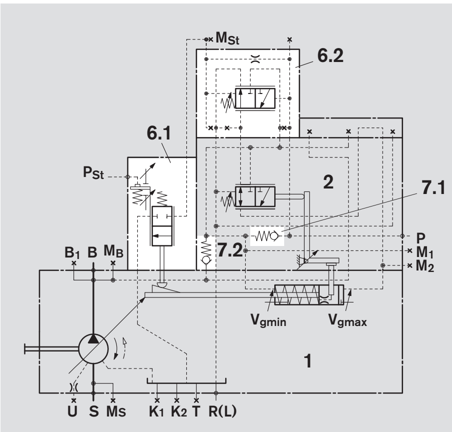
Size 125 to 355

Example A4VSO LR2H



Size 500 to 1000

Example: A4VSO LR2H



Ports

P	Control pressure port
P_{St}	Pilot pressure port
M_{St}	Gauging port pilot control pressure (plugged)
M_1, M_2	Gauging port control chamber pressure (Size 125 to 1000)

Subassemblies

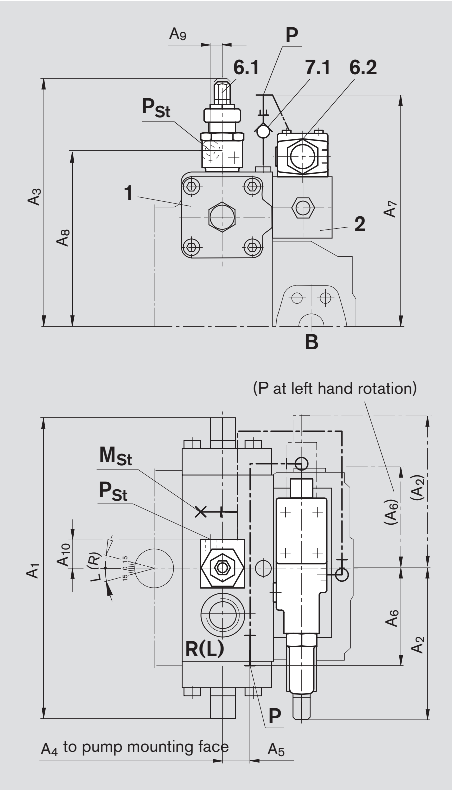
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
6.1	Pilot valve-stroke limiter
6.2	Pressure control valve for stroke limiter
7.1	Check valve (for size 40 and 71 external, integrated in sizes 125 to 1000)
7.2	Integrated check valve

Unit dimensions LR.H

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

Right hand rotation (left hand)



Valve mounting for left hand rotation item 2, 6.2 and 7.1 each rotated 180°

Subassemblies

1 A4VSO with hydraulic control device (see RE 92050)

2 Power control valve

6.1 Pilot valve-stroke limiter

6.2 Pressure control valve for stroke limiter

7.1 Check valve

Ports

				max. tightening torque[1]
P	Control pressure port	DIN 3853	S8 Form W	50 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W plugged	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	260	132	254	144	34	83	198	163	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	268	166	39	83	215	178	15	35	

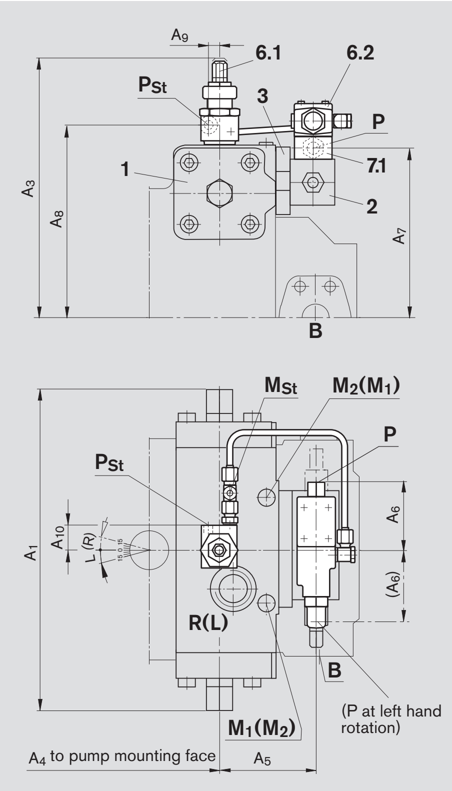
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.H

Before finalising your design please request a certified installation drawing Dimensions in mm.

Size 125 to 355

Right hand rotation (left hand)



Valve mounting for left hand rotation item 2, 6.2 and 7.1 each rotated 180°

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate
6.1	Pilot valve-stroke limiter
6.2	Pressure control valve for stroke limiter
7.1	Integrated check valve in sandwich plate

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control press.	DIN 3853	S8 Form W closed	50 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep; plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
125/180	354	304	203	112	88	192	214	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	424	352	248	129	88	228	261	15	35	

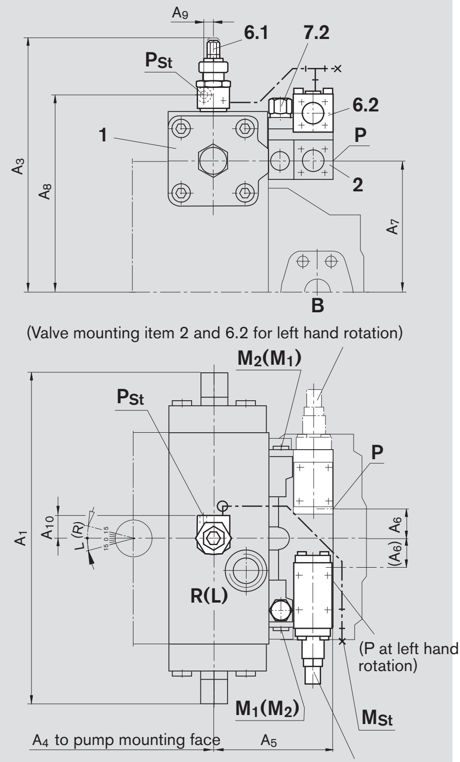
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.H

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation (left hand)



Valve mounting item 2 and 6.2 for right hand rotation

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
6.1	Pilot valve-stroke limiter
6.2	Pressure control valve for stroke limiter
7.2	Integrated check valve in item 2

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}
500	510	397	279	185	47	202	306	15	35
750	582	435	301	196	47	232	345	15	35
1000	622	463	360	202	47	255	372	15	35

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

[1]) please observe the general notes for the max. tightening torques on page 68

LR.M with mechanical stroke limiter $V_{g\,max}$

Initial position in pressureless condition: $V_{g\,max}$

In addition to the power control function it is also possible to limit the max. displacement $V_{g\,max}$ steplessly through adjustment of a screw spindle. The setting must be done in a pressureless condition.

Adjustment data of stroke limiter $V_{g\,max}$

Setting range: 100% $V_{g\,max}$ ...0% $V_{g\,max}$
(can go up to 104% of nominal displacement value)

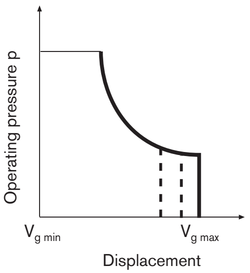
Standard setting: Nominal-$V_{g\,max}$

Size			40	71	125	180	250	355
V_g-change/revolution		cm³	4,3	6,3	9,1	13,1	14,4	20,6
Total adjustment stroke	*s*	mm	14,2	17,1	20,7	20,7	25,9	25,9

Right hand rotation (with view on screw spindle)–increase of displacement

Left hand rotation (with view on screw spindle)–decrease of displacement

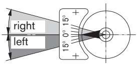
Characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

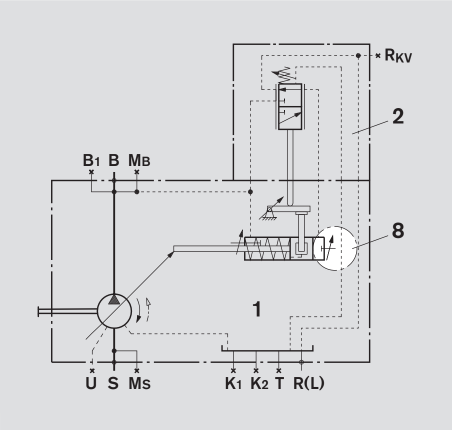
[1]) Compare swivel angle indicator



Schematics LR.M

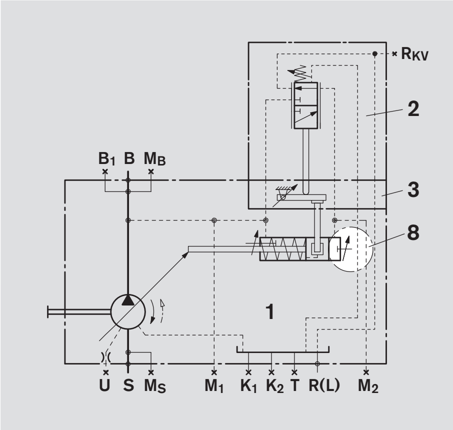
Size 40 and 71

Example: A4VSO LR2M



Size 125 to 355

Example: A4VSO LR2M



Ports

R_{kV}	External control fluid return
M_1, M_2	Gauging port control chamber pressure (Size 125 to 355)

Subassemblies

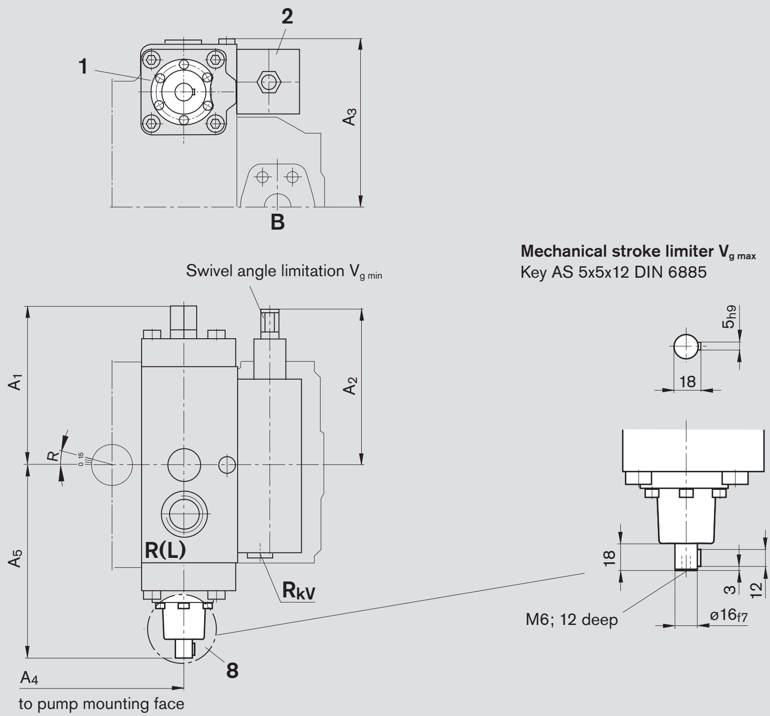
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
8	mechanical stroke limiter $V_{g\ max}$

Unit dimensions LR.M

Before finalising your design please request a certified installation drawing Dimensions in mm.

Size 40 and 71

Example: left hand rotation



For right hand rotation the $V_{g\,max}$ - mechanical stroke limiter and $V_{g\,min}$ - swivel angle limitation exchanged positions, see presentation size125 to 355 page 33.

Subassemblies see page 31

Ports

				max. tightening torque [1])
R_{kV}	External control fluid return	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	
40	130	132	148	144	172	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	148	132	159	166	188	

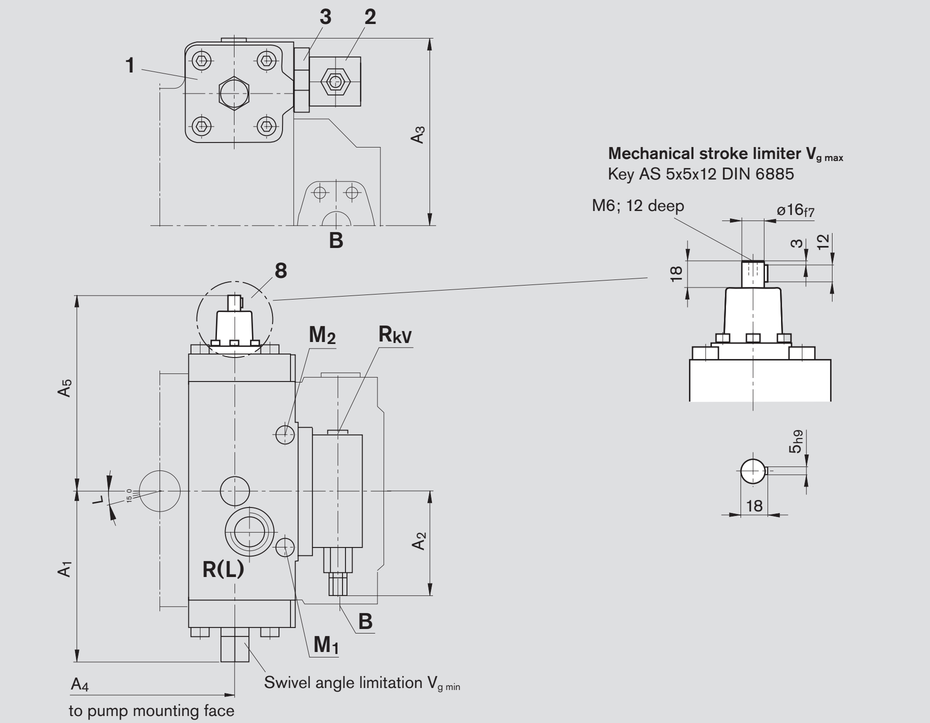
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.M

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 125 to 355

Example: right hand rotation



For left hand rotation the $V_{g\ max}$ - mechanical stroke limiter and $V_{g\ min}$ - swivel angle limitation exchanged positions, see presentation size 40 and 71 page 32.

Subassemblies see page 31

Ports

				max. tightening torque [1])
R_{kV}	External control fluid return	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep; plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	
125/180	177	132	195	203	213	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	212	132	238	248	243	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.Z Hydraulic two-point control

can be used as easy start option, external pilot pressure required

Initial position in pressureless condition and with R_{kV} port unloaded: $\mathbf{V_{gmax}}$

The LR2(3)Z is a simple 2-point displacement adjustment with overriding power control.

Pressurizing port R_{kv} brings the control device towards the adjustable V_{gmin}-stop. Unloading the port R_{kv} to tank enables the pump to perform the LR2(3)-control functions.

For the power and pressure pressure control functions port R_{kv} must be unloaded to tank (by customer).

This feature enables a pump to be started against a reduced starting torque.

Recommended pilot pressure at port R_{kv}:

$$p_p = \frac{\text{Output press. } p_{HD}}{2} \quad \text{however at least 20 bar.}$$

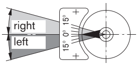
The $V_{g\,min}$-stop will be factory set (between 0...50% $V_{g\,max}$).
Please state desired value in clear text when ordering.

For prolonged periods in standby we recommend to use LR.G with external unloading of pilot pressure.

Direction of flow S to B

Pump direction of rotation	Swivel range [1])	Pressure port
right hand	left	B
left hand	right	B

[1]) Compare swivel angle indicator

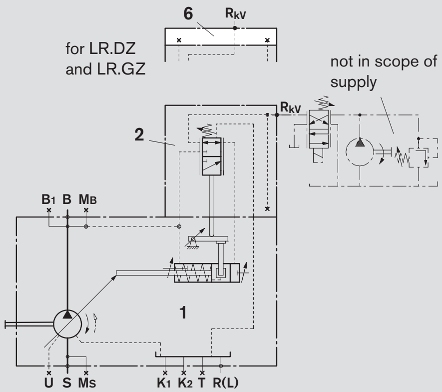


Schematics LR.Z

Size 40 and 71

Example: A4VSO LR2Z

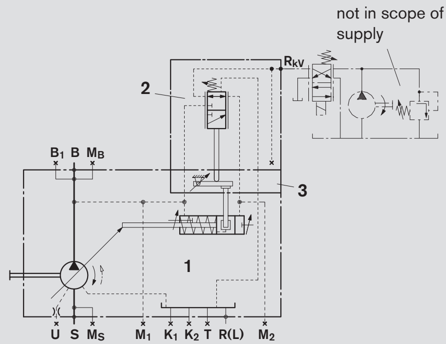
as easy start option with external pilot pressure supply



Size 125 to 355

Example: A4VSO LR2Z

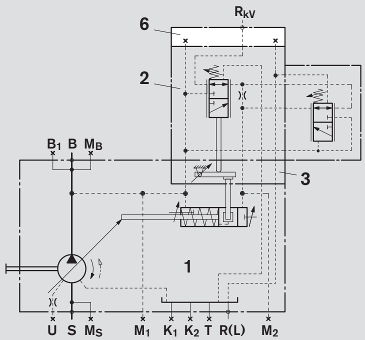
as easy start option with external pilot pressure supply



Size 125 to 355

Example: A4VSO LR2DZ

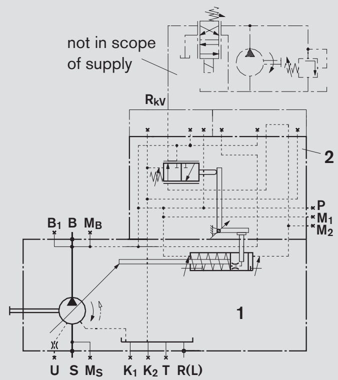
with adapter plate R_{kV} with pressure control



Size 500 to 1000

Example: A4VSO LR2Z

as easy start option with external pilot pressure supply



Ports

R_{kV}	External control fluid return
M_1, M_2	Gauging port control chamber pressure (Size 125 to 1000)
P	Control pressure port (Size 500 to 1000)

Subassemblies

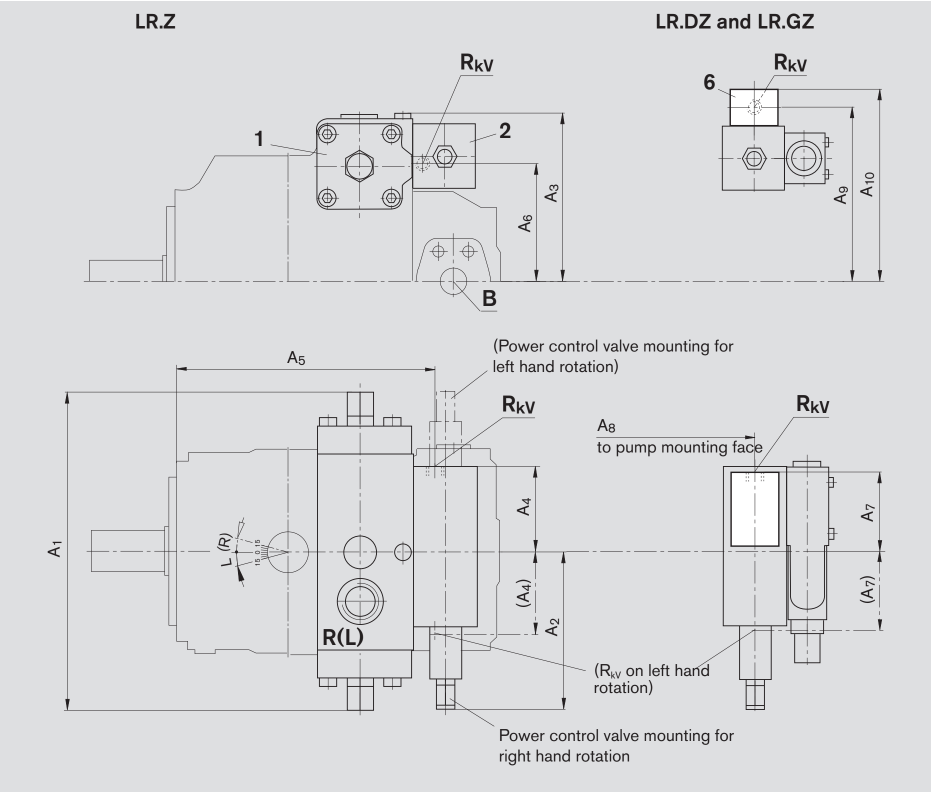
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
6	Adapter plate R_{kV} for LR.**D**Z and LR.**G**Z (Size 40 to 355)

Unit dimension LR.Z

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

Right hand rotation (left hand)



Subassemblies see page 35

Ports

			max. tightening torque [1]
R_{kV}	External control fluid return	DIN 3852 M18x1,5; 12 deep	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	260	132	149	80	209	114	63	219	152	168	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	159	80	236	125	63	246	163	184	

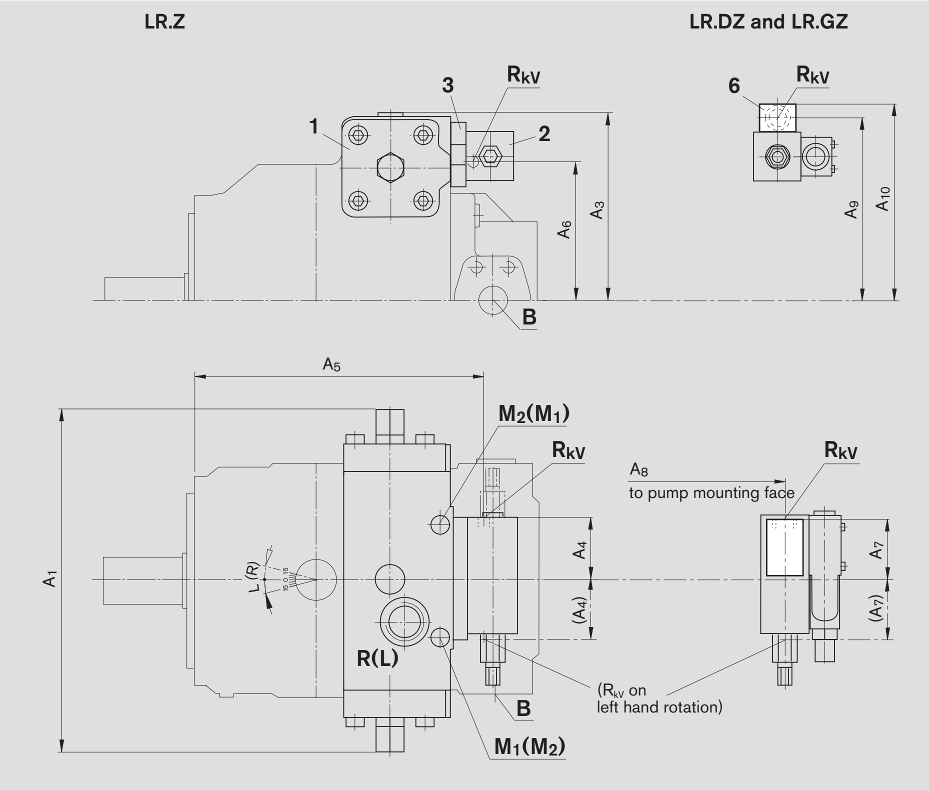
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimension LR.Z

Before finalising your design please request a certified installation drawing. Dimensions in mm..

Size 125 to 355

Right hand rotation (left hand)



Subassemblies see page 35

Ports

				max. tightening torque [1])
R_{kV}	External control fluid return	DIN 3852	M18x1,5; 12 deep	140 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep; plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
125/180	354	195	80	305	155	63	315	193	209	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	424	238	80	367	191	63	377	229	250	

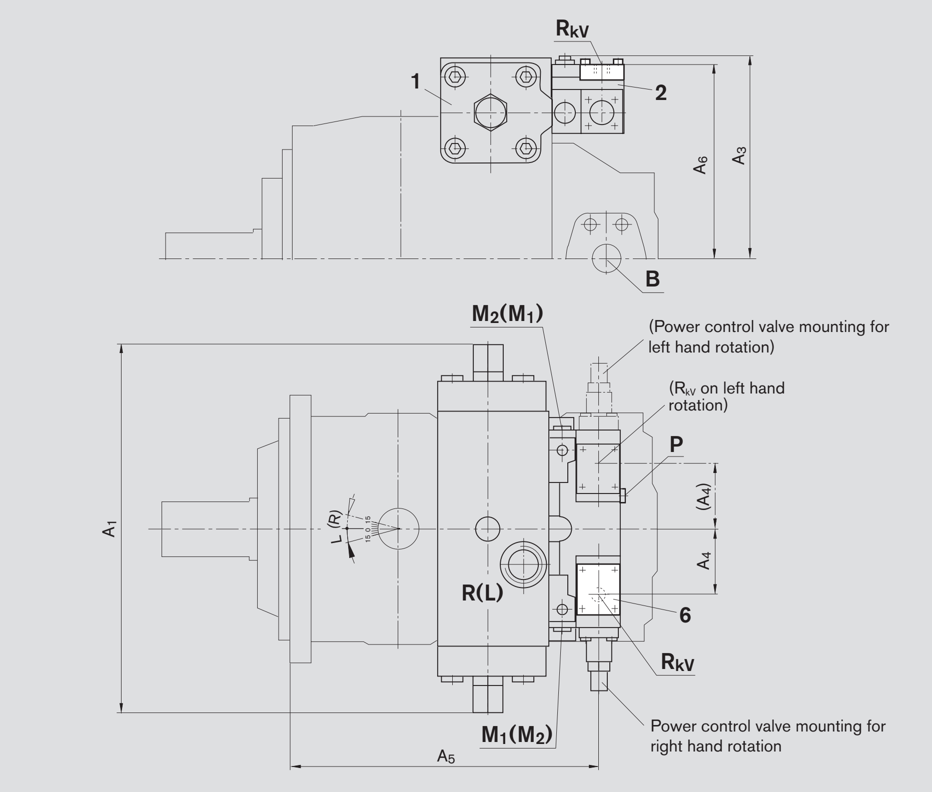
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.Z

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation (left hand)



Subassemblies see page 35

Ports

				max. tightening torque [1])
R_{kV}	External control fluid return	DIN 3852	M18x1,5; 12 deep	140 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	
500	510	285	94	433	277	For detailed unit dimensions and technical data on the variable pump see technical dat sheet A4VSO RE 92050
750	582	322	94	465	307	
1000	622	350	94	532	330	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.Y Electric two-point control

with internal supply of pilot pressure

Initial position in pressureless condition and solenoid energized: V_{gmax}

The LR2(3)Y is an electric two-position displacement adjustment with overriding power control and internal pilot pressure supply, i.e. the necessary pilot pressure is taken out of the pump pressure side.

Valve function:

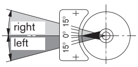
a) Solenoid de-energized = easy start, pump swivels back towards V_{gmin}-stop as soon as an operating pressure of approx. 4...10 bar is reached

b) Solenoid energized = pump operates in power control mode

Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

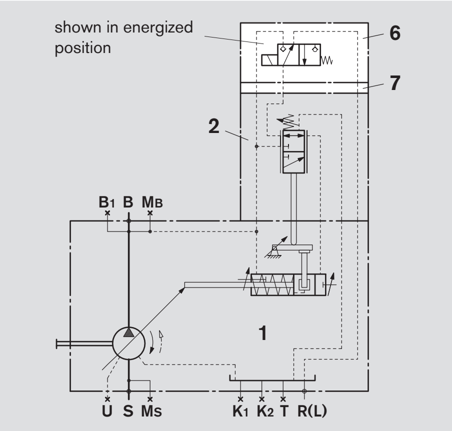
[1]) Compare swivel angle indicator



Schematics LR.Y

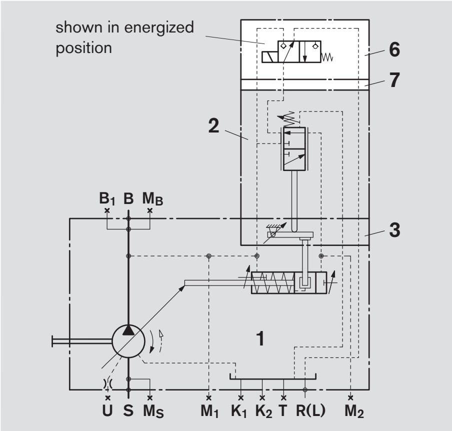
Size 40 and 71

Example: A4VSO LR2Y



Size 125 to 355

Example: A4VSO LR2Y



Ports

M_1, M_2 Gauging port control chamber pressure (size 125 to 355)

Subassemblies

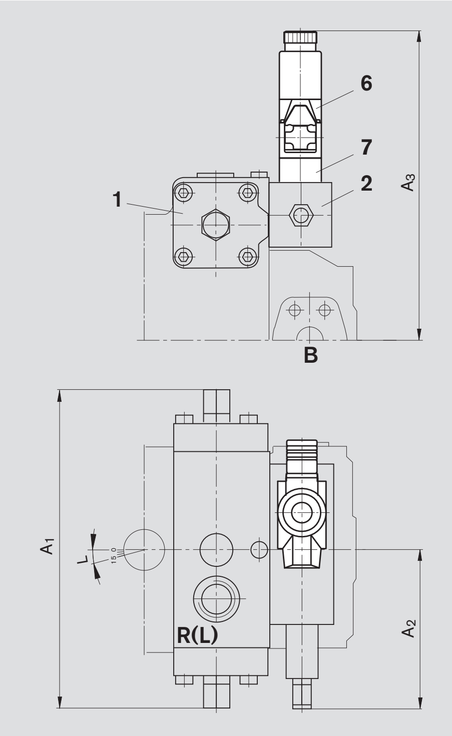
1	A4VSO with hydraulic control device (see RE 92050)	
2	Power control valve	
3	Sandwich plate (size 125 to 355)	
6	3/2-directional poppet valve see RE 22058 (for size 40 to 355)	
	Type	**Solenoid**
	M-3SEW6U3X/420MG24N9K4	Solenoid with junction box (Hirschmann) to DIN EN 175 301-803 cable joint M16x1,5 for cable dia. 4,5...10 mm protection IP65
7	sandwich plate	

Unit dimensions LR.Y

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

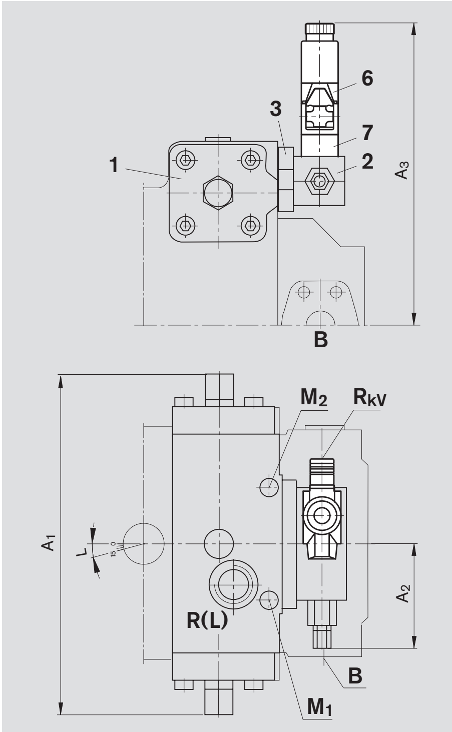
Example: Right hand rotation



For left hand rotation mounting positions of items 2, 6 and 7 are rotated 180°

Size 125 to 355

Example: Right hand rotation



For left hand rotation mounting positions of items 2, 6 and 7 are rotated 180°

Subassemblies see page 40

Ports

max. tightening torque[1])

M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep; plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	
40	260	132	292	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	308	
125/180	354	132	338	
250/355	424	132	374	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.S with Load-Sensing valve

and remote pressure control

Initial position in pressureless condition: V_{gmax}

The LRS- control works as a load pressure independent flow controller and matches the pump output flow with the flow requirement from the actuator.

The pump output pressure at port B will always be higher by the set differential pressure Δp than the load pressure at the actuator.

The pump flow depends on the opening cross section of an orifice item 4.1 (throttle valve, proportional valve or valve block), and below the power control curve the pump flow is not influenced by the actual load pressure.

The Load-Sensing valve compares the operating pressure upstream of the orifice item 4.1 (throttle valve, proportional valve or valve block) with the operating pressure downstream of this orifice and keeps the pressure drop (differential pressure Δp) constant at the set value, i.e. the pump flow remains constant.

At a change of the differential pressure Δp over orifice (item 4.1), caused by a change in orifice or valve opening cross section, the pump flow adapts to this new condition, i.e. increase of differential pressure brings the pump to a smaller displacement.

Optional pressure control (item 5 and 5.1)
As soon as the load pressure reaches the level as set at pressure relief valve (item5), the system will go to the pressure control mode, regardless of the actual differential pressure at orifice (item 4.1). This requires an additional orifice (item 5.1).

The standard setting of the differential pressure at the Load Sensing valve (item 4) amounts to Δp = 14 bar.

Actuation of relief valve (item 5) causes a pilot fluid consumption of approx. 1,3 L/min with an orifice dia. of 0,8 mm (item 5.1) and a Δp =14 bar.

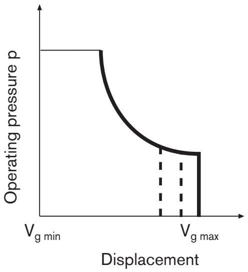
The max. line length to the separate pressure relief valve (item 5) should not exceed 2 m.

Notes to the setting of the remote pressure control:

The setting of the separate pressure relief valve (item 5) plus the pressure differential at the Load-Sensing valve determines the overall pressure control level.

Example:	external pressure relief valve	336 bar
	Differential pressure at Load-Sensing	14 bar
	results in pressure control of 336 + 14 =	350 bar

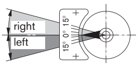
Characteristic



Direction of flow S to B

Pump direction of rotation	Swivel range [1])	Pressure port
right hand	left	B
left hand	right	B

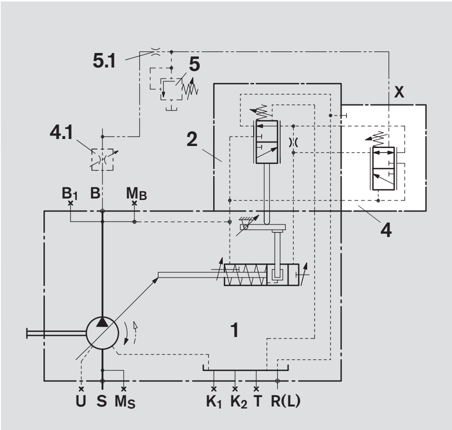
[1]) Compare swivel angle indicator



Schematics LR.S

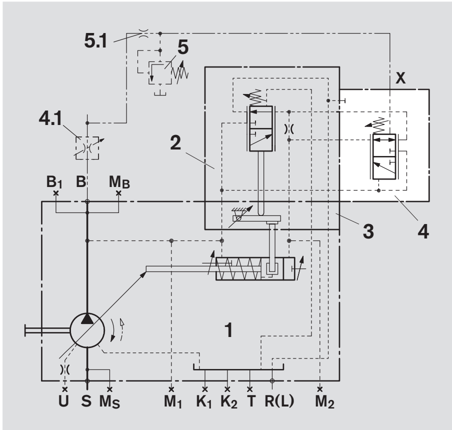
Size 40 and 71

Example: A4VSO LR2S



Size 125 to 355

Example: A4VSO LR2S



Ports

X	Pilot pressure control
M_1, M_2	Gauging port control chamber pressure (Size 125 to 355)

Subassemblies

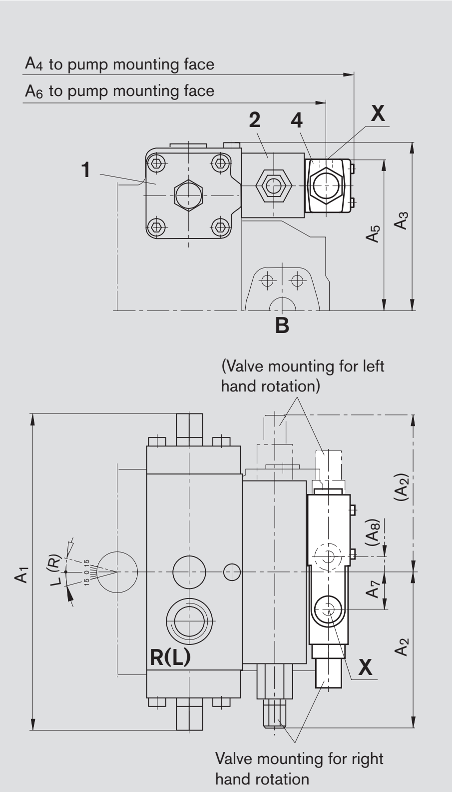
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
4	Load-Sensing valve
4.1	Orifice for load sensing (not in scope of supply)
5	Pressure relief valve optional (not in scope of supply) Recommended: DBD 6 (hydraulic) to RE 25402 or DBETR-SO 437 (electric) to RE 29166
5.1	Orifice for remote pressure control optional (not in scope of supply) Recommended: 0,8 - 1mm depending on the load sensing control the pressure increase can amount to 14 bar

Unit dimensions LR.S

Before finalising your design please request a certified installation drawing. Dimensions in mm.

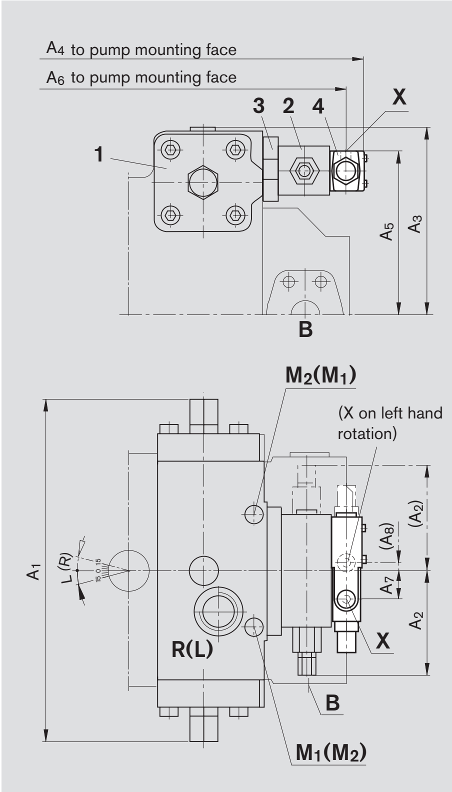
Size 40 and 71

Right hand rotation (left hand)



Size 125 to 355

Right hand rotation (left hand)



Subassemblies see page 43

Ports

				max. tightening torque [1])
X	Pilot pressure port	DIN 3852	14x1,5; 12 deep	80 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180)	80 Nm
			M18x1,5; 12 deep plugged (Size 250 a. 355)	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8
40	260	132	148	295	130	269	37	7
71	296	132	159	322	141	296	37	7
125/180	354	132	195	391	171	365	37	7
250/355	424	132	238	453	207	427	37	7

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

[1]) please observe the general notes for the max. tightening torques on page 68

LR.N Hydraulic stroke control, pilot pressure dependent

Initial position in pressureless condition: $V_{g\,min}$

The hydraulic stroke control needs an external control pressure supply to port P

The displacement is increased proportional to an external pilot pressure signal in port P_{St}.

The hyperbolic power control is overriding the pilot pressure signal and will keep the pre-determined drive power constant.

$p \cdot V_g =$ constant

p = Operating pressure
V_g = Displacement

Limitation of displacement is possible via:
- Direct swivel angle limitation at the control piston (item 1) - **mechanical**
- Additional stroke limitation at the pilot valve (item 6.1) - **hydraulic**

Setting range

mechanical swivel angle limitation at the control piston:

$V_{g\,min}$ 0...50 % of $V_{g\,max}$ $V_{g\,max}$ 100...50 % of $V_{g\,max}$

hydraulic stroke limitation at the pilot valve:

$V_{g\,min}$ 0...100 % of $V_{g\,max}$ $V_{g\,max}$ 100...0 % of $V_{g\,max}$

The min. and max. mechanical swivel angle limitations are factory set to a fixed value. Please state the desired value in clear text when ordering.

The standard setting of the hydraulic stroke limitation is done in such a manner, that the above mentioned mechanical $V_{g\,min}$- and $V_{g\,max}$ settings can be achieved. Different settings please state in clear text.

Technical data

Min. required control pressure in P	$p_{contr\,min}$	bar	35
Min. required control pressure in P with boosted inlet S of max. 20 bar	$p_{contr\,min}$	bar	50
Max. permissible control pressure in P	$p_{contr\,max}$	bar	100
Control fluid consumption in P (at p = 50 bar)		L/min	max. 4
Pilot pressure range	p_{pilot}	bar	10...45
Beginning of power control curve, however must be above control press. p_{contr}	p	bar	50...350
Hysteresis			≤ ± 2% von V_{gmax}

Please observe the following in control combinations with remote pressure control (LR2GN and LR3GN):

With a pressure control setting below the pressure level of the external control pressure supply p_{contr} in P all pumps up to size 355 will remain against the mechanical stroke limiter $V_{g\,min}$ and the sizes 500 to 1000 may experience oscillations.

Table of values LR.N

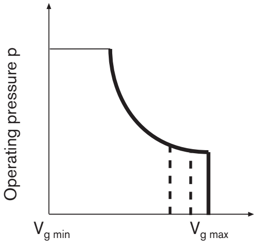
Size			40	71	125	180	250	355	500	750	1000
Control volume	V_{1max}	cm³	11,4	21,5	37,5	37,5	73,2	73,2	125,0	210,0	263,3
Control volume	V_{2max}	cm³	2,9	5,4	12,7	12,7	24,9	24,9	40,1	72,6	88,0
Differential volume	$V_1 - V_2$	cm³	8,5	16,1	24,8	24,8	48,3	48,3	84,9	137,4	175,3
Control fluid required for de-stroking at											
Control pressure p_{contr} = 50 bar; Operating pressur p < 50 bar; Beginnig of power control p > 50 bar		L/min	5,16*	6,44*	7,44*	7,44*	9,66*	9,66*	10,13*	11,00*	10,50*
at de-stroking time		s	0,10	0,15	0,20	0,20	0,30	0,30	0,50	0,75	1,00

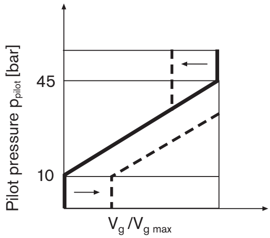
* Note that the control pressure supply needs an additional 4 L/min flow to compensate for the flow losses in the pilot circuit

LR.N hydraulic stroke control, pilot pressure dependent

Initial position in pressureless condition: $V_{g\,min}$

Characteristics

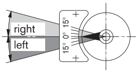




Direction of flow S to B

Pump direction of rotation	Swivel range [1]	Pressure port
right hand	left	B
left hand	right	B

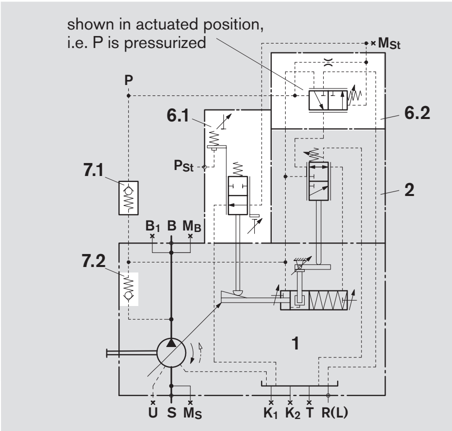
[1]) Compare swivel angle indicator



Schematics LR.N

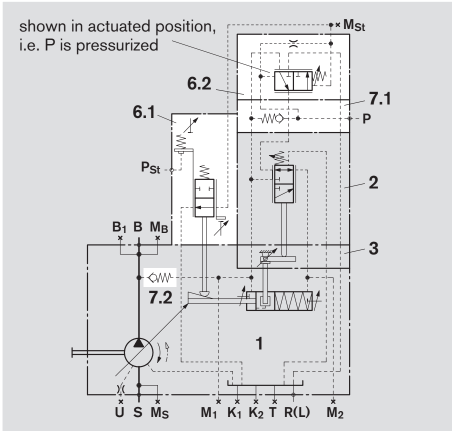
Size 40 and 71

Example: A4VSO LR2N



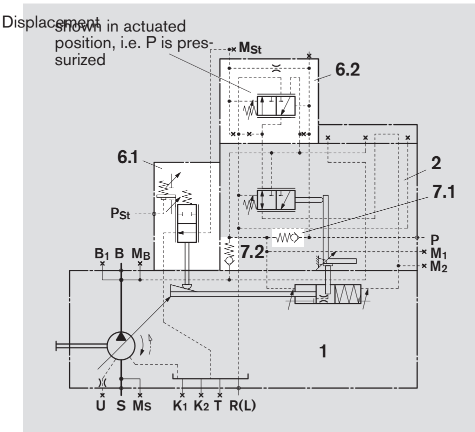
Size 125 to 355

Example: A4VSO LR2N



Size 500 to 1000

Example: A4VSO LR2N



Ports

P	Control pressure port
P_{St}	Pilot pressure port
M_{St}	Gauging port pilot control pressure (closed)
M_1, M_2	Gauging port control chamber press. (Size 125 to 1000)

Subassemblies

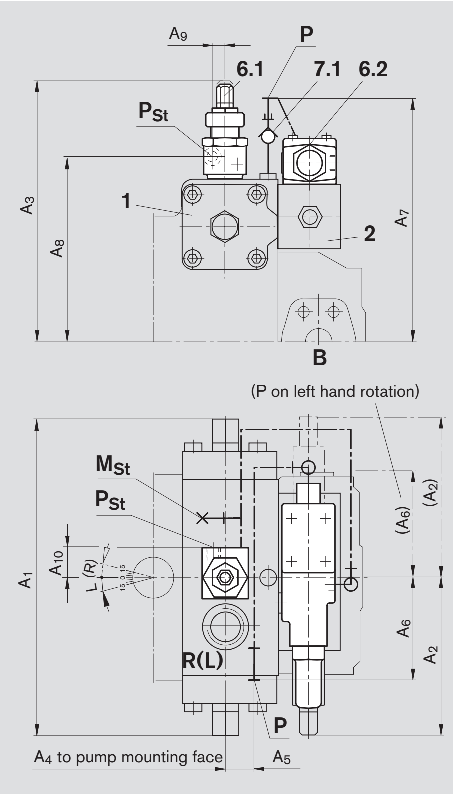
1	Pump with hydraulic control device A4VSO (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
6.1	Pilot valve
6.2	Control valve
7.1	Check valve (integrated in sizes 125 to 1000)
7.2	Integrated check valve

Unit dimensions LR.N

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

Right hand rotation (left hand)



Valve mounting position for left hand rotation item 2, 6.2 and 7.1 rotated by 180°

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
6.1	Pilot valve
6.2	Control valve
7.1	check valve

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3853	S8 Form W	50 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	260	132	248	144	34	83	198	163	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	264	166	39	83	215	180	15	35	

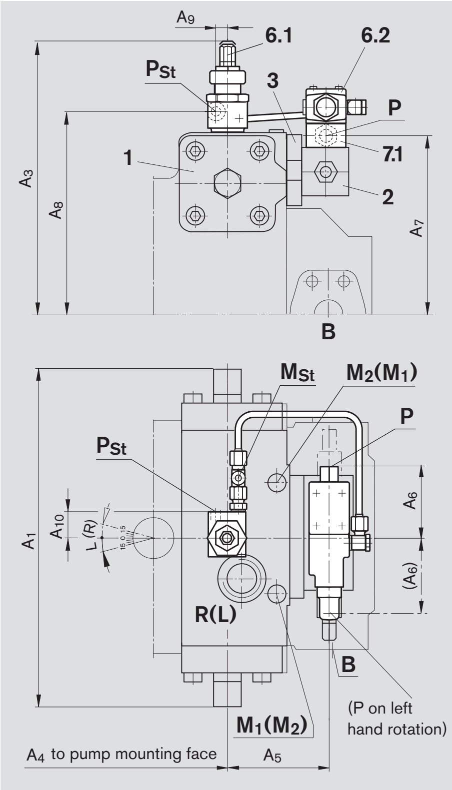
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.N

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 125 to 355

Right hand rotation (left hand)



Valve mounting position for left hand rotation item 2, 6.2 and 7.1 rotated by 180°

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
6.1	Pilot valve
6.2	Pilot control valve
7.1	Integrated check valve in sandwich plate

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
125/180	354	298	203	112	88	192	214	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	424	346	248	129	88	228	261	15	35	

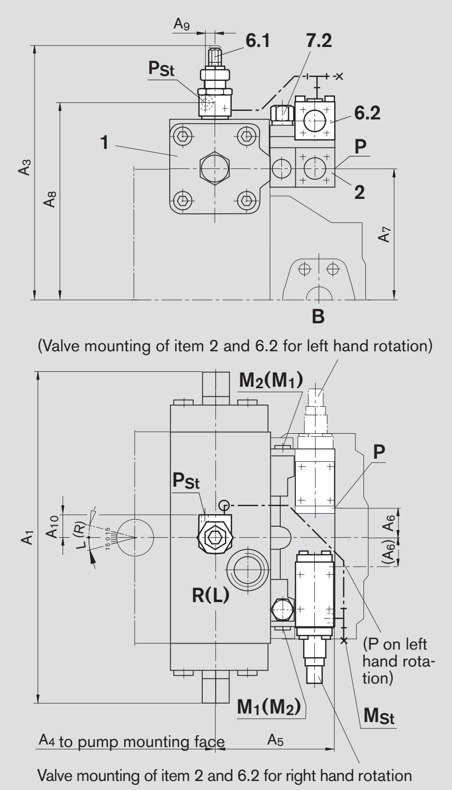
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.N

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation (left hand)



Subassemblies

1 A4VSO with hydraulic control device (see RE 92050)

2 Power control valve

6.1 Pilot valve

6.2 Pilot control valve

7.2 Integrated check valve in item 2

Ports

				max. tightening torque [1])
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
500	510	392	279	185	47	202	306	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
750	582	430	301	195	47	232	345	15	35	
1000	622	456	360	203	47	255	372	15	35	

[1]) please observe the general notes for the max. tightening torques on page 68

LR.NT with hydr. stroke control and electric control of pilot pressure

Initial position in pressureless condition: $V_{g\ min}$

Only available in right hand rotation.

This control needs an external control pressure supply to port P

The proportional relief valve DBEP6 (to RE 29164) supplies a pilot pressure signal to the pilot pressure chamber at P_{St} proportional to the valve solenoid current.
The solenoid current controls and limits the pilot pressure.

Control through an electric command value. Current control through pulse width modulation.

Analogue or digital amplifiers can be used to drive the solenoids eg. proportional amplifier VT 3000 with 170 Hz (see RE 29935). Please order separately.

For the selection of electronics and operating fluids, description of functions and emergency overrides and further technical data please observe RE 29164.

Technical data – electric

Operating voltage	24 V
Nominal solenoid current	700 mA
Control current	
Beginning of control at V_{g0} and 10 bar pilot pressure	300 mA
End of control at V_{gmax} and 45 bar pilot pressure	700 mA
Nominal resistance at 20°C (R_{20})	19,5 Ω
Max. duty cycle	100 % (S1)
Solenoid plug	Solenoid with cable box (Hirschmann) DIN EN 175 301-803 with cable junction M16x1,5 for cable dia. 4,5...10 mm
Protection to DIN/EN 60529	IP 65
Emergency override	yes, siehe RE 29164
Coil operating temperature	to 150 °C

Technical data – hydraulic

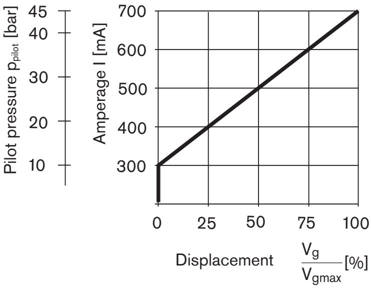
Control pressure (in P)	p_{min}	bar	50
	p_{max}	bar	100
Hysteresis			≤ ± 4 % of V_{gmax}
Repeatability			≤ 2% von V_{gmax}

When calculating the required flow in port P it is necessary to consider the pilot flow losses in the proportional valve (eg. 4 L/min. at p = 50 bar).

LR.NT hydr. stroke control and electric control of pilot pressure

Initial position in pressureless condition: $V_{g\,min}$

Characteristic

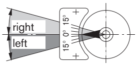


only available in right hand rotation

Direction of flow S to B

Pump direction of rotation	Swivel range [1])	Pressure port
right hand	left	B

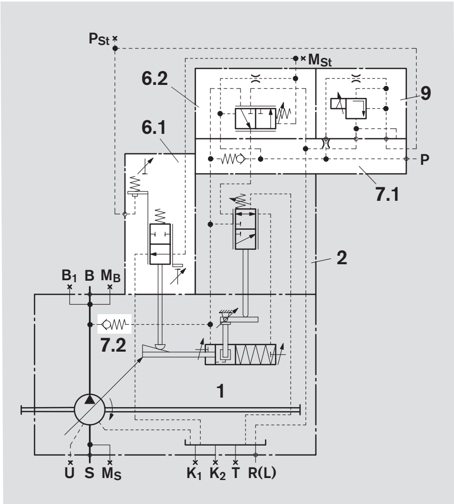
[1]) Compare swivel angle indicator



Schematics LR.NT

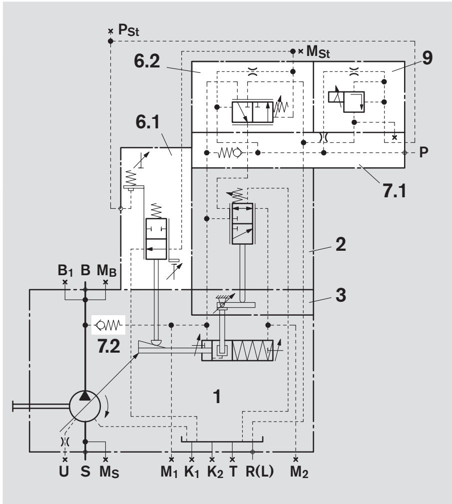
Size 40 and 71

Example: A4VSO LR2NT



Size 125 to 355

Example: A4VSO LR2NT



2

Ports

P	Control pressure port
P_{St}	Gauging port pilot pressure
M_{st}	Gauging port pilot control pressure
M_1, M_2	Gauging port control chamber pressure (Size 125 to 355)

Subassemblies

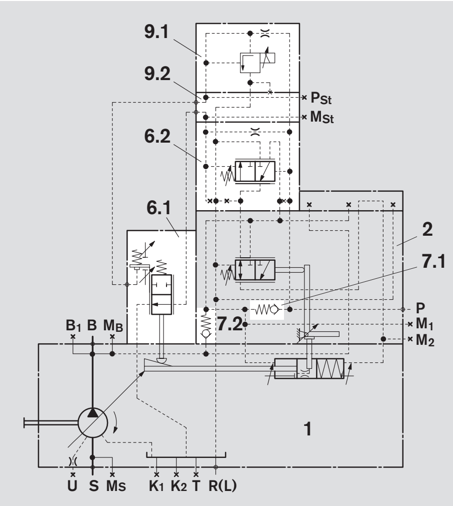
1	A4VSO with hydraulic control device (see RE 92050)	
2	Power control valve	
3	Sandwich plate (only on size 125 to 355)	
6.1	Pilot valve	
6.2	Pilot control valve (shown in actuated position, i.e. P is pressurized)	
7.1	Sandwich plate for mounting of proportional valve with check valve	
7.2	Check valve, integrated in item 1	
9	Proportional-pressure relief valve DBEP6 B06-1X/45AG24NZ4M-382 with meter-in orifice dia. 1,0 mm	 Solenoid with cable box (Hirschmann) to DIN EN 175 301-803 protection class IP 65 cable junction box M16x1,5 for cable dia. 4,5...10 mm

Size 500 to 1000 see page 54

Schematics LR.NT

Size 500 to 1000

Example: A4VSO LR2NT



Ports

P	Control pressure port
P_{St}	Gauging port pilot pressure
M_{St}	Gauging port pilot control pressure
M_1, M_2	Gauging port control chamber pressure

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)	
2	Power control valve	
6.1	Pilot valve	
6.2	Pilot control valve (shown in actuated position i.e. P is pressurized)	
7.1, 7.2	Check valve integrated in power control valve (item 2)	
9.1	Proportional pressure relief valve DBEP6 A06-1X/45AG24NZ4M-382 with meter-in orifice dia. 1,0 mm	 Solenoid with cable box (Hirschmann) to DIN EN 175 301-803 protection class IP 65 cable junction box M16x1,5 for cable dia. 4,5...10 mm
9.2	Sandwich plate for mounting of proportional valve	

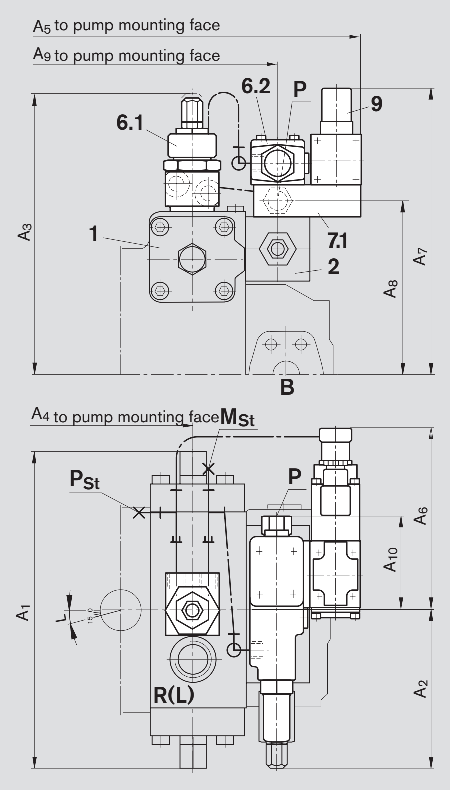
Size 40 to 355 see page 53

Unit dimensions LR.NT

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

Right hand rotation



Subassemblies see page 53

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Gauging port pilot pressure	DIN 3853	S8 Form W; closed	50 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	260	132	248	144	297	173	256	151	219	88	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	264	166	324	173	267	162	246	88	

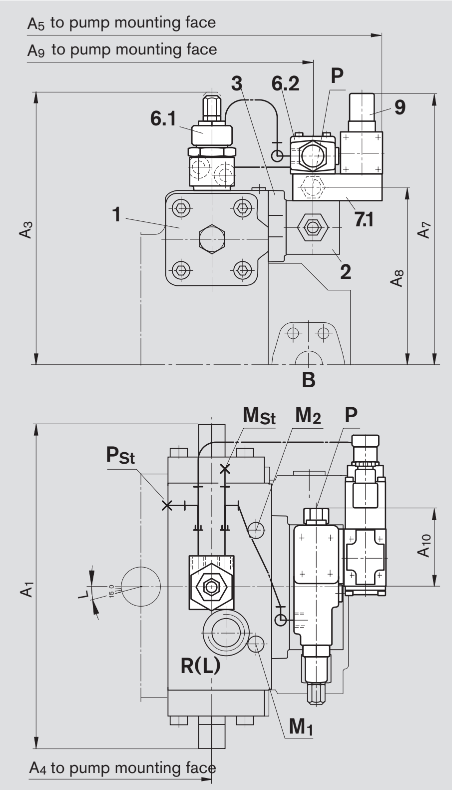
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.NT

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 125 to 355

Right hand rotation



Subassemblies see page 53

Ports

				max. tightening torque [1])
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Gauging port pilot pressure	DIN 3853	S8 Form W; closed	50 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_7	A_8	A_9	A_{10}	
125/180	354	298	203	393	297	192	315	88	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	424	346	248	455	333	228	377	88	

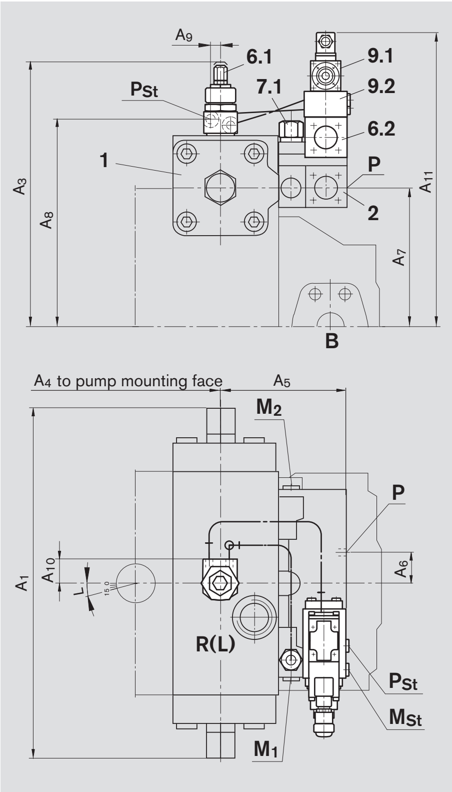
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR.NT

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation



Subassemblies see page 54

Ports

				max. tightening torque [1]
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
P_{St}	Gauging port pilot pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	
500	510	392	279	185	47	202	306	15	35	438	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
750	582	430	301	196	47	232	345	15	35	468	
1000	622	456	360	203	47	255	372	15	35	491	

[1]) please observe the general notes for the max. tightening torques on page 68

Example of control combination LR2GN

Hyperbolic power control with hydraulic stroke control and remote pressure control

Initial position in pressureless condition: $V_{g\ min}$

For a description and the technical data in each case see:

– hyperbolic power control LR2 see page 4

– remote pressure control G see page 17

– hydraulic stroke control N see page 45

This control needs an external control pressure supply to port P.

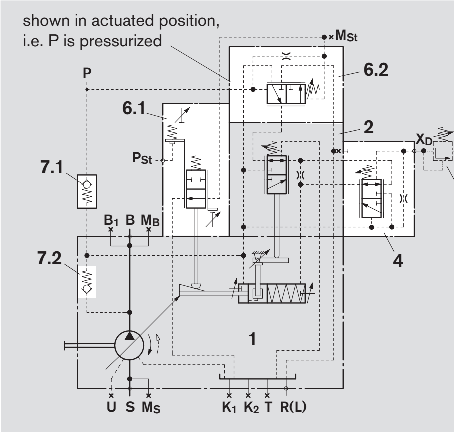
With control combinations LR2GN and LR3GN please note the following:

With a pressure control setting below the pressure level of the external control pressure supply p_{contr} in P all pumps up to size 355 will remain against the mechanical stroke limiter $V_{g\ min}$ and the sizes 500 to 1000 may experience oscillations.

Schematics LR2GN

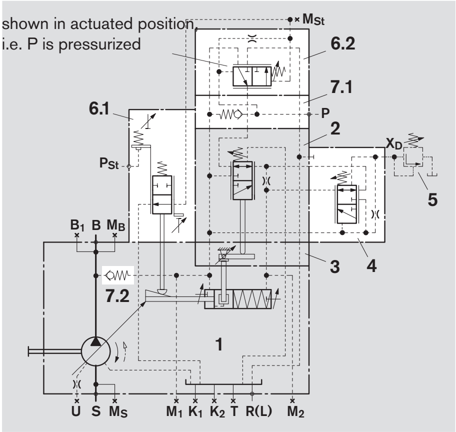
Size 40 and 71

A4VSO LR2GN



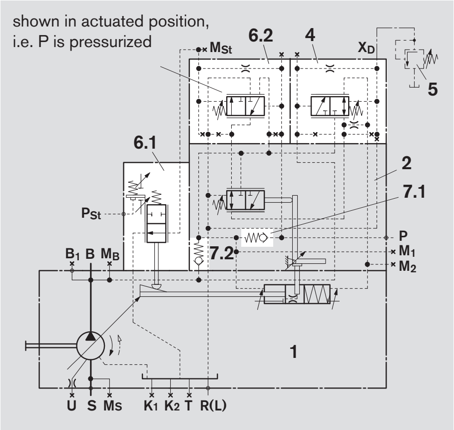
Size 125 to 355

A4VSO LR2GN



Size 500 to 1000

A4VSO LR2GN



Ports

X_D	Pilot port for remote pressure control
P	Control pressure port
P_{St}	Pilot pressure port
M_{St}	Gauging port pilot control pressure
M_1, M_2	Gauging port control chamber press. (Size 125 to 1000)

Subassemblies

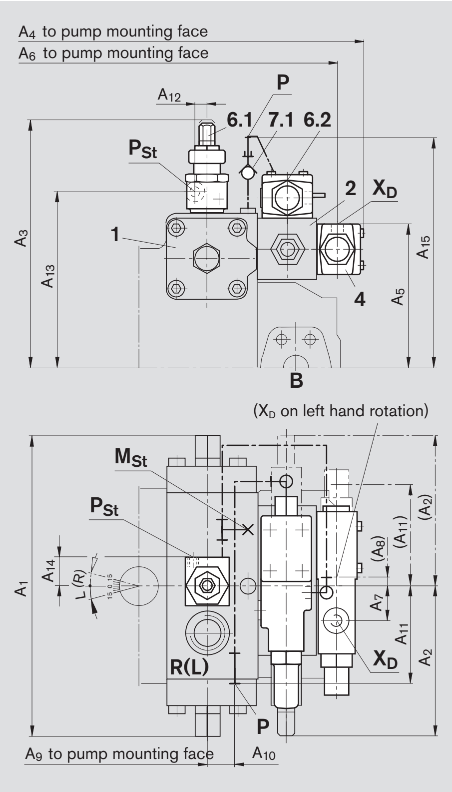
1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate (Size 125 to 355)
4	Pilot control valve for remote pressure control
5	Separate pressure relief valve (not in scope of supply)
6.1	Pilot valve
6.2	Pilot control valve
7.1	Check valve (integrated in size 125 to 1000)
7.2	Integrated check valve

Unit dimensions LR2GN

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

Right hand rotation (left hand)



Valve mounting position for left hand rotation item 2, 4, 6.2 and 7.1 with piping rotated by 180°

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
4	Pilot control valve for remote pressure control
5	Separate pressure relief valve (not in scope of supply)
6.1	Pilot valve
6.2	Pilot control valve
7.1	Check valve

Ports

				max. tightening torque [1])
X_D	Pilot pressure port for remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3853	S8 Form W	50 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	
40	260	132	248	295	130	269	37	7	144	34	83	15	163	35	198	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
71	296	132	258	322	146	296	37	7	166	39	83	15	180	35	215	

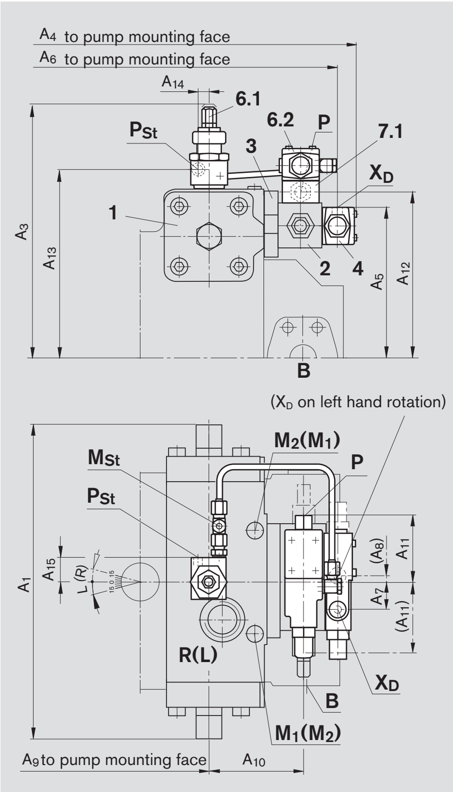
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR2GN

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 125 to 355

Right hand rotation (left hand)



Valve mounting position for left hand rotation item 2, 6.2 and 7.1 rotated by 180°

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
3	Sandwich plate
4	Pilot control valve for remote pressure control
5	Separate pressure relief valve (not in scope of supply)
6.1	Pilot valve
6.2	Pilot control valve
7.1	Integrated check valve

Ports

				max. tightening torque [1])
X_D	Pilot port for remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	
125/180	354	299	391	171	365	37	7	203	112	88	192	214	15	35	For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050
250/355	424	346	453	207	427	37	7	248	129	88	228	261	15	35	

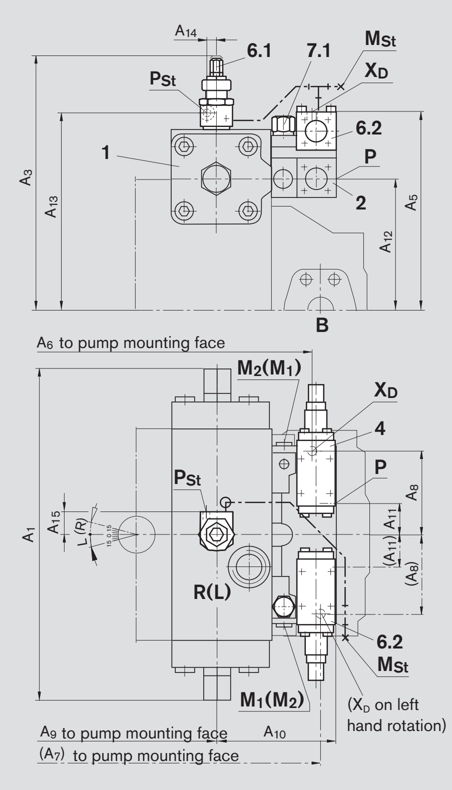
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR2GN

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation (left hand)



Valve mounting position for left hand rotation item 2, 4 and 6.2 rotated by 180° (mirror view around pump axis)

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)
2	Power control valve
4	Pilot control valve for remote pressure control
5	Separate pressure relief valve (not in scope of supply)
6.1	Pilot valve
6.2	Pilot control valve
7.1	Integrated check valve

Ports

				max. tightening torque [1]
X_D	Pilot pressure port for remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
P_{St}	Pilot pressure port	DIN 3852	M14x1,5; 12 deep	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_3	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}
500	510	392	311	430	441	125	279	186	47	202	306	15	35
750	582	430	342	462	473	125	301	195	47	232	345	15	35
1000	622	456	364	528	539	125	360	203	47	255	372	15	35

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

[1]) please observe the general notes for the max. tightening torques on page 68

Example of control combination LR2GNT

Hyperbolic-power control with hydraulic stroke control, electric control of pilot pressure and remote pressure control

Initial position in pressureless condition: $V_{g\,min}$

Only available in right hand rotation.

For the description and technical data see previous pages:

– hyperbolic power control LR2 page 4
– remote pressure control G page 17
– hydraulic stroke control N page 45
– electric pilot pressure control T page 51

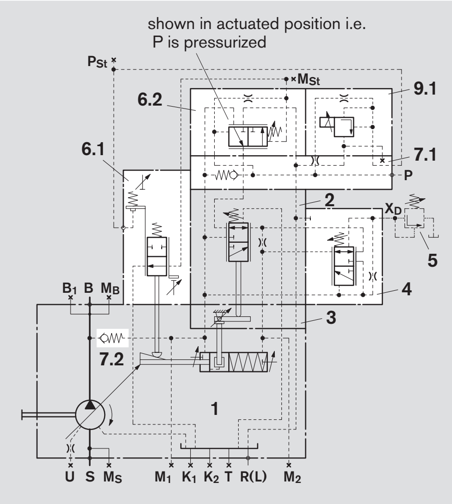
This control needs an external control pressure supply to port P.

With control combinations LR2GNT and LR3GNT please note the following:
With a pressure control setting below the pressure level of the external control pressure supply p_{contr} in P all pumps up to size 355 will remain against the mechanical stroke limiter $V_{g\,min}$ and the sizes 500 to 1000 may experience oscillations.

Schematics LR2GNT

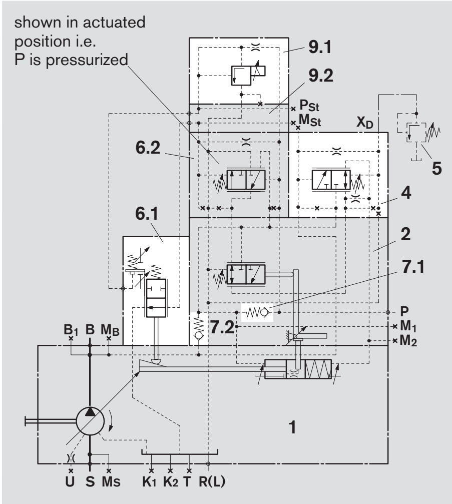
Size 125 to 355

A4VSO LR2GNT, right hand rotation



Size 500 to 1000

A4VSO LR2GNT, right hand rotation



Ports

X_D	Pilot pressure port for remote pressure control
P	Control pressure port
P_{St}	Gauging port pilot pressure
M_1, M_2	Gauging port control chamber pressure
M_{St}	Gauging port pilot control pressure

Subassemblies

1	A4VSO with hydraulic control device (see RE 92050)	
2	Power control valve	
3	Sandwich plate (Size 125 to 355)	
4	Pilot control valve for remote pressure control	
5	Separate pressure relief valve (not in scope of supply)	
6.1	Pilot valve	
6.2	Pilot control valve	
7.1	Sandwich plate for mounting of proportional valve with check valve (Size 125 to 355) Check valve, integrated in item 2 (Size 500 to 1000)	
7.2	Check valve, integrated in item 1 (Size 125 to 355) Check valve, integrated in item 2 (Size 500 to 1000)	
9.1	Proportional pressure relief valve DBEP6 B06-1X/45AG24NZ4M-382 (Size 125 to 355) DBEP6 A06-1X/45AG24NZ4M-382 (Size 500 to 1000) with meter-in orifice dia. 1,0 mm	 Solenoid with cable box(Hirschmann) to DIN EN 175 301-803 protection class IP 65 cable junction M16x1,5 for cable dia. 4,5...10 mm
9.2	Sandwich plate for mounting of proportional valve (Size 500 to 1000)	

Size 40 and 71 available on request.

Unit dimensions LR2GNT

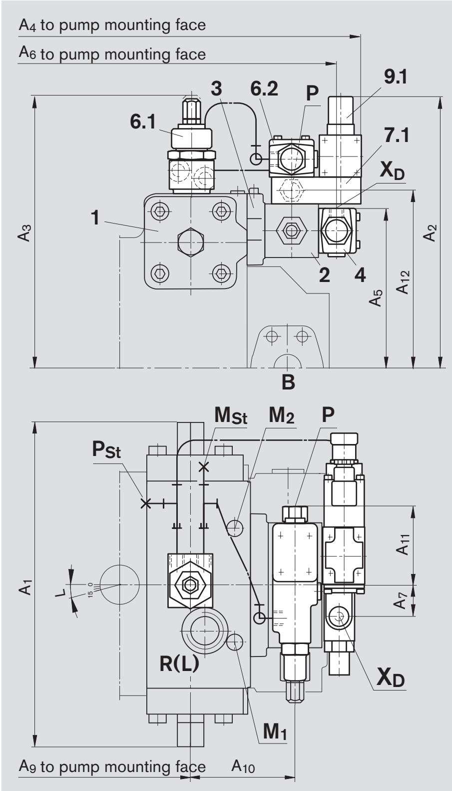
Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 40 and 71

available on request

Size 125 to 355

Right hand rotation



Subassemblies see page 64

Ports

				max. tightening torque [1])
X_D	Pilot pressure port remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M18x1,5; 12 deep	140 Nm
P_{St}	Gauging port pilot pressure	DIN 3853	S8 Form W; closed	50 Nm
M_{St}	Gauging port pilot control pressure	DIN 3853	S8 Form W; closed	50 Nm
M_1; M_2	Gauging port control chamber press.	DIN 3852	M14x1,5; 12 deep; plugged (Size 125 a. 180) M18x1,5; 12 deep; plugged (Size 250 a. 355)	80 Nm 140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	
125/180	354	297	194	393	171	365	37	7	203	112	88	192	For detailed unit dimensions and technical data on the variable pump see technical dat sheet A4VSO RE 92050
250/355	424	333	346	455	207	427	37	7	248	129	88	228	

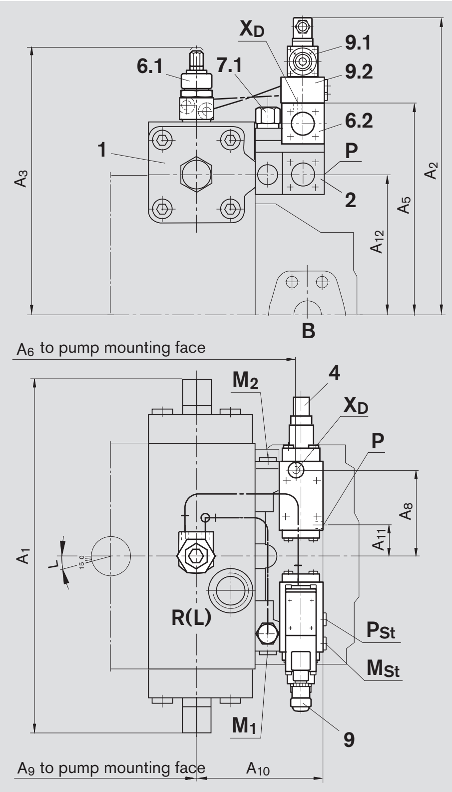
[1]) please observe the general notes for the max. tightening torques on page 68

Unit dimensions LR2GNT

Before finalising your design please request a certified installation drawing. Dimensions in mm.

Size 500 to 1000

Right hand rotation



Subassemblies see page 64

Ports

				max. tightening torque [1])
X_D	Pilot pressure port for remote pressure control	DIN 3852	M14x1,5; 12 deep	80 Nm
P	Control pressure port	DIN 3852	M22x1,5; 14 deep	210 Nm
P_{St}	Gauging port pilot pressure	DIN 3852	M14x1,5; 12 deep; plugged	80 Nm
M_{St}	Gauging port pilot control pressure	DIN 3852	M14x1,5; 12 deep plugged	80 Nm
M_1; M_2	Gauging port control chamber pressure	DIN 3852	M18x1,5; 12 deep; plugged	140 Nm

Unit dimensions

Size	A_1	A_2	A_3	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
500	510	438	392	311	430	441	125	279	185	47	202
750	582	468	430	342	462	473	125	301	196	47	232
1000	622	491	456	364	528	539	125	360	203	47	255

For detailed unit dimensions and technical data on the variable pump see technical data sheet A4VSO RE 92050

[1]) please observe the general notes for the max. tightening torques on page 68

Installation notes

For mounting of pumps with control version LR.**Y** and LR.**NT** and combinations thereof inside the reservoir please consult us.

General notes

– The control devices LR2, LR3 and LR.N together with the pump A4VSO were designed for operation in open loop circuits.

– Systems design, installation and commissioning require trained technicians or tradesmen.

– All hydraulic ports and connections for control functions can only be used for the fastening of hydraulic lines.

– Tightening torques: The tightening torques mentioned in this data sheet are maximum values and must not be exceeded (Maximum values for thread). Manufacturers information concerning the maximum permitted tightening torques of the various fittings is to be observed!
For DIN 13 mounting bolts, we recommend that tightening torques be checked on a case by case basis in accordance with VDI 2230 published 2003.

– During and shortly after operation of a pump the housing and especially the solenoids can be extremely hot, avoid being burned. Wear protective clothing.

– All data, information and instructions mentioned in this data sheet must be adhered to.

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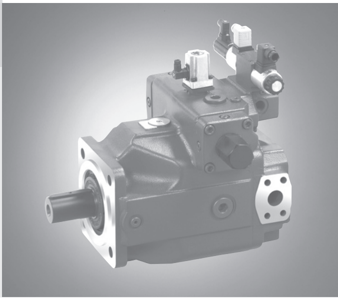
Bosch Group

Control Systems HM, HS, HS4 and EO

RE 92076/08.10 **1**/52
Replaces: 03.05 and 05.10

Data sheet



For the axial piston variable pumps
A4VSO, A4VBO and A4VSG series 1 and 3
A4CSG series 3
Open and closed circuit

Contents

Ordering code for A4VSO 2
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Features

- Basis system to control the displacement of variable piston pumps A4VSO, A4VBO, A4VSG and A4CSG
- Control with servo or proportional valve
- In conjunction with amplifier and PC-program BODAC free programmable (HS4)
- High precision control of displacement, pressure and power (HS4P)
- Mechanical limitation of $V_{g\ min}$ and $V_{g\ max}$
- Electrical control system for oil immersed mounting inside the reservoir (HS4M)
- Special version for mooring, over centre operation and de-compression by means of the pump.
- Optional with internal control pressure supply (HS4V)

Further information:

Variable pump A4VSO	Size 40...1000	RE 92050
Variable pump A4VBO	Size 71...450	RE 92122
Variable pump A4VSG	Size 40...1000	RE 92100
Variable pump A4CSG	Size 250...750	RE 92105

Ordering code for A4VSO

	A4VS(L)O			/			–					
01	02	03	04		05	06		07	08	09	10	11	12

01	**Fluid / version** (detailed information see RE 92050)	

Axial piston unit / Type of operation

02	Swash plate design, variable / pump, open circuit (see RE 92050)	A4VS(L)O

Size

03	Displacement $V_{g\,max}$ in cm^3	40	71	125	180	250	355	500	750	1000

Control device

		40	71	125	180	250	355	500	750	1000	
04	**Hydraulic control, control volume dependent**										
	min. control pressure 20 bar	●	●	●	–	●	–	–	–	–	HM1
	min. control pressure 50/100/125 bar	●	●	●	●	●	●	●	●	●	HM2
	Hydraulic control, with servo valve for electrical control of displacement with VT-SR7-1X	●	●	●	●	●	●	●	●	●	HS*
	supply without valve	●	●	●	●	●	●	●	●	●	HSE
	with short circuit valve	●	●	●	●	●	●	●	●	●	HSK*
	Hydraulic control with proportional valve, for electrical and electronic control of displacement- as well as control of pressure and power with VT -VPCD-1X	●	●	●	●	●	●	●	●	●	HS4*
	with short circuit valve	●	●	●	●	●	●	●	●	●	HS4K*
	with pressure transducer HM 17	●	●	●	●	●	●	●	●	●	HS4P*
	with short circuit valve and press. transducer HM 17	●	●	●	●	●	●	●	●	●	HS4KP*
	suitable for oil immersed operation	●	●	●	●	●	●	●	●	●	HS4M*
	with internal control pressure supply	❍	❍	❍	❍	●	●	–	–	–	HS4V*
	Hydraulic control with proportional valve for electrical control of displacement with VT 5035-1X										
	min. control pressure 20 bar	●	●	●	–	●	–	–	–	–	EO1*
	with short circuit valve	●	●	●	–	●	–	–	–	–	EO1K*
	min. control pressure 50/100/125 bar	●	●	●	●	●	●	●	●	●	EO2*
	with short circuit valve	●	●	●	●	●	●	●	●	●	EO2K*

Series

		40	71	125	180	250	355	500	750	1000	
05		●	●	–	–	–	–	–	–	–	10
		–	–	●	●	●	●	●	●	●	30

06	**Direction of rotation**	
07	**Seals**	
08	**Drive shaft**	For detailed information see RE 92050 – A4VSO
09	**Mounting flange**	
10	**Service line connections**	
11	**Through drive**	

Filtration (only for HS-control)

		40	71	125	180	250	355	500	750	1000	
12	Without filter (no code)	●	●	●	●	●	●	●	●	●	
	Sandwich plate filter for HS-control	●	●	●	●	●	●	–	–	–	Z

* Operation with HF-fluids on request

● = available ❍ = on request – = not available

Ordering code for A4VBO

A4VBO		HS4	/			–					
01	02	03		04	05		06	07	08	09	10

Axial piston unit / Type of operation

01	Swash plate design, variable / pump, open circuit (see RE 92122)				A4VBO

Size

02	Displacement $V_{g\ max}$ in cm^3	071	125	450	

Control device

03	**Hydraulic control with proportional valve** for electrical and electronic control of displacement and power with VT -VPCD-1X	●	●	●	HS4*

Series

04	Series 1, Index 0	●	–	–	10
	Series 3, Index 0	–	●	●	30

05	**Direction of rotation**	
06	**Seals**	
07	**Drive shaft**	For detailed information: see RE 92122 – A4VBO
08	**Mounting flange**	
09	**Service line connections**	
10	**Through drive**	

* Operation with HF-fluids on request

● = available – = not available

2

Ordering code for A4VSG

	A4VSG			**/**			**–**							
01	02	03	04		05	06		07	08	09	10	11	12	13

01	**Fluid / version** (detailed information see RE 92100)	

Axial piston unit / Type of operation

02	Swash plate design, variable / pump, closed circuit (see RE 92100)	**A4VSG**

Size

03	Displacement $V_{g\ max}$ in cm^3	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**

Control device

		40	71	125	180	250	355	500	750	1000	
04	**Hydraulic control, control volume dependent**										
	min. control pressure 20 bar	●	●	●	–	●	–	–	–	–	**HM1**
	min. control pressure 50/100/125 bar	●	●	●	●	●	●	●	●	●	**HM2**
	Hydraulic control with servo valve for electrical control of displacement with VT-SR7-1X	●	●	●	●	●	●	●	●	●	**HS***
	supply without valve	●	●	●	●	●	●	●	●	●	**HSE**
	with short circuit valve	●	●	●	●	●	●	●	●	●	**HSK***
	Hydraulic control with proportional valve for electrical and electronic control of displacement- as well as control of pressure and power with VT -VPCD-1X	●	●	●	●	●	●	●	●	●	**HS4***
	with short circuit valve	●	●	●	●	●	●	●	●	●	**HS4K***
	with pressure transducer HM 17	●	●	●	●	●	●	●	●	●	**HS4P***
	with short circuit valve and press. transducer HM 17	●	●	●	●	●	●	●	●	●	**HS4KP***
	suitable for oil immersed operation	●	●	●	●	●	●	●	●	●	**HS4M***
	Hydraulic control with proportional valve for electrical control of displacement with VT 5035-1X										
	min. control pressure 20 bar	●	●	●	–	●	–	–	–	–	**EO1***
	with short circuit valve	●	●	●	–	●	–	–	–	–	**EO1K***
	min. control pressure 50/100/125 bar	●	●	●	●	●	●	●	●	●	**EO2***
	with short circuit valve	●	●	●	●	●	●	●	●	●	**EO2K***

Series

		40	71	125	180	250	355	500	750	1000	
05		●	●	–	–	–	–	–	–	–	**10**
		–	–	●	●	●	●	●	●	●	**30**

06	**Direction of rotation**	
07	**Seals**	
08	**Drive shaft**	
09	**Mounting flange**	For detailed information: see RE 92100 – A4VSG
10	**Service line connections**	
11	**Through drive**	
12	**Valves**	

Filtration

		40	71	125	180	250	355	500	750	1000	
13	Without filter	●	●	●	●	●	●	●	●	●	**N**
	With filter, mounted in boost circuit	●	●	●	●	●	●	●	●	●	**F**
	With sandwich plate filter for HS-control	●	●	●	●	●	●	–	–	–	**Z**
	With filter, mounted in boost circuit and sandwich plate filter for HS-control	●	●	●	●	●	●	–	–	–	**U**

* Operation with HF-fluids on request

● = available ❍ = on request – = not available

Ordering code for A4CSG

A4CSG			/	30		–								
01	02	03		04	05		06	07	08	09	10	11	12	13

Axial piston unit/ Type of operation

01	Compact unit swash plate design, variable / pump, closed circuit (see RE 92105)	A4CSG

Size

02	Displacement $V_{g\ max}$ in cm^3	250	355	500	750

Control device

		250	355	500	750	
03	**Hydraulic control, control volume dependent**					
	min. control pressure 100/125 bar	●	●	●	●	HM2
	Hydraulic control with servo valve for electrical control of displacement with VT-SR7-1X	●	●	●	●	HS
	supply without valve	●	●	●	●	HSE
	with short circuit valve	●	●	●	●	HSK
	Hydraulic control with proportional valve for electrical and electronic control of displacement- as well as control of pressure and power with VT -VPCD-1X	●	●	●	●	HS4
	with short circuit valve	●	●	●	●	HS4K
	with pressure transducer HM 17	●	●	●	●	HS4P
	with short circuit valve and press. transducer HM 17	●	●	●	●	HS4KP
	suitable for oil immersed operation	●	●	●	●	HS4M
	Hydraulic control with proportional valve **for** electrical control of displacement with VT 5035-1X					
	min. control pressure 100/125 bar	●	●	●	●	EO2
	with short circuit valve	●	●	●	●	EO2K

Series

04		●	●	●	●	30

05	Direction of rotation	
06	Seals	
07	Drive shaft	
08	Mounting flange	For detailed information: see RE 92105 – A4CSG
09	Service line connections	
10	Boost pump	
11	Through drive	
12	Valves	

Filtration

		250	355	500	750	
13	Without filter	●	●	●	●	N
	With threaded connection for filter in boost circuit	●	●	●	●	D
	With mounted filter in boost circuit (with optical-electrical dirt indicator)	●	●	●	●	M
	With threaded connection for filter in boost circuit (D) and sandwich plate filter for HS-control	●	●	–	–	Z
	With mounted filter in boost circuit (M) and sandwich plate filter for HS-control	●	●	–	–	U

● = available ❍ = on request – = not available

HM1 / HM2 – Hydraulic control, control volume dependent

For A4VSO and A4VSG: HM1, HM2
For A4CSG: only HM2

The HM 1/2- control adjusts the pump displacement, dependent on the control oil volume.
This control is used for 2-point control systems or as a base unit for controls with proportional valves (an additional electric feed back device is required).

The minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % of $V_{g\ max}$. For the size 500 $V_{g\ min}$ is also adjustable up to 50 % of $V_{g\ max}$ but $V_{g\ max}$ only up to 70% of $V_{g\ max}$.

Setting at the A4VSO and A4VBO (open cicuit):
The $V_{g\ min}$-stop is set in such a position, that, with a blocked pressure port B a pressure of 15...20 bar is reached.
The $V_{g\ max}$-stop is set to the nominal value of $V_{g\ max}$.

Setting at the A4VSG and A4CSG (closed circuit):
The $V_{g\ max}$-stops on both sides of centre are set to the nominal value of $V_{g\ max}$.

If other settings are desired, please state in clear text when ordering.

Spring centering of the control cylinder is standard. It is used for settings and adjustments in the unpressurized zero (centre) position, however without a defined reset during high pressure operation.

2 versions are available:

HM1	Minimum control pressure 20 bar	for sizes 40, 71, 125 and 250 see page 7
HM2	Minimum control pressure 50/100/125 bar	for sizes 40...1000 see page 8

Over centre operation of the A4VSO is available on request.

Important
At the **A4VSO** for open circuit operation (one side of centre) the V_{gmin}-stop is set in such a position, that, with a blocked pressure port B a pressure of approx. 20 bar is reached.

HM1

Size 40 to 125 and 250 for A4VSO and A4VSG

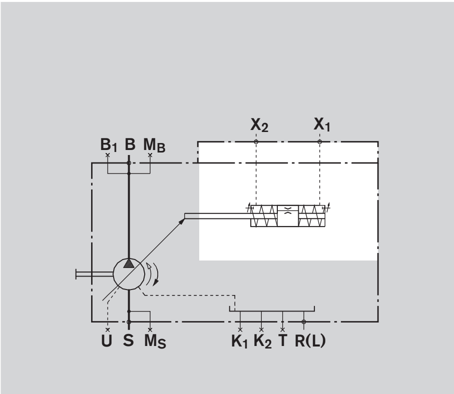
Technical data

Size			40	71	125	250
Control pressure (in X_1, X_2)	p_{min}	bar	20			
	p_{max}	bar	100			
Control stroke s_{max}		mm	14.2	17.1	20.7	25.9
Control area A		cm^2	16.6	24.6	36.3	56.7
Control volume $V_{S\ max}$		cm^3	23.6	42.1	75.2	147
Weight approx. (A4VSO...HM1...N00)		kg	38	55	92	194

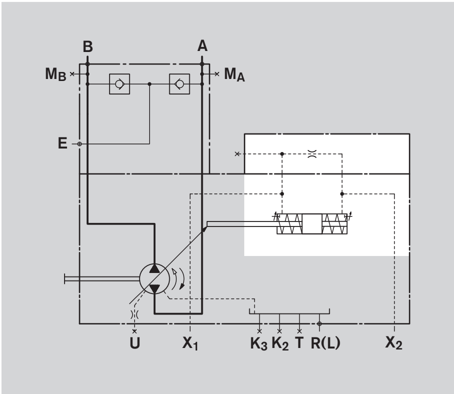
2

Schematics

Size 40 and 71
Example: open circuit A4VSO



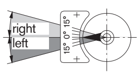
Size 125 aund 250
Example: closed circuit A4VSG



Ports and direction of flow

X_1	Control pressure port	for pressure **in B** at clockwise rotation, swivel range* left for pressure **in A** at counter clockwise rotation, swivel range* left
X_2	Control pressure port	for pressure **in A** at clockwise rotation, swivel range* right for pressure **in B** at counter clockwise rotation, swivel range* right

* compare swivel angle indicator



For example of schematic with proportional valve see page 29

HM2

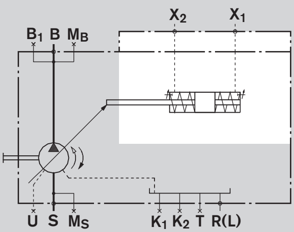
Size 40 and 71 for A4VSO and A4VSG

Technical data

Size			40	71
Control pressure (in X_1, X_2)	p_{min}	bar	50	50
	p_{max}	bar	350	
Control stroke s_{max}		mm	14.2	17.1
Control area A		cm^2	8.1	12.6
Control volume $V_{S\ max}$		cm^3	11.4	21.5
Weight approx. (A4VSO...HM2...N00)		kg	38	55

Schematic

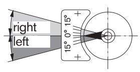
Example: open circuit A4VSO



Ports and direction of flow

X_1	Control pressure port	for pressure **in B** at clockwise rotation, swivel range* left for pressure **in A** at counter clockwise rotation, swivel range* left
X_2	Control pressure port	for pressure **in A** at clockwise rotation, swivel range* right for pressure **in B** at counter clockwise rotation, swivel range* right

* compare swivel angle indicator



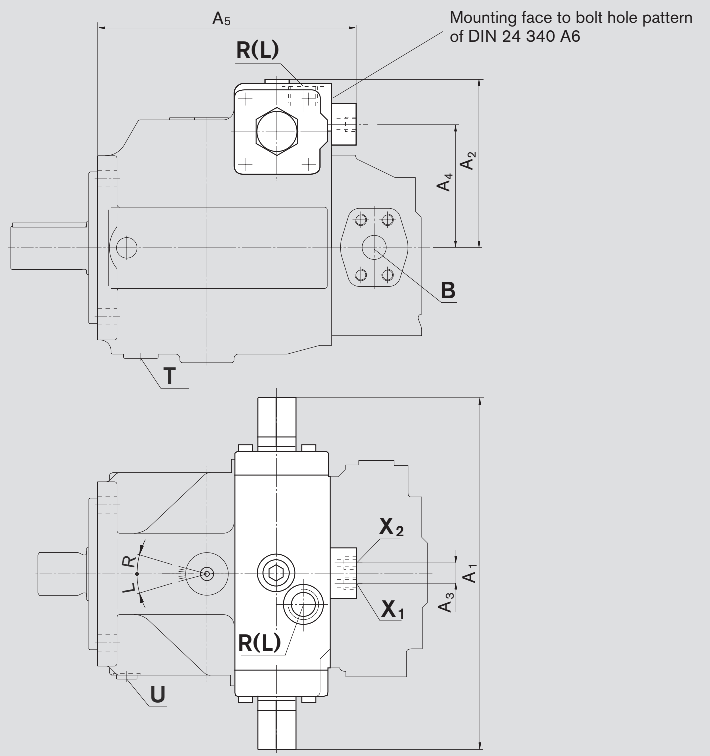
Example of schematic with proportional valve see page 29

Dimensions HM1 / HM2

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 and 71

Dimensions are valid for A4VSO and A4VSG



Size	A_1	A_2	A_3	A_4	A_5
40	296	136	24	102	217
71	332	157	28	120	245

For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050 or A4VSG RE 92100

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
X_1; X_2	control pressure	DIN 3852-1	M14 x 1.5; 12 deep	100 (bei HM1) 350 (bei HM2)	O

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)

HM2

Size 125 to 355 for A4VSO and A4VSG
Size 250 and 355 for A4CSG

Pump **A4CSG** with HM2-control does not need the control pressure relief valve and the cavity is plugged.

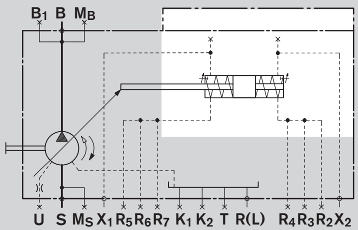
In order to minimize the control fluid consumption the control chambers on the sizes 125...1000 are sealed, and can be bled through the ports R_2...R_7.

Technical data

Size			125	180	250	355
Control pressure (in X_1, X_2)	p_{min}	bar	50	100	100	100
	p_{max}	bar	350			
Control stroke s_{max}		mm	20.7	20.7	25.9	25.9
Control area A		cm^2	18.1	18.1	28.3	28.3
Control volume $V_{S\ max}$		cm^3	37.5	37.5	73.2	73.2
Weight approx. (A4VSO...HM2...N00)		kg	92	106	194	214

Schematic

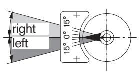
Example: open circuit A4VSO



Ports and direction of flow

X_1	Control pressure port	for pressure **in B** at clockwise rotation, swivel range* left for pressure **in A** at counter clockwise rotation, swivel range* left
X_2	Control pressure port	for pressure **in A** at clockwise rotation, swivel range* right for pressure **in B** at counter clockwise rotation, swivel range* right
R_2...R_7	Air bleed control chamber	

* compare swivel angle indicator



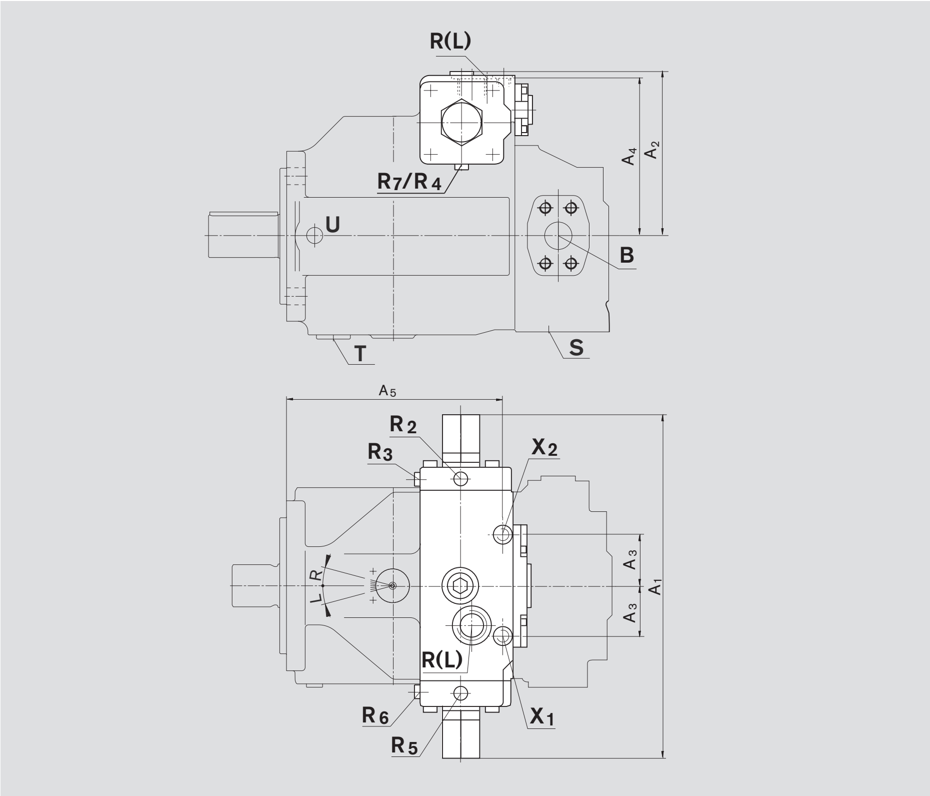
Example of schematic with proportional valve see page 29

Dimensions HM1 / HM2

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 125 to 355

Dimensions are valid for A4VSO, A4VSG and A4CSG



Size	A_1	A_2	A_3	A_4	A_5	
125/180[1]	402	191	67	186.5	251	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
250/355[1]	485	238	71	233	311	

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
X_1; X_2	Control pressure	DIN 3852-1	M14 x 1.5; 12 deep (Size125 and 180) M18 x 1.5; 12 deep (Size250 and 355)	100 (HM1) 350 (HM2)	O O
R_2...R_7	Bleed port control chamber	DIN 3852-1	M10 x 1; 8 deep	350 (only at HM2)	X

1) Size 180 and 355 only at HM2
2) For the maximum tightening torques the general safety information on page 52 must be observed.
3) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HM2

Size 500 to 1000 for A4VSO and A4VSG
Size 500 and 750 for A4CSG

Pump **A4CSG** with HM2-control does not need the control pressure relief valve and the cavity is plugged.

In order to minimize the control fluid consumption the control chambers on the sizes 500 to 1000 are sealed, and can be bled through the ports R_2...R_7.

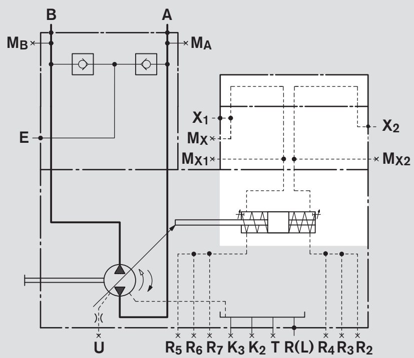
.

Technical data

Size			500	750	1000
Control pressure (in X_1, X_2)	p_{min}	bar	125	125	125
	p_{max}	bar		350	
Control stroke s_{max}		mm	32.6	37.0	41.4
Control area A		cm^2	38.2	56.8	63.6
Control volume $V_{S\,max}$		cm^3	124.5	210	263.3
Weight approx. (A4VSO...HM2...N00)		kg	327	470	600

Schematic

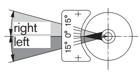
Size 500...1000
Examplel: closed circuit A4VSG



Ports and direction of flow

X_1	Control pressure port	for pressure **in B** at clockwise rotation, swivel range* left for pressure **in A** at counter clockwise rotation, swivel range* left
X_2	Control pressure port	for pressure **in A** at clockwise rotation, swivel range* right for pressure **in B** at counter clockwise rotation, swivel range* right
M_X; M_{X1}; M_{X2}	Measuring ports control pressure	
R_2...R_7	Bleed ports control chamber	

* compare swivel angle indicator



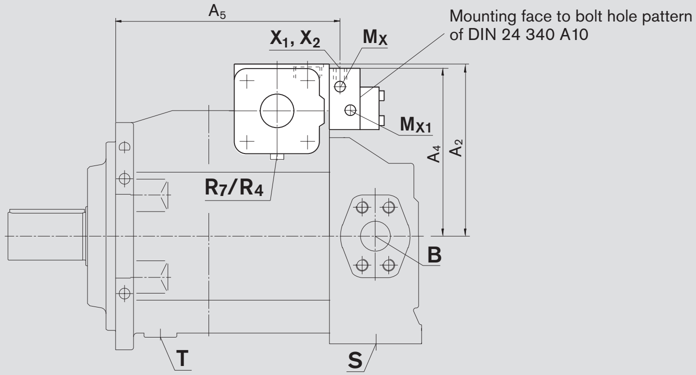
Example of schematic with proportional valve see page 29

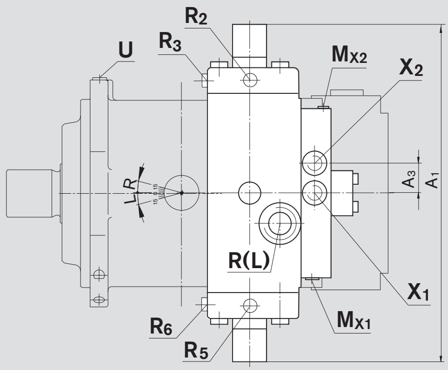
Dimensions HM2

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 500 to 1000

Dimensions are valid for A4VSO, A4VSG and A4CSG





Size	A_1	A_2	A_3	A_4	A_5	
500	555	283	50	274	388	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92100
750	630	320	50	304	420	
1000	670	347	50	327	486	

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
X_1; X_2	Control pressure	DIN 3852-1	M27 x 2; 16 deep	350	O
M_X; M_{X1}; M_{X2}	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep	350	X
R_2...R_7	Air bleed control chamber	DIN 3852-1	M14 x 1.5; 12 deep	350	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HS – Control system with servo valve

For A4VSO, A4VSG und A4CSG

for electric control of displacement with VT-SR7-1X

The HS- control adjusts the pump displacement with a servo valve proportional to a setpoint value.

The feed back of the actual pump swivel angle (pump displacement) is accomplished with a built on positional transducer. In conjunction with the compatible amplifier VT-SR7-1X we have a very accurate control of pump displacement.

This amplifier VT-SR7-1X does not belong to the supply of the HS-control. Please order separately acc. to RE 29993.

Spring centering in the control cylinder is standard. It is used for **settings and adjustments in the unpressurized zero position**, however without a defined reset during high pressure operation.
The spring centering is not a safety device.

The minimum and maximum **swivel angle limitation** is mechanically adjustable up to 50 % of $V_{g\ max}$. For the size 500, $V_{g\ min}$ is also adjustable up to 50 % of $V_{g\ max}$ but $V_{g\ max}$ only up to 70% of $V_{g\ max}$.

Setting at the A4VSO (open cicuit):
The $V_{g\ min}$-stop is set in such a position, that, with a blocked pressure port B a pressure of 15...20 bar is reached.
The $V_{g\ max}$-stop is set to the nominal value of $V_{g\ max}$.

Setting at the A4VSG and A4CSG (closed circuit):
The $V_{g\ max}$-stops on both sides of centre are set to the nominal value of $V_{g\ max}$.

If other settings are desired, please state in clear text when ordering.

In order to minimize the control fluid consumption the control chambers in the sizes 125...1000 are sealed and can be bled through the ports R_2 - R_7.

In order to protect the servo valve the pump is supplied with a sandwich flushing plate (see schematic).

After the flushing process the flushing plate must be removed and the servo valve must be screwed directly onto the subplate (using the screws supplied). Please observe the commissioning and flushing instructions in RE 07700 and RE 29583.

Optional: HSE without servo valve or
HSK with short circuit valve

Important

The valve spool in the control system can get stuck in a non defined position (contaminated hydraulic fluid, wear particles or contamination from the general system components). Through this, the pump flow will not follow the operators commands anymore

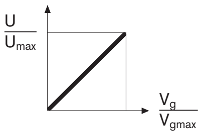
Check whether your machine needs safety measures to bring the driven actuators in a safe position (i.e. immediate stop).

A4VSO - open circuit

Please note: On the **A4VSO** pump for open circuit applications (swivel to one side only) the V_{gmin}-stop is set so that, when port B is plugged a pressure of approx. 20 bar is reached.

Over centre operation of the A4VSO is available on request.

Characteristic

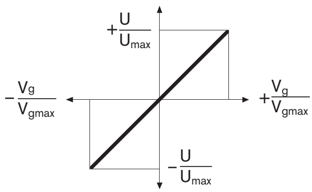


Direction of flow S to B

Direction of rotation	Swivel range*
clockwise	left
counter clockwise	right

A4VSG and A4CSG - closed circuit

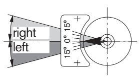
Characteristic



Direction of flow

Direction of rotation		Swivel range*
clockwise	counter clockwise	
B to **A**	**A** to **B**	right
A to **B**	**B** to **A**	left

* compare swivel angle indicator



HS – Control system with servo valve

Technical data

Size		NG	40	71	125	180	250	355	500	750	1000
Control pressure in P	p_{min}	bar	100	100	100	125	125	125	150	150	150
	p_{max} 1)	bar	315								
Cleanliness class of fluid 1) Optional sandwich plate filter see page 49			18/16/13 to ISO 4406 (C)								
Control stroke s_{max}		mm	14.2	17.1	20.7	20.7	25.9	25.9	32.6	37.0	41.4
Control area A		cm^2	8.1	12.6	18.1	18.1	28.3	28.3	38.2	56.8	63.6
Control volume $V_{S\ max}$		cm^3	11.4	21.5	37.5	37.5	73.2	73.2	124.5	210	263.3
Control time t_{min} 2)		s	0.04	0.06	0.09	0.09	0.12	0.12	0.15	0.2	*
Weight approx. (A4VSO...HS...N00)		kg	42	59	98	112	200	220	333	476	606
Quality of control loop	hysteresis		≤ 0.2 %								
	repeating accuracy		≤ 0.2 %								
	swivel angle linearity deviation		≤ 1.0 %								

1) conditional upon permissible data of servo valve

2) at minimum control pressure

* on request

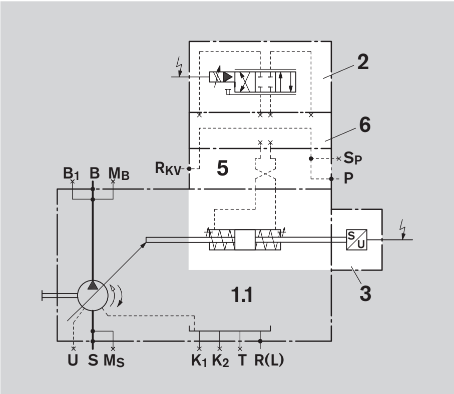
2

HS – Control system with servo valve

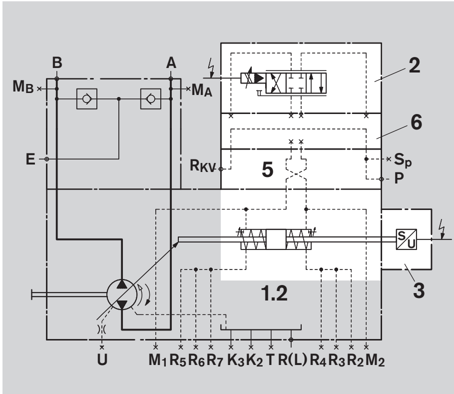
Size 40 to 355 for A4VSO and A4VSG
Size 250 to 355 for A4CSG

Schematics

Size 40 and 71
Example: open circuit A4VSO



Size 125 to 355
Example: closed circuit A4VSG



Ports

P	Control pressure port
S_P	Port for control pressure accumulator
R_{KV}	Return line control fluid
M_1; M_2	Measuring port control pressure (plugged), Size 125...355
R_2...R_7	Bleed port control chamber (plugged), Size 125...355

Components

1 Pump with hydraulic control device

1.1 A4VSO (see RE 92050)

1.2 A4VSG (see RE 92100)

2 4/3-way servo valve (see RE 29583)

Size	Type	
40 and 71	4WS2EM10-5X/20B11ET315K31EV	with cable box to DIN EN 175.201-804 for cable diameter 8...13.5mm
125 and 180	4WS2EM10-5X/30B11ET315K31EV	
250 and 355	4WS2EM10-5X/45B11ET315K31EV	

3 Inductive positional transducer IW9-03-01
with cable box (mating plug) to DIN EN 175 301-803-A / ISO 4400
cable connection M16 x 1.5 for cable diameter 4.5...10mm

5 Sandwich plate

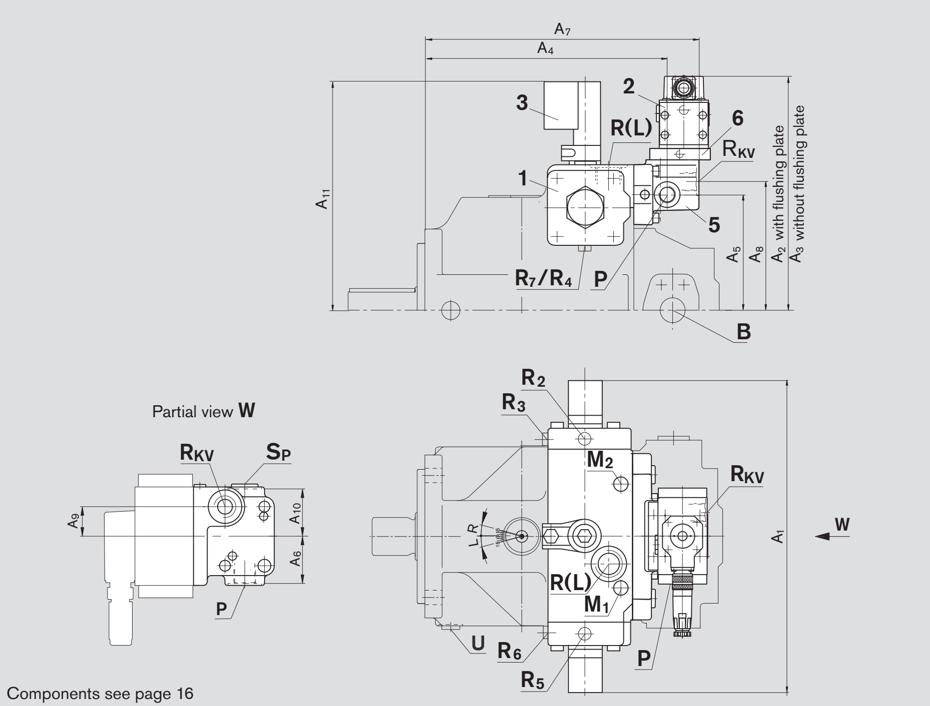
6 Flushing plate

Dimensions HS

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 to 355

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components see page 16

2

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}
40	296	269	254	222	108	43	273	128	35	53	246
71	332	287	272	249	123	48	300	143	30	48	263
125 / 180	402	304	289	309	148	39	350	148	0	39	298
250 / 355	485	341	326	371	184	39	412	184	0	39	345

For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
P	Control pressure	DIN 3852-1	M22 x 1.5; 14 deep	315	O
S_p	Accumulator control pressure	DIN 3852-1	M22 x 1.5; 14 deep	315	X
R_{KV}	Return line control fluid	DIN 3852-1	M22 x 1.5; 14 deep	100	O
M_1; M_2	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep (size 125 and 180) M18 x 1.5; 12 deep (size 250 and 355)	315 315	X X
R_2...R_7	Bleed port control chamber	DIN 3852-1	M10x1; 8 deep	315	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

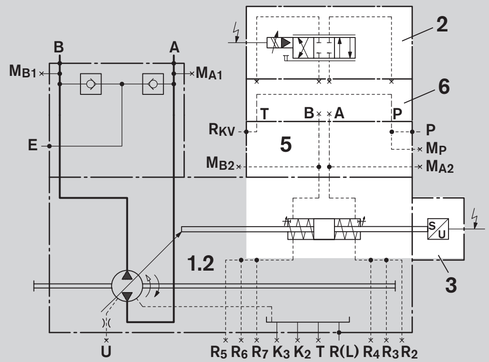
O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HS – Control system with servo valve

Size 500 to 1000 for A4VSO and A4VSG
Size 500 and 750 for A4CSG

Schematic

Example: closed circuit A4VSG



Ports

P	Control pressure port
R_{KV}	Return line control fluid
M_{A2}; M_{B2}; M_P	Measuring ports control pressure (plugged)
R_2...R_7	Bleed port control chamber (plugged)

Components

1 Pump with hydraulic control device

1.2 A4VSG (see RE 92100)

2 4/3-way servo valve (see RE 29583)

Size	Type	
500...1000	4WS2EM10-5X/75B11ET315K31EV	with cable box to DIN EN 175.201-804 for cable diameter 8...13.5 mm

3 Inductive positional transducer IW9-03-01
with cable box (mating plug) to DIN EN 175 301-803-A / ISO 4400
cable connection M16 x 1.5 for cable diameter 4.5...10mm

5 Sandwich plate

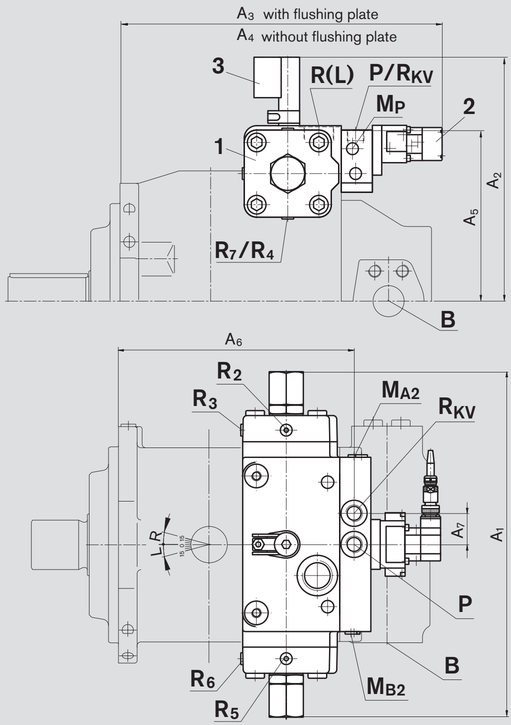
6 Flushing plate

Dimensions HS

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 500 to 1000

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components sehe page 18

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7
500	555	392	527	512	274	388	50
750	630	427	558	543	304	420	50
1000	670	456	624	609	327	486	50

For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105

Ports

Designation	Port for	Standard	Size1)	Peak pressure [bar]2)	State
P	Control pressure	DIN 3852-1	M27 x 2; 16 deep	315	O
R_{KV}	Return line control fluid	DIN 3852-1	M27 x 2; 16 deep	100	O
M_{A2}, M_{B2}, M_P	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep	315	X
R_2...R_7	Bleed port control chamber	DIN 3852-1	M14 x 1.5; 12 deep	315	X

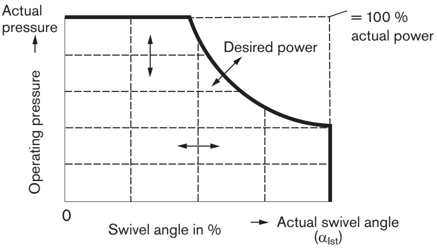
1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HS4(P) – Control system with proportional valve

For A4VSO, A4VBO, A4VSG and A4CSG

for electric and electronic displacement as well as pressure and power control with VT-VPCD-1X



The HS4-control adjusts the pump displacement with a directly controlled proportional valve proportional to a setpoint value.

Actual pump swivel angle (displacement) feedback is provided by means of a position transducer.

Control HS4P features a built on pressure transducer HM17 which serves to detect and feed back system pressure, pumps A4VSG and A4CSG have a pressure transducer on each pressure side. In conjunction with the compatible control module VT-VPCD and the operating software BODAC the user has at his disposal a highly accurate and free programmable control, which offers a comfortable operating and diagnostics interface.

The digital control amplifier VT-VPCD-1X to drive the HS4-control does not belong to the scope of supply. It must be ordered separately to RE 30028.

Programming the digital control amplifier VT-VPCD is executed via the amplifier's serial interface with the PC-program BODAC. For more information see RE 30028.

Optional: HS4P with pressure transducer for additional pressure and power control

HS4K, HS4KP with short circuit valve

HS4M suitable for oil immersed operation

HS4V with internal control pressure supply

The minimum and maximum **swivel angle limitation** is mechanically adjustable up to 50 % of $V_{g\,max}$. For the size 500, $V_{g\,min}$ is also adjustable up to 50 % of $V_{g\,max}$ but $V_{g\,max}$ only up to 70% of $V_{g\,max}$. (75% at the A4VBO 450)

Setting at the A4VSO and A4VBO (open cicuit):
The $V_{g\,min}$-stop is set in such a position, that, with a blocked pressure port B a pressure of 15...20 bar is reached.
The $V_{g\,max}$-stop is set to the nominal value of $V_{g\,max}$.

Setting at the A4VSG and A4CSG (closed circuit):
The $V_{g\,max}$-stops on both sides of centre are set to the nominal value of $V_{g\,max}$.

If other settings are desired, please state in clear text when ordering.

Spring centering in the control cylinder is standard. It is used for settings and adjustments in the unpressurized zero position, however without a defined reset during high pressure operation.

The spring centering is not a safety device.

In order to minimize the control fluid consumption, the control chambers in pump sizes 125...1000 are sealed and can be bled via ports R_2 - R_7.

Important

The valve spool in the control system can get stuck in a non defined position (contaminated hydraulic fluid, wear particles or contamination from the general system components). Through this, the pump flow will not follow the operators commands anymore

Check whether your machine needs safety measures to bring the driven actuators in a safe position (i.e. immediate stop).

HS4(P) – Control system with proportional valve

Technical data

Size		NG	40	71	125	180	250	355	500	750	1000
Control pressure in P	p_{min} *A4VSO, A4VSG, A4CSG*	bar	100	100	100	125	125	125	150	150	150
	p_{min} *A4VBO*	bar	–	130	130	–	–	–	190 size 450	–	–
	p_{max} 1)	bar	315								
Control stroke s_{max}		mm	14.2	17.1	20.7	20.7	25.9	25.9	32.6	37.0	41.4
Control area A		cm^2	8.1	12.6	18.1	18.1	28.3	28.3	38.2	56.8	63.6
Control volume $V_{S\,max}$		cm^3	11.4	21.5	37.5	37.5	73.2	73.2	124.5	210	263.3
Control time t_{min} 2)		s	0.04	0.06	0.09	0.09	0.12	0.12	0.15	0.2	0.25
Weight approx. (A4VSO...HS4...N00)		kg	42	59	98	112	200	220	333	476	606
Quality of control loop	hysteresis		≤ 0.2 %								
	repeating accuracy		≤ 0.2 %								
	swivel angle linearity deviation		≤ 1.0 %								
	pressure linearity deviation		≤ 1.5 % of p_{max} 3)								

1) conditional upon the permissible data of the proportional valve

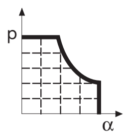
2) at minimum control pressure

3) Pressure transducer value

2

A4VSO – open circuit

Characteristic



Initial position at version without short circuit valve, de-energized proportional valve and connected control pressure: $V_{g\,min}$ (see table)

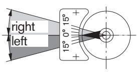
Direction of flow S to B

Direction of rotation	Swivel range*	Initial position
clockwise	left	$V_{g\,min}$ (from left)
counter clockwise	right	$V_{g\,min}$ (from right)

Over centre operation is available on request.

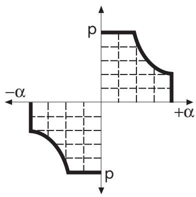
The $V_{g\,min}$-stop is set in such a position, that, with a blocked pressure port B a pressure of approx. 20 bar is reached.

* compare swivel angle indicator



A4VSG, A4CSG – closed circuit

Characteristic



Initial position at version without short circuit valve, de-energized proportional valve and connected control pressure: $V_{g\,max}$ (see table)

Direction of flow

Direction of rotation	Swivel range*	Direction of flow	Initial position
clockwise	right	**B** to **A**	$V_{g\,max}$ right
	left	**A** to **B**	
counter clockwise	right	**A** to **B**	$V_{g\,max}$ left
	left	**B** to **A**	

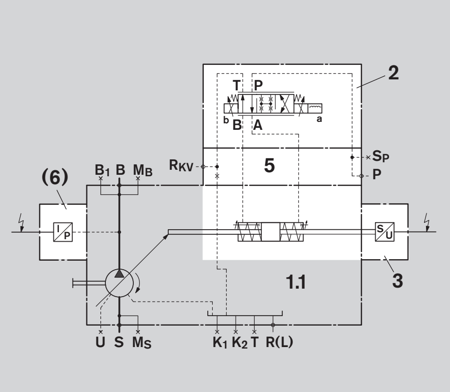
HS4(P) – Control system with proportional valve

Size 40 and 71 for A4VSO and A4VSG
Size 71 for A4VBO

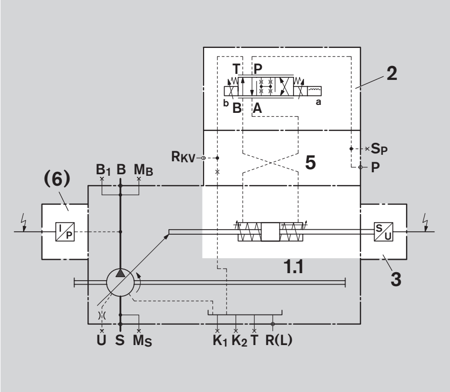
Schematics

Example: A4VSO HS4P (with pressure transducer)

Clockwise rotation



Counter clockwise rotation



Ports

P	Control pressure port
S_P	Port for control pressure accumulator
R_{KV}	Return line control fluid

Components

1 Pump with hydraulic control device

1.1 A4VSO (see RE 92050) or A4VBO (see RE 92122)

2 4/3-way proportional valve (see RE 29061) with electric positional feedback (incl. cable connector 4-pin Pg7-G4W1F)

Size	Type	
40 and 71	4WRE6V08-2X/G24K4/V-822	Solenoids with plugs to DIN EN 175.301-803 / ISO 4400 cable screw connection M16 x 1.5 for cable diameter 4.5...10mm

3 Inductive positional transducer AWXF004D01 with cable connector 4-pin Pg7-G4W1F

5 Sandwich plate

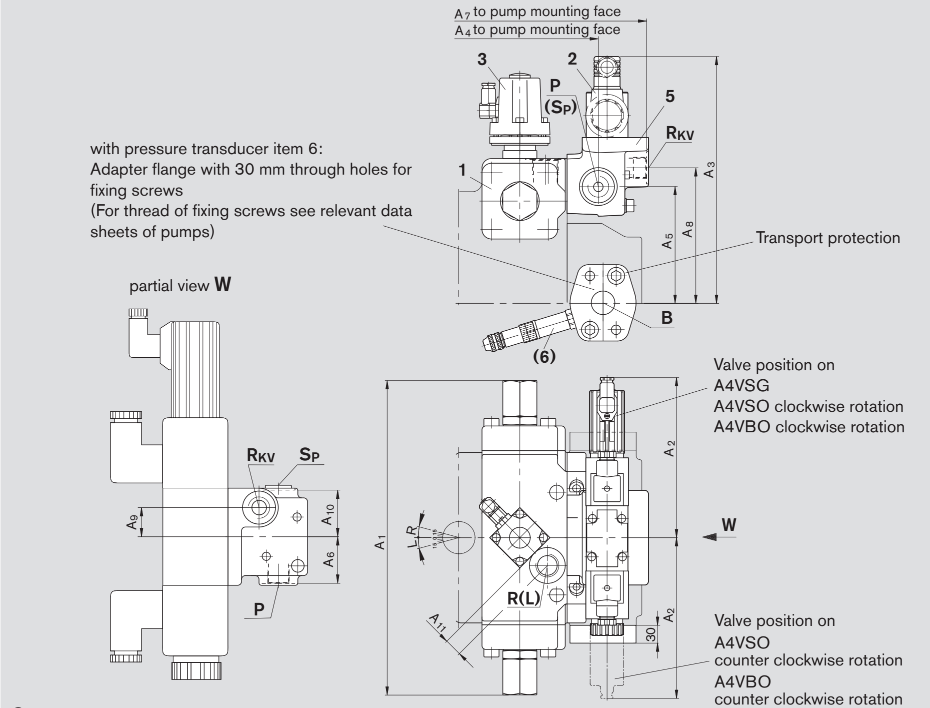
6 **only on HS4P** pressure transducer HM17-1X/450-C/VO/O (see RE 30269) with adaptor flange, on A4VSG and A4CSG (closed circuit) each pressure side has a built on pressure transducer

Dimensions HS4(P)

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 and 71 Example: A4VSO HS4P with a pressure transducer in port B

On A4VSO and A4VBO clockwise and counter clockwise rotation some dimensions are different („R“ and „L“).
For A4VSG the dimensions „R“. are valid for both directions of rotation



Components see page 22

Size	A_1	A_{2R}	A_{2L}	A_{3R}	A_{3L}	A_{4R}	A_{4L}	A_5	A_6	A_{7R}	A_{7L}	A_{8R}	A_{8L}	A_{9R}	A_{9L}	A_{10}	A_{11}	
40	296	174	166	245	226	230	222	108	43	273	253	128	94	35	5	54	16.5	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VBO RE 92122 or A4VSG RE 92100
71	332	169	171	261	243	257	249	123	48	300	280	143	109	30	0	48	20.9	

Ports

Designation	Port for	Standard[1]	Size[2]	Peak pressure [bar][3]	State
P	Control pressure	DIN 3852-1	M22 x 1.5; 14 deep	315	O
S_p	Accumulator control press.	DIN 3852-1	M22 x 1.5; 14 deep	315	X
R_{KV}	Return line control fluid	DIN 3852-1	M22 x 1.5; 14 deep	210	O

1) ISO 6149 on A4VBO 71
2) For the maximum tightening torques the general safety information on page 52 must be observed.
3) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

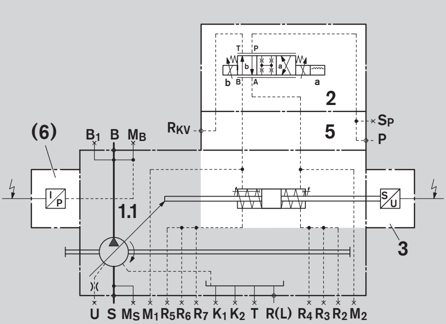
HS4(P) – Control system with proportional valve

Size 125 to 355 for A4VSO and A4VSG
Size 125 for A4VBO
Size 250 and 355 for A4CSG

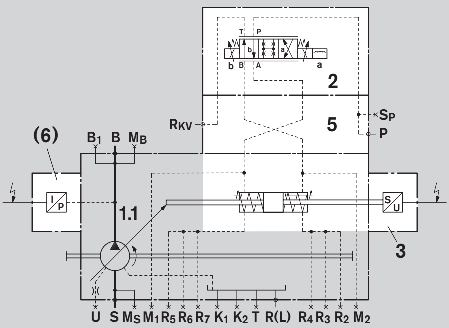
Schematics

Example: A4VSO HS4P (with pressure transducer)

Clockwise rotation



Counter clockwise rotation



Ports

P	Control pressure port
S_P	Port for control pressure accumulator
R_{KV}	Return line control fluid
M_1; M_2	Measuring ports control pressure
R_2...R_7	Bleed port control chamber

Components

1 Pump with hydraulic control device

1.1 A4VSO (see RE 92050)

2 4/3-way proportional valve (see RE 29061) with electric positional feedback (incl. cable connector 4-pin Pg7-G4W1F)

Size	Type	
125 and 180	4WRE6V08-2X/G24K4/V-822	Solenoids with plugs to DIN EN 175.301-803 / ISO 4400 cable screw connection M16 x 1.5 for cable diameter 4.5...10mm
250 und 355	4WRE6V16-2X/G24K4/V-822	

3 Inductive positional transducer AWXF004D01 with cable connector 4-pin Pg7-G4W1F

5 Sandwich plate

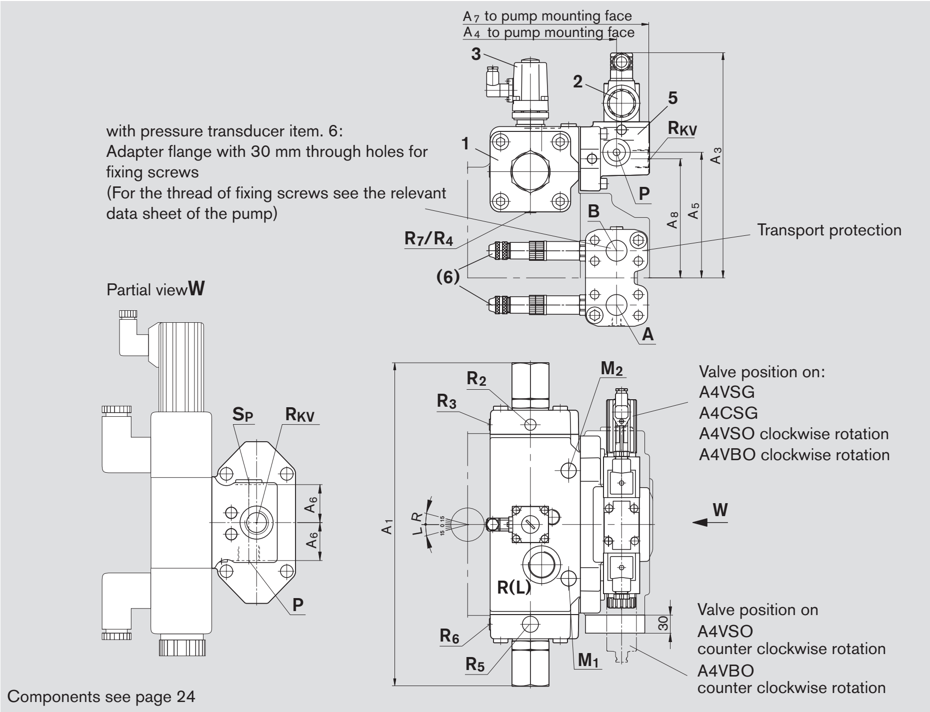
6 **only on HS4P** pressure transducer HM17-1X/450-C/VO/O (see RE 30269) with adapter flange, on A4VSG and A4CSG each pressure side has a built on pressure transducer

Dimensions HS4(P)

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 125 to 355 Example: A4VSG HS4P with a pressure transducer on port A and B

On A4VSO and A4VBO dimension A_4 is different for clockwise and counter clockwise rotation.
On A4VSG und A4CSG the dimension A_{4R} is valid for both directions of rotation.



Size	A_1	A_3	A_{4R}	A_{4L}	A_5	A_6	A_7	A_8	
125/180	402	280	310	318.5	156	39	350	148	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VBO RE 92122, A4VSG RE 92100 or A4CSG RE 92105
250/355	485	316	372	380.5	192	39	412	184	

Ports

Designation	Port for	Standard[1]	Size[2]	Peak pressure [bar][3]	State
P	Control pressure	DIN 3852-1	M22 x 1.5; 14 deep	315	O
S_p	Control pressure accumulator	DIN 3852-1	M22 x 1.5; 14 deep	315	X
R_{KV}	Return line control fluid	DIN 3852-1	M22 x 1.5; 14 deep	210	O
M_1; M_2	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep; (Size 125 and 180) M18 x 1.5; 12 deep; (Size 250 and 355)	315 315	X X
R_2...R_7	Bleed control chamber	DIN 3852-1	M10 x 1; 8 deep	315	X

1) ISO 6149 on A4VBO 125
2) For the maximum tightening torques the general safety information on page 52 must be observed.
3) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

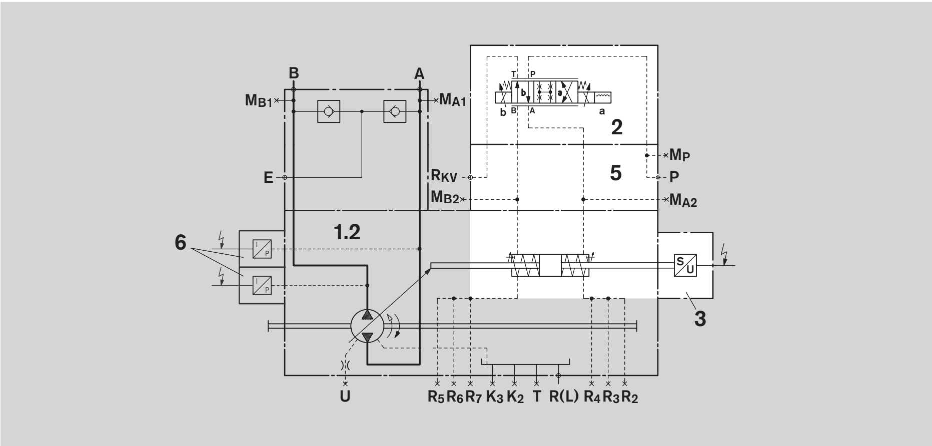
O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HS4(P) – Control system with proportional valve

Size 500 to 1000 for A4VSO and A4VSG
Size 450 for A4VBO
Size 500 and 750 for A4CSG

Schematic

Example: A4VSG HS4P (with pressure transducer)



Ports

P	Control pressure port
R_{KV}	Return line control fluid
M_{A2}; M_{B2}; M_P	Measuring port control pressure
R_2...R_7	Bleed port control chamber

Components

1 Pump with hydraulic control device

1.2 A4VSG (see RE 92100)

2 4/3-way proportional valve (see RE 29061) with electric positional feedback (incl. cable connector 4-pin Pg7-G4W1F)

Size	Type	
500...1000	4WRE6V16-2X/G24K4/V-822	Solenoids with plug to DIN EN 175.301-803 / ISO 4400 cable screw connection M16 x 1.5 for cable diameter 4.5...10mm

3 Inductive positional transducer AWXF004D01 with cable connector 4-pin Pg7-G4W1F

5 Adapter plate

6 **only on HS4P** pressure transducer HM17-1X/450-C/VO/O (see RE 30269) with adapter flange, on A4VSG and A4CSG each pressure side has a built on pressure transducer

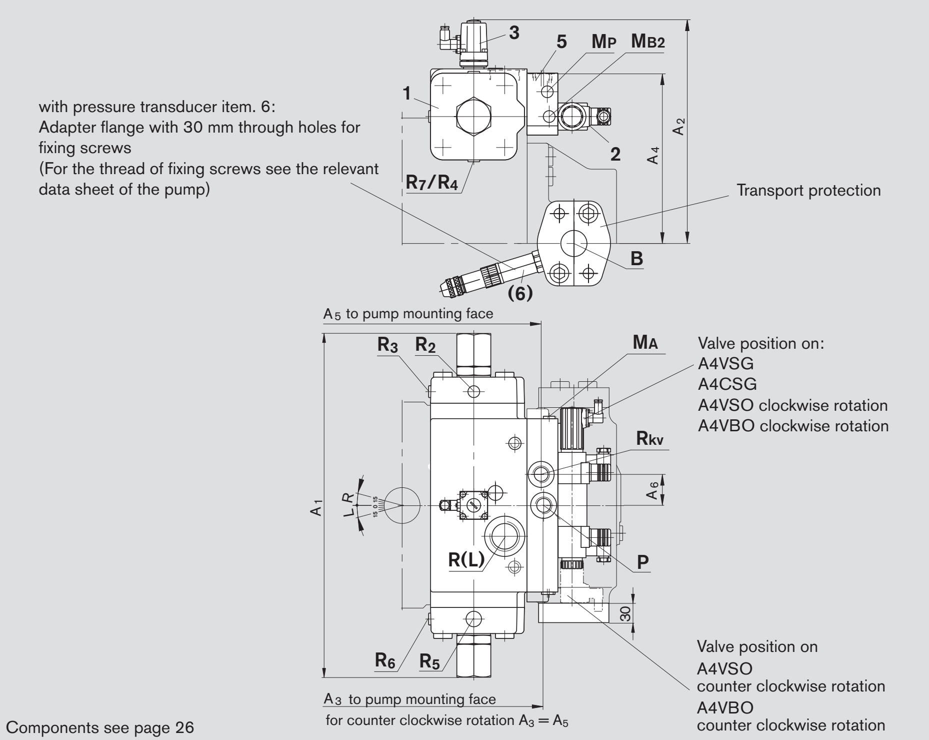
Dimensions HS4(P)

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 500 to 1000

Example A4VSO HS4P with a pressure transducer in port B

Dimensions are valid for A4VSO, A4VBO, A4VSG and A4CSG



Components see page 26

Size	A_1	A_2	A_3	A_4	A_5	A_6	
500 (450 for A4VBO)	555	361	392	274	388	50	For detailed dimensions and technical data of the variable pump see data sheets A4VSO RE 92050, A4VBO RE 92122, A4VSG RE 92100 or A4CSG RE 92105
750	630	400	424	304	420	50	
1000	670	427	490	327	486	50	

Ports

Designation	Port for	Standard[1]	Size[2]	Peak pressure [bar][3]	State
P	Control pressure	DIN 3852-1	M27 x 2; 16 deep	315	O
R_{KV}	Return line control fluid	DIN 3852-1	M27 x 2; 16 deep	120	O
M_{A2}; M_{B2}; M_P	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep	315	X
R_2...R_7	Air bleed control chamber	DIN 3852-1	M14 x 1.5; 12 deep	315	X

1) ISO 6149 on A4VBO 450
2) For the maximum tightening torques the general safety information on page 52 must be observed.
3) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

2

HS4M – for oil immersed (under oil level) operation

For A4VSO, A4VSG and A4CSG

Control option HS4M corresponds to the HS4 version however without proportional valve, but with control pressure ports X_1 and X_2.
The proportional valve can be mounted separately into the system and be connected to the relevant ports X_1 and X_2 of the pump.
The pump unit together with the attached positional transducer can be mounted inside the reservoir.
Approved for HLP-fluids DIN 51524.

Recommended: proportional valve 4WRE6-2X see RE 29061
electronic control VT-VPCD-1X see RE 30028
cable see RE 30028-B

Please note:
On the **A4VSO** pumps for open circuit applications (one side of centre) the $V_{g\ min}$-stop is set so that, when port B is plugged, a pressure of approx. 20 bar is reached.

Over centre operation is available on request.

Technical data

Size			40	71	125	180	250	355	500	750	1000
Control pressure (in X_1, X_2)	p_{min}	bar	50	50	50	100	100	100	125	125	125
	p_{max}	bar					350[1)]				
Control stroke s_{max}		mm	14.2	17.1	20.7	20.7	25.9	25.9	32.6	37.0	41.4
Control area A		cm^2	8.1	12.6	18.1	18.1	28.3	28.3	38.2	56.8	63.6
Control volume $V_{S\ max}$		cm^3	11.4	21.5	37.5	37.5	73.2	73.2	124.5	210	263.3
Weight approx. (A4VSO...HS4M..N00)		kg	38	55	92	106	194	214	327	470	600

1) Observe possible restrictions due to the used proportional valve

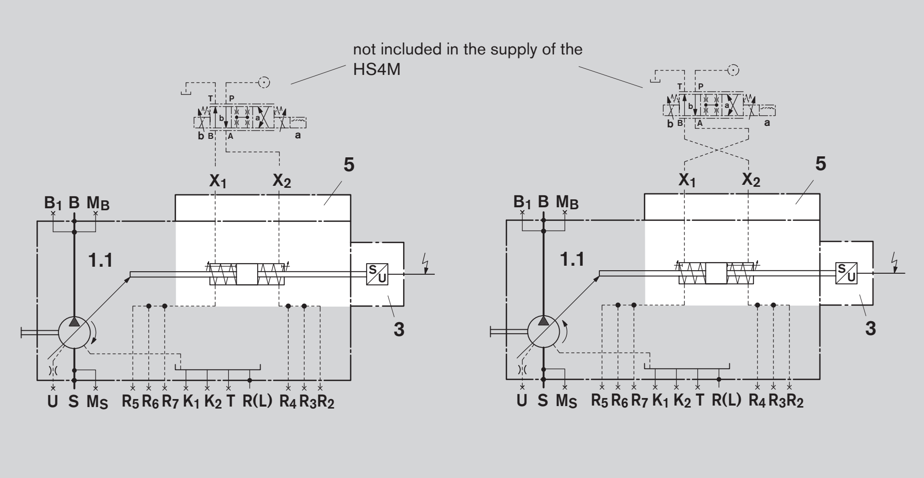
HS4M – for oil immersed operation

Size 40 to 750 for A4VSO and A4VSG
Size 250 to 500 for A4CSG

Example of schematic for open circuit

Example: A4VSO 500 and 750

Clockwise rotation **Counter clockwise rotation**

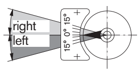


Ports and direction of the flow

X_1	Control pressure port	for pressure **in B** with clockwise rotation, swivel range* left for pressure **in A**[1] with c.clockwise rotation, swivel range* left
X_2	Control pressure port	for pressure **in A**[1] with clockwise rotation, swivel range* right for pressure **in B** with c.clockwise rotation, swivel range* right
$R_2...R_7$	Bleed port control chamber (size 125...1000)	

[1] only for closed circuit

* compare swivel angle indicator



Components

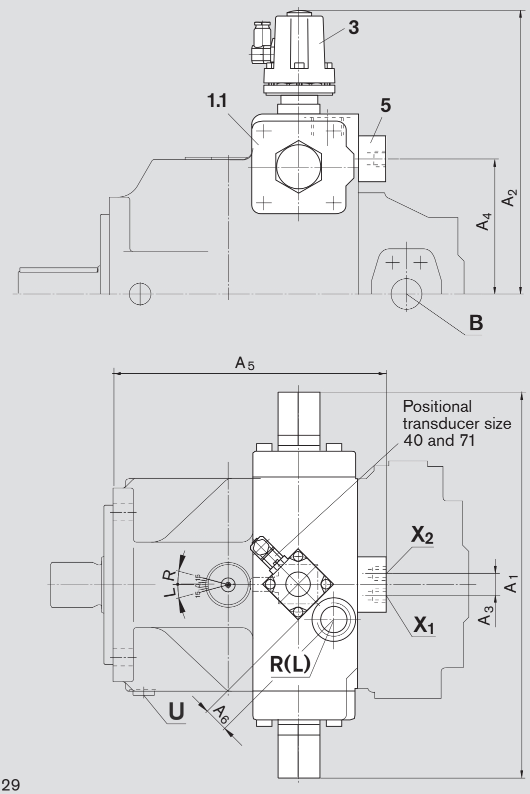
1 Pump with hydraulic control device
1.1 A4VSO (see RE 92050)
3 Inductive positional transducer AWXF004D01 with cable connector 4-pin Pg7-G4W1F, protection IP65
5 Subplate (size 40, 71, 500 and 750) or end plate (size 125 to 355)

Dimensions HS4M

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40, 71, 500 and 750

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components see page 29

Size	A_1	A_2	A_3	A_4	A_5	A_6	
40	296	221.5	28	102	217	16.5	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
71	332	243	28	120	245	20.9	
500	555	361	224	205	399	–	
750	630	400	224	235	431	–	

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
X_1; X_2	Control pressure	DIN 3852-1	M14 x 1.5; 12 deep (size 40 and 71) M22 x 1.5; 14 deep (size 500)	350 350	O O

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

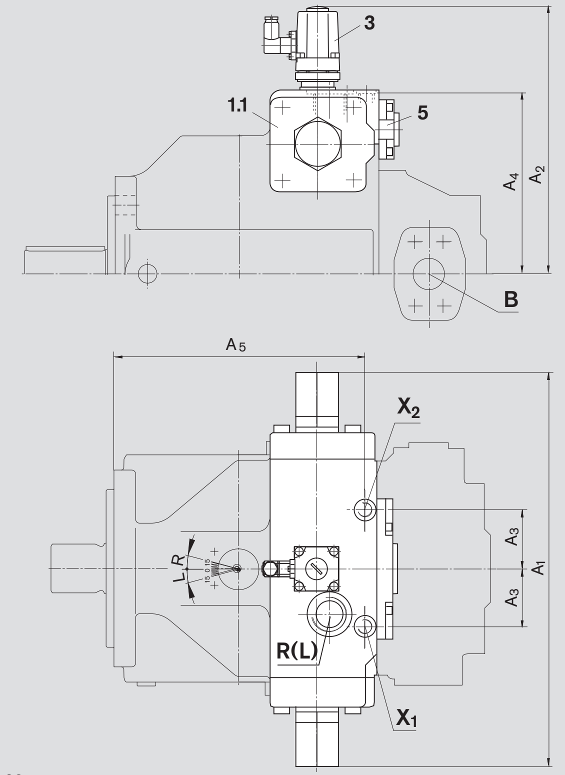
O = Must be connected (plugged upon delivery)

Dimensions HS4M

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 125 to 355

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components see page 29

Size	A_1	A_2	A_3	A_4	A_5	
125/180	402	273	67	186.5	251	For detailed dimensions and technical data of the variable pumps see data sheets A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
250/355	485	309	71	233	311	

Ports

Designation	Port for	Standard	Size[1)]	Peak pressure [bar][2)]	State
X_1; X_2	Control pressure	DIN 3852-1	M14 x 1.5; 12 deep (size125 and 180) M18 x 1.5; 12 deep (size250 and 355)	350 350	O O

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)

HS4V – with internal control pressure supply

For A4VSO

The HS4V control type corresponds to the HS4-version however with internal control pressure supply, differential control piston and an unpressurized initial position $\mathbf{V_{g\,max}}$. This eliminates the need for an external control pressure supply. The control pressure is taken directly out of the pump pressure outlet.
With a switched-off electric motor and an unpressurized control system a spring force will swivel the pump to it's maximum displacement ($V_{g\,max}$).

For a reliable control, the system pressure must be at least 20 bar.
If the pump must be controlled below this 20 bar, it is necessary to use a pressure pre-charge block AGEV4-05728-AA/46 (see example of schematic). Please consult us.

Fail Safe-properties
With a de-energized proportional valve and a closed pump outlet, the unit will swivel to the minimum pressure (6 to 10 bar). This will also happen in case of an error or without a control release.

Electronics: VT-VPCD-1X see RE 30028

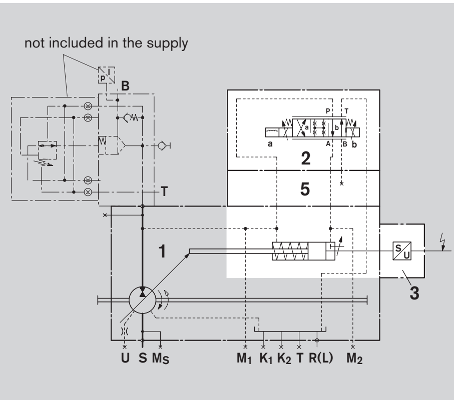
Technical data

Max. operating pressure	p_{nom}[1)]	315	bar
Min. operating pressure	p_{min}	20	bar

1) limited through the permissible data of the proportional valve, higher pressure on request

Schematic

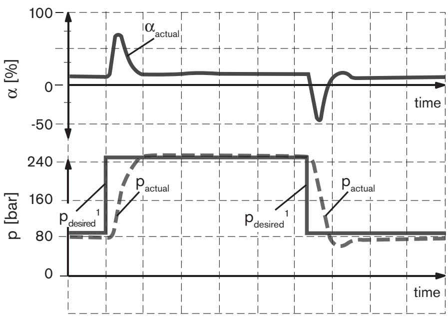
Example: A4VSO HS4V (size 250 and 355)
with pre-charge block AGEV4-05728-AA/46



Swivel range -100% tos +100%

As a special feature, the pump can reverse the direction of flow. This possibility to swivel over centre enables a very fast pressure decrease.

Dynamic characteristic of the sudden pressure drop via the pump



Ports

M_1; M_2 Measuring ports control pressure

Components

1 Pump with hydraulic control device A4VSO (see RE 92050)

2 4/3-way proportional valve (see RE 29061) with electric positional feedback (incl. cable connector 4-pin Pg7-G4W1F)

Size	Type	
250 and 355	4WRE6V16-2X/G24K4/V-822	Solenoids with plug to DIN EN 175.301-803 / ISO 4400 cable screw connection M16 x 1.5 for cable diameter 4.5...10mm

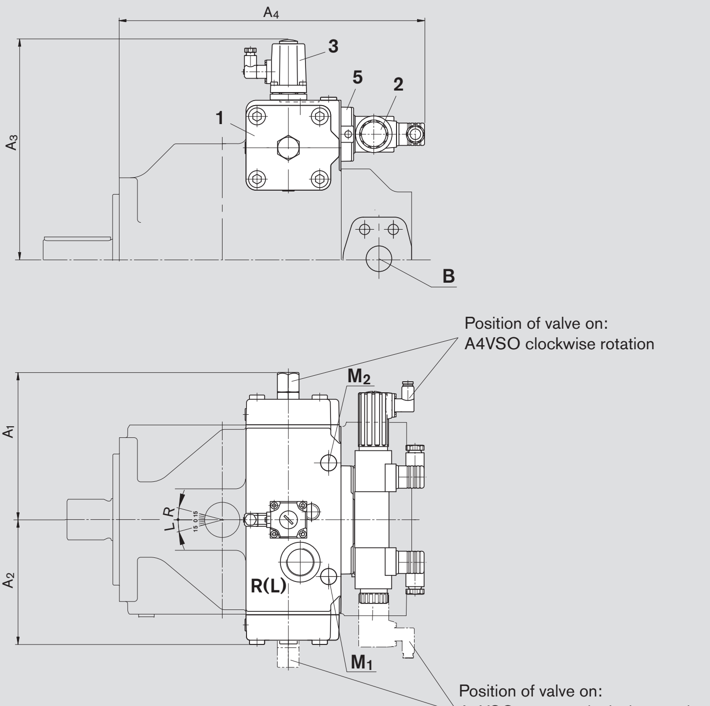
3 Inductive positional transducer AWXF004D01 with cable connector 4-pin Pg7-G4W1F

5 Sandwich plate

Dimensions HS4(V)

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 250 and 355



Components see page 32

Size	A_1	A_2	A_3	A_4	
250/355	212	179	309	433	For detailed dimensions and technical data of the variable pump see data sheet A4VSO RE 92050

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
M_1; M_2	Measuring control pressure	DIN 3852-1	M18 x 1.5; 12 deep	315	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

X = Plugged (in normal operation)

EO1 / EO2 – Control system with proportional valve

For A4VSO and A4VSG: EO1, EO2
For A4CSG: only EO2

For electric control of displacement with VT 5035-1X

The EO1/2 control adjusts the pump displacement proportional to a command input value, by means of a built on directly driven proportional directional valve.

The feedback signal for the actual pump swivel angle (displacement) is provided by a positional transducer.

The minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % of $V_{g\,max}$. For the size 500, $V_{g\,min}$ is also adjustable up to 50 % of $V_{g\,max}$ but $V_{g\,max}$ only up to 70% of $V_{g\,max}$.

Setting at the A4VSO and A4VBO (open cicuit):
The $V_{g\,min}$-stop is set in such a position, that, with a blocked pressure port B a pressure of 15...20 bar is reached.
The $V_{g\,max}$-stop is set to the nominal value of $V_{g\,max}$.

Setting at the A4VSG and A4CSG (closed circuit):
The $V_{g\,max}$-stops on both sides of centre are set to the nominal value of $V_{g\,max}$.

If other settings are desired, please state in clear text when ordering.

Spring centering of the control cylinder is standard. It is used for **settings and adjustments in the unpressurized zero position**, however without a defined reset during high pressure operation.

The spring centering is not a safety device.

The electric amplifier VT 5035-1X to control the pump displacement does not belong to the supply of the EO, it must be ordered separately acc. to RE 29955.

2 versions are available:

EO1 min. control pressure 20 bar for pump sizes 40...250 see page 35...38

EO2 min. control pressure 50/100/125 bar for pump sizes 40...1000 see page 39...43

Important

The valve spool in the control system can get stuck in a non defined position(contaminated hydraulic fluid, wear particles or contamination from the general system components). Through this, the pump flow will not follow the operators commands anymore

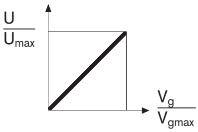
Check whether your machine needs safety measures to bring the driven actuators in a safe position (i.e. immediate stop).

A4VSO - open circuit

Please note: On the **A4VSO** pump for open circuit applications (swivel to one side only) the V_{gmin}-stop is set so that, when port B is plugged a pressure of approx. 20 bar is reached.

Over centre operation is available on request.

Characteristic

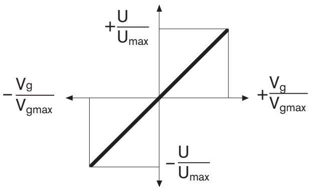


Direction of flow S to B

Direction of rotation	Swivel range* / or solenoid energized
clockwise	left / a
counter clockwise	right / b

A4VSG and A4CSG - closed circuit

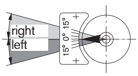
Characteristic



Direction of flow

Direction of rotation		Swivel range* / or solenoid energized
clockwise	counter clockwise	
B to **A**	**A** to **B**	right / b
A to **B**	**B** to **A**	left / a

* compare swivel angle indicator



EO1 – Control system with proportional valve

Technical data

Size			40	71	125	250
Control pressure in P	p_{min}	bar	20			
	p_{max}	bar	100			
Control stroke s_{max}		mm	14.2	17.1	20.7	25.9
Control area A		cm^2	16.6	24.6	36.3	56.7
Control volume $V_{S\ max}$		cm^3	23.6	42.1	75.2	147
Control time t_{min} 1)		s	0.12	0.20	0.22	0.40
Weight approx. (A4VSO...EO1..N00)		kg	42	59	98	200
maximum hysteresis ΔV_g 2)			$\leq \pm$ 2 % of $V_{g\ max}$			
minimum repeating accuracy 2)			$\leq \pm$ 1.5 % of $V_{g\ max}$			
Linearity deviation 2)			$\leq$ 2.5 % of $V_{g\ max}$			

1) at 50 bar control pressure
2) Values are valid for constant operating temperature of 50 °C

2

EO1 – Control system with proportional valve

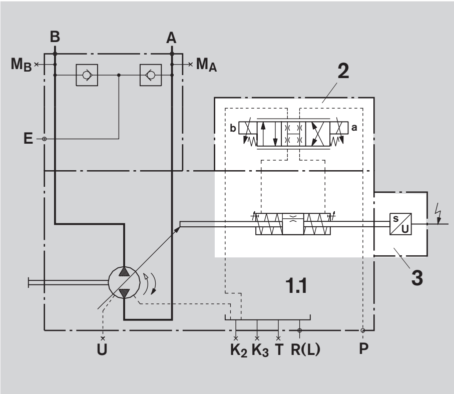
Size 40, 71, 125 and 250 for A4VSO and A4VSG

The external control fluid, which must be fed into port P is leaving the pump via the case drain port R(L).

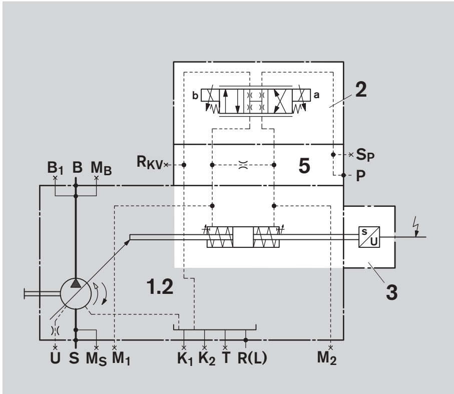
For pump type **A4CSG** with EO1- control, the control is fed from the boost circuit (port M_{E3}), that means port P is piped already. Recommended setting of boost pressure relief valve: 25 bar.

Schematics

Size 40 and 71
Example: closed circuit A4VSG



Size 125 and 250
Example: open circuit A4VSO



Ports

P	Control pressure port
S_P	Port for control pressure accumulator Size 125 and 250
R_{KV}	Return line control fluid Size 125 and 250
M_1; M_2	Measuring ports control pressure Size 125 and 250

Components

1 Pump with hydraulic control device

1.1 A4VSG (see RE 92100)

1.2 A4VSO (see RE 92050)

2 4/3-way proportional valve

Size	Type	
40 and 71	4WRA6V15-2X/G24N9K4/V-589	with plug in connector to DIN EN 175 301-803 / ISO 4400 cable screw joint M16x1.5 for cable diameter 4.5..10mm
125 and 250	4WRA6V30-2X/G24N9K4/V-589	

3 Inductive positional transducer IW9-03-01
with plug in connector to DIN EN 175 301-803-A / ISO 4400
cable screw joint M16x1.5 for cable diameter 4.5...10mm

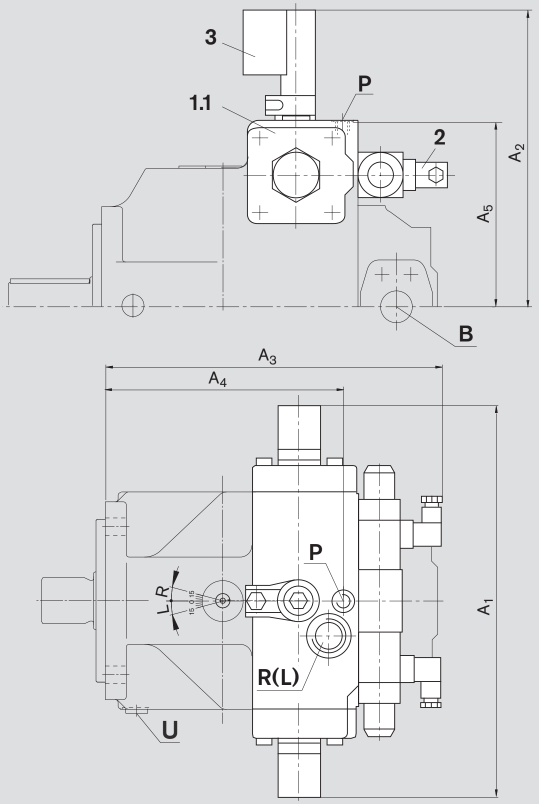
5 Throttle plate

Dimensions EO1

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 and 71

Dimensions are valid for A4VSO and A4VSG



Components see page 36

Size	A_1	A_2	A_3	A_4	A_5	
40	296	246	279	178	135	For detailed dimensions and technical data of the variable pumps see A4VSO RE 92050, or A4VSG RE 92100
71	332	265	306	205	152	

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
P	Control pressure	DIN 3852-1	M14 x 1.5; 12 deep	100	O

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

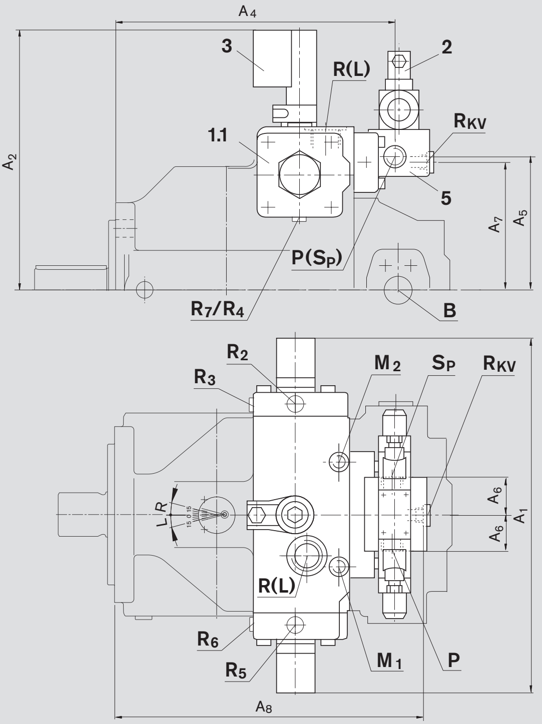
O = Must be connected (plugged upon delivery)

Dimensions EO1

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 125 and 250

Dimensions are valid for A4VSO and A4VSG



Components see page 36

Size	A_1	A_2	A_4	A_5	A_6	A_7	A_8	
125	402	298	312	156	39	148	352	For detailed dimensions and technical data of the variable pumps see A4VSO RE 92050 or A4VSG RE 92100
250	485	345	372	192	39	184	412	

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
P	Control pressure	DIN 3852-1	M22 x 1.5; 14 deep	100	O
S_p	Control pressure accumulator	DIN 3852-1	M22 x 1.5; 14 deep	100	X
R_{KV}	Return line control fluid	DIN 3852-1	M22 x 1.5; 14 deep	4	X
M_1; M_2	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep (size 125) M18 x 1.5; 12 deep (size 250)	100 100	X X
$R_2 ... R_7$	Air bleed control chamber	DIN 3852-1	M10 x 1; 8 deep	100	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

EO2 – Control system with proportional valve

Technical data

Size			40	71	125	180	250	355	500	750	1000
Control pressure in P	p_{min}	bar	50	50	50	100	100	100	125	125	125
	p_{max}[1)]	bar	315								
Control stroke s_{max}		mm	14.2	17.1	20.7	20.7	25.9	25.9	32.6	37.0	41.4
Control area A		cm^2	8.1	12.6	18.1	18.1	28.3	28.3	38.2	56.8	63.6
Control volume $V_{S\,max}$		cm^3	11.4	21.5	37.5	37.5	73.2	73.2	124.5	210	263.3
Control time t_{min}[2)]		s	0.1	0.12	0.2	0.2	0.25	0.25	0.3	*	*
Weight approx. (A4VSO..EO2..N00)		kg	42	59	98	112	200	220	338	481	611
maximum hysteresis ΔV_g[3)]			$\leq \pm$ 2 % of $V_{g\,max}$								
minimum repeating accuracy[3)]			$\leq \pm$ 1.5 % of $V_{g\,max}$								
Linearity deviation[3)]			$\leq$ 2.5 % of $V_{g\,max}$								

1) limited by permissible data of proportional valve

2) at minimum control pressure

3) Values are valid for constant operating temperature of 50 °C

* on request

2

EO2 – Control system with proportional valve

Size 40 to 355 for A4VSO and A4VSG
Size 250 and 355 for A4CSG

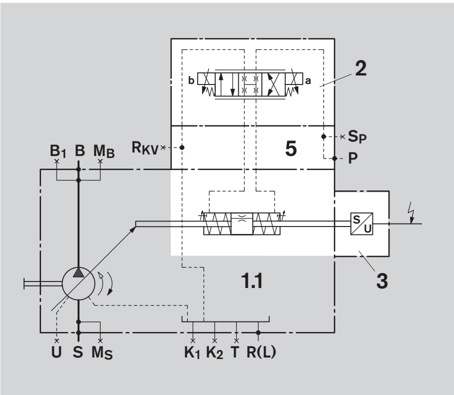
The external control fluid, which must be fed into port P leaves the pump via case drain port R(L).

On pump type **A4CSG** with EO2-control the control pressure relief valve is not needed and replaced by a plug.

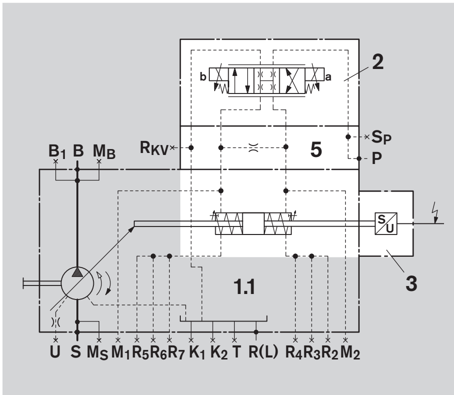
In order to minimize the control fluid consumption the control chambers on the sizes 125...355 are sealed and can be bled via ports R_2 .... R_7.

Schematics

Size 40 and 71
Example: open circuit A4VSO



Size 125 to 355
Example: open circuit A4VSO



Ports

P	Control pressure port
S_P	Port for control pressure accumulator
R_{KV}	Return line control fluid
M_1; M_2	Measuring ports control pressure Size 125 to 355
R_2...R_7	Bleed port control chamber size 125 to 355

Components

1 Pump with hydraulic control device

1.1 A4VSO (see RE 92050)

2 4/3-way proportional valve

Size	Typ	
40 and 71	4WRA6V15-2X/G24N9K4/V-589	with plug in connector to DIN EN 175 301-803 / ISO 4400
125 to 355	4WRA6V30-2X/G24N9K4/V-589	cable screw joint M16x1.5 for cable diameter 4.5..10mm

3 Inductive positional transducer IW9-03-01
with plug in connector (mating plug) to DIN EN 175 301-803-A / ISO 4400
cable screw joint M16x1.5 for cable diameter 4.5...10mm

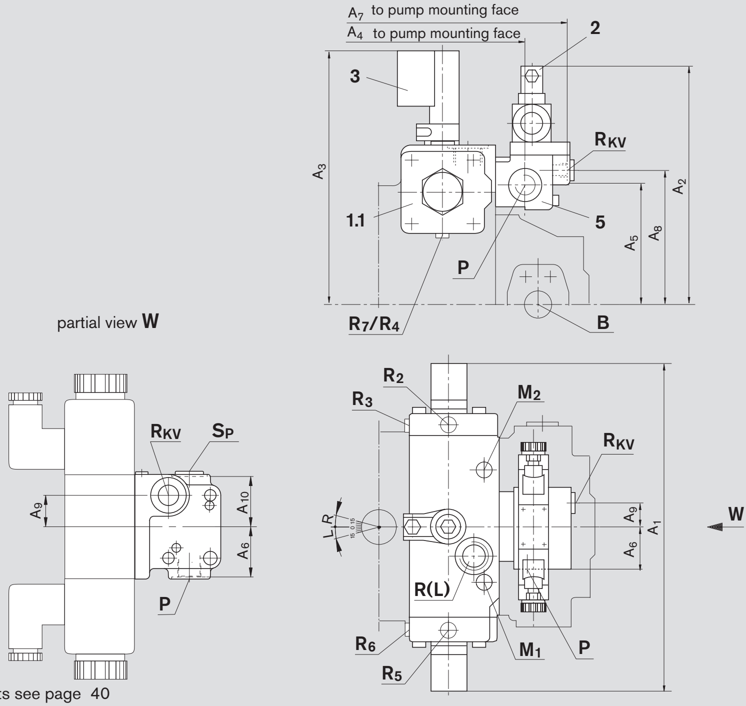
5 Sandwich plate

Dimensions EO2

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 to 355

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components see page 40

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	
40	296	248	246	222	108	43	273	128	35	53	For detailed dimensions and technical data of the variable pumps see A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105
71	332	264	265	249	123	48	300	143	30	48	
125/180	402	281	298	310	156	39	350	148	0	39	
250/355	485	317	345	372	192	39	412	184	0	39	

Ports

Designation	Port for	Standard	Size[1]	Peak pressure [bar][2]	State
P	Control pressure	DIN 3852-1	M22 x 1.5; 14 deep	315	O
S_p	Control pressure accumulator	DIN 3852-1	M22 x 1.5; 14 deep	315	X
R_{KV}	Return line control fluid	DIN 3852-1	M22 x 1.5; 14 deep	210	X
M_1; M_2	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep (size 125 and 180) M18 x 1.5; 12 deep (size 250 and 355)	315 315	X X
R_2...R_7	Air bleed control chamber	DIN 3852-1	M10 x 1; 8 deep (size 125 to 355)	315	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

EO2 – Control system with proportional valve

Size 500 to 1000 for A4VSO and A4VSG
Size 500 and 750 for A4CSG

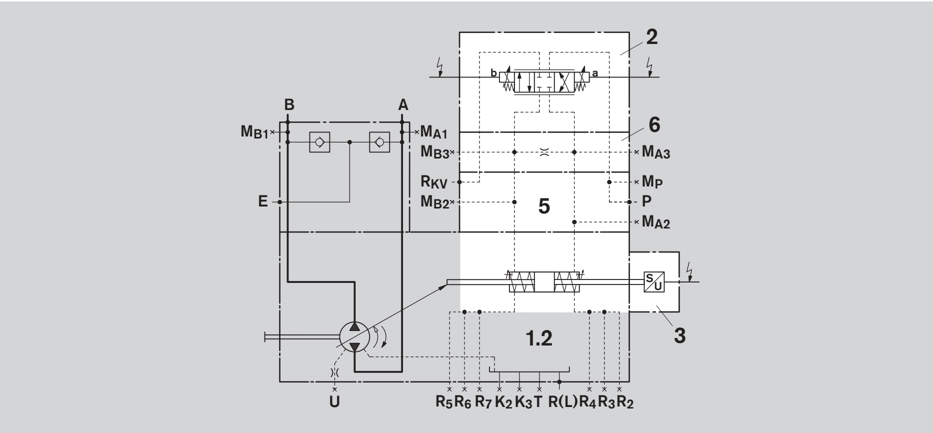
The external control fluid, which must be fed into port P is discharged via port R_{KV}, which must be piped to tank.

On pump type **A4CSG** with EO2-control the control pressure relief valve is not needed and replaced by a plug.

In order to minimize the control fluid consumption the control chambers are sealed and can be bled via ports R_2 .... R_7.

Schematic

Example: closed circuit A4VSG



Ports

P	Control pressure port
R_{KV}	Return line control fluid
M_{A2}; M_{B2}; M_P; M_{A3}; M_{B3}	Measuring ports control pressure
R_2...R_7	Bleed port control chamber

Components

1 Pump with hydraulic control device

1.2 A4VSG (see RE 92100)

2 4/3-way proportional valve

Size	Type	
500 to 1000	4WRE10E25-2X/24K4/V-93	with plug in connector to DIN EN 175 301-803 / ISO 4400 cable screw joint M16x1.5 for cable diameter 4.5..10mm

3 Inductive positional transducer IW9-03-01
with plug in connector (mating plug) to DIN EN 175 301-803-A / ISO 4400
cable screw joint M16 x 1.5 for cable diameter 4.5...10mm

5 Sandwich plate

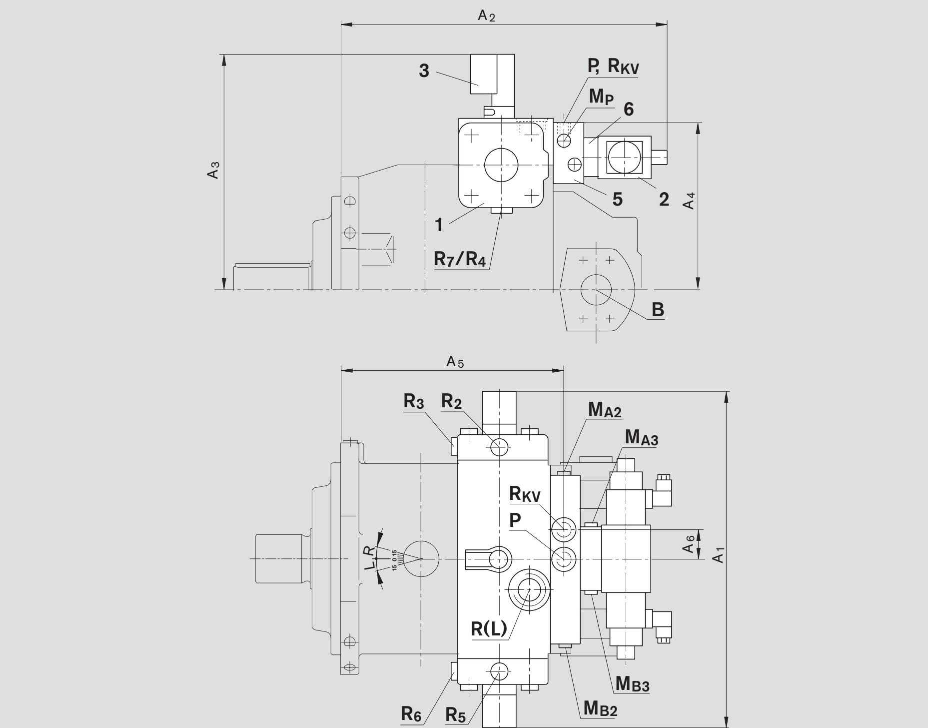
6 Throttle plate

Dimensions EO2

Before finalising your design request a certified installation drawing. Dimensions in mm

Size500 to 1000

Dimensions are valid for A4VSO, A4VSG and A4CSG



Components see page 42

Size	A_1	A_2	A_3	A_4	A_5	A_6
500	555	559	392	274	388	50
750	630	591	427	304	420	50
1000	670	657	456	327	486	50

For detailed dimensions and technical data of the variable pumps see A4VSO RE 92050, A4VSG RE 92100 or A4CSG RE 92105

Ports

Designation	Port for	Standard	Size[1)]	Peak pressure [bar][2)]	State
P	Control pressure	DIN 3852-1	M27 x 2; 16 deep	315	O
R_{KV}	Return line control fluid	DIN 3852-1	M27 x 2; 16 deep	210	O
M_P; M_{A2}; M_{B2}	Measuring control pressure	DIN 3852-1	M14 x 1.5; 12 deep	315	X
M_{A3}; M_{B3}	Measuring control pressure	DIN 3852-2	G 1/4 in	315	X
R_2...R_7	Air bleed control chamber	DIN 3852-1	M14 x 1.5; 12 deep	315	X

1) For the maximum tightening torques the general safety information on page 52 must be observed.
2) Depending on the application momentary pressure spikes can occur. To be considered when selecting the measuring equipment and fittings.

O = Must be connected (plugged upon delivery)
X = Plugged (in normal operation)

HSE without valve

Size 40 to 1000 for A4VSO and A4VSG
Size 250 to 750 for A4CSG

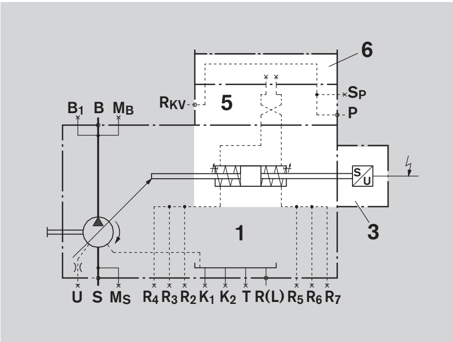
The HSE-version is being supplied without servo valve.

Apart from that, this version corresponds to the respective basic execution – technical data, respective schematics and unit dimensions see basic control version HS page 14 ff.

The mounting pad for the servo valve for all pump sizes corresponds to **porting pattern DIN 24340-A10**.

Schematic

Example A4VSO size 125 to 355



Ports

P	Control pressure port
S_P	Port for control pressure accumulator
R_{KV}	Return line control fluid
R_2...R_7	Bleed port control chamber

Components

1 Pump with hydraulic control device

3 Inductive positional transducer Type IW9-03-01

5 Sandwich plate

6 Flushing plate

HSK – short circuit valve

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 40 to 1000 for A4VSO and A4VSG
Size 250 to 750 for A4CSG

A solenoid actuated 4/2-way shut off valve is mounted between the proportional valve and the control device.

This short circuit arrangement is used for settings and adjustments in the unpressurized zero position, however without a defined reset during high pressure operation – **this is not an emergency shut-down function**.

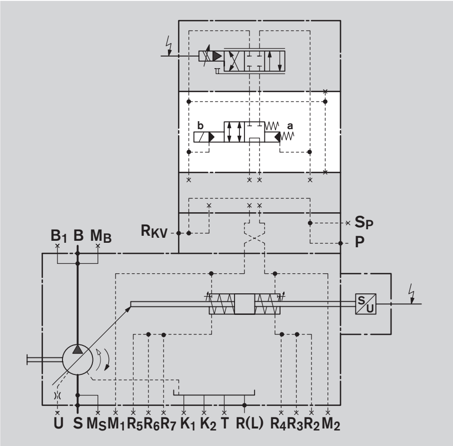
Important:
With a de-energized short circuit valve the servo valve cannot be activated due to the interrupted connection.

Short circuit valve (4/2-way shut off valve) type Z4WEH10E68-4X/6EG24N9ETZ4/B10D3 (see RE 24753)
with plug in connector DIN EN 175301-803-A
cable screw joint M16 x 1.5 for cable diameter 4.5...10 mm.

2

Schematic

Example: A4VSO size 125 to 355
on sizes 40 and 71 the ports R_2...R_7 are omitted



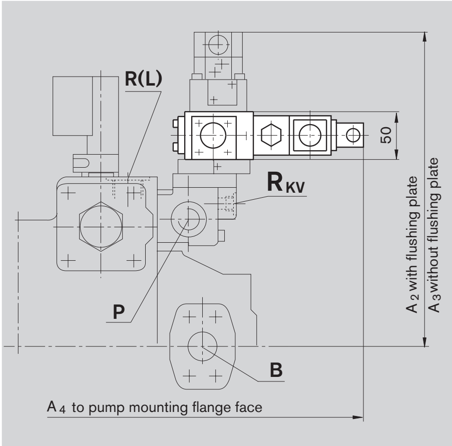
Size	A_2	A_3	A_4	A_5	A_6	A_7	A_8
40	318	303	403	–	–	–	–
71	336	321	430	–	–	–	–
125 / 180	355	340	479	–	–	–	–
250 / 355	390	375	541	–	–	–	–
500	–	–	–	577	562	401	392
750	–	–	–	608	593	431	427
1000	–	–	–	674	659	454	456

HS4K / EO1K / EO2K size 40 to 355 see page 46 and 47

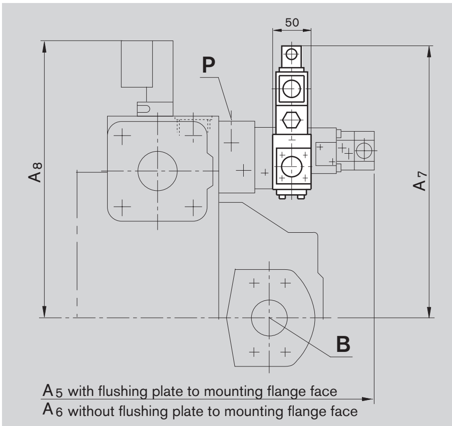
EO2K size 500 to 1000 see page 48

Dimensions

Size 40 to 355



Size 500 to 1000



HS4K / EO1K / EO2K – short circuit valve

Before finalising your design request a certified installation drawing. Dimensions in mm

HS4K size 40 to 1000
EO1K size 40 to 125 and 250
EO2K size 40 to 355

A solenoid actuated 4/2-way shut off valve is mounted between the proportional valve and the control device.

This short circuit arrangement is used for settings and adjustments in the unpressurized zero position, however without a defined reset during high pressure operation – **this is not an emergency shut-down function**.

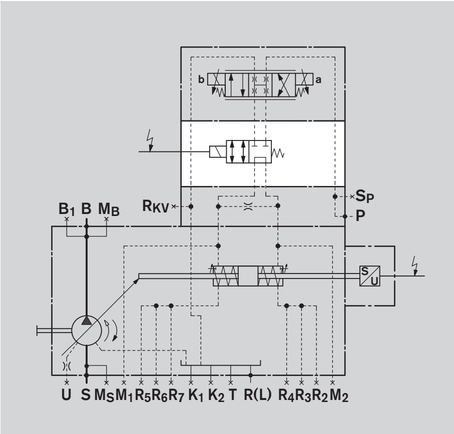
Important:
With a de-energized short circuit valve the proportional valve cannot be activated due to the interrupted connection.

Short circuit valve (4/2-way shut off valve) type Z4WEH10E68-4X/6EG24N9ETZ4/B10D3 (see RE 24753)
with plug in connector DIN EN 175301-803-A
cable screw joint M16 x 1.5 for cable diameter 4.5...10 mm.

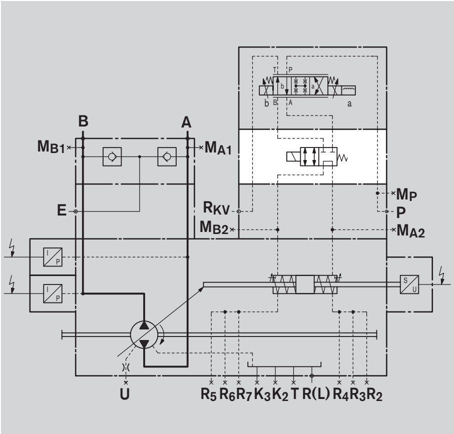
Please observe performance limits to RE 23193.

Schematics

Example: A4VSO EO2K size 125 to 355



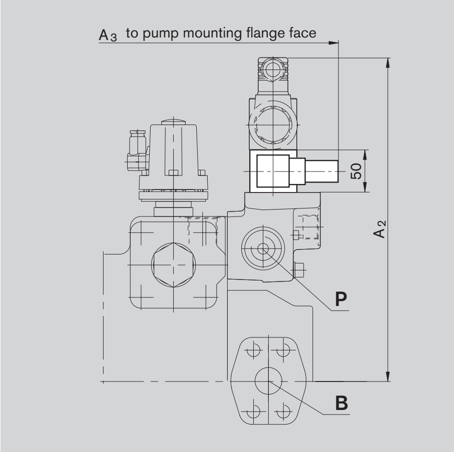
Example: A4VSG HS4KP size 500 to 1000



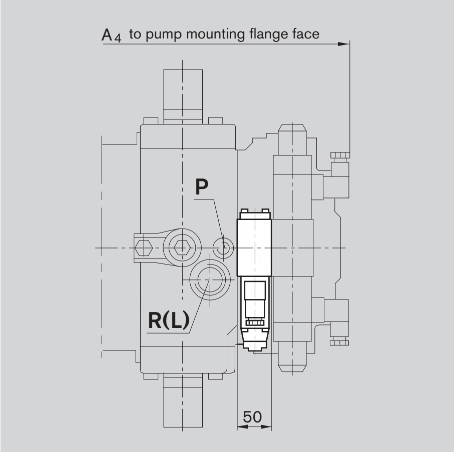
HS4K / EO1K / EO2K – Dimensions

Before finalising your design request a certified installation drawing. Dimensions in mm

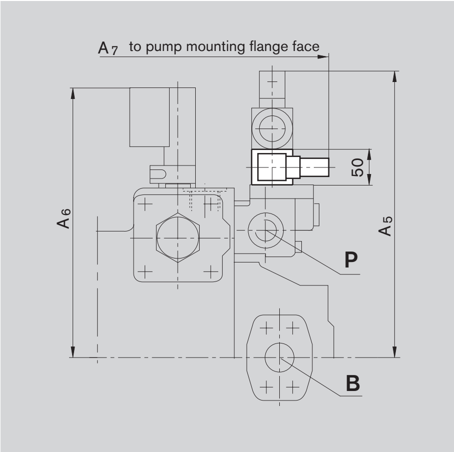
HS4K size 40 to 355



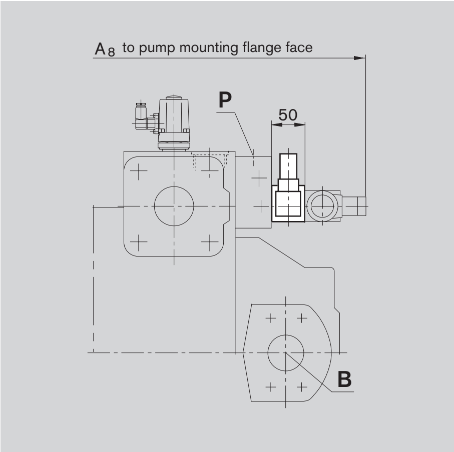
EO1K size 40 and 71



EO1K size 125 and 250
EO2K size 40 to 355



HS4K size 500 to1000



Size	A_2	A_3	A_4	A_5	A_6	A_7
40	295	296	324	298	246	295
71	311	323	351	314	265	322
125 / 180	330	381	–	331	298	379
250 / 355	365.5	443	–	365	345	443

Size	A_8
500	551
750	583
1000	649

EO2K size 500 to 1000 see page 48

EO2K – short circuit valve

Before finalising your design request a certified installation drawing. Dimensions in mm

Size 500 to 1000

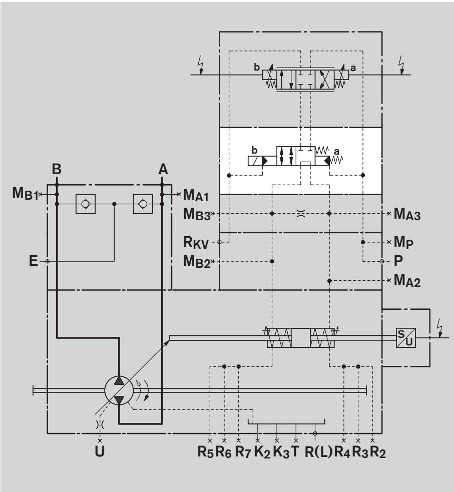
A solenoid actuated 4/2-way shut off valve is mounted between the proportional valve and the control device.

This short circuit arrangement is used for settings and adjustments in the unpressurized zero position, however without a defined reset during high pressure operation – **this is not an emergency shut-down function**.

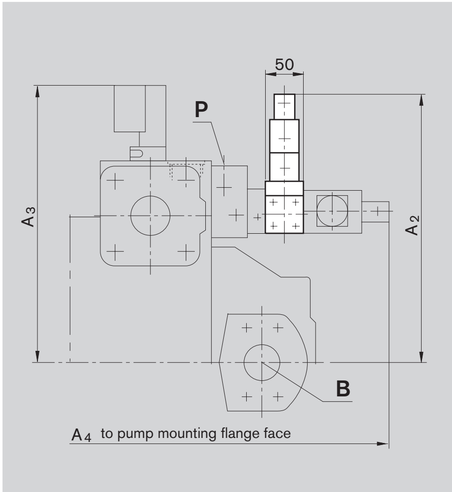
Important:
With a de-energized short circuit valve the proportional valve cannot be activated due to the interrupted connection.

Schematic

Example: A4VSG



Dimensions



Short circuit valve (4/2-way shut off valve)
type Z4WEH10E68-4X/6EG24N9ETZ4/B10D3
(see RE 24753)
with plug in connector DIN EN 175301-803-A
cable screw joint M16 x 1.5
for cable diameter 4.5...10 mm.

Size	A_2	A_3	A_4
500	386	392	609
750	417	427	641
1000	439	456	707

EO2K size 40 to 355 see page 46 and 47

Z – sandwich plate filter at HS

Before finalising your design request a certified installation drawing. Dimensions in mm

Indicated by the digit in the filtration option of the ordering code

Size 40 to 355 for A4VSO and A4VSG
Size 250 to 355 for A4CSG

This sandwich plate filter is used to filter the control fluid before entering the servo valve in the HS-control.
It is denoted with the letter **Z** in the pump model code.

HS4 with sandwich plate filter on request.

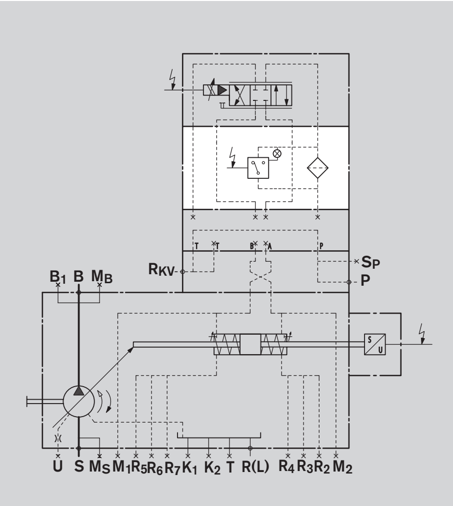
Sandwich plate filter

The contamination indicator is optical and electrical – Indicator lamp voltage 24V

Size	Type
40 and 71	DFBH/HC60Z10D2.0/V-L24
125 to 355	DFBH/HC110Z10D2.0/V-L24

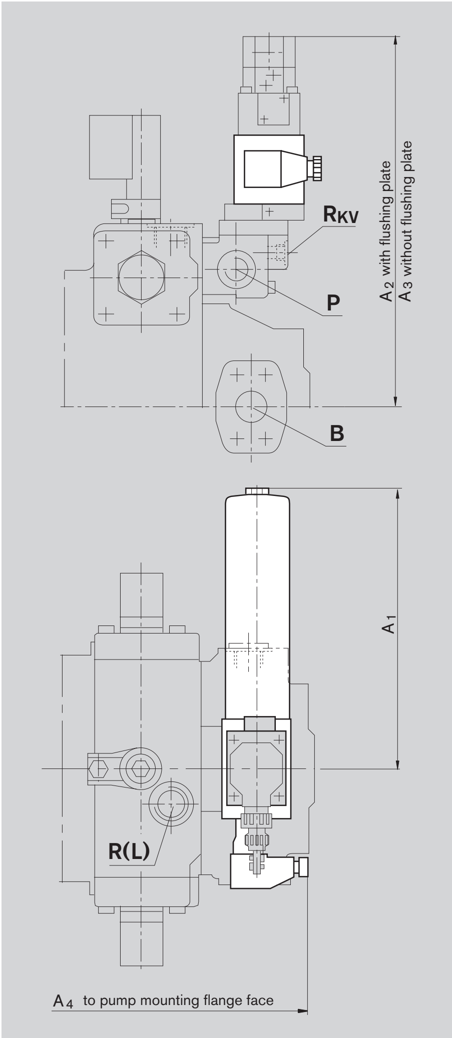
Schematic

Example: A4VSG



Size	A_2	A_3	A_4	A_5
40	216	342	327	300
71	212	350	335	312
125 / 180	272	374	359	376
250 / 355	272	411	396	438

Dimensions HS...Z



Installation instructions

Basically the installation instructions for the respective variable pumps are applicable:
A4VSO – RE 92050
A4VBO – RE 92122
A4VSG – RE 92100
A4CSG – RE 92105

Only the control versions HM1, HM2 and HS4M are suitable for oil immersed (under fluid level) operation.

Notes

General safety information

– The control systems HM, HS, HS4 and EO were designed for operation in open loop circuits (A4VSO, A4VBO) or closed circuits (A4VSG, A4CSG).

– Systems design, installation and commissioning of the axial piston unit require trained technicians or tradesmen.

– Before operating the axial piston unit make sure to read the relevant operating manuel carefully and completely. If needed, request this information from Rexroth

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned; take suitable safety measures (wear protective clothing).

– Pressure ports:
All materials and port threads are selected and designed in such a manner, that they can withstand the peak pressures.
The machine and system manufacturer must ensure, that all connecting elements and hydraulic lines are suitable for the actual operating conditions (pressures, flow, fluid, temperature) in accordance with the necessary safety factors.

– All given data and information must be adhered to.

– The product has not been released as a component in the safety concept of a total machine system acc. to DIN EN ISO 13849

– The following tightening torques are valid:

- Fittings:
please comply with the manufacturer's information regarding the maximum permissible tightening torques for the used fittings.

- Fastening bolts:
for fastening bolts to DIN 13 we recommend to check the permissible tightening torques in each individual case to VDI 2230.

- Female threads in the axial piston unit:
the maximum permissible tightening torques $M_{G\,max}$ are maximum values for the female threads in the pump casting and may not be exceeded. For values see table below.

- Plugs:
for the metal plugs, supplied with the axial piston unit the following minimum required tightening torques M_V apply (see table)

Thread size of ports		Maximum permissible tightening torque for female thread $M_{G\,max}$	Minimum required tightening torque of plugs M_V	Across the flats in socket of Allan head screw
A4VSO, A4VSG, A4CSG				
M10 x 1	DIN 3852-1	30 Nm	12 Nm	5 mm
M14 x 1.5	DIN 3852-1	80 Nm	35 Nm	6 mm
M18 x 1.5	DIN 3852-1	140 Nm	60 Nm	8 mm
M22 x 1.5	DIN 3852-1	210 Nm	80 Nm	10 mm
M27 x 2	DIN 3852-1	330 Nm	135 Nm	12 mm
G 1/4 in	DIN 3852-2	70 Nm	30 Nm	6 mm
A4VBO				
M10 x 1	ISO 6149	30 Nm	20 Nm	5 mm
M14 x 1.5	ISO 6149	80 Nm	45 Nm	6 mm
M18 x 1.5	ISO 6149	140 Nm	70 Nm	8 mm
M22 x 1.5	ISO 6149	210 Nm	100 Nm	10 mm
M27 x 2	ISO 6149	330 Nm	170 Nm	12 mm

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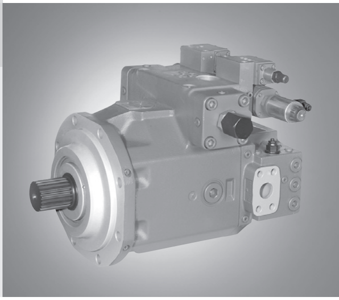
Rexroth
Bosch Group

Electro-hydraulic control with proportional solenoid EP

for closed circuit operation



for variable pump
A4CSG series 3
A4VSG series 1and 3

Contents

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EPGB with remote pressure control for port B only	9
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Features

- Electro-proportional control current dependent
- High control accuracy
- With fail-safe to zero flow (spring centered) on power loss
- Emergency manual override
- Use of standard proportional amplifiers possible

Further information:

Variable pump A4CSG	Size 250...750	RE 92105
Variable pump A4VSG	Size 40...1000	RE 92100

Ordering code

A4	G		EP...	/			–								
					Series	Direction of rotation		Seals	Shaft end	Mounting flange	Service ports	Boost pump	Through drive	Valves	Filtration

For detailed data see: RE 92105 – A4CSG
RE 92100 – A4VSG

Axial piston unit

Compact unit, swash plate design, variable	●	A4CS
Swash plate design, variable	❍	A4VS

Type of operation

Pump, closed circuit	G

Size

≙ Displacement $V_{g\ max}$ (cm³)	40	71	125	180	250	355	500	750	1000

Control and adjustment devices

Electro-hydraulic control, with proportional solenoid EP...

Pressure control	40	71	125	180	250	355	500	750	1000	
without pressure control – without code	❍	❍	❍	❍	●	●	❍	❍	❍	
with pressure control in A	❍	❍	❍	❍	●	●	●	●	❍	.. A
with remote pressure control in A	❍	❍	❍	❍	●	●	●	●	❍	..GA
with pressure control in B	❍	❍	❍	❍	●	●	●	●	❍	..B
with remote pressure control in B	❍	❍	❍	❍	●	●	●	●	❍	..GB
with pressure control both sides	❍	❍	❍	❍	●	●	●	●	❍	..D
with remote pressure control both sides	❍	❍	❍	❍	●	●	●	●	❍	..G

● = available ❍ = in preparation

EP - Electro-hydraulic control with proportional solenoid

The EP control adjusts the pump displacement proportional to the solenoid current.

The mechanical feedback system ensures a reliable and secure center (zero flow) position on power loss. This push-back to zero flow position is assited by the standard spring centering.

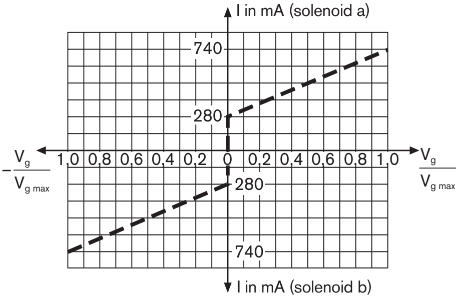
There are two solenoids: one for each swivel direction.

Standard is an emergency manual override on each solenoid. On actuation, these enable an adjustment of displacement from zero to V_{gmax} (proportional to applied force).

To control the solenoids, we recommend the use of current controlled amplifiers with PWM-signal (pulse width modulation), eg. VT 10159 (corresponds to VT 3000 but with 100 Hz see RE 29935). Please order separately.

Flows in both swivel directions can be limited by mechanical stops between V_{gmax} and 50% V_{gmax}, for the size 500 between V_{gmax} and 70% V_{gmax}.

Characteristic

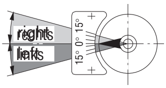


Relation between

Direction of rotation-solenoid-direction of flow

Direction of rotation	Solenoid	Swivel range[1])	Direction of flow	Pressure side
clockwise	b	right	B to A	A
	a	left	A to B	B
c. clockwise	b	right	A to B	B
	a	left	B to A	A

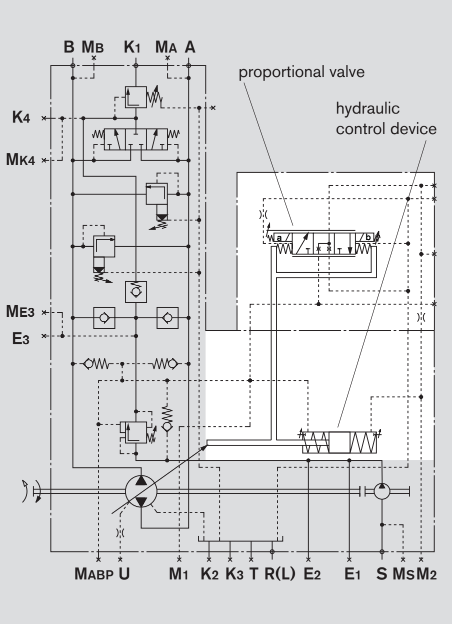
[1]) compare swivel angle indicator.



Technical data and circuit drawing

Circuit drawing EP

Example A4CSG250EP/30X-XXXXXF344N



Technical data – electrical

Operating voltage	24V
Nominal current	800 mA
Control current	
Beginning of control at V_{g0}	280 mA
End of control at V_{gmax}	740 mA
Current limit at U_{max}	1,05 A
Nom. resistance at 20°C (R_{20})	19 Ω
Max. duty cycle	100% (S1)
Dither frequency for PWM-signal	100 – 200 Hz (Recommended 100 Hz)
Class of isolation	F (T_{max} = 155°C)
Type of plug see page 16	DIN EN 175 301-803/ISO 4400
Protection to DIN/EN 60529	IP 65
Emergency override	Pressure plate in rubber cap
Force to actuate manual override	180 N for V_{gmax}
Operating temperature coils	130°C Danger: see safety information page 16

Formula for calculation of resistance

at T > 20 °C

$$R_W = \frac{R_{20} \times (235 + T)}{255}$$

Technical data – hydraulics

Size			40	71	125/180	250/355	500	750
Travel of control piston	s_{max}	mm	14,2	17,1	20,7	25,9	32,6	37
Area of control piston	A	cm²	3,9	6,4	9	14,4	18,8	28,5
Control volume	V_{Smax}	cm³	5,5	11	18,7	37,3	61,4	105
Min. required control pressure	p_{min}	bar	double boost pressure in M1 (measuring port small control chamber)					
Control time* (at 200 bar high press.)	t	s	0,08	0,09	0,10	0,15	0,75	1,0
Hysteresis			5...7 % of V_{gmax}					
Repeatability			< 2 % von V_{gmax}					

* with integrated pressure control longer control times are possible dependent on difference between actual operating pressure and setting of pressure control.

Pressure control

The pressure control is an additional function, which regulates pump displacement as soon as a pre-set command value of pressure is reached. This max pressure is set at a pilot pressure control valve, and if this pressure is exceeded the pressure control valve opens and de-strokes the pump until this pre-set pressure is reached again.

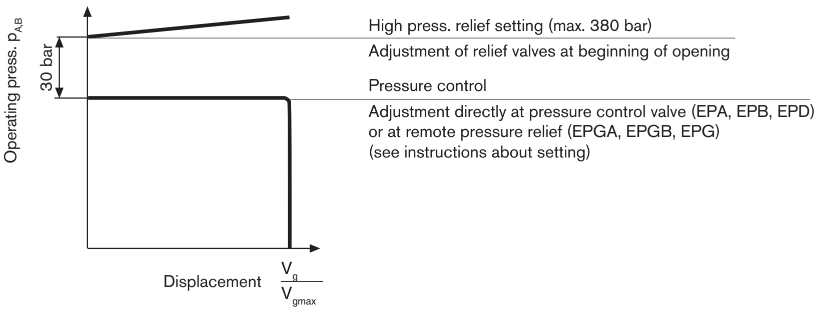
The pressure control is available as an option: EPA in port A only (circuit drawings see page 6)
EPB in port B only (circuit drawings see page 8)
EPD in both ports A and B (circuit drawings see page 10)

Adjustment range 50...350 bar

Standard setting of pressure control is 350 bar, other settings please state in clear text when ordering. The pressure control settings must be around 30 bar lower than the settings of the high pressure relief valves (A4CSG), in order to avoid that the high pressure relief valves open before the pressure control is activated (heat development and loss of energy).

2

Characteristic



Remote pressure control

Remote setting of pressure control is accomplished via ports X_A resp. X_B.

The external pressure relief valves do not belong to the scope of supply.

Recommended: direct operated relief valve DBD 6 (RE 25 402)

Max. line lenght between pump and external relief valve not to exceed 2 m.

Standard setting of differential pressure at pressure control valve 30 bar. Pilot oil consumption in this case approx. 2L/min.

If a different setting is required please state in clear text (range 14 - 50 bar).

Information for adjustment of remote pressure control:

Setting of external pressure relief valve plus differential pressure at pressure control valve = pressure control setting.

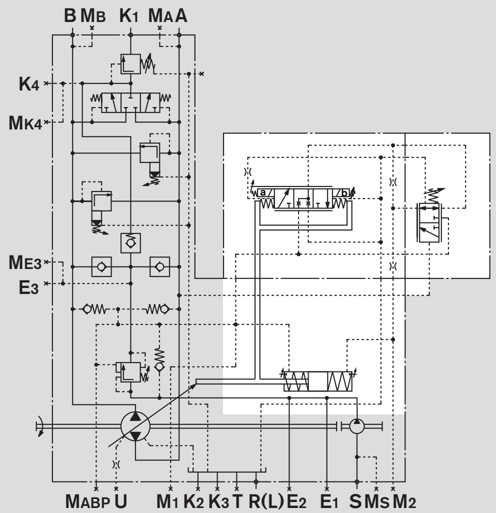
Example:	external pressure relief valve:	320 bar
	differential pressure at pressure control valve:	30 bar
	results in pressure control setting of 320 + 30 =	350 bar

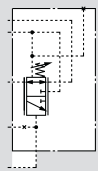
Optional remote pressure control : EPGA in port A only (circuit drawing see page 7)
EPGB in port B only (circuit drawing see page 9)
EPG in both ports A and B (circuit drawing see page 11)

EPA with pressure control for port A only

The pressure control valve regulates the pressure in port A.
Description see page 5.

Circuit drawing sizes 250 and 355

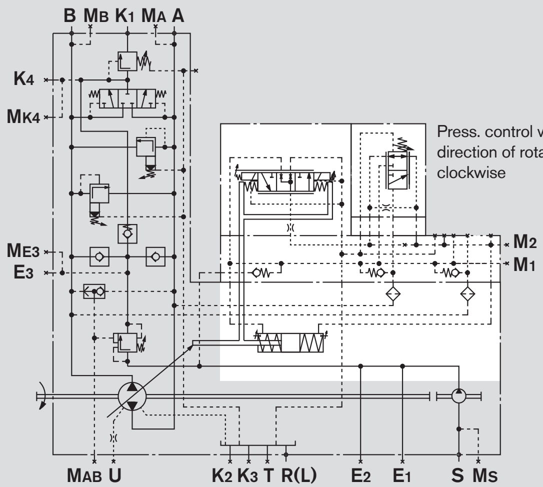


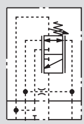


Ports

M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

Circuit drawing sizes 500 and 750





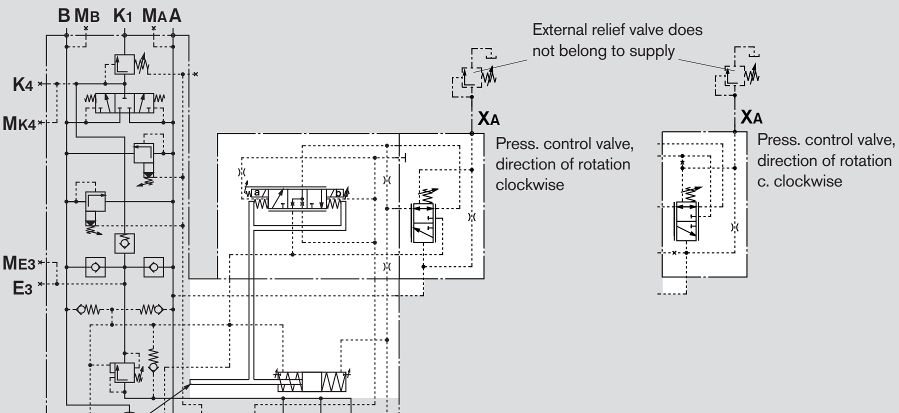
Ports

M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

EPGA with remote pressure control in port A only

Remote setting of pressure control is accomplished via port X_A. The external relief valve is not included in the supply. Description see page 5.

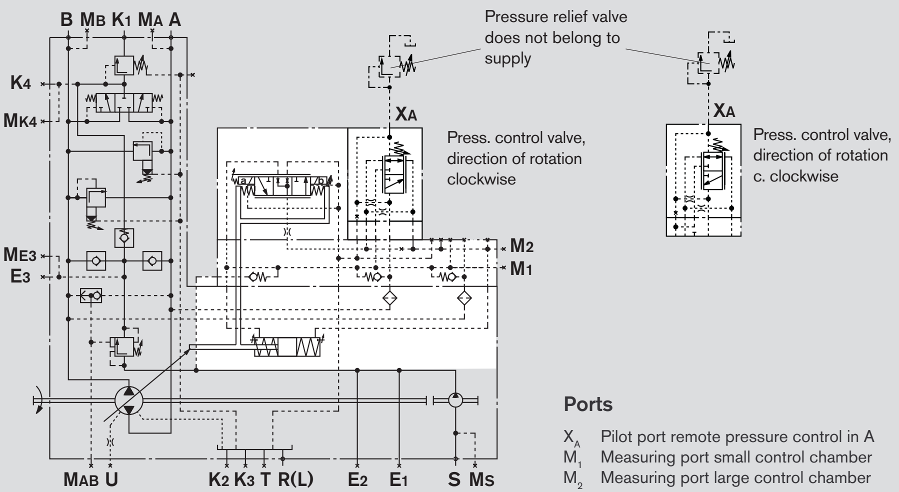
Circuit drawing sizes 250 and 355



Ports

X_A	Pilot port remote pressure control in A
M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

Circuit drawing sizes 500 and 750



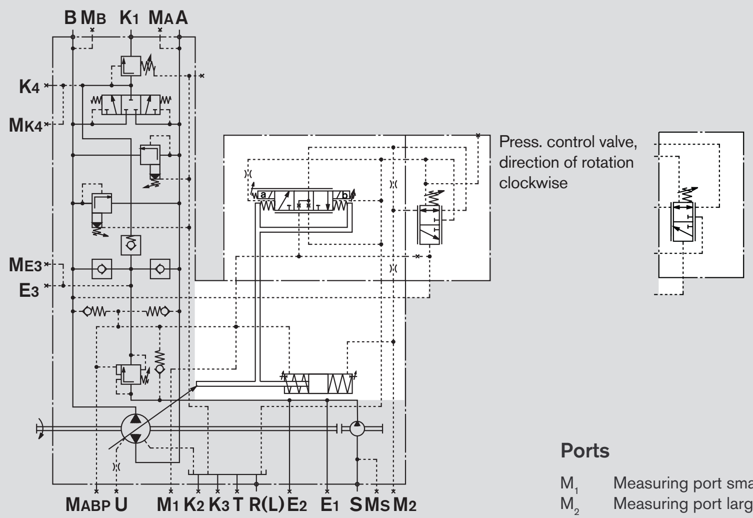
Ports

X_A	Pilot port remote pressure control in A
M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

EPB with pressure control in port B only

The pressure control valve regulates the pressure in port B.
Description see page 5.

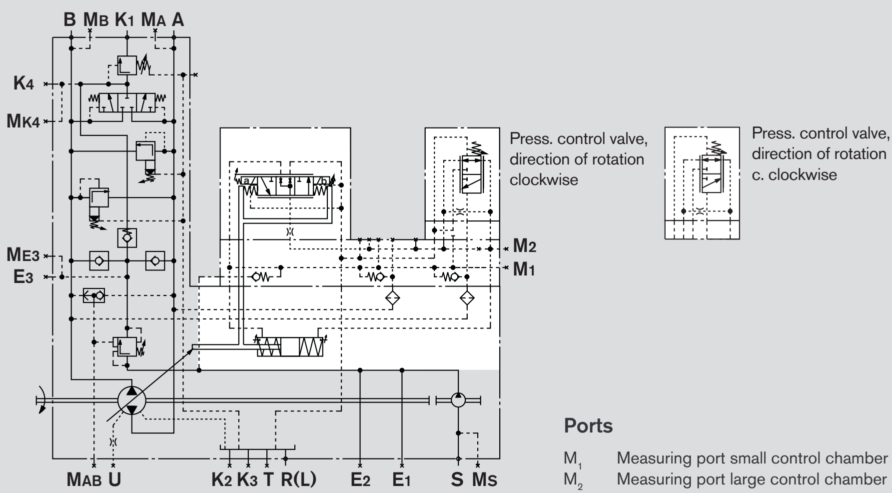
Circuit drawing sizes 250 and 355



Ports

M_1 Measuring port small control chamber
M_2 Measuring port large control chamber

Circuit drawing sizes 500 and 750



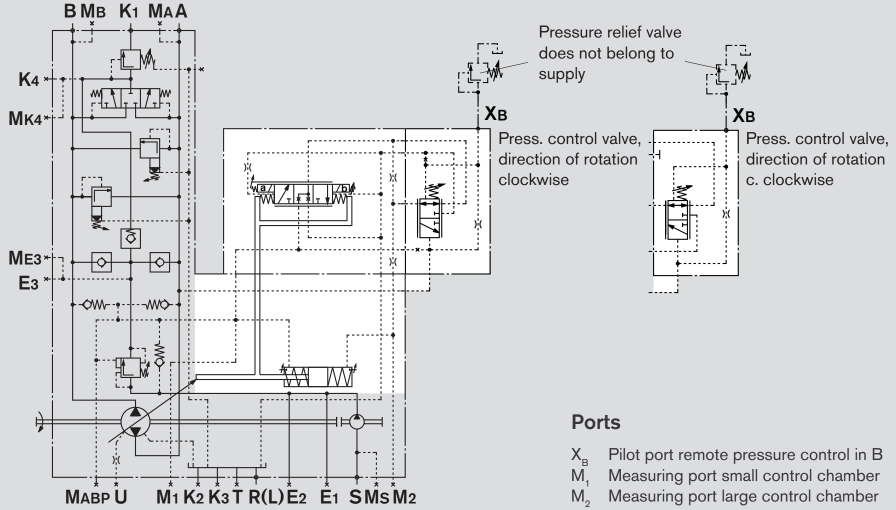
Ports

M_1 Measuring port small control chamber
M_2 Measuring port large control chamber

EPGB with remote pressure control in port B only

Remote setting of pressure control is accomplished via port X_B. The external relief valve does not belong to the supply. Description see page 5.

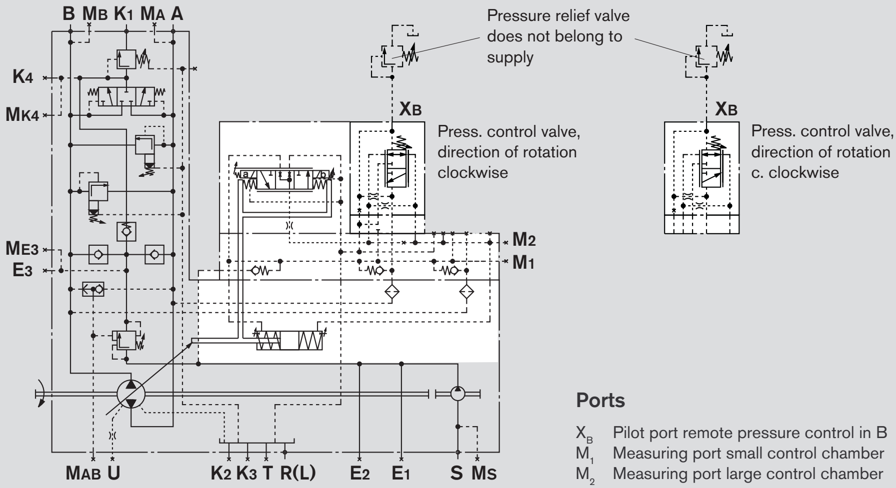
Circuit drawing sizes 250 and 355



Ports

X_B	Pilot port remote pressure control in B
M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

Circuit drawing sizes 500 and 750



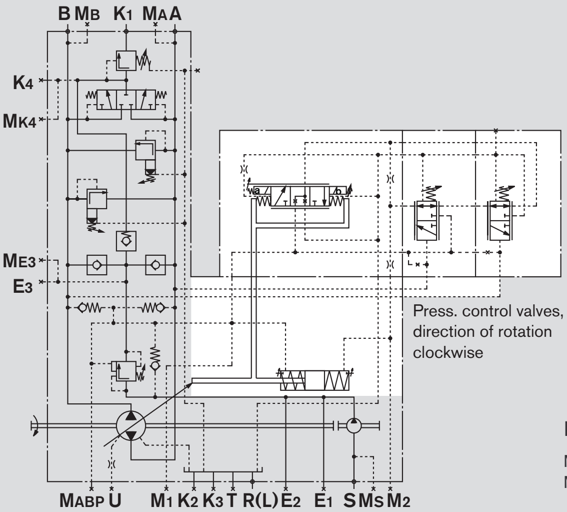
Ports

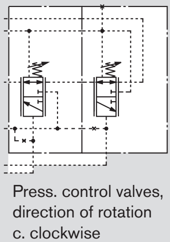
X_B	Pilot port remote pressure control in B
M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

EPD with pressure control in both ports A and B

Two pressure relief valves control the pressure independently in ports A resp. B.
Description see page 5.

Circuit drawing EPD sizes 250 and 355

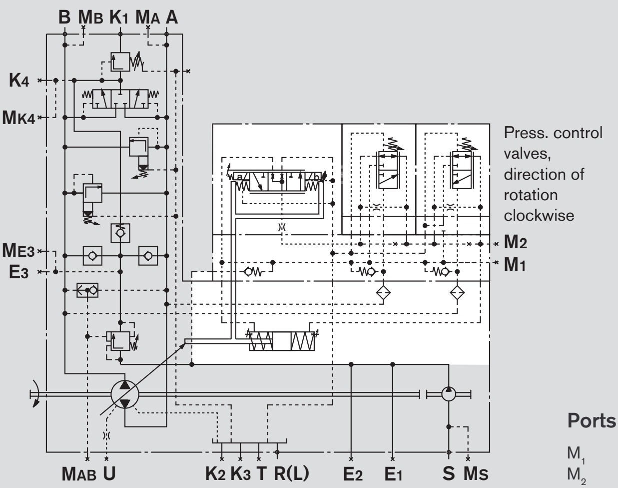


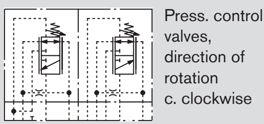


Ports

M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

Circuit drawing EPD sizes 500 and 750





Ports

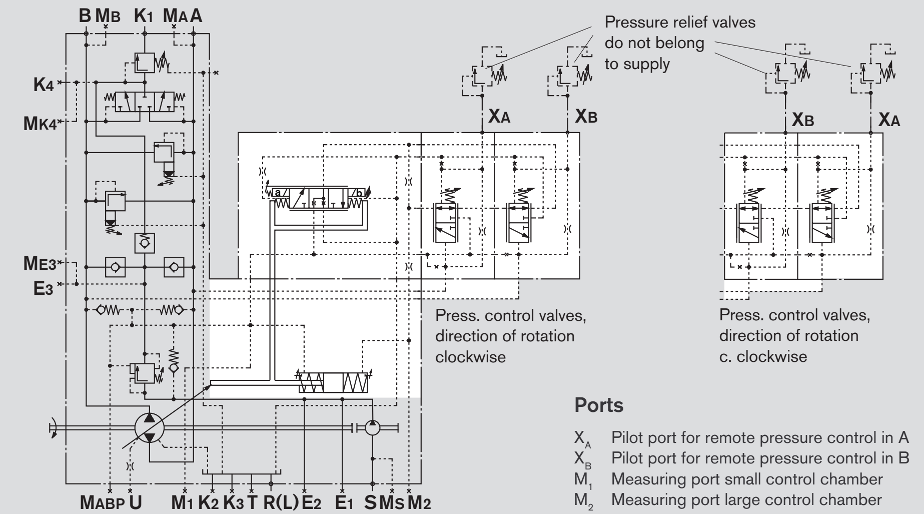
M_1	Measuring port small control chamber
M_2	Measuring port large control chamber

EPG with remote pressure control in both ports A and B

The remote setting of pressure is accomplished via ports X_A and X_B. The external relief valves do not belong to the scope off supply. Description see page 5.

2

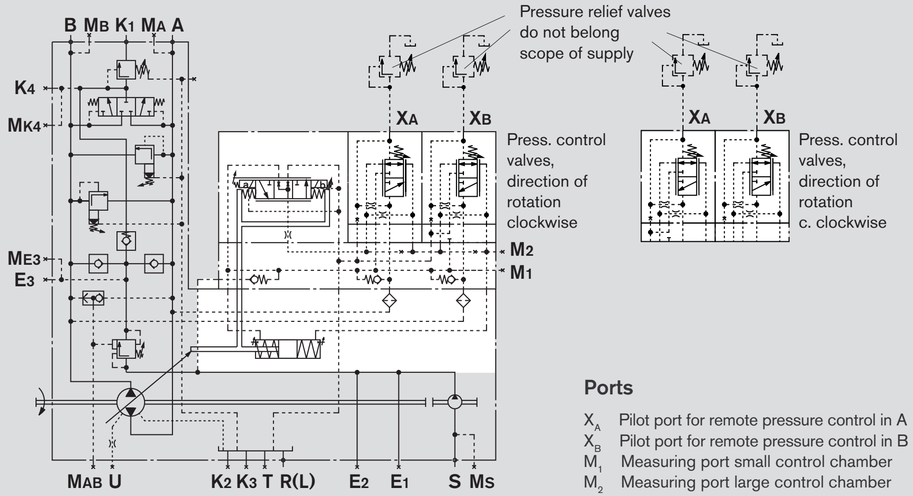
Circuit drawing EPG sizes 250 and 355



Ports

X_A Pilot port for remote pressure control in A
X_B Pilot port for remote pressure control in B
M_1 Measuring port small control chamber
M_2 Measuring port large control chamber

Circuit drawing EPG sizes 500 und 750



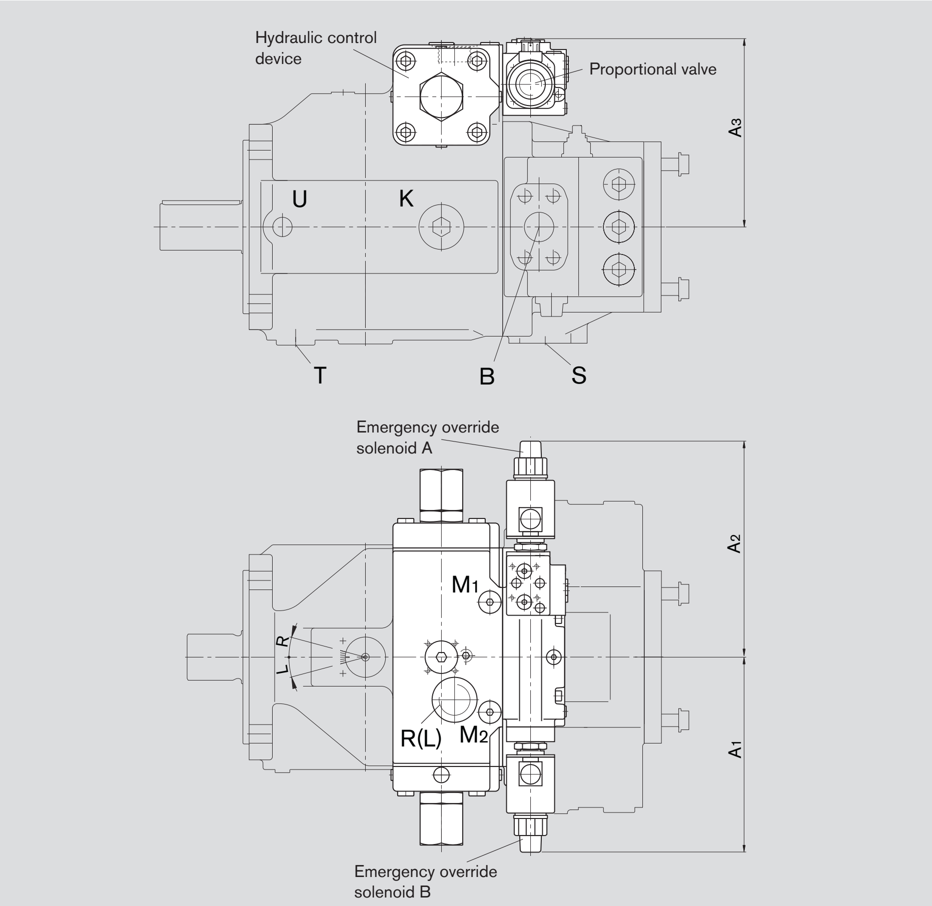
Ports

X_A Pilot port for remote pressure control in A
X_B Pilot port for remote pressure control in B
M_1 Measuring port small control chamber
M_2 Measuring port large control chamber

Unit dimensions EP

Before finalising your design please request a certified installation drawing.

Sizes 250 and 355



Unit dimensions

Size	A_1	A_2	A_3
250	252	279	243
355	252	279	243

For detailed dimensions and technical data see the main data sheets A4CSG RE 92105 or A4VSG RE 92100.

Ports

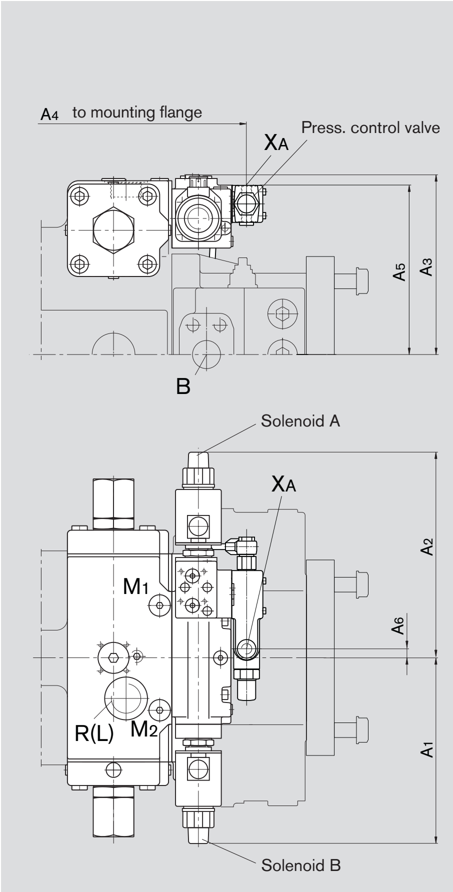
				max. tightening torque [1])
M_1	Measuring port small control chamber	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm
M_2	Measuring port large control chamber	DIN 3852	M18x1,5; 12 deep (plugged)	140 Nm

[1]) see safety information

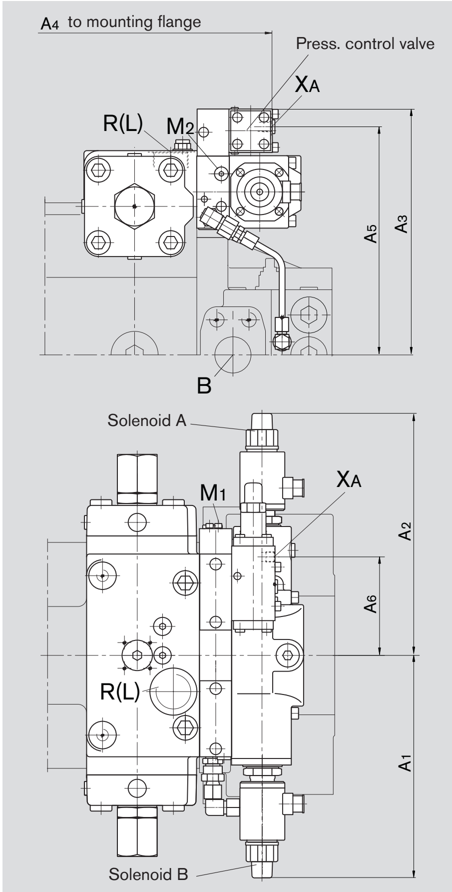
Unit dimensions EPA / EPGA

Before finalising your design please request a certified installation drawing.

Sizes 250 and 355



Sizes 500 and 750



Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6
250	252	279	243	428	228	13
355	252	279	243	428	228	13
500	306	332	342	469	315	136
750	315	332	372	501	345	136

For detailed dimensions and technical data of the variable pump see main data sheet A4CSG RE 92105 or A4VSG RE 92100.

Ports

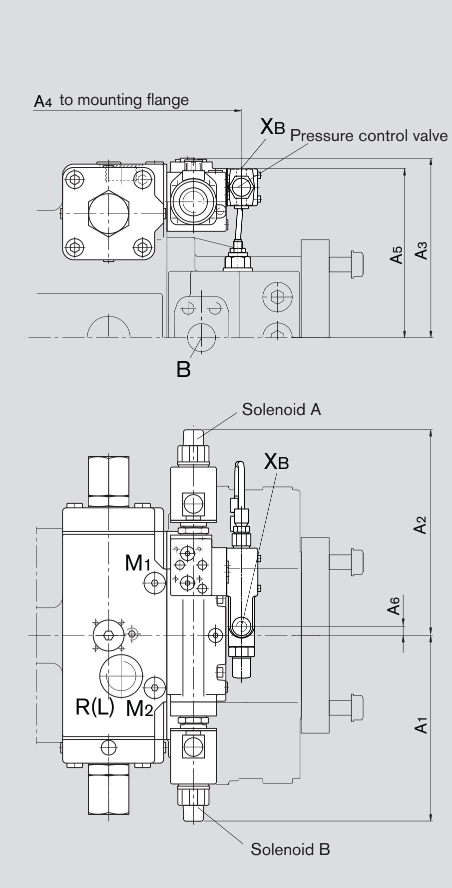
				max. tightening torque ¹)
X_A	Pilot port for remote pressure control in A	DIN 3852	M14x1,5; 12 deep (with EPA plugged)	80 Nm
M_1	Measuring port small control chamber	DIN 3852	M18x1,5; 12 deep ²) (Size 250 a. 355)	140 Nm
			M22x1,5; 14 deep ²) (Size 500 a. 750)	210 Nm
M_2	Measuring port large control chamber	DIN 3852	M18x1,5; 12 deep ²) (Size 250 a. 355)	140 Nm
			M14x1,5; 12 deep ²) (Size 500 a. 750)	80 Nm

¹) see safety information ²) plugged

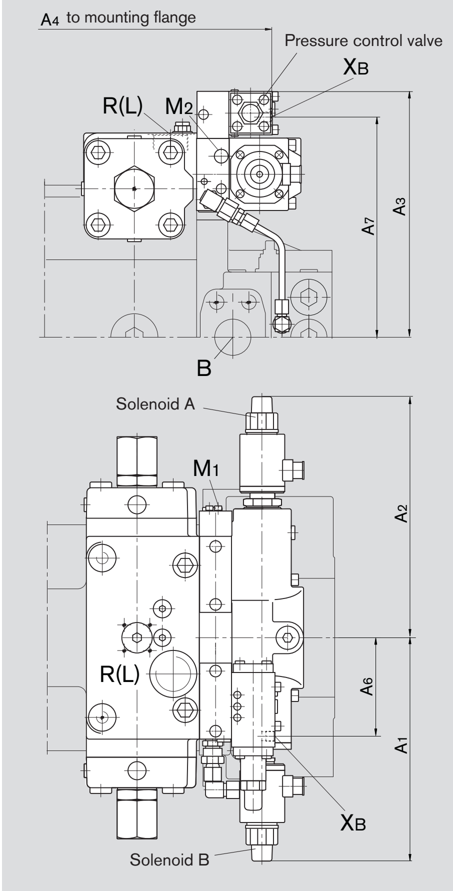
Unit dimensions EPB / EPGB

Before finalising your design please request a certified installation drawing.

Sizes 250 and 355



Sizes 500 and 750



Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7
250	252	279	243	428	228	13	–
355	252	279	243	428	228	13	–
500	306	332	342	469	–	136	304
750	315	332	372	501	–	136	304

For detailed dimensions and technical data of the variable pump see main data sheets A4CSG RE 92105 or A4VSG RE 92100.

Ports

				max. tightening torque [1])
X_B	Pilot port for remote pressure control in B	DIN 3852	M14x1,5; 12 deep (with EPB plugged)	80 Nm
M_1	Measuring port small control chamber	DIN 3852	M18x1,5; 12 deep [2]) (Size 250 a. 355)	140 Nm
			M22x1,5; 14 deep [2]) (Size 500 a. 750)	210 Nm
M_2	Measuring port large control chamber	DIN 3852	M18x1,5; 12 deep [2]) (Size 250 a. 355)	140 Nm
			M14x1,5; 12 deep [2]) (Size 500 a. 750)	80 Nm

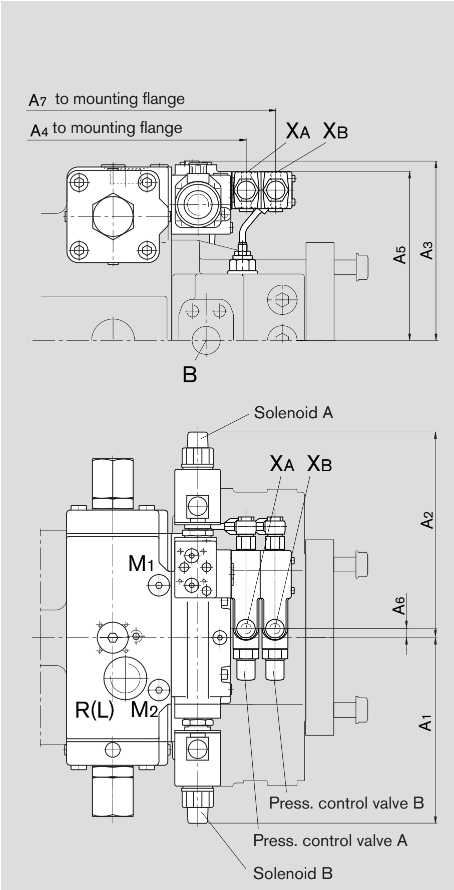
[1]) see safety information

[2]) plugged

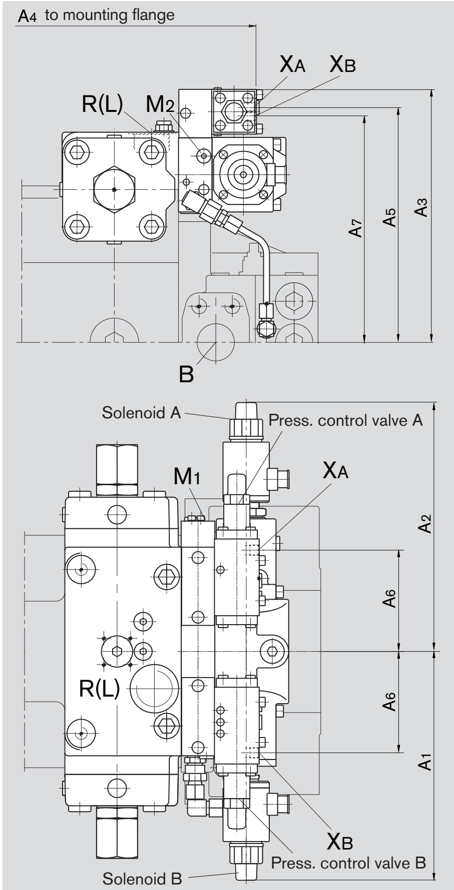
Unit dimensions EPD / EPG

Before finalising your design please request a certified installation drawing.

Sizes 250 and 355



Sizes 500 and 750



Unit dimensions

Size	A_1	A_2	A_3	A_4	A_5	A_6	A_7
250	252	279	243	428	228	13	468
355	252	279	243	428	228	13	468
500	306	332	342	469	315	136	304
750	315	332	372	501	345	136	334

Detailed dimensions and technical data of the variable pump see main data sheets A4CSG RE 92105 or A4VSG RE 92100.

Ports

				max. tightening torque [1])
X_A, X_B	Pilot ports for remote pressure control	DIN 3852	M14x1,5; 12 deep (with EPD plugged)	80 Nm
M_1	Measuring port small control chamber	DIN 3852	M18x1,5; 12 deep [2]) (Size 250 a. 355)	140 Nm
			M22x1,5; 14 deep [2]) (Size 500 a. 750)	210 Nm
M_2	Measuring port large control chamber	DIN 3852	M18x1,5; 12 deep [2]) (Size 250 a. 355)	140 Nm
			M14x1,5; 12 deep [2]) (Size 500 a. 750)	80 Nm

[1]) see safety information

[2]) plugged

Type of connector

Hirschmann-connector

to DIN EN 175301-803/ISO 4400

Type of protection IP 65

Male plug: to DIN EN 175 301–803/ISO 4400 with screwed connection for cable joint M16x1,5 for cable ø 4,5...10mm does not belong to supply of EP, is available however under the following Rexroth Material-Nr.: R902602623 (black)
or R902602622 (grey)

Safety information

– The pump A4V(C)SG was designed for operation in closed circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques: all max. tightening torques, mentioned in this data sheet are maximum values and cannot be exceeded (they represent the max. permissible value for the female threads in the castings)

For fastening screws to DIN 13 we recommend to check the permissible tightening torques in each individual case acc. to VDI 2230 dated 2003.

– **Warning-high temperature hazard**

During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned!

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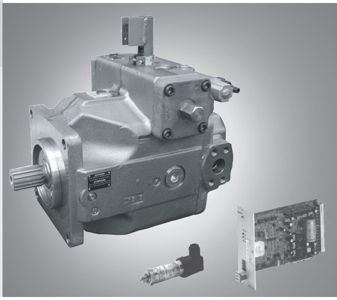
Electro-hydraulic Control system DFE1

RE 92 088/08.04 **1**/12
Additional to. RE 92 050

Technical data sheet

Size 125...355
Series 30
Nominal pressure 350 bar
Peak pressure 400 bar
open circuit



Contents

Type code - standard range	2
Components	4
Functional description	5
DFE1	6
DFE1Y	7
DFE1Z	8
Transition at jump in command input for swivel angle	9
Quality of control	10
Unit dimensions	10
Safety information	11

Features

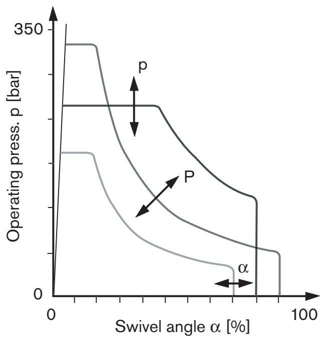
The DFE1 control system is used for the electro-hydraulic control of

– Pressure

– Flow

– Power (optional)

The control system is used together with the axial piston pump A4VSO in sizes 125, 180, 250, and 355 acc. to RE 92050.



Type code - standard range

Fluid/Version

	125	180	250	355	
Mineral oil (Without prefix)	●	●	●	●	
HF-Fluids	on request				E
High speed	-	-	●	●	H

Axial piston unit

Swashpate design, variable, industrial use 350 bar, peak pressure 400 bar	A4VS

Mode of operation

Pump, open circuit	O

Size

Displacement V_{gmax} [cm^3]	125	180	250	355

Type of control

Electronic pressure-flow control					
internal supply of control oil, swivel range -100% to +100%	●	●	●	●	DFE1
external supply of control oil, swivel range -100% bis +100%	●	●	●	●	DFE1Y
external supply of control oil, swivel range 0 bis +100%	●	●	●	●	DFE1Z

Series

	30

Direction of rotation

looking at shaft end	clockwise	R
	c. clockwise	L

Seals

NBR Nitrile-Rubber to DIN ISO 1629 (shaft seal in FKM)	P
FKM Fluoro-Rubber to DIN ISO 1629	V

Shaft end

Cyl. with key DIN 6885	P
Splined end DIN 5480	Z

● available
o in preperation
\- not available

	A4VS	O			/30	-			B	

- Fluid/Version
- Axial piston unit
- Mode of operation
- Size
- Type of control
- Series
- Direction of rotation
- Seals
- Shaft end

Mounting flange

ISO 4-hole	**B**

Port for service lines

Pressure port B, Inlet port S: SAE on side 90° offset, fixing screws metric	**13**
Pressure port B, Inlet port S: SAE on side 90° offset, fixing screws metric 2. Press. portB_1 opposite B-, on delivery closed with blanking plate	**25**

Through drive

			125	180	250	355	
Without through drive			●	●	●	●	**N00**
Flange ISO	Coupler for splined shaft DIN 5480	Seal					
125, 4-hole	32x2x30x14x9g	radial	●	●	●	●	**K31**
140, 4-hole	40x2x30x18x9g	radial	●	●	●	●	**K33**
160, 4-hole	50x2x30x24x9g	radial	●	●	●	●	**K34**
224, 4-hole	60x2x30x28x9g	radial	-	-	●	●	**K35**
224, 4-hole	70x3x30x22x9g	radial	-	-	-	●	**K77**
Flange SAE J744	Coupler for splined shaft	Seal					
82-2 (A)	5/8 in (A)	radial	●	●	●	●	**K01**
82-2 (A)	3/4 in (A-B)	radial	●	●	●	●	**K52**
101-2 (B)	7/8 in (B)	axial	●	●	●	●	**K02**
101-2 (B)	7/8 in (B)	radial	●	●	●	o	**K68**
101-2 (B)	1in (B)	radial	●	o	●	●	**K04**
127-2 (C)	1 1/4 in (C)	radial	o	o	o	o	**K07**
127-2 (C)	1 1/2 in (C-C)	axial	●	●	●	o	**K24**
152-4 (D)	1 3/4 in (D)	axial	-	o	o	o	**K17**
with through dr. shaft,without coupler,without adapter flange,closed with cover			●	●	●	●	**K99**

Combination pumps

If a second Rexroth pump is to be factory mounted, then both type codes are to be connected wit a „+" . Type code 1. Pump **+** Type code 2. Pumpe

Example: A4VSO 250 DFE1/30R - PPB13K34 **+** A4VSO 125 DFE1/30R - PZB13N00

If an auxiliary pump is to be factory mounted , please contact us.

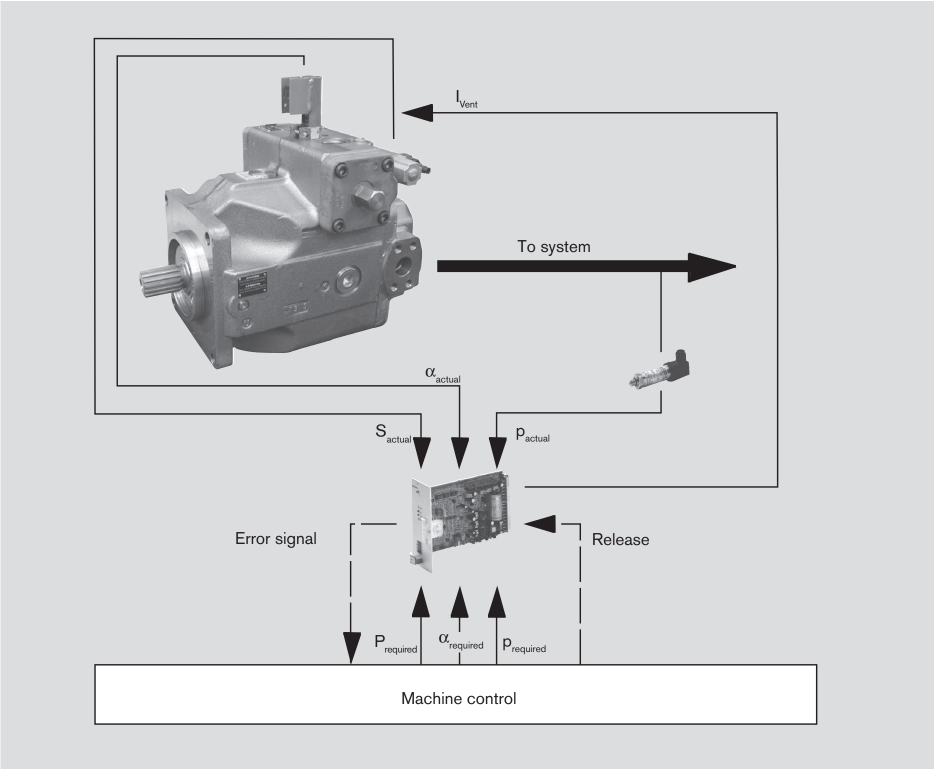
Components

The controlsystem DFE1 comprises the following components:

– Well proven high pressure axial piston pump A4VSO in swashplate designfor use in heavy duty industrial applications
– Proportional valve VT-DFP-A-2X for exact control with feed back of valve spool position (see RE 29 016)
– Inductive displacement transducer for feedback of swashplate angle
– Pressure transducer HM 12-1X for feedback of system pressure to RE 29 933 (optional, only required with pressure and power control functions, please order separately)
– Analog amplifier VT 5041-2X to RE 30 240 (please order separately)

The system contains the following features:

– Pump combinations are posible
– Control pressure internal or external via pilot pump (see page 7 and 8)
– Fast decompression of trapped fluid by letting the pump go over center as a standard (see page 6)
– Rotary group optimised for long life in standby operation



Functional description

The power,pressure and displacement control of pump A4VSO-DFE1 is accomplished by means of an electro-proportional control valve (4). A current to the proportional valve results in an oil flow to the pump's control piston (2), which determines via the displacement transducer (3) the swashplate angle (1) and thus the pump flow.

With the pump in standstill, and the control system without pressure, the bias spring will push the pump to max. displacement (V_{gmax}).

Standby pressure (DFE1):

With a de-energized proportional valve and a closed pump outlet the pump will go to V_{gmin} - Standby pressure.In this condition the pressure level will reach 4 to 8 bar. The same applies also in case of an error signal or missing control release.

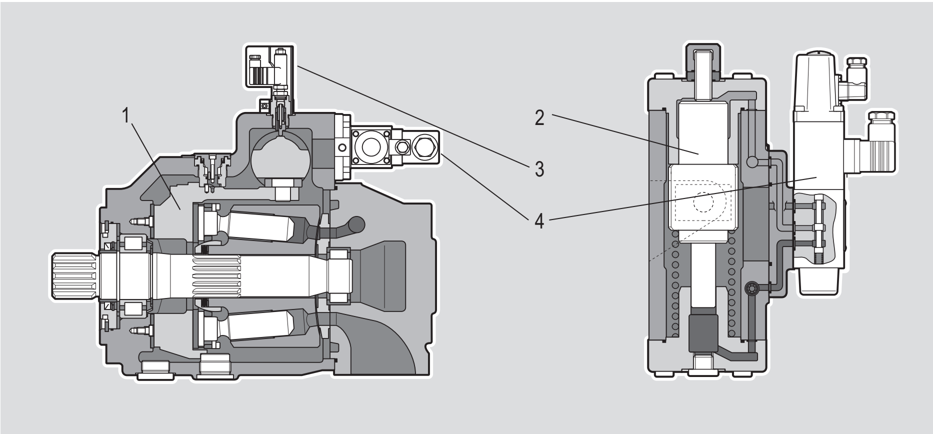
If the standby pressure of 4 to 8 bar is not desired, it is possible to use type DFE1Y, or DFE1Z .

The necessary oil to operate the hydraulic control system can be supplied in two different ways:

1. Internal (DFE1) from own pump outlet (page 6)
2. External (DFE1Y, DFE1Z) from separate system (page 7/8)

The proportional valve is controlled with amplifier card VT 5041-2X. This card processes all control signals which are necessary to operate pump A4VSO.DFE1 Standard are input signals for pressure and swivel angle as well as an optional signal for power control. The actual value for pressure is picked up by a pressure transducer. A displacement transducer picks up the actual pump swivel angle. The amplifier card compares these actual values with the command inputs. A minimum value generator assures the activation of the appropriate controller. The output signal of this generator is used as the input signal to the proportional valve solenoid. In order to achieve a better quality of control, the proportional valve operates as a secundary control loop.

2



DFE1

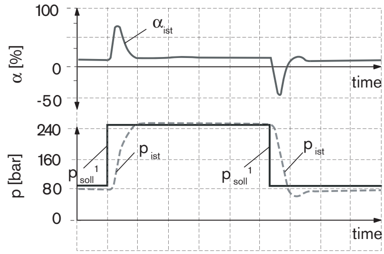
Control oil supply internal,
Swivel range -100% to +100%

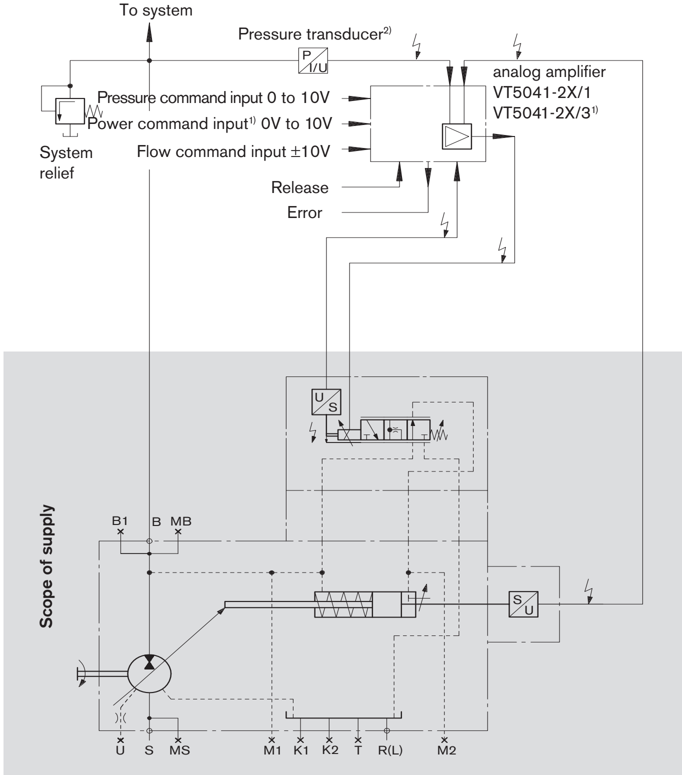
With DFE1 the control energy is taken out of the main pump flow. The min. pressure must be at least 4 to 8 bar. (see also point „Standby pressure“on page 5 and „Fail safe feature“) This min pressure is necessary for the control of flow, pressure and power. Below this pressure, the pump tends to go to max. displacement regardless of the input signals.

As a special feature the pump is able to change the direction of flow.This capability to swivel over center enables a fast de-compression of trapped oil volume.

Fail safe feature

Below 4 to 8 bar the pump will stroke to larger displacement; an undesired operation with negative flow cannot occur.





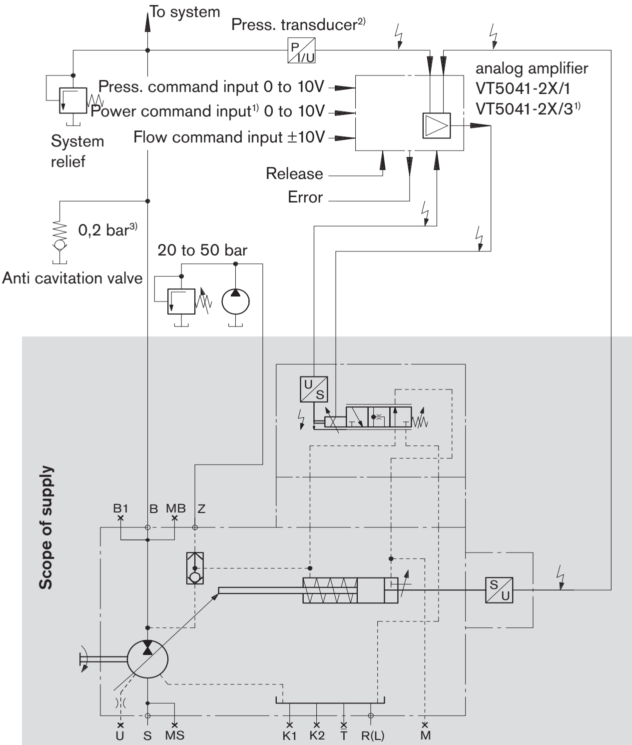
1) optional, power limiting
2) only needed with pressure resp. power control

DFE1Y

External supply of control oil,
Swivel range -100% to +100%

With DFE1Y the control energy has to be supplied externally, eg. a gear pump. An automatic change-over to internal supply is accomplished by means of a shuttle valve.

This control version features a reversal of the direction of flow, also at pressures below 4 to 8 bar. This option enables a fast decompression of trapped oil volume by swiveling over center.



Caution!

– In the case of an externally supplied control system (Swivel range ± 100%), the function, which swivels the pump to zero stroke when the output stage of the control card is de-energized is inactive.

– In the case of a de-energized output stage of the control card (e.g. in case of an error), the external control pressure pushes the variable pump's swashplate to the negative limit stop (100% flow is delivered from the system to the tank). In order to avoid cavitation the use of a checkvalve (anti cavitation valve with 0,2 bar spring) is required.

– When an error is detected, the output stage switches off and the external supply causes the pump to swivel towards the negative limit stop. Upon detection of an error message, it is essential that the machine control responds (e.g drive motor of the pump must be switched off, external supply of the control system must be interrupted).

– The command values for pressure and flow must always be greater than zero ($p_{comm} \geq$ 3bar, $\alpha_{comm} \geq$ 5%), since, due to drift or inaccurate control, there is no exact “zero“ pressure or “zero“ swivel angle. Under unfavourable conditions, smaller command values can cause cavitation.

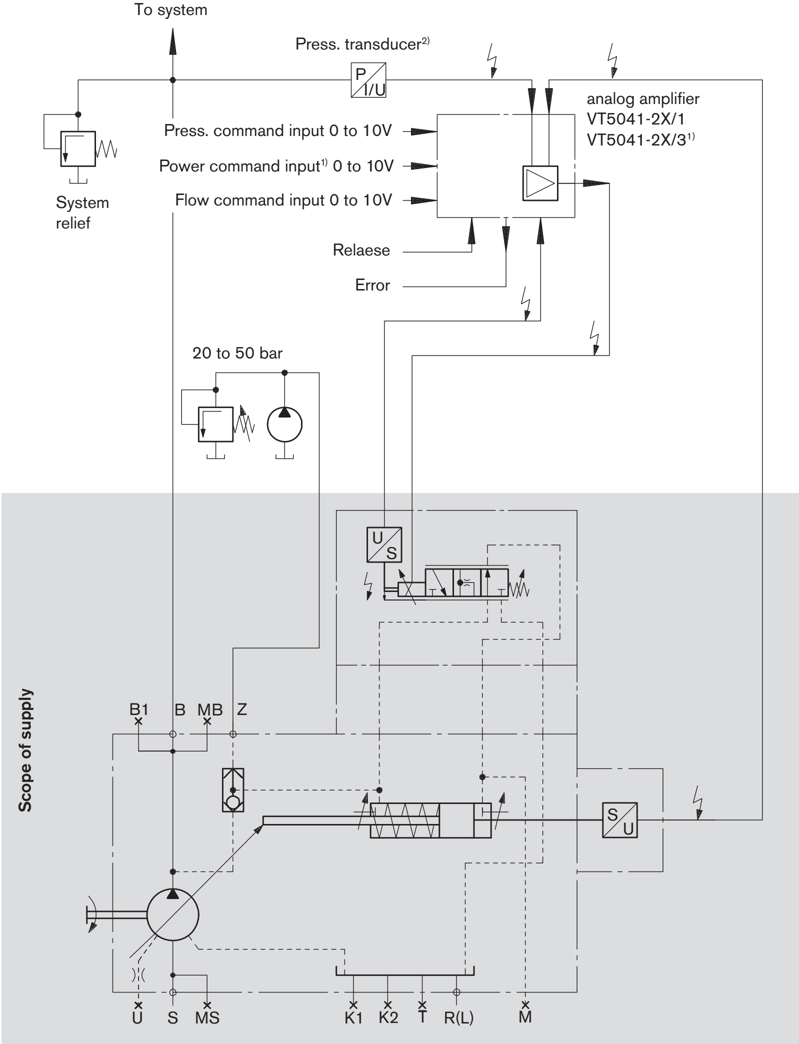
[1] optional, Power limiting
[2] only needed with press. resp. power control

DFE1Z

Control oil supply external, swivel range 0 to 100%

Version DFE1Z has an input port for external supply of control flow, e.g. from a gear pump. The DFE1Z control offers a Q_{min}-limiting screw which prevents the unit from going over center.

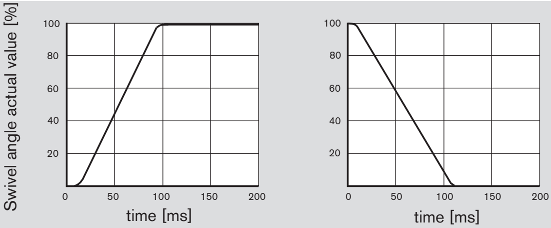
Therefore, the option of fast decompression of trapped oil volume does not exist with this version.



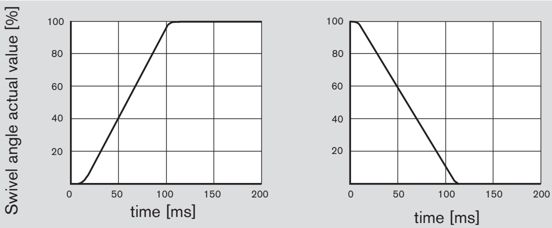
1) optional, power limiting
2) only needed with press. resp. power control

Transition at jump in command input for swivel angle

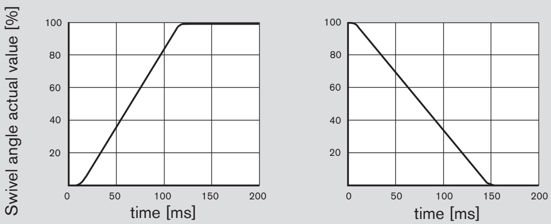
Size 125, p = 100 bar



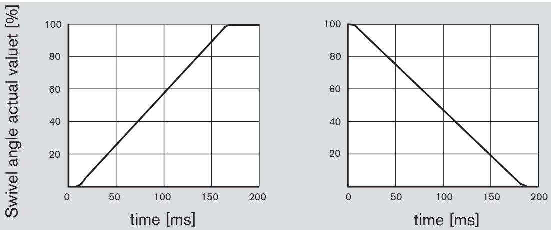
Size 180, p = 100 bar



Size 250, p = 100 bar



Size 355, p = 100 bar



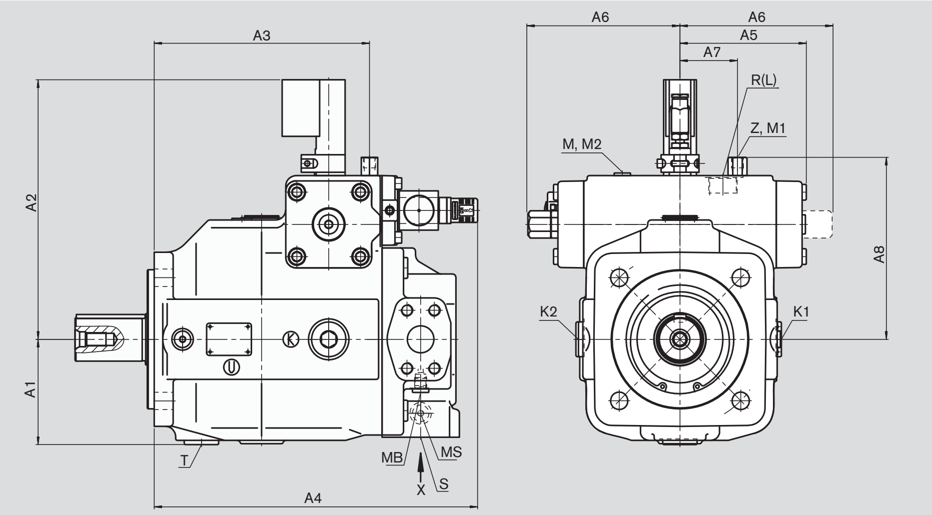
Quality of control

	Swivel angle control	Pressure control
Linearity tolerance	≤ 1,0%	≤ 1,5%
Hysteresis	≤ 0,2%	≤ 0,2%
Repeatibility	≤ 0,2%	≤ 0,2%

(The above values are only valid when using the appropriate components acc. to the ordering code)

Unit dimensions

Sizes 125 to 355 (Shown: size 125 in clockwise rotation)



Size	A1	A2	A3	A4	A5	A6	A7	A8
125 [mm]	121	298	250,5	376	147	177	50	209
180 [mm]	121	298	250,5	376	147	177	50	209
250 [mm]	154	345	310,5	438	212	179	55	259
355 [mm]	154	345	310,5	464	212	179	55	259

Ports		125	180	250	355
Z	Control press. port	M14x1,5	M14x1,5	M14x1,5	M14x1,5
B	Pressure port [in]	$1^1/_4$	$1^1/_4$	$1^1/_2$	$1^1/_2$
T	Case drain	M33x2	M33x2	M42x2	M42x2
MB	Gauging port system pressure	M14x1,5	M14x1,5	M14x1,5	M14x1,5
MS	Gauging port inlet pressure	M14x1,5	M14x1,5	M14x1,5	M14x1,5
S	Inlet port [in]	$2^1/_2$	3	3	4
K1, K2	Flushing port	M33x2	M33x2	M42x2	M42x2
R(L)	Oil fill or bleed port	M33x2	M33x2	M42x2	M42x2
M1, M2	Gauging port control pressure	M14x1,5	M14x1,5	M18x1,5	M18x1,5

Safety information

– Pump A4VSO was designed for operation in open loop circuits.

– Systems design, installation and commissioning require trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

–Tightening torques:
The tightening torques mentioned in this data sheet are maximum values and must not be exceeded (max. values for thread). Manufacturers information concerning the maximum permitted tightening torques of the various fittings are to be observed! For DIN 13 mounting bolts, we recommend that tightening torques be checked on a case by case basis in accordance with VDI 2230, published 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned!

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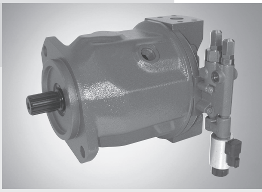
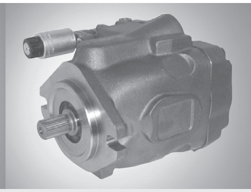
Differential pressure control, electrically adjustable

RE 92 709/05.04 1/8

open circuit



A10V(S)O...EFx.../31



A10VO...EFx.../53

for variable pump
A10V(S)O series 31
A10VO series 53

Contents

Ordering code - standard range, series 31 2
Ordering code - standard range, series 53 3
Differential pressure control, electrically adjustable 4
Differential pressure control, electrically adjustable 5
Unit dimensions, series 31 6
Unit dimensions, series 53 7
Connector options and electronic controls 8
Safety information 8

Features

- Electro-proportional differential pressure control, current dependent
- High control accuracy
- Fail safe behaviour, e.g. for operation of brake or steering functions
- Use of standard amplifiers possible
- Compact design

Applications

- More resolution in fine metering range
- Provides easy control of max. flow
- Enables speed sensing power control
- Damping-end of cylinder travel

Further information:

Variable pump A10VSO/31	size 18...140	RE 92 711
Variable pump A10V(S)O/31	size 18...140	RE 92 701
Variable pump A10VO/53	size 10...85	in preparation

Ordering code - standard range, series 31

A10V(S)O...EFx series 31

A10V(S)	O		/31	-					

see RE 92 711
RE 92 701

Axial piston unit

Swashplate design, variable, nom. pressure 280 bar, peak pressure 350 bar	**A10V(S)**

Mode of operation

Pump, open circuit	**O**

Size, resp. displacement V_{gmax} [cm^3]

A10VO series 31	**–**	**28**	**45**	**71**	**100**	**140**
A10VSO series 31	**18**	**28**	**45**	**71**	**100**	**140**

Control devices

Pressure-flow control														
12V	EF	1	D		F			o	●	●	●	●	–	**EF1DF**
24V	EF	2	D		F			o	●	●	●	●	–	**EF2DF**
Pressure-flow control, no connection between X-T														
12V	EF	1	D		S			o	●	●	●	●	–	**EF1DS**
24	EF	2	D		S			o	●	●	●	●	–	**EF2DS**

Series

	31

Connector design

Deutsch-connector, permanently moulded	●	●	●	●	●	●	**P**

● available

o in preparation

\- not available

Ordering code - standard range, series 53

A10VO...EFx(LAx) series 53

A10V	**O**		**/53**	**-**						

Data sheet in preparation

Axial piston unit													
Swashplate design, variable, nom. pressure 250 bar, peak pressure 315 bar													**A10V**
Mode of operation													
Pump, open circuit													**O**
Size, resp. displacement V_{gmax} [cm^3]													
A10VO series 53									**28**	**45**	**63**	**85**	
Control devices													
Pressure-flow control													
12V	EF	1	D		F				●	o	●	●	**EF1DF**
24V	EF	2	D		F				●	o	●	●	**EF2DF**
Pressure-flow control, no connection between X-T													
12V	EF	1	D		S				●	o	●	●	**EF1DS**
24	EF	2	D		S				●	o	●	●	**EF2DS**
Pressure-flow-torque control, no connection between X-T													
12V beginning of control at 10...35 bar	LA	5			S		1		o	o	o	o	**LA5S1**
36...70 bar	LA	6			S		1		o	o	o	o	**LA6S1**
71...105 bar	LA	7			S		1		o	o	o	o	**LA7S1**
106...140 bar	LA	8			S		1		o	o	o	o	**LA8S1**
141...230 bar	LA	9			S		1		o	o	o	o	**LA9S1**
24V beginning of control at 10...35 bar	LA	5			S		2		o	o	o	o	**LA5S2**
36...70 bar	LA	6			S		2		o	o	o	o	**LA6S2**
71...105 bar	LA	7			S		2		o	o	o	o	**LA7S2**
106...140 bar	LA	8			S		2		o	o	o	o	**LA8S2**
141...230 bar	LA	9			S		2		o	o	o	o	**LA9S2**
Series													
													53
Connector design													
Deutsch-connector, permanently moulded									●	●	●	●	**P**

● available

o in preparation

\- not available

2

Differential pressure control, electrically adjustable

This control is based on a pressure-flow controller (see RE 92 701 or RE 92 711 for series 31, data sheet for series 53 in preperation).

In addition to the pressure control, the flow control function enables an adjustment of the pump output flow to match the actual required flow of the hydraulic user through a controlled differential pressure over an orifice (e.g. valve opening) between pump and hydraulic user.

With the differential pressure control it is possible to reduce the pressure difference by 10 bar via a solenoid onto the pump control valve. To control the solenoid force a PWM signal is used (pulse width modulation).

The electrically adjustable differential pressure control enables the following functions:

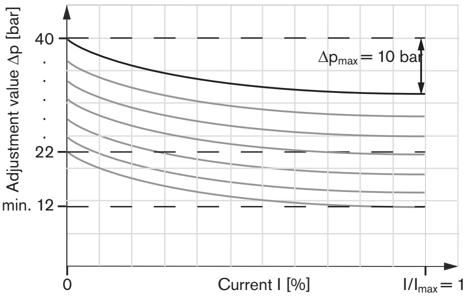
– Wider range of fine control for delicate movements

– Adaptation of max. flow for each user

– Use as speed sensing power control

– Damping at end of cylinder travel

Characteristic of differential pressure control



On delivery the Δp value is set at 35 bar. If another setting is required please state in clear text.

With the valve in the pump outlet closed, the X-port connected to the tank, and the solenoid de-energized the pump outlet will show a standby pressure value dependent on the Δp-setting. This standby pressure will be approx. 3 bar higher than the Δp-setting.

Example:

With a Δp-setting of 25 bar, the standby pressure level will be around 28 ± 2 bar.

Important:

With max. current to the solenoid the differential pressure Δp may not fall below 12 bar.

Technical data - electrical

Version	EF1.../LA...1	EF2.../LA...2
Operating voltage	12V – 20%	24V – 20%
Control range	0–1200 mA	0–600 mA
Nominal resistance at 20°C (R_{20})	5,5Ω	22,7Ω
Limit current at U_{max}	1,54 A	0,77A
Max. duty cycle	100 %	
Operating temperature range (valve)	-20°C to + 115°C	
Ditherfrequency for PWM signal	100 – 200 Hz	
Solenoid class of material	H (Tmax = 180°C)	

Calculation formula for resistance

at T > 20 °C

$$R_W = \frac{R_{20} \cdot (235 + T)}{255}$$

Warning - avoid being burned:

The pump and especially the valve will be extremely hot during and after operation!

Wear appropriate protection.

Differential pressure control, electrically adjustable

Basic controller A10V(S)O...EFx series 31

The controller is based on a pressure-flow control (see also RE 92 701 or RE 92 711).

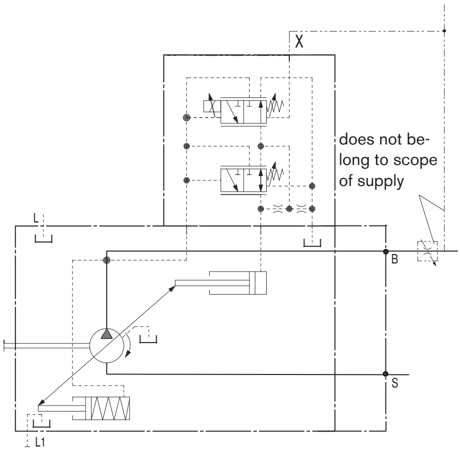
Basic controller A10VO...EFx series 53

The controller is based on a pressure-flow control (see also data sheet A10VO/53, in preparatiom).

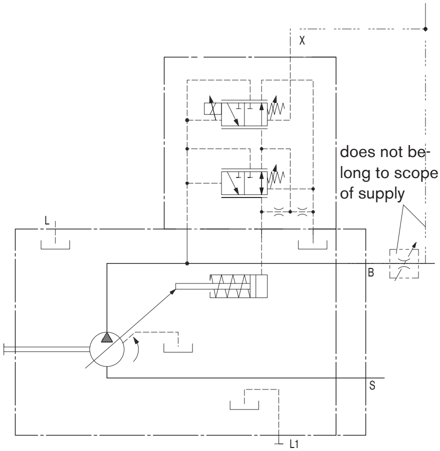
Dynamic characteristic – change in solenoid current (command value)

Measured values to this characteristic are available upon request.

Circuit drawing A10V(S)O...EFx series 31



Circuit drawing A10VO...EFx series 53



Connetions

B	Pressure port
S	Inlet port
L, L_1	Case drain port (L_1 plugged)
X	Pilot pressure port

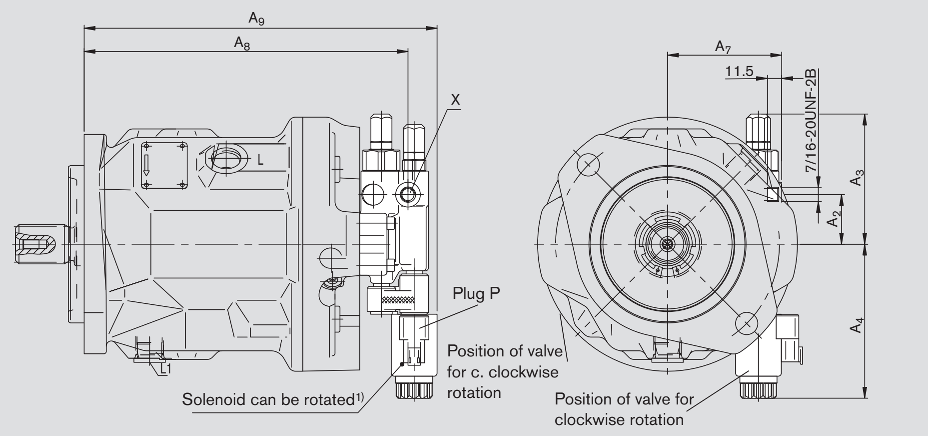
Control data

See RE 92 701 or RE 92 711 for A10V(S)O series 31. Data sheet for A10VO series 53 in preparation.

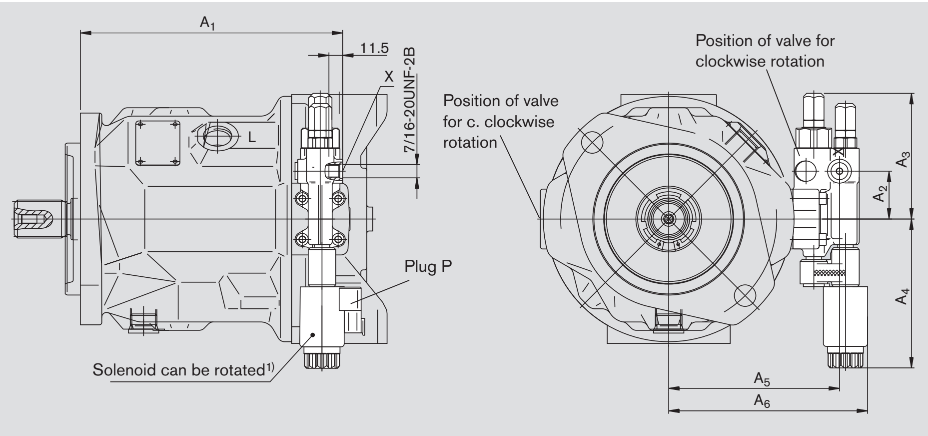
Unit dimensions, series 31

Before finalising your design please request a certified installation drawing.

Ports at rear - version 11N00



Ports on side - version 12N00



size	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9
18	166	40	105	124	109	133	–	–	–
28	176	40	105	124	119	142	74	209	232
45	192	40	105	124	129	153	82	228	251
71	220	40	105	124	143	167	93	262	285
100	286	40	105	124	148	172	100	327	350

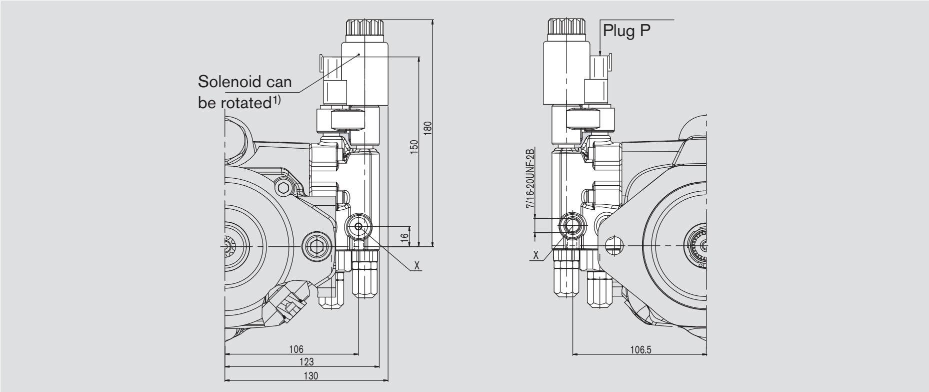
Detailed unit dimensions and technical data of the pumps can be found in the main catalogs RE 92 701 (A10VO) and RE 92 711 (A10VSO).

1) The orientation of the plug is optional by rotation of the solenoid. After rotation the plastic cap must be re-tightened again with 5^{+1} Nm torque.

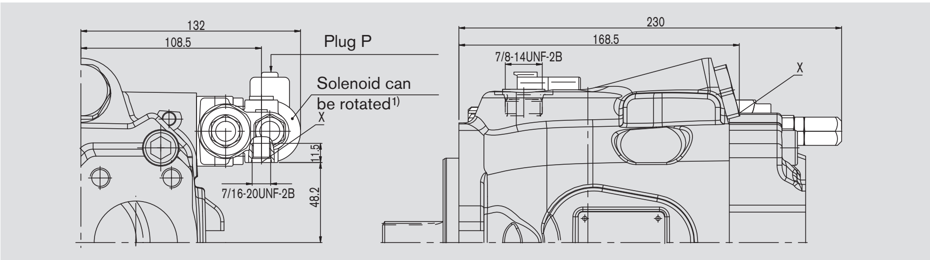
Unit dimensions, series 53

Before finalising your design please request a certified installation drawing.

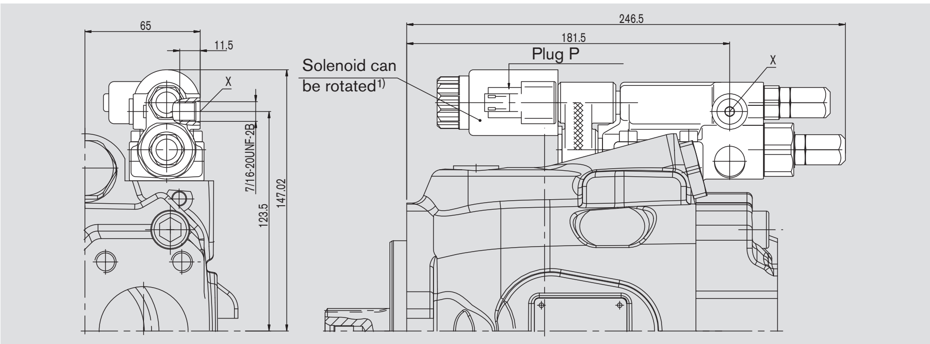
Size 28



Size 63



Size 85



Detailed unit dimensions and technical data of the pumps can be found in the main catalog (in preparation).

1) The orientation of the plug is optional by rotation of the solenoid. After rotation the plastic cap must be re-tightened again with 5^{+1} Nm torque.

Connector options and electronic controls

Connectors

Option P

Deutsch-connector DT 04-2P permanently moulded

Protection class IP 69K

Male plug: DT 06–2S–EP04[1)]

Rexroth material no.: 02601804

Electronic controls

Control	electronic function	Electronics		Further infromation
Electric pressure control	Regulated current output	PV	analog	RF 95 023
		VT2000	analog	RF 29 904
		RC2-2[2)]	digital	RF 95 200

1) Male plugs not included in scope of supply. Available upon request.
2) Current outputs for 2 valves, seperately controllable.

Safety information

– Pump A10V(S)O was designed for operation in open loop circuits.

– Systems design, installation and commissioning require trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques:
The tightening torques mentioned in this data sheet are maximum values and must not be exceeded (max. values for thread).
Manufacturers information concerning the maximum permitted tightening torques of the various fittings is to be observed!
For DIN 13 mounting bolts, we recommend that tightening torques be checked on a case by case basis in accordance with VDI 2230, published 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned!.

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Mobile Hydraulics
Product Segment Axial Piston Units
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72160 Horb a.N., Germany
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Telefax +49 (0) 74 51 - 82 21
info.brm-ak@boschrexroth.de
www.boschrexroth.com/axial-piston-pumps

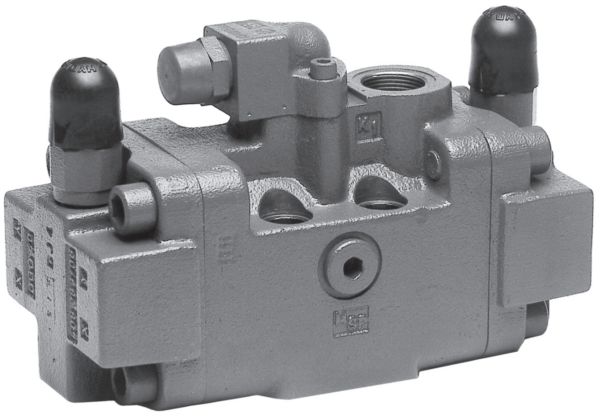
Rexroth
Bosch Group

Scavenging and Pressure Relief Valve Block SDVB

Control Elements of the A4VSG and A2P

RE
95533/03.96

Replaces 01.82



The scavenging and pressure relief valve block serves to maintain the feed pressure, to exhaust excess oil and to limit the operating pressure in a closed hydraulic circuit.
Both service ports A and B can be pressurised with high or low pressure as required. The high pressure controlled scavenging spools ensure that upon changeover of the gigh and low pressure sides the scavenging valve is connected to the low pressure side.
Pilot operation of the double acting pressure relief valves allows simple setting, with minimum force, of the required pressure value for both pressure sides of the circuit. These settings may be carried out independent of one another. On sizes 30 and 50, remote control is also possible via external pilot oil connections (X and Y). When the relief valves are actuated, oil flows from the high pressure to the low pressure side.

The set pressure value corresponds to the pressure drop between high and low pressure side. This valve type is extremely compact in relation to its flow capacity.
The SDVB can also be used as a double-acting pressure relief valve. When used as a relief valve, the supply line to the scavenging valve is closed.
By means of independently or direct mounted unloading valves, the pilot valves can be connected externally with the tank or internally with the low pressure side. With this function the SDVB 30 and 50 can serve as a bypass valve. For high dynamic swivel operations with flushing and pressure relief valve block SDVB, when changing the high pressure side there will be free flow between A and B for a short time. Direct operated valve blocks are suitable for this application and are available in sizes 16 and 30 on request.

Ordering code

SDVB				/				

Description

scavenging and pressure relief valve block piloted	**SDVB**

Size

size 16	**16**
size 30	**30**
size 50	**50**

Model (see unit dimensions)

without direct operated flushing valve	without pre-load valve	**N**
with direct operated flushing valve	without pre-load valve	**S**
with direct operated flushing valve	without pre-load valve	**T***
without direct operated flushing valve	with pre-load valve	**V**
with direct operated flushing valve	with pre-load valve	**W**
with direct operated flushing valve	with pre-load valve	**Z***

* Model T and Z only for SDVB 16 (in prep.) and SDVB 30

Control type

pilot oil supply	pilot oil drain	unloading with	unloading without	
internal	internal		●	**1**
internal	external		●	**2**
external	internal		●	**3**
external	external		●	**4**
internal (de-energised when closed)	external	●		**5[1])**
internal with external pilot ports X-Y (plugged)	internal		●	**6**
internal (de-energised when open)	external	●		**7[1])**

[1]) both solenoids must be operated simultaneously

Model of port plate

port plate M 33	**A**
port plate M 42	**B**
port plate M 48	**C**
port plate SAE 1 1/2"	**D**
without port plate	**N**

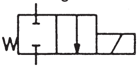
Series

	20	**30**

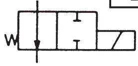
30 – SDVB 16
20 – SDVB 30/50

Symbols for control type 5

de-energised when closed **A**



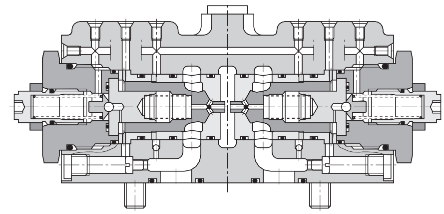
open **B**

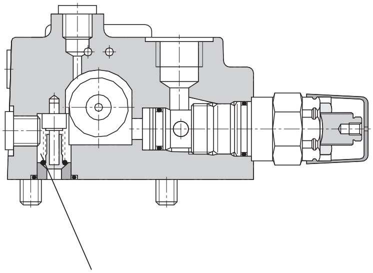


Voltages types for control type 5

12 V DC voltage - A closed	**1**
24 V DC voltage - B open	**2**
110-R AC voltage	**3**
220-R AC voltage	**4**
220-50 AC voltage	**5**

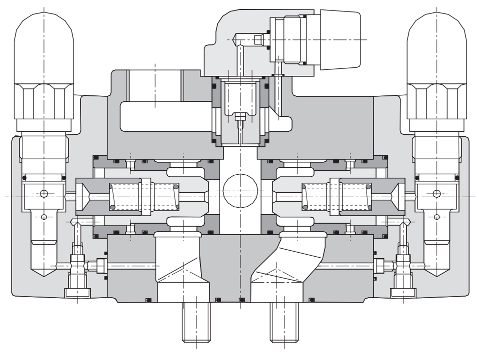
Construction

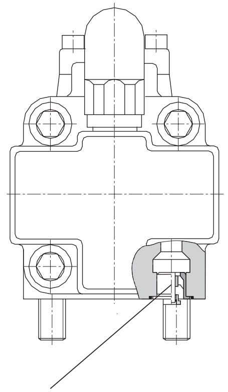




SDVB 16

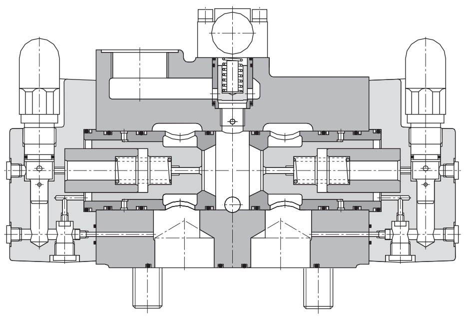
pre-load valve if A4VSG mounted

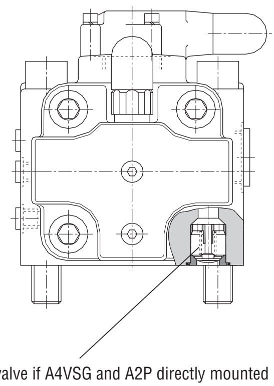




SDVB 30

pre-load valve if A4VSG and A2P directly mounted



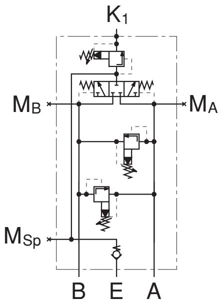


SDVB 50

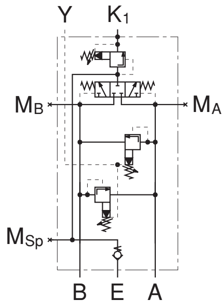
pre-load valve if A4VSG and A2P directly mounted

Control type (with pre-load valve)

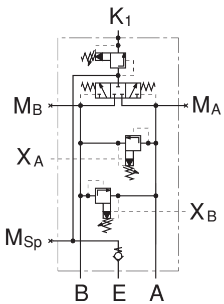
Control Type 1



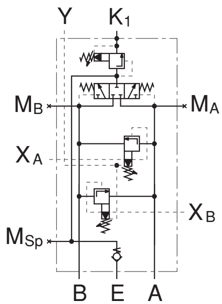
Control Type 2



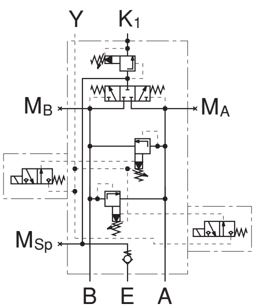
Control Type 3



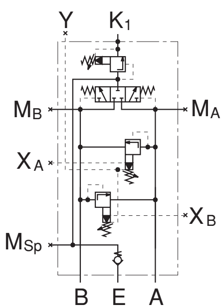
Control Type 4



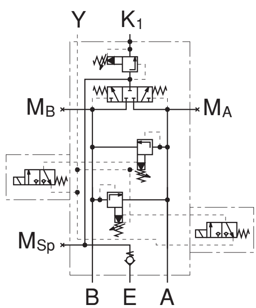
Control Type 5



Control Type 6



Control Type 7



The types of control shown only apply to size 16.
With the SDVB 30 and 50 there are two X and two Y ports.
Control types for size 30 are same as those for sizes 16 and 50 but without gauge ports MA and MB.

Technical data (partly to VDI 3276)

Design: combined scavenging and pressure relief valves controlled by operating pressure

Mounting: flange model with O-ring seal (4 fixing holes in housing)

Pipe connections and connection sizes: see Unit Dimensions

Weight (kg)

Size	16	30	50
without subplate	6,5	23	61
with subplate		30	68

Mounting position: optional

Direction of flow: from A to B resp. B to A and from A to K_1 resp. B to K_1

Operating pressure range: p_N = 0…400 bar

The pressure measured at port $X_{A/B}$ is only identical to the pressure in the service line as long as the pressure relief valve is not actuated. Once the pilot valve has begun to open, the operating pressure in the main line can be around 15% higher. It is therefore recommended to measure the operating pressure direct at M_A or M_B resp. A or B.

Pressure setting range:
Operating pressure: $p_{v\ min}…p_{v\ max}$ = 50…400 bar
Scavenging pressure at nominal flow Q_{NSp}: SDVB 16, 30 and 50 are infinitely adjustable. Please state the required pressure setting for operating pressure and scavenging pressure when ordering. More details see RE 92100.

Fluid temperature range
$\vartheta_{m\ min}…\vartheta_{m\ max}$ = –20° C…+80° C

Viscosity range $\nu_{min}…\nu_{max}$ = 10…1000 mm²/s

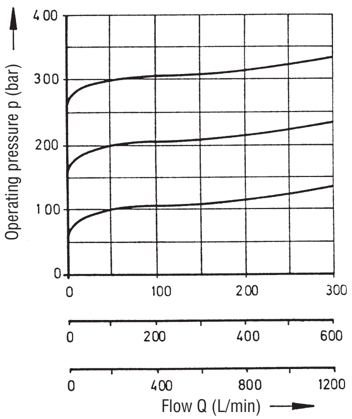
Nominal flow

Size	16	30	50
Main circuit Q_N (L/min)	200	600	1200
Scavenging circuit Q_{NSp} (L/min)	40	100	200

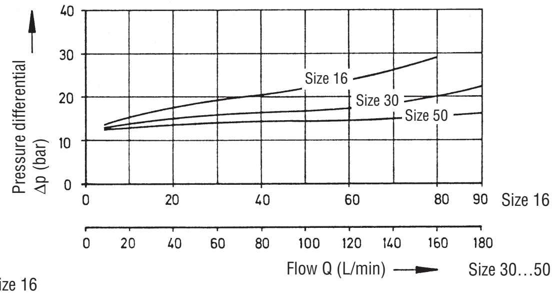
2

Δp-Q-Characteristics

Operating pressure p = f (Q)



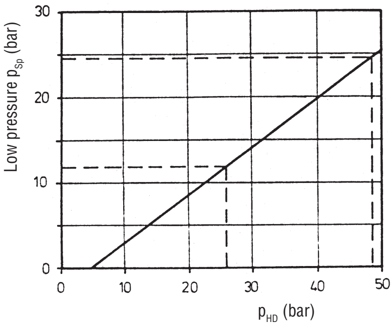
Scavenging pressure p_{Sp} = f (Q_{Sp})



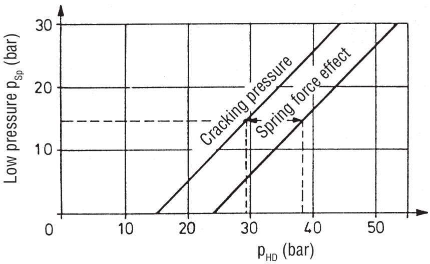
Pressure setting (Operating pressure)

Size	16	30	50
p (bar/Umdr.) approx.	150	105	105

SDVB 16



SDVB 30 and 50



Switching pressure

In order to switch both sides of the circuit A and B to the scavenging valve, a pressure differential between the high pressure and low pressure sides is required.

This pressure differential and therefore the switching pressure on the high pressure side is dependent on the setting on the low pressure side. With the SDVB 30 and 50, the spring force effect must also be taken into consideration, since this requires a pressure increase of around 9 bar until the valve poppet is fully open (see diagrams on left).

Max. pilot oil volume

$Q_{St\ max}$ (taken from main circuit)

Size	**16**	**30**	**50**
$Q_{St\ max}$ (L/min)	≈4	≈5	≈6

Remote control

To allow the setting of different pressure values for the pressure relief valves, external pilot oil connections "X" and "Y" are provided for remote control.

Functional variations

The SDVB 16 to 50 may also be used as a double acting pressure relief valve.

If only the double acting pressure relief valve function is required, the supply line to the scavenging valve is closed or the pressure setting of the scavenging valve is set higher than that on the relevant low pressure side.

Co-ordination with axial piston units

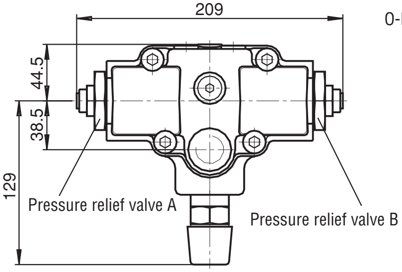
Direct mounting

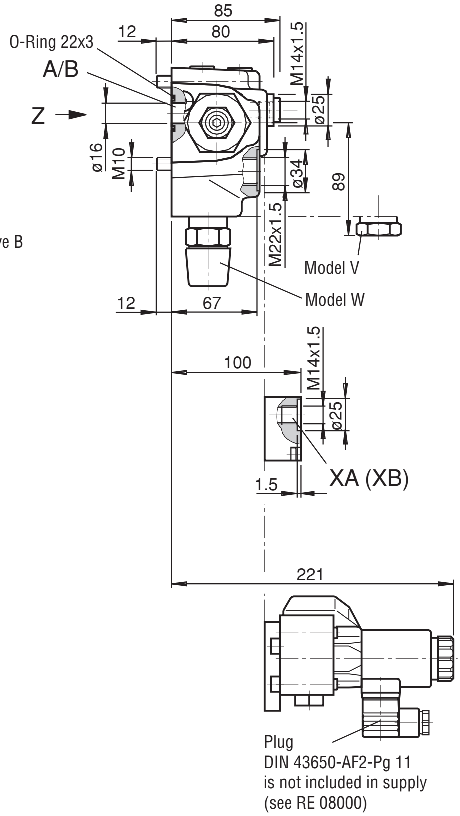
SDVB	Axial piston unit												
	A4VSG									A2P, Series 5			
	40	71	125	180	250	355	500	750	1000	250	355	500	1000
16	●	●	●	●									
30					●	●	●			●	●	●	
50								●	●				●

2

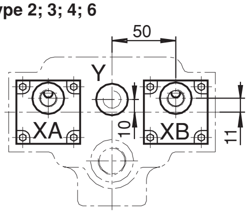
Unit Dimensions Size 16

Control Type 1

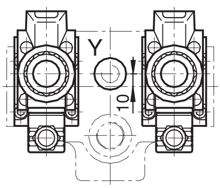




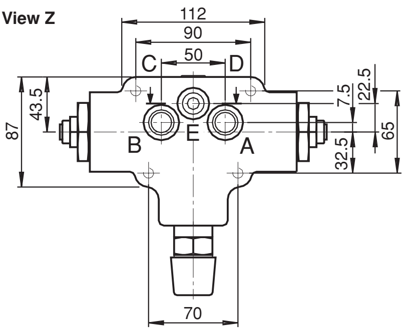
Control Type 2; 3; 4; 6



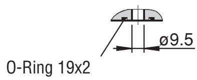
Control Type 5; 7



View Z

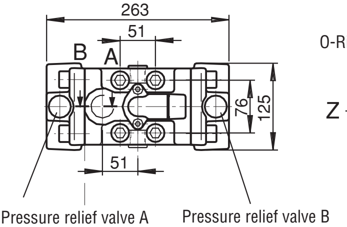


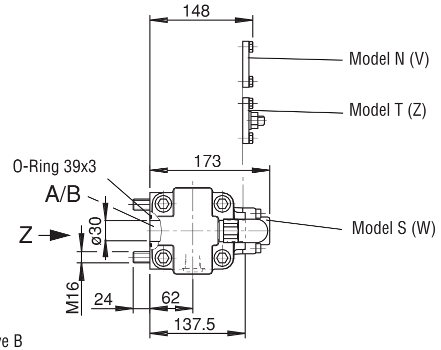
Section C-D



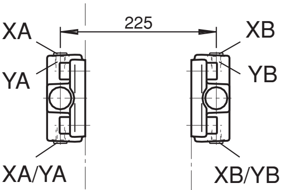
Unit Dimensions Size 30

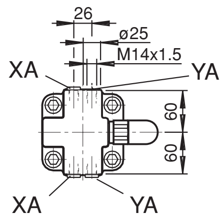
Control Type 1



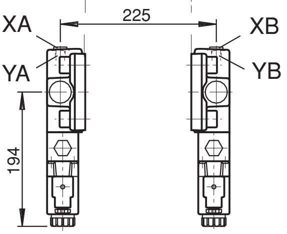


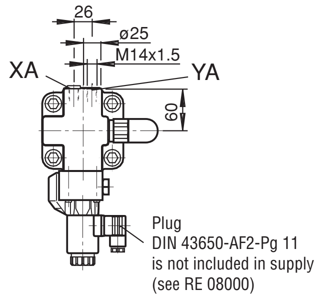
Control Type 2; 3; 4; 6



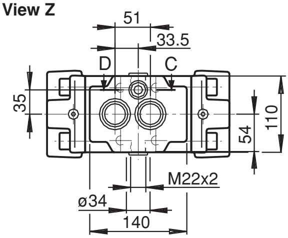


Control Type 5; 7

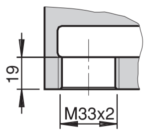




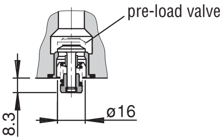
View Z



Section A-B

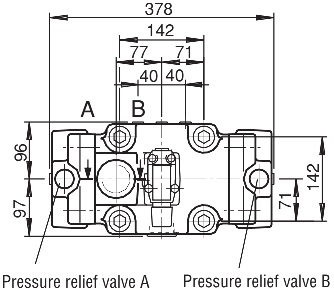


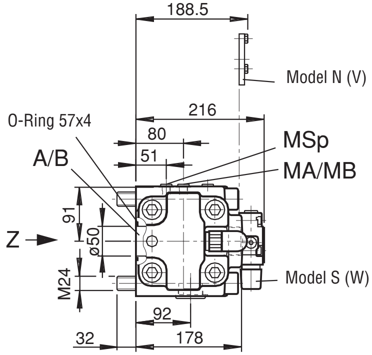
Section C-D



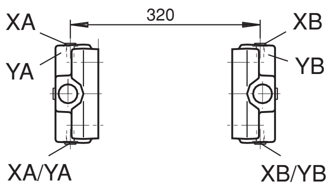
Unit Dimensions Size 50

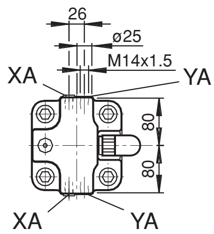
Control Type 1



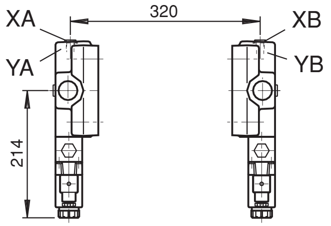


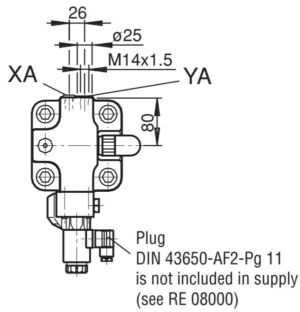
Control Type 2; 3; 4; 6



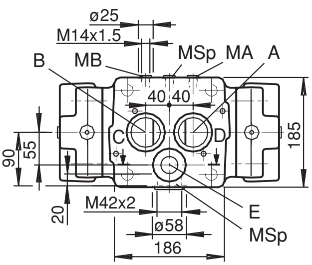


Control Type 5; 7

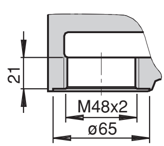




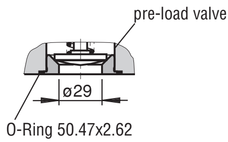
View Z



Section A-B



Section C-D

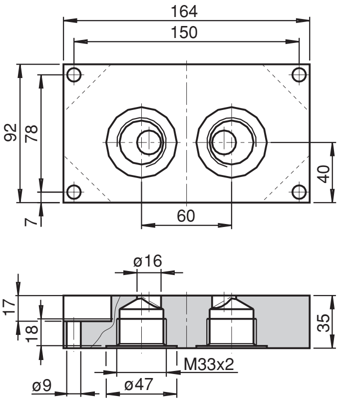


2

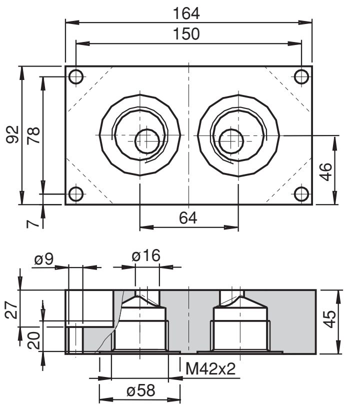
Before finalising your design, please request a certified drawing.
Subject to revision.

Subplate

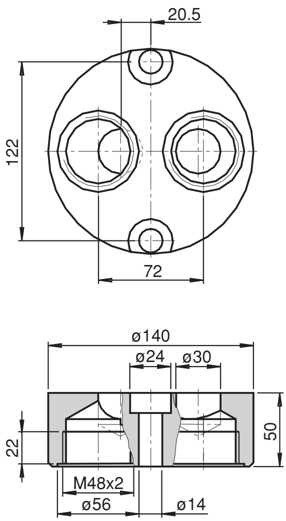
SDVB 16 (M33x2)



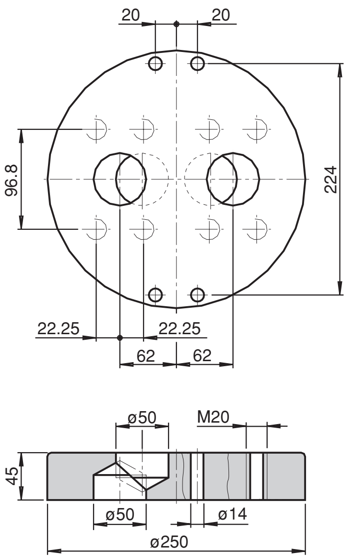
SDVB 16 (M42x2)



SDVB 30

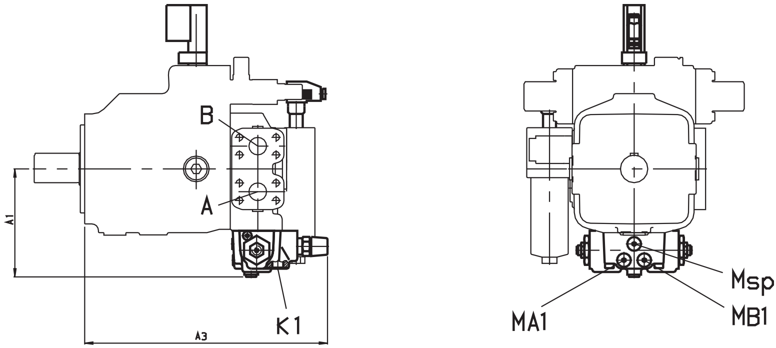


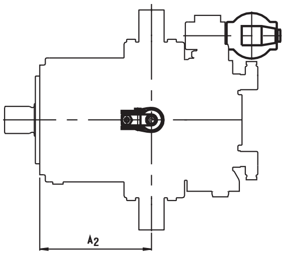
SDVB 50



Unit Dimensions

A4VSG with scavenging block SDVB 16





Unit Dimensions				**Ports**		
Size	A_1	A_2	A_3	M_A, M_B	M_{SP}	K_1
40	174	144	approx. 364	M14x1,5	M14x1,5	M22x1,5; 14 deep
71	177	166	389	M14x1,5	M14x1,5	M22x1,5; 14 deep
125	196,5	203	442	M14x1,5	M14x1,5	M22x1,5; 14 deep
180	196,5	203	442	M14x1,5	M14x1,5	M22x1,5; 14 deep
250	317	248	448	M14x1,5	M22x1,5	M33x2; 18 deep
355	319	248	455	M14x1,5	M22x1,5	M33x2; 18 deep
500	353	279	487	M14x1,5	M22x1,5	M33x2; 18 deep

Bosch Rexroth AG
Mobile Hydraulics
Product Segment Axial Piston Units
Plant Horb
An den Kelterwiesen 14
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Telefax +49 (0) 74 51 82 21
info.brm-ak@boschrexroth.de
www.boschrexroth.com/bri

Rexroth Bosch Group	Power Limiting Valve LV 06 (Constant Horsepower Control) Control Elements for Series 5 and Series E/C	RE 95546/05.87 replaces 01.82

Ordering code

LV	06	1	A	5

Description

Power limiting valve — LV

Size

Size — 06

Model [1])

Threaded connections — 1

O-ring connections — 2

O-ring and threaded connections — 3

Type of connection

without subplate — O

with subplate — A

Series [2])

Series E/C — 0

Series 5 — 5

Ordering Example
LV06.1.A.5
Power limiting valve
size 6 with threaded connections
and subplate, for series 5

[1]) For model variations see unit dimensions.
[2]) When mounting direct on a pump, the correct valve must be used.
When mounting separately, the LV 06 is independent of the pump model.

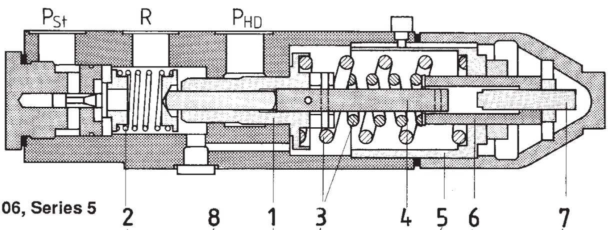
Description

Power limiting valve LV 06 consists of a direct operated relief valve and a stepped spool (1), which is loaded on both sides by the pilot control spring (2) and the regulator spring set (3), and which is hydraulically operated by the main system pressure.

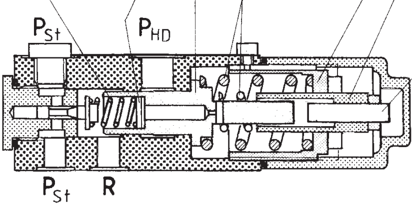
In hydrostatic drives, it is often required to alter the output flow of the pump in such a manner that the pre-determined input drive torque is not exceeded, even with varying working pressures. This means that, at a constant drive speed, the input power must be limited.

Design details

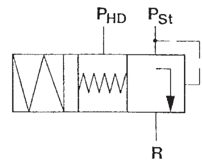
LV 06, Series E/C



LV 06, Series 5



Symbol



1 stepped spool
2 pilot spring
3 regulating spring set
4 screw
5 threaded cap
6 hollow screw
7 screw
8 shims

Connections
p_{HD} operating pressure
p_{St} pilot pressure
R return line

The setting of the pilot spring (2) is achieved by means of screw (4) or by shims (8). The two parts of the regulating spring set (3) are set completely independent of each other by the threaded cap (5) and the hollow screw (6). The end stop is set by screw (7).

Technical data (partly to VDI 3276)

Design: direct operated, seated type pressure relief valve

Mounting: flanged model with O-ring seals or threaded connections

Pipe connections and connection sizes: see unit dimensions

Weight (kg)	Series E/C	Series 5
without subplate	4,5	2,3
with subplate	6,5	4,0

Mounting position: optional

Direction of flow: from P_{St} to R

Operating pressure range
High pressure side: p_{HD} = 0...400 bar
Pilot pressure side: p_{St} = 0...60 bar

Pressure setting range (pilot pressure side)
p_{St} = 10...28 or 10...45 bar (alternative settings on enquiry)
The pressure setting range must be stated in clear text when ordering.

Fluid temperature range
$\delta_{m\,min}...\delta_{m\,max}$ = – 20° C... + 80° C

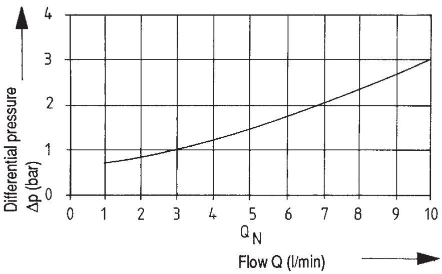
Viscosity range $\nu_{min.}..\nu_{max}$ = 10...1000 mm²/s

Nominal flow Q_N = 5 l/min

Operating curves

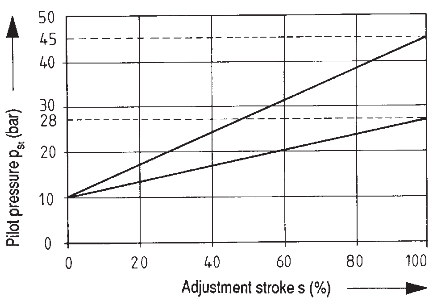
Δp-Q-curve

ν = 35 mm²/s
δ = 50° C



Pilot pressure curve

Q_N = 5 l/min
ν = 35 mm²/s
δ = 50° C

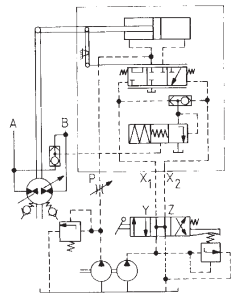


Co-ordination with control devices

Direct mounting
Direct mounting on the HD control (series 5) and also on control type S 3041 (series E/C) is possible (note point 5 in ordering code).
Note that control type S 3041 is changed when LV 06 is fitted, to S 3141.

Separate mounting
Power limiting valve LV 06 can be fitted in the pilot circuit of all axial piston units with pressure dependent control devices, independent of the build series, if it is installed separately.

Application example
Port P_{St} is connected via a shuttle valve with the pilot circuit of the control device, while port P_{HD} is connected via another shuttle valve into the main circuit of the axial piston pump. If the operating pressure exceeds the pre-load of the regulating spring for the start of control, the stepped piston moves against the spring set and so reduces the load on the pilot control spring and, in turn, the pilot pressure, so that the predetermined maximum drive power at a constant drive speed is never exceeded at any operating point.



Power curves
The power curves follow extensively the power curves laid down in DIN 42973, and the rated powers of axial piston units with built-on regulating devices.
For the various power curves available, according to unit series and size, see pages 3 to 5.

Power overshoot
The variation in regulated value of a power limiting valve is very small, as the response time is 0,02 sec. When used with control device S 3041, or the HD control, the actual variation is greater, as the minimum setting time of the pump is limited to 0,15 sec. or 0,2 sec. respectively.
For further details of control tolerances, see catalogue sheet "Control Elements Type S", series E and C.

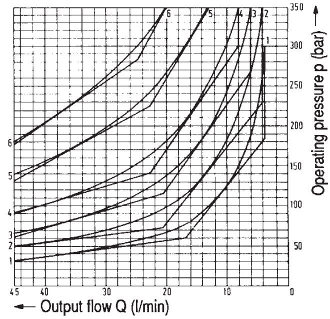
Power Limiting valve LV 06

Power curves, series E (for control device S 3141)

Size 31

Curve No.	Drive power P kW	Drive torque M Nm
1	3	20
2	4	27
3	5,5	37
4	7,5	49
5	11	74
6	15	98

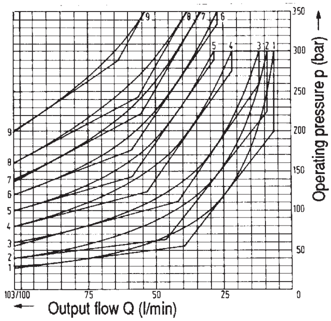
Output flow and drive power are taken for a standard speed n_N = 1450 rpm



Size 71

Curve No.	Drive power P kW	Drive torque M Nm
1	5,5	37
2	7,5	49
3	11	74
4	15	99
5	18,5	123
6	22	148
7	26	173
8	30	197
9	37	247

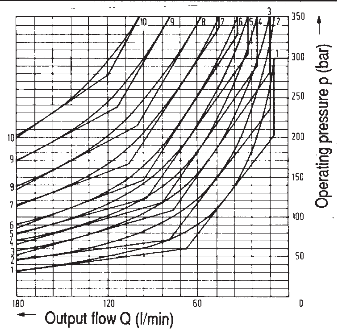
Output flow and drive power are taken for a standard speed n_N = 1450 rpm



Size 125

Curve No.	Drive power P kW	Drive torque M Nm
1	11	74
2	15	98
3	18,5	123
4	22	148
5	26	172
6	30	196
7	37	246
8	45	296
9	55	370
10	66	444

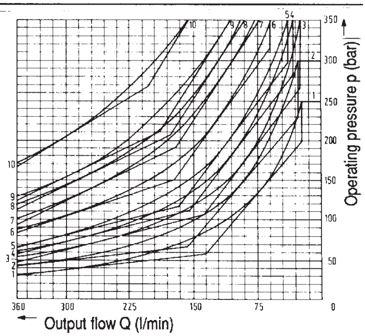
Output flow and drive power are taken for a standard speed n_N = 1450 rpm



Size 250

Curve No.	Drive power P kW	Drive torque M Nm
1	22	148
2	30	198
3	37	248
4	40	273
5	45	296
6	59	398
7	66	446
8	75	494
9	90	595
10	110	745

Output flow and drive power are taken for a standard speed n_N = 1450 rpm

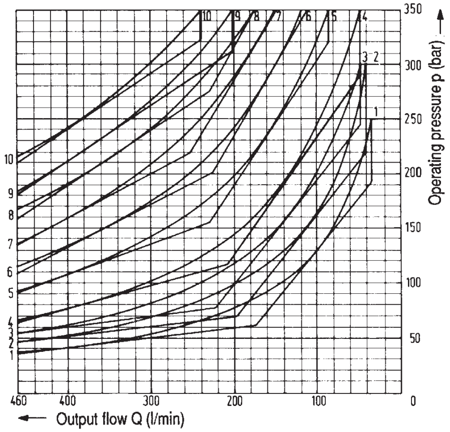


Power curves, series C (for control device S 3141)

Size 481

Curve No.	Drive power P kW	Drive torque M Nm
1	30	300
2	37	370
3	45	440
4	55	550
5	75	740
6	90	920
7	110	1110
8	132	1330
9	147	1470
10	172	1740

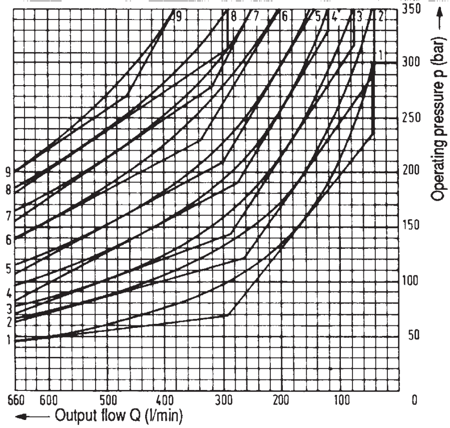
Output flow and drive power are taken for a standard speed n_N = 970 rpm



Size 900

Curve No.	Drive power P kW	Drive torque M Nm
1	55	720
2	75	950
3	90	1190
4	110	1430
5	132	1720
6	160	2100
7	186	2440
8	220	2860
9	243	3150

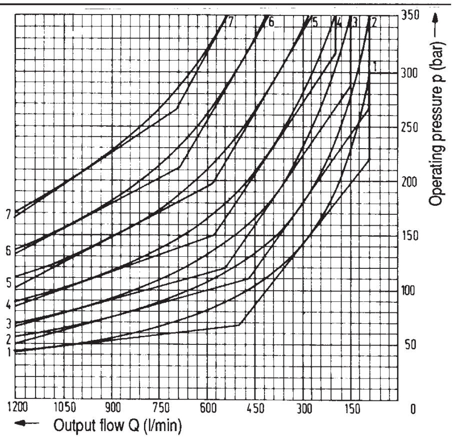
Output flow and drive power are taken for a standard speed n_N = 750 rpm



Size 2000

Curve No.	Drive power P kW	Drive torque M Nm
1	92	1500
2	118	1900
3	147	2400
4	184	3000
5	236	3800
6	295	4760
7	370	5900

Output flow and drive power are taken for a standard speed n_N = 600 rpm



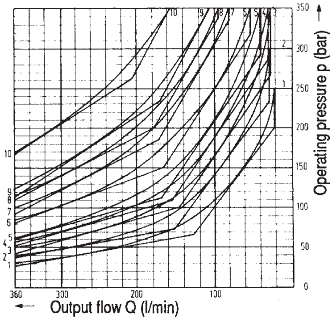
When mounting control device type S 3141 on the Brueninghaus double pumps type ET, the power curves are necessarily determined by the transmission ratio.

Power curves, series 5 (for HD control with constant horsepower control)

Size 250

Curve No.	Drive power P kW	Drive torque M Nm
1	22	145
2	30	194
3	37	242
4	40	267
5	44	290
6	55	363
7	66	437
8	74	485
9	88	582
10	110	726

Output flow and drive power are taken for a standard speed n_N = 1450 rpm

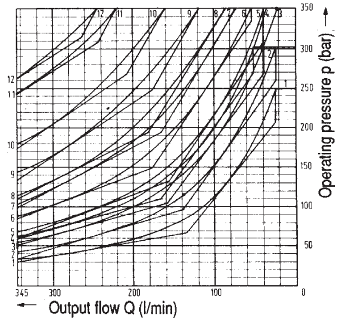


2

Size 355

Curve No.	Drive power P kW	Drive torque M Nm
1	22	217
2	30	285
3	37	362
4	40	398
5	44	435
6	55	543
7	66	647
8	74	726
9	88	863
10	110	1079
11	147	1452
12	160	1580

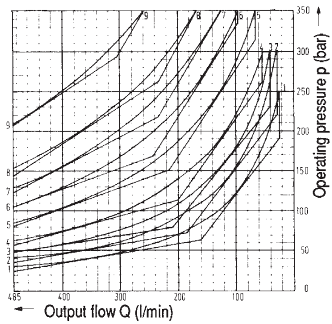
Output flow and drive power are taken for a standard speed n_N = 970 rpm



Size 500

Curve No.	Drive power P kW	Drive torque M Nm
1	30	289
2	37	362
3	44	435
4	55	543
5	74	724
6	90	907
7	110	1086
8	132	1304
9	180	1774

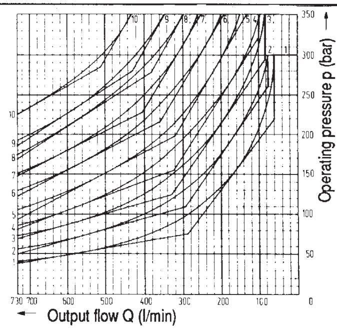
Output flow and drive power are taken for a standard speed n_N = 970 rpm



Size 1000

Curve No.	Drive power P kW	Drive torque M Nm
1	55	706
2	75	932
3	90	1167
4	110	1403
5	132	1687
6	160	2060
7	188	2394
8	220	2806
9	243	3090
10	290	3845

Output flow and drive power are taken for a standard speed n_N = 730 rpm



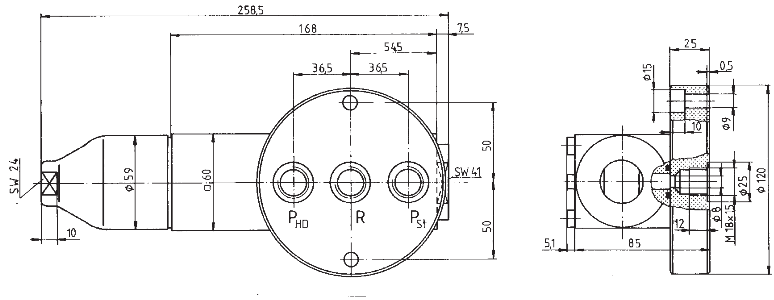
The control device is set to the nominal envelope curve with a variation of ± 5 % of the set value.

Power Limiting valve LV 06

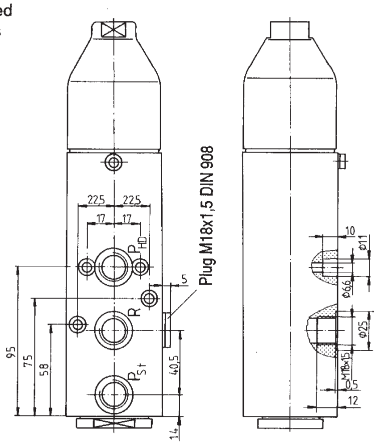
Unit dimensions

LV 06, Series E/C

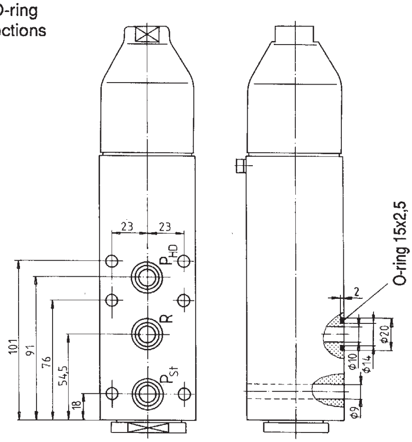
Type LV06.2.A.0
with threaded
subplate



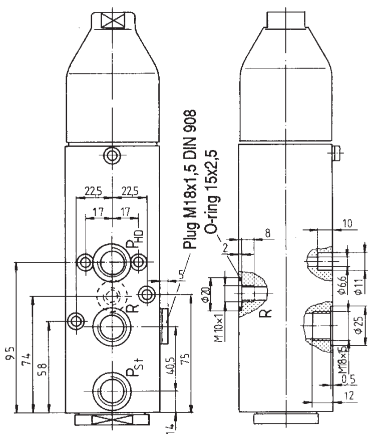
Type LV06.1.0.0
with threaded
connections



Type LV06.2.0.0
with O-ring
connections



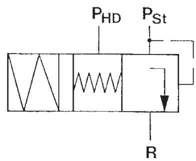
Type LV 06.3.0.0
with O-ring and
threaded connections



State model required when ordering.

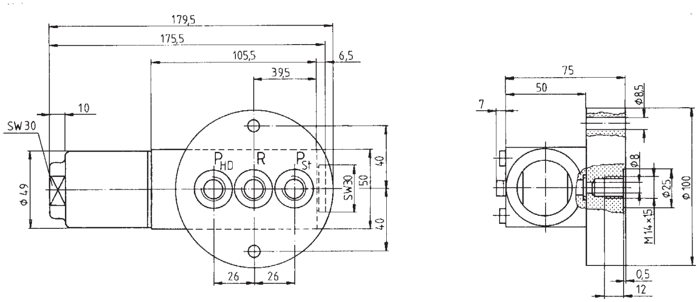
Port designation stamped in body.

p_{HD} = operating pressure
p_{St} = pilot pressure
R = return line

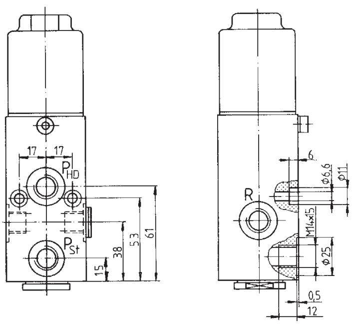


LV 06, Series 5

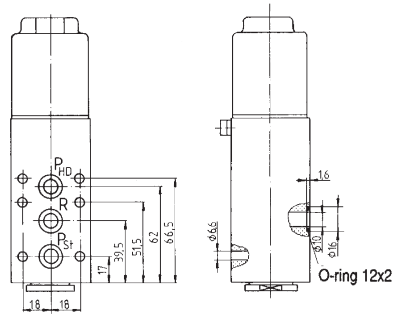
Type LV06.2.A.5
with threaded
subplate



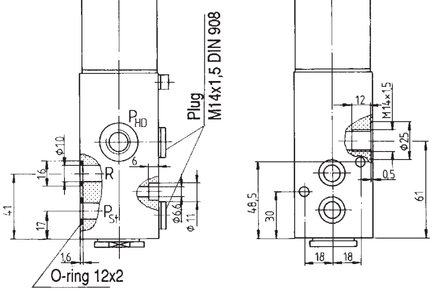
Type LV06.1.0.5
with threaded
connections



Type LV06.2.0.5
with O-ring
connections



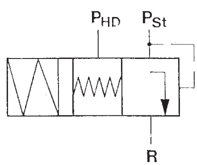
Type LV 06.3.0.5
with O-ring and
threaded connections



State model required when ordering.

Port designation stamped in body.

p_{HD} = operating pressure
p_{St} = pilot pressure
R = return line



Power Limiting valve LV 06

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Product Segment Axial Piston Units
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info.brm-ak@boschrexroth.de
www.boschrexroth.com/bri

The Drive & Control Company

Rexroth
Bosch Group

Universal Through Drive for Variable Pump A10VSO, A4VSO, A15VSO and A11V(L)O

RE 95581
Issue: 11.2012
Replaces: 01.2012

- For A10VSO Series 32; Size 45 to 180
- For A4VSO Series 30; Size 125 to 355
- For A15VSO Series 10; Size 110 to 280
- For A11V(L)O Series 40; Size 110 to 280

Features

- Flexibel universal through drive
- The through drive are exchangeable without machining the port plate

For more information see data sheet:

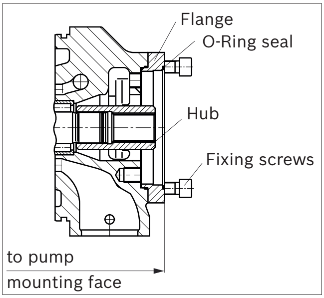
- RE 92050 Variable Pump A4VSO
- RE 92800 Variable Pump A15VSO
- RE 92510 Variable Pump A11V(L)O
- RE 92714 Variable Pump A10VSO
- RE 92705 Variable Pump A10VO
- RE 91485 Variable Pump A10VZO

Contents

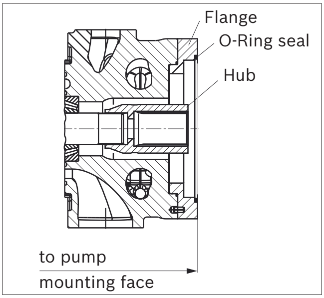
Adapter Kits 2
Material number for U00 at A10VSO series 32 2
Material number at A4VSO series 30 4
Material number at A15VSO series 10 8
Material number at A11V(L)O series 40 10
General instructions 12

Adapter Kits

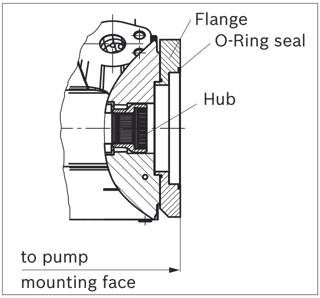
A4VSO/30



A10VSO/32



A15VSO/10; A11V(L)O/40



Assembly Group

The through drive is delivered as assembly group. The assembly group „flange and hub“ includes flange, hub, cylinder head screws and O-ring seal.
Fixing screws for the 2. pump will be delivered only for universal through drives of the A4VSO.

Material number for U00 at A10VSO series 32

Code	Available for pump	Length to pump mounting flange [mm]	Assembly group „Cover“ with cover, cylinder head screw
U00[1]	A10VSO45	254	R902496168
	A10VSO71	289	R902496186
	A10VSO100	350	R902496173
	A10VSO140	367	
	A10VSO180	377	
ISO 3019-2			**Assembly group „Cover“ with cover, cylinder head screw**
UB2	A10VSO45	264	R902496439
	A10VSO71	299	R902496440
	A10VSO100	360	R902496441
	A10VSO140	377	R902496442
	A10VSO180	387	R902496443
UB3	A10VSO45	264	R902492531
	A10VSO71	299	R902512434
	A10VSO100	360	R902496445
	A10VSO140	377	R902496446
	A10VSO180	387	R902496447
UE1	A10VSO 45	264	R902510125
	A10VSO 71	299	R902510126
	A10VSO 100	360	R902510127
	A10VSO 140	377	R902510128
	A10VSO 180	387	R902510129
UB8	A10VSO71	299	R902496458
	A10VSO100	360	R902496459
	A10VSO140	377	R902496460
	A10VSO180	387	R902496461
ISO 3019-2	**Available for pump**	**Length to pump mounting flange [mm]**	**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**

1) Incompatible with U99. Use for new projects U00.

Material number for U00 at A10VSO series 32

UB9	A10VSO100	360	R902496462
	A10VSO140	377	R902496463
	A10VSO180	387	R902496464
UB7	A10VSO140	377	R902496465
	A10VSO180	387	R902496466

ISO 3019-1 (SAE J744)			**Assembly group „Flange and hub" with Flange, hub, cylinder screw**
U01	A10VSO45	264	R902496467
	A10VSO71	299	R902496468
	A10VSO100	360	R902496469
	A10VSO140	377	R902496470
	A10VSO180	387	R902496471
U52	A10VSO45	264	R902496472
	A10VSO71	299	R902496473
	A10VSO100	360	R902496474
	A10VSO140	377	R902496475
	A10VSO180	387	R902496476
U68	A10VSO45	264	R902496477
	A10VSO71	299	R902496478
	A10VSO100	360	R902496479
	A10VSO140	377	R902496480
	A10VSO180	387	R902496481
U04	A10VSO45	264	R902496482
	A10VSO71	299	R902496663
	A10VSO100	360	R902496664
	A10VSO140	377	R902496665
	A10VSO180	387	R902496666
UE2	A10VSO 45	264	R902510131
	A10VSO 71	299	R902510132
	A10VSO 100	360	R902510133
	A10VSO 140	377	R902510134
	A10VSO 180	387	R902510135
U24	A10VSO 100	360	R902510136
	A10VSO 140	377	R902510137
	A10VSO 180	387	R902510138
U15	A10VSO 71	299	R902510139
	A10VSO 100	360	R902510140
	A10VSO 140	377	R902510141
	A10VSO 180	387	R902510142
U96	A10VSO100	360	R902496667
	A10VSO140	377	R902496668
	A10VSO180	387	R902496669
U17	A10VSO140	377	R902496670
	A10VSO180	387	R902496671

Material number at A4VSO series 30

Code	Available for pump	Length to pump mounting flange [mm]	Assembly group „Cover“ with cover, cylinder head screw
U99	A4VSO125	359	R902438778
	AA4VSO125	361	
	A4VSO180	383	
	AA4VSO180	385	
	A4VSO250	443	R902444736
	AA4VSO 250	445	
	A4VSO355	472	
	AA4VSO 355	474	
ISO 3019-2			**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**
UB2	A4VSO125	369	R902446991
	A4VSO180	393	
	A4VSO250	453	R902446993
	A4VSO355	482	
UB3	A4VSO125	369	R902446996
	A4VSO180	393	
	A4VSO250	453	R902446998
	A4VSO355	482	
UB4	A4VSO125	369	R902447001
	A4VSO180	393	
	A4VSO250	453	R902447003
	A4VSO355	482	
UB5	A4VSO125	369	R902447006
	A4VSO180	393	
	A4VSO250	453	R902447007
	A4VSO355	482	
UB6	A4VSO125	369	R902447008
	A4VSO180	393	
	A4VSO250	453	R902447009
	A4VSO355	482	
U31	A4VSO125	369	R902447010
	A4VSO180	393	
	A4VSO250	453	R902447011
	A4VSO355	482	
U33	A4VSO125	369	R902447012
	A4VSO180	393	
	A4VSO250	453	R902447013
	A4VSO355	482	
UB8	A4VSO125	369	R902447014
	A4VSO180	393	
	A4VSO250	453	R902447016
	A4VSO355	482	
U34	A4VSO125	369	R902447019
	A4VSO180	393	
	A4VSO250	453	R902447020
	A4VSO355	482	

Material number at A4VSO series 30

ISO 3019-2			**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**
UB9	A4VSO125	382	R902447021
	A4VSO180	406	
	A4VSO250	453	R902447022
	A4VSO355	482	
UB7	A4VSO180	406	R902447025
	A4VSO250	453	R902447026
	A4VSO355	482	
U35	A4VSO250	469	R902447028
	A4VSO355	498	
U77	A4VSO355	498	R902447029
ISO 3019-1 (SAE J744)			
(The lengths to the pump mounting face are valid for the SAE version. The metric pumps are 2mm shorter)			
Code	**Available for pump**	**Length to pump mounting flange [mm]**	**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**
U01	A4VSO125	369	R902447030
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447032
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U52	A4VSO125	369	R902447035
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447037
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U68	A4VSO125	369	R902447040
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447042
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	

2

Material number at A4VSO series 30

ISO 3019-1 (SAE J744) (The lengths to the pump mounting face are valid for the SAE version. The metric pumps are 2mm shorter)			
Code	**Available for pump**	**Length to pump mounting flange [mm]**	**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**
U04	A4VSO125	369	R902447045
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447047
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U07	A4VSO125	369	R902447050
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447051
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U24	A4VSO125	369	R902447052
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447053
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U15	A4VSO125	369	R902447054
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447055
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U16	A4VSO125	369	R902447056
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447057
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	

Material number at A4VSO series 30

ISO 3019-1 (SAE J744) (The lengths to the pump mounting face are valid for the SAE version. The metric pumps are 2mm shorter)			
Code	**Available for pump**	**Length to pump mounting flange [mm]**	**Assembly group „Flange and hub“ with Flange, hub, cylinder screw**
U96	A4VSO125	369	R902447058
	AA4VSO125	371	
	A4VSO180	393	
	AA4VSO180	395	
	A4VSO250	453	R902447059
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U17	A4VSO125	382	R902447062
	AA4VSO125	384	
	A4VSO180	406	
	AA4VSO180	408	
	A4VSO250	453	R902447063
	AA4VSO250	455	
	A4VSO355	482	
	AA4VSO355	484	
U18	A4VSO250	479	R902447067
	AA4VSO250	481	
	A4VSO355	508	
	AA4VSO355	510	
U72	A4VSO250	479	R902453019
	AA4VSO250	481	
	A4VSO355	508	
	AA4VSO355	510	

2

Material number at A15VSO series 10

Code	Available for pump	Length to pump mounting flange [mm]	Assembly group „Cover“ with cover, cylinder head screw
U000	A15VSO 110	285	R902473330 (Cover, O-Ring, cylinder head screw)
	A15VSO 145	310	
	A15VSO 175	327	
	A15VSO 210	345	
	A15VSO 280	387	
ISO 3019-2			**Assembly group „Flange and hub“ with Flange, hub, cylinder head screw**
K2S3	A15VSO 110 [1)]	–	–
	A15VSO 145 [1)]	–	–
	A15VSO 175	340	R902497159
	A15VSO 210 [1)]	358	R902497159
	A15VSO 280 [1)]	–	–
K5S3	A15VSO 110 [1)]	–	–
	A15VSO 145 [1)]	–	–
	A15VSO 175	340	R902497161
	A15VSO 210	358	R902497161
	A15VSO 280 [1)]	–	–
L5S4	A15VSO 110 [1)]	–	–
	A15VSO 145 [1)]	–	–
	A15VSO 175	354	R902497173
	A15VSO 210	372	R902497173
	A15VSO 280 [1)]	–	–
P4S7	A15VSO 110 [1)]	–	–
	A15VSO 145 [1)]	–	–
	A15VSO 175 [1)]	–	–
	A15VSO 210 [1)]	–	–
	A15VSO 280	414	R902512007
R4S9	A15VSO 110 [1)]	–	–
	A15VSO 145 [1)]	–	–
	A15VSO 175 [1)]	–	–
	A15VSO 210 [1)]	–	–
	A15VSO 280	419	R902514299

[1)] Material number of the through drives and length to pump mounting face on request.

Material number at A15VSO series 10

ISO 3019-1 (SAE J744)	Available for pump	Length to pump mounting flange [mm]	Assembly group „Flange and hub“ with Flange, hub, cylinder head screw
A1S2	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175	340	R902480838
	A15VSO 210	358	R902480838
	A15VSO 280	400	R902511997
B3S4	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175	354	R902510920
	A15VSO 210	372	R902510920
	A15VSO 280	414	R902512054
B3S5	A15VSO 110	312	R902512157
	A15VSO 145	337	R902512157
	A15VSO 175 [1]	–	–
	A15VSO 210 [1]	–	–
	A15VSO 280 [1]	–	–
C3S7	A15VSO 110	323	R902511033
	A15VSO 145	348	R902511033
	A15VSO 175	354	R902514325
	A15VSO 210	372	R902514325
	A15VSO 280	414	R902515215
C3S9	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175 [1]	–	–
	A15VSO 210 [1]	–	–
	A15VSO 280	414	R902514098
D4A1	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175 [1]	–	–
	A15VSO 210 [1]	–	–
	A15VSO 280	414	R902515220
E4A2	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175	363	R902495006
	A15VSO 210	381	R902495006
	A15VSO 280	423	R902495955
E4A4	A15VSO 110 [1]	–	–
	A15VSO 145 [1]	–	–
	A15VSO 175 [1]	–	–
	A15VSO 210 [1]	–	–
	A15VSO 280	423	R902495953

[1] Material number of the through drives and length to pump mounting face on request.

Material number at A11V(L)O series 40

Code	Available for pump	Length to pump mounting flange [mm]	Assembly group „Cover“ with cover, cylinder head screw
U000	A11VO 110	285	R902473330 (cover, O-Ring, cylinder head screw)
	A11VO 145	310	R902473330
	A11VLO 145[1]	–	–
	A11VO 175	327	R902473330
	A11VLO 175[1]	–	–
	A11VO 210	345	R902473330
	A11VLO 210[1]	–	–
	A11VO 280	387	R902473330
	A11VLO 280[1]	–	–
ISO 3019-1 (SAE J744)			**Assembly group „Flange and hub“ with Flange, hub, cylinder head screw**
A1S2	A11VO 110[1]	–	–
	A11VO 145[1]	–	–
	A11VLO 145[1]	–	–
	A11VO 175	340	R902480838
	A11VLO 175[1]	–	–
	A11VO 210	358	R902480838
	A11VLO 210[1]	–	–
	A11VO 280	400	R902511997
	A11VLO 280[1]	–	–
B3S4	A11VO 110[1]	–	–
	A11VO 145[1]	–	–
	A11VLO 145[1]	–	–
	A11VO 175	354	R902510920
	A11VLO 175[1]	–	–
	A11VO 210	372	R902510920
	A11VLO 210[1]	–	–
	A11VO 280	414	R902512054
	A11VLO 280[1]	–	–
B3S5	A11VO 110	312	R902512157
	A11VO 145	337	R902512157
	A11VLO 145[1]	–	–
	A11VO 175[1]	–	–
	A11VLO 175[1]	–	–
	A11VO 210[1]	–	–
	A11VLO 210[1]	–	–
	A11VO 280[1]	–	–
	A11VLO 280[1]	–	–
C3S7	A11VO 110	323	R902511033
	A11VO 145	348	R902511033
	A11VLO 145[1]	–	–
	A11VO 175	354	R902514325
	A11VLO 175[1]	–	–
	A11VO 210	372	R902514325
	A11VLO 210[1]	–	–
	A11VO 280	414	R902515215
	A11VLO 280[1]	–	–

1) Material number of the through drives and length to pump mounting face on request.

Material number at A11V(L)O sries 40

ISO 3019-1 (SAE J744)	Available for pump	Length to pump mounting flange [mm]	Assembly group „Flange and hub“ with Flange, hub, cylinder head screw
C3S9	A11VO 110[1]	–	–
	A11VO 145[1]	–	–
	A11VLO 145[1]	–	–
	A11VO 175[1]	–	–
	A11VLO 175[1]	–	–
	A11VO 210[1]	–	–
	A11VLO 210[1]	–	–
	A11VO 280	414	R902514098
	A11VLO 280[1]	–	–
E4A4	A11VO 110[1]	–	–
	A11VO 145[1]	–	–
	A11VLO 145[1]	–	–
	A11VO 175[1]	–	–
	A11VLO 175[1]	–	–
	A11VO 210[1]	–	–
	A11VLO 210[1]	–	–
	A11VO 280	423	R902495953
	A11VLO 280[1]	–	–

2

[1] Material number of the through drives and length to pump mounting face on request.

General instructions

- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).
- Before finalizing your design, request a binding installation drawing.
- For mounting bolts with metric ISO threads according to DIN 13, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
- Please note and find further information in the data sheets to the products on page 1.

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External gear pumps

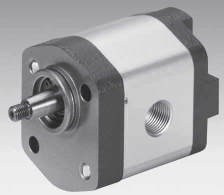
Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Displacement pump, series B	AZPB	1 ... 71		280	10087	1025
Displacement pump, series F	AZPF	4 ... 28	1X; 2X	280	10089	1053
Displacement pump, series N	AZPN	20 ... 36		250	10091	1121
Displacement pump, series G	AZPG	22,5 ... 100		280	10093	1145
Displacement pump, series S, SILENCE Version	AZPS	4 ... 28	1X; 2X	280	10095	1209
Displacement pump, series T, SILENCE Version	AZPT	20 ... 36		280	10092	1241
Displacement pump, series U, SILENCE Version	AZPU	22,5 ... 63		280	10098	1263
Displacement pump, series J, SILENCE PLUS Version	AZPJ	12 ... 16		280	10094	1289

3

External gear pump
Series B

RE 10 087/11.09
Replaces:
RE 10 087/08.07

AZPB-22...



Fixed pumps
V = 1.0...7.1 cm^3/rev

Overview of contents

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Features

– Nominal pressure 280 bar (up to 5 cm^3/rev)
– Slide bearings for heavy duty applications
– Standardized drive shafts
– Line ports:
  Connection flange or internal thread
– Long service life thru reinforced design
  of shafts and gray cast iron cover
– Consistent high quality thru mass production
– Numerous configuration variants available

General

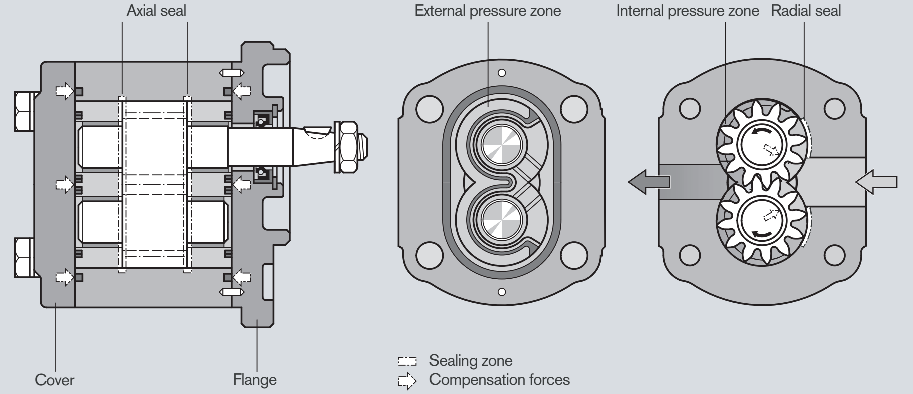
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G and as SILENCE gear pumps in the series of S, T and U, in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

Construction

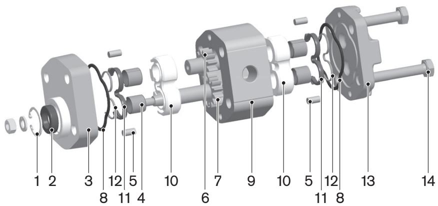
The external gear pump consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special slide bearings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

Axial and radial compensation for gear pump

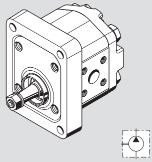
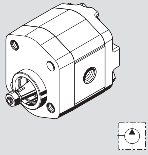
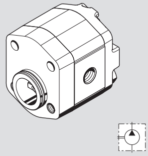
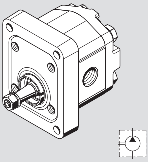
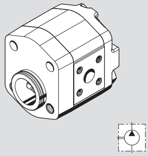
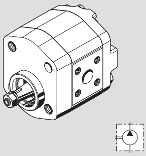
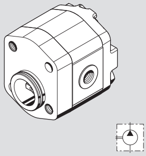


Schematic representation



1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

Overview of “Series B” standard types

Version	Page	Version	Page	Version	Page
	16		19		22
	17		20		
	18		21		

Ordering code

External gear units Single pumps Standard

AZ	P	B	–	x	x	–	4.0	R	C	P	02	M	D	200 xx	S xxxx

Function
P = Pump

Series
2 = 2nd generation

Version
2 = corrosion-resistant, pinned

Size (B)
1.0 = 1.00 cm^3/rev
2.0 = 2.00 cm^3/rev
2.5 = 2.50 cm^3/rev
3.1 = 3.15 cm^3/rev
4.0 = 4.00 cm^3/rev
4.5 = 4.50 cm^3/rev
5.0 = 5.00 cm^3/rev
6.3 = 6.30 cm^3/rev
7.1 = 7.10 cm^3/rev

Direction of rotation
R = Clockwise
L = Counterclockwise

*) Some of the special designs shown on pages 16–22 are not covered in the illustration of the ordering code.

Special design *)

Valve adjustment
200 xx = PRV 200 bar

Rear cover
B = Standard
D = DBV, internal residual current

Seals
M = NBR
K = NBR, shaft seal ring in FKM
P = FKM

Drive shafts

		Suitable front cover
C	Tapered key shaft 1:5	P
H	Tapered key shaft 1:8	O
N	Two-surface Claw	M, Y

Front cover

P	2-bolt mounting Centering Ø 32 mm
O	Square flange Centering Ø 25.28 mm
M	2-bolt mounting Centering Ø 32 mm, with seal ring
Y	2-bolt mounting Centering Ø 32 mm, with seal ring, mounting on series F

Line ports

01	Pipe thread ISO 228/1
02	Thread, metric ISO 9974-1
20	Rectangular flange

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units, Multiple pumps, Standard

AZ	P	BB	–	x	x	–		4.0/4.0	R	H	O	20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm³/rev
S = 4.0...28 cm³/rev
F = 4.0...28 cm³/rev
T = 20.0...36 cm³/rev
N = 20.0...36 cm³/rev
U = 22.5...63 cm³/rev
G = 22.5...63 cm³/rev

Series, relates to pump section 1
2 = Case width 110 mm

Version, relates to pump section 1
2 = corrosion-resistant, pinned

Size
as per individual Series

Direction of rotation
R = Clockwise
L = Counterclockwise

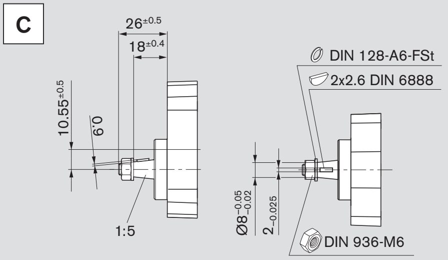
Rear cover
relates to last pump stage
B = Standard

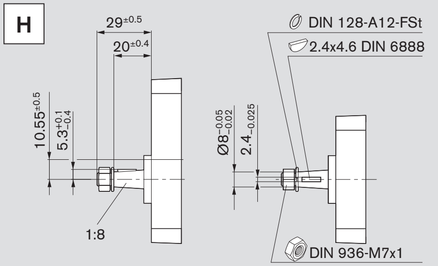
Seals
M = NBR
K = NBR, shaft seal ring pump stage 1 in FKM
P = FKM

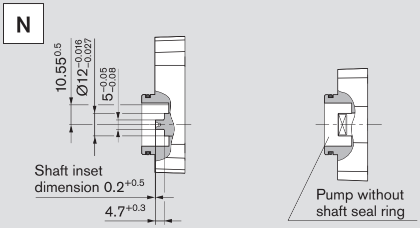
Drive shafts relates to pump stage 1		Suitable front cover	**Front cover** relates to pump stage 1		**Line ports** every pump stage	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**01**	Pipe thread ISO 228/1
					20	Rectangular flange
Series F, S:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm	**30**	Rectangular flange
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-hole mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-hole mounting	**20**	Rectangular flange
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-hole mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm	**30**	Rectangular flange

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

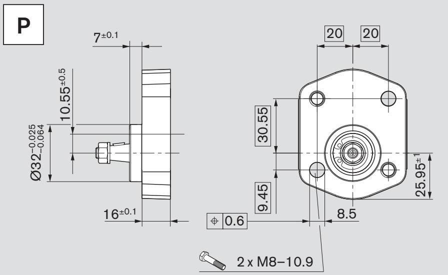
Drive shafts

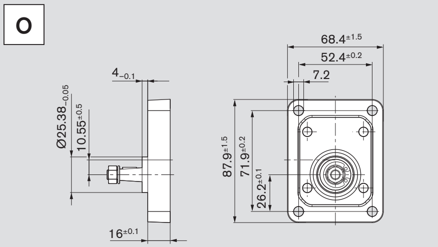


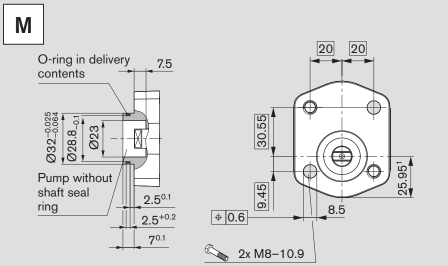


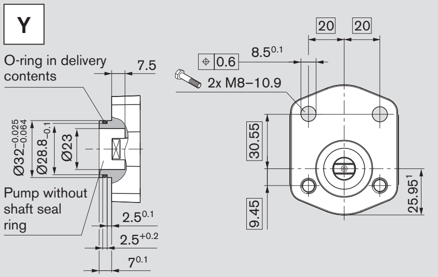


Front cover

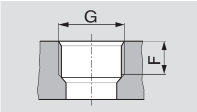








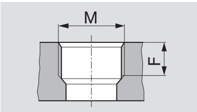
Line ports



01 **Pipe thread ISO 228/1**

Limited service life compared to line port 20

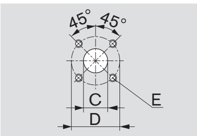
Ordering code	Size	Pressure side		Suction side	
		G	**F**	**G**	**F**
01	1...3.15 cm^3	G $^{3}/_{8}$	13	G $^{3}/_{8}$	13
	4.0...7.1 cm^3	G $^{3}/_{8}$		G $^{1}/_{2}$	13



02 **Pipe thread ISO 9974-1**

Limited service life compared to line port 20

Ordering code	Size	Pressure side		Suction side	
		M	**F**	**M**	**F**
02	1...3.15 cm^3	14x1.5	13	M18x1.5	13
	4...7.1 cm^3			M22x1,5	



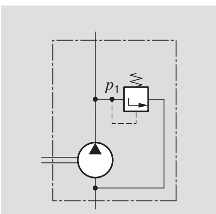
20 **Rectangular flange**

Ordering code	Size	Pressure side			Suction side		
		C	**D**	**E**	**C**	**D**	**E**
20	2...3.5 cm^3	12	30	M6 depth 13	12	30	M6 depth 11.5
	3.15...7.1 cm^3	15	35		15	35	

3

Gear pumps with integrated pressure-relief valve

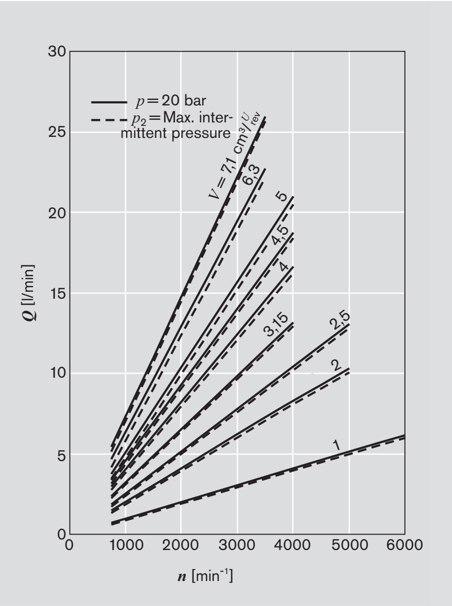
In order to reduce external pipework it is possible to incorporate a pressure-relief valve in the cover of the gear pump.



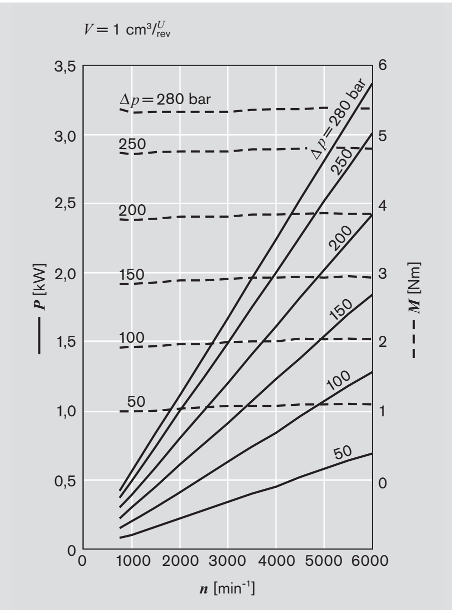
Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

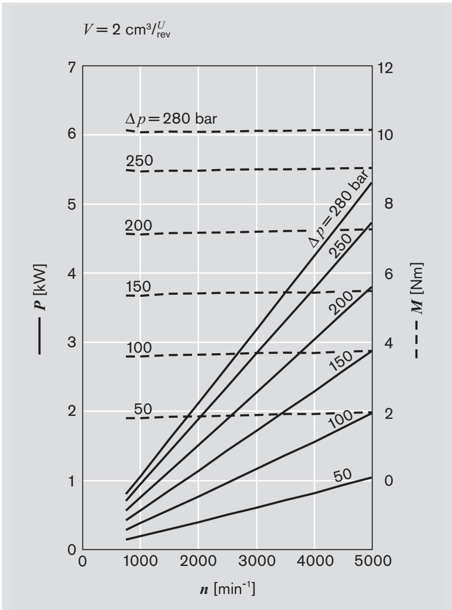
Performance charts

$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$

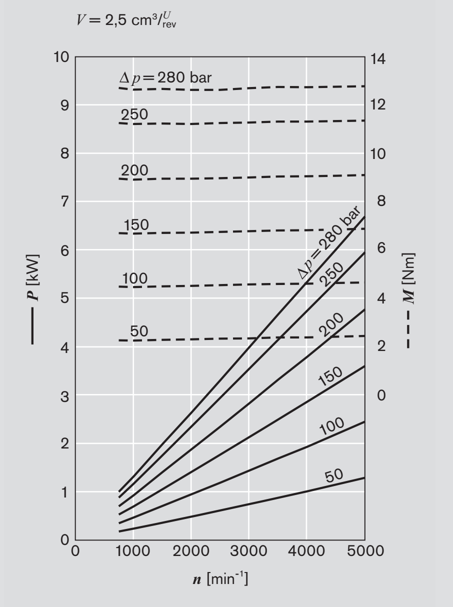


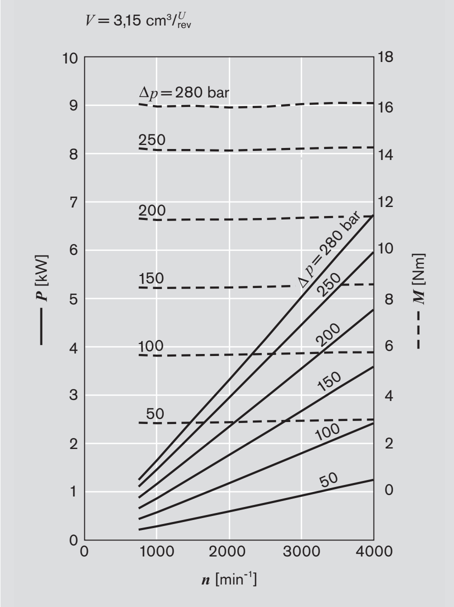
$Q = f\ (n, V)$ incl. η_v
$P = f\ (n, p)$ ——— incl. η_t
$M = f\ (n, p)$ - - - incl. η_{hm}

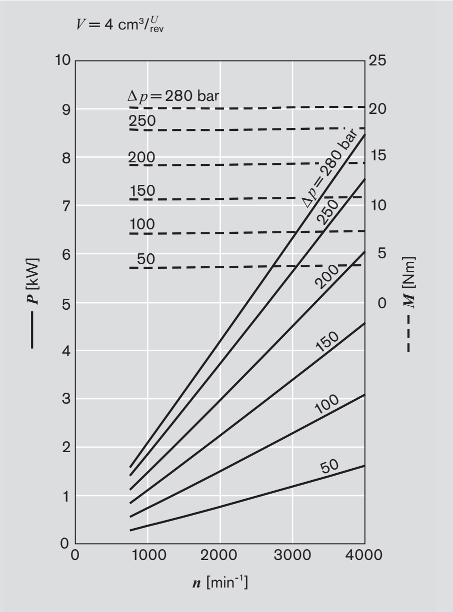


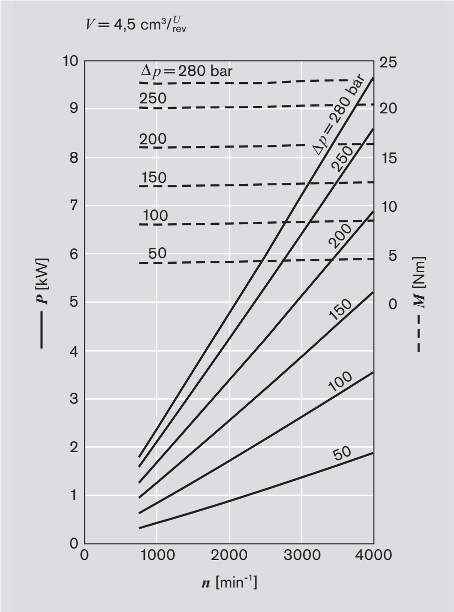


Performance charts (continued)

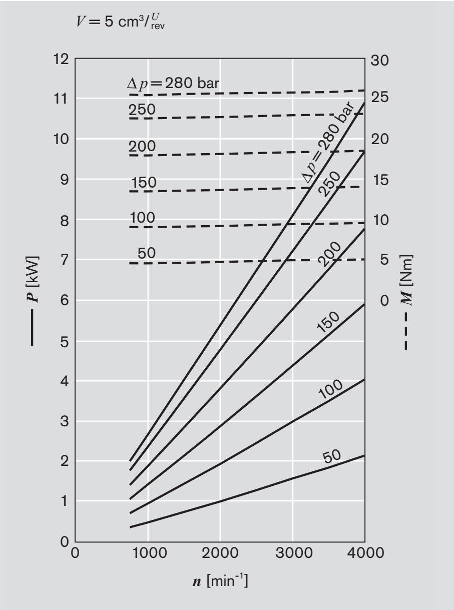


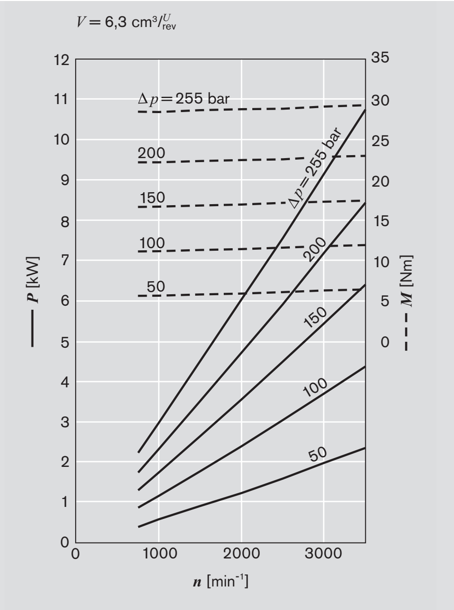


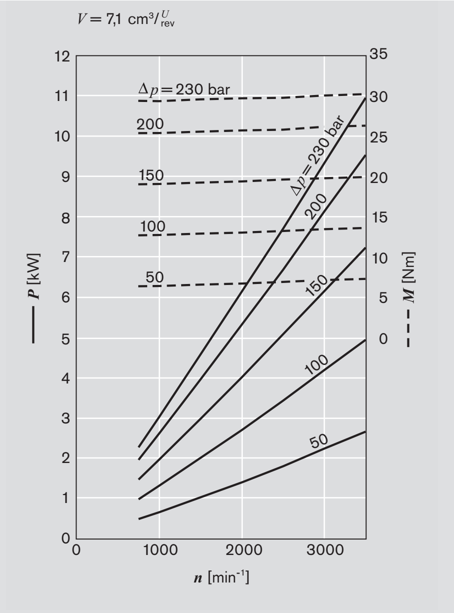




Performance charts (continued)



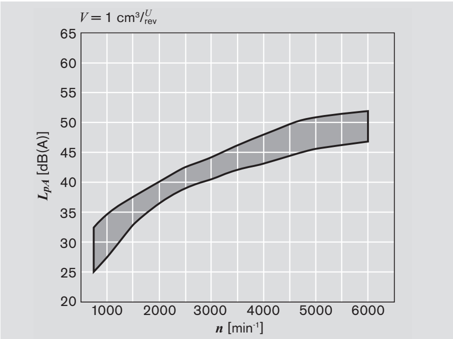


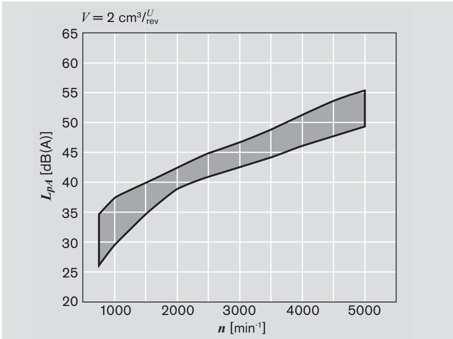


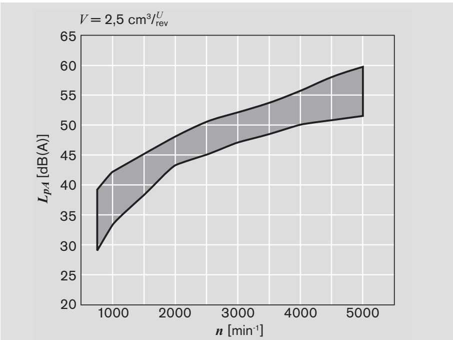
Noise charts

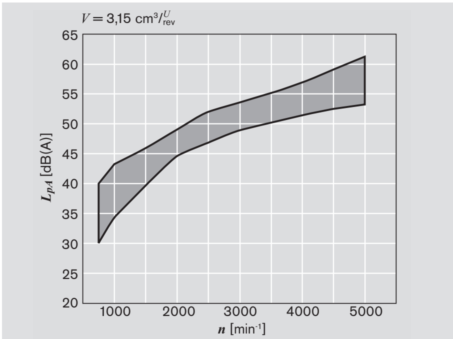
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 13 Specifications table).
Oil data: $\nu = 32\ mm^2/s$, $\vartheta = 50\ °C$.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

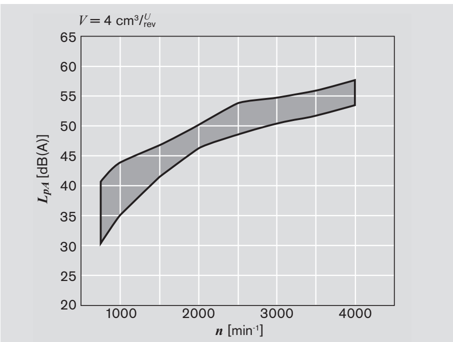
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

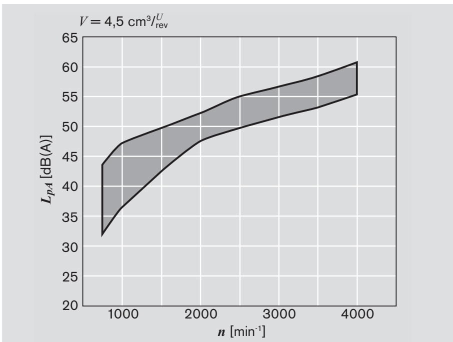












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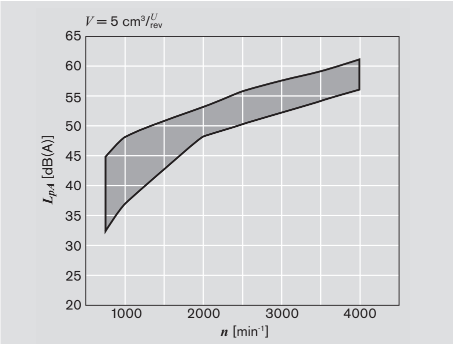
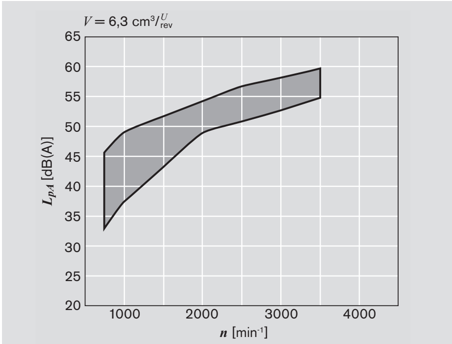
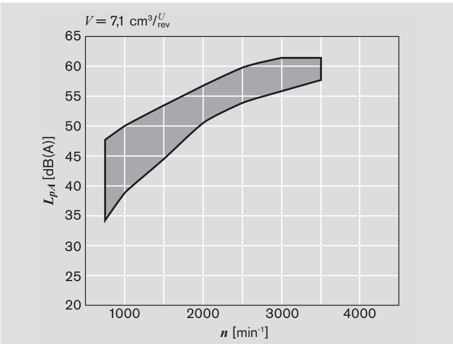
Noise charts (continued)







Design calculations for pumps

The design calculations for pumps are based on the following parameters:

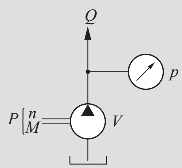
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagram for approximate selection data can be found on pages 8...10.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

n —— $\eta_v \longrightarrow Q$
M —— $\eta_{hm} \longrightarrow p$
P —— $\eta_t \longrightarrow p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

Caution: η [%] e.g. 95 [%]

Specifications

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Internal thread, flange
Direction of rotation (looking on shaft)	Clockwise or counterclockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C with NBR seal –20 °C...+110 °C with FKM seals
Fluids	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permissible range 20...100 mm²/s recommended range ...2000 mm²/s permissible range for start up
Fluid temperature range	max. +80 °C with NBR seals max. +110 °C with FKM seals
Filtration *)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

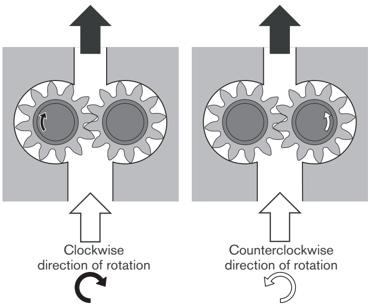
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

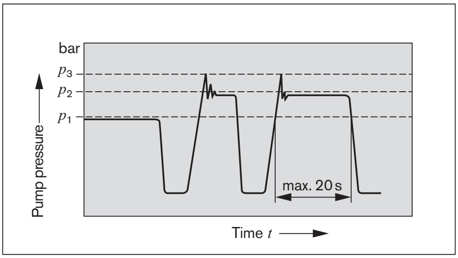
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps. On counterclockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



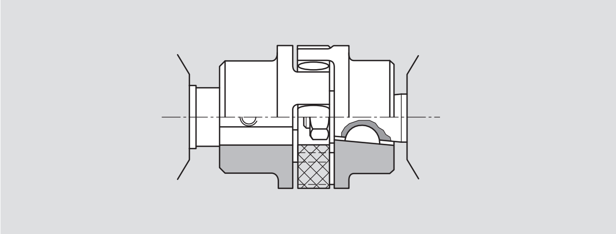
p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPB-22

Displacement	V	cm³/rev	1	2	2.5	3.15	4	4.5	5	6.3	7.1
Suction pressure	p_e	bar	0.7...3 (absolute)								
max. continuous pressure	p_1		250	250	250	250	250	250	250	225	200
max. intermittent pressure	p_2		280	280	280	280	280	280	280	255	230
max. peak pressure	p_3		300	300	300	300	300	300	300	275	250
min. rotational speed		rpm	750	750	750	750	750	750	750	750	750
max. rotational speed at	p_2		6,000	5,000	5,000	4,000	4,000	4,000	4,000	3,500	3,500

Drive arrangement

The coupling must not transfer any radial or axial forces to the pump.

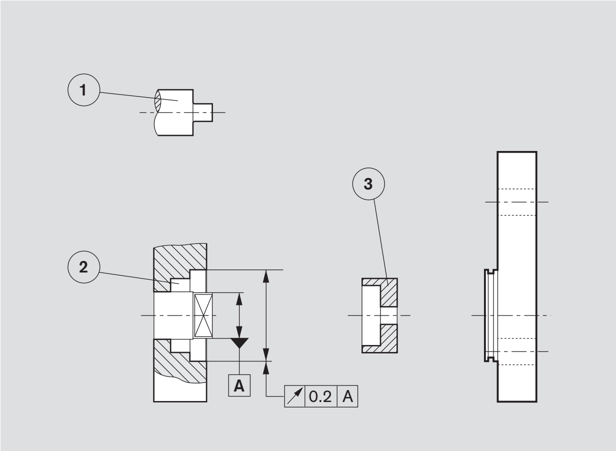


1. Flexible couplings
Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.

The maximum radial runout of pump shaft spigot is 0.2 mm.

2. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.



Transferrable torque:
AZPB-22 = 25 Nm.
Suitable couplings for AZPB-22:
1 510 001 002 for AZPFB,
1 510 240 001 for AZPBB.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm 2}$
Surface for sealing ring
ground without rifling $R_t \leq 4 \mu m$

② **Radial shaft seal**
with rubber covered seal
(see DIN 3760, Type AS, or double-lipped ring).
Please take note of the seal ring manufacturer's guidelines for arrangement of the installation space.

Multiple gear pumps

Gear pumps are suitable for multiple setups, whereby the drive shaft for the 1st pump is extended to a second and even a 3rd pump. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

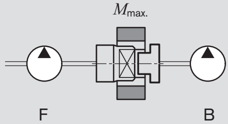
Pressure restrictions
In the case of series B (AZPB-22), the driver for the second pumping stage can carry a load of up to $M_{max.} = 25$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		max. transferrable drive torque * [Nm]
C	1:5	26
H	1:8	30
N	Claw	25

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

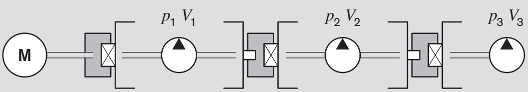


Combinations

Series Pump 1	$M_{max.}$ [Nm]	Series Pump 2
F	25	B
B	25	B

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

3

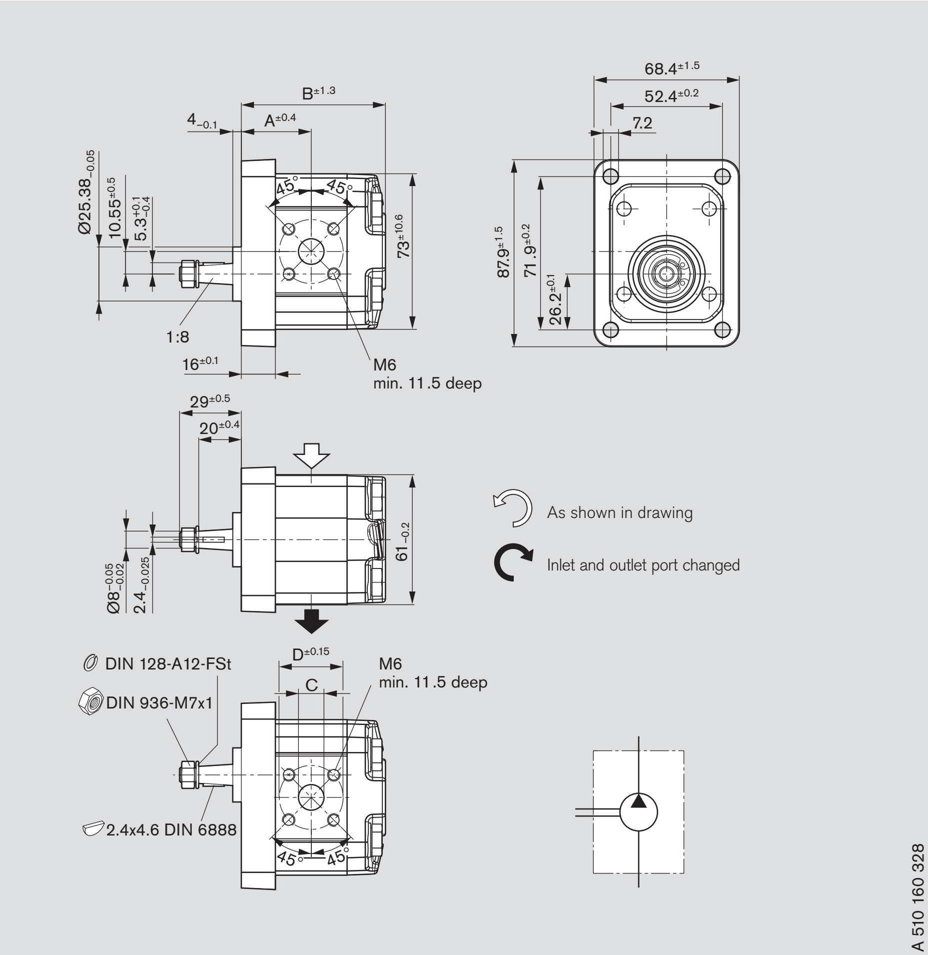


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Unit dimensions

Standard range

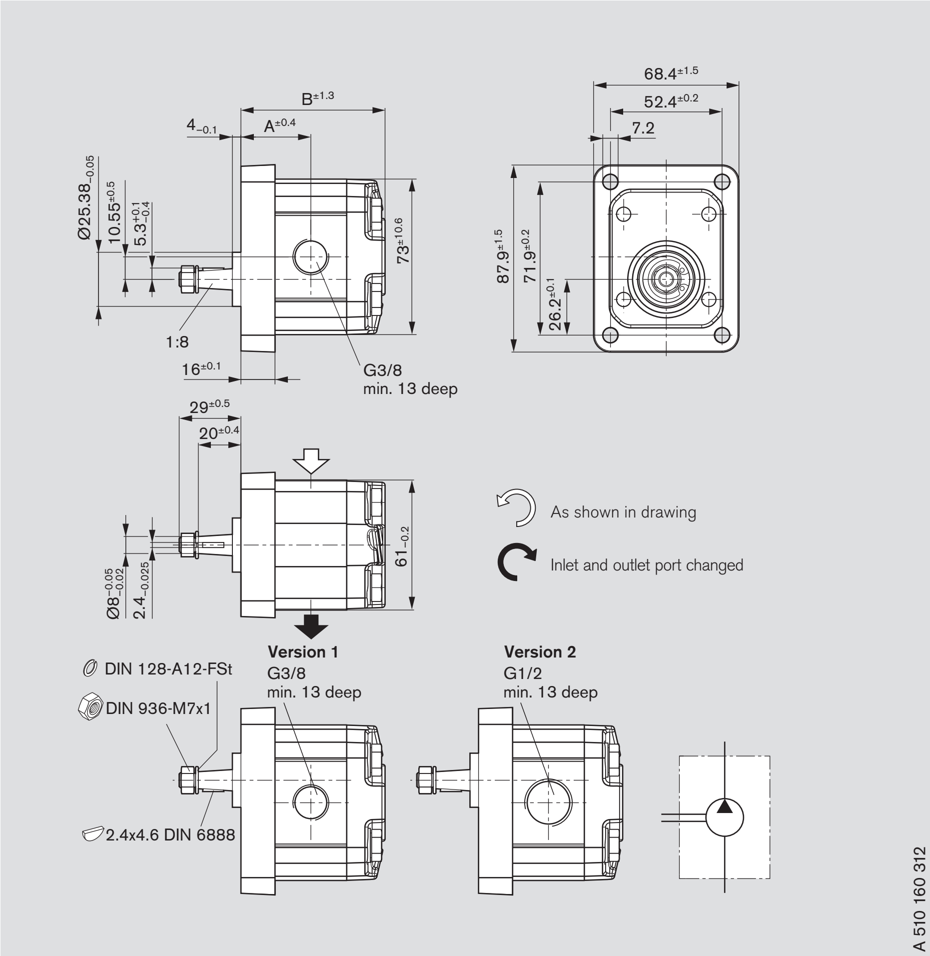


Ordering code:
AZPB – 22 – □□□ □ H O 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	C	D
2	**0 510 120 310**	**0 510 120 012**	280	5,000	1.5	32.8	67.9	12	30
2.5	**0 510 120 311**	**0 510 120 013**	280	5,000	1.5	33.8	69.8	12	30
3.15	**0 510 120 312**	**0 510 120 014**	280	4,000	1.5	35.0	72.3	15	35
4	**0 510 120 313**	**0 510 120 015**	280	4,000	1.6	36.6	75.5	15	35
4.5	**0 510 120 314**	**0 510 120 016**	280	4,000	1.6	37.8	77.4	15	35
5	**0 510 120 315**	**0 510 120 017**	280	4,000	1.6	38.6	79.5	15	35
6.3	**0 510 120 316**	**0 510 120 018**	255	3,500	1.7	41.0	84.2	15	35
7.1	**0 510 120 317**	**0 510 120 019**	230	3,500	1.7	42.5	87.3	15	35

Unit dimensions

Standard range



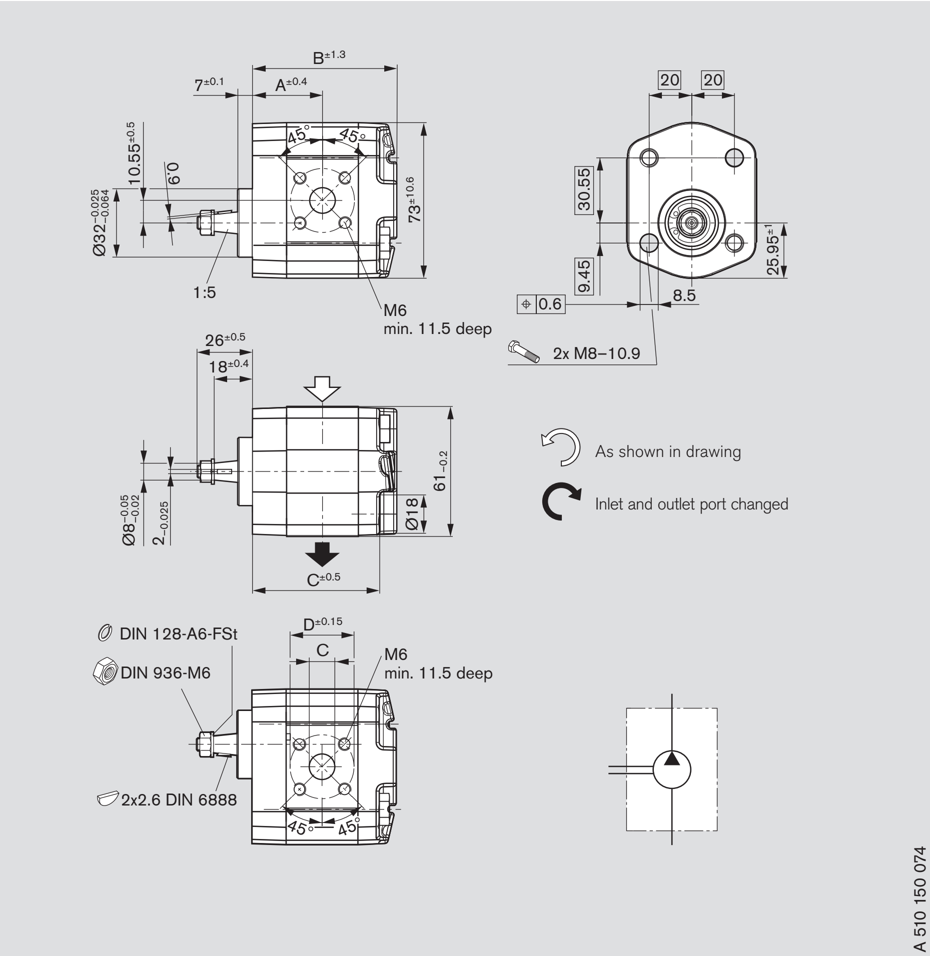
3

Ordering code:
AZPB – 22 – □ □ □ □ H O 01 M B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	Version
1	**0 510 020 302**	**0 510 020 002**	280	6,000	1.4	30.9	64.1	1
2	**0 510 120 302**	**0 510 120 004**	280	5,000	1.5	32.8	67.9	1
2.5	**0 510 120 303**	**0 510 120 005**	280	5,000	1.5	33.8	69.8	1
3.15	**0 510 120 304**	**0 510 120 006**	280	4,000	1.5	35.0	72.3	1
4	**0 510 120 305**	**0 510 120 007**	280	4,000	1.6	36.6	75.5	2
4.5	**0 510 120 306**	**0 510 120 008**	280	4,000	1.6	37.8	77.4	2
5	**0 510 120 307**	**0 510 120 009**	280	4,000	1.6	38.6	79.5	2
6.3	**0 510 120 308**	**0 510 120 010**	255	3,500	1.7	41.0	84.2	2
7.1	**0 510 120 309**	**0 510 120 011**	230	3,500	1.7	42.5	87.3	2

Unit dimensions

Standard range

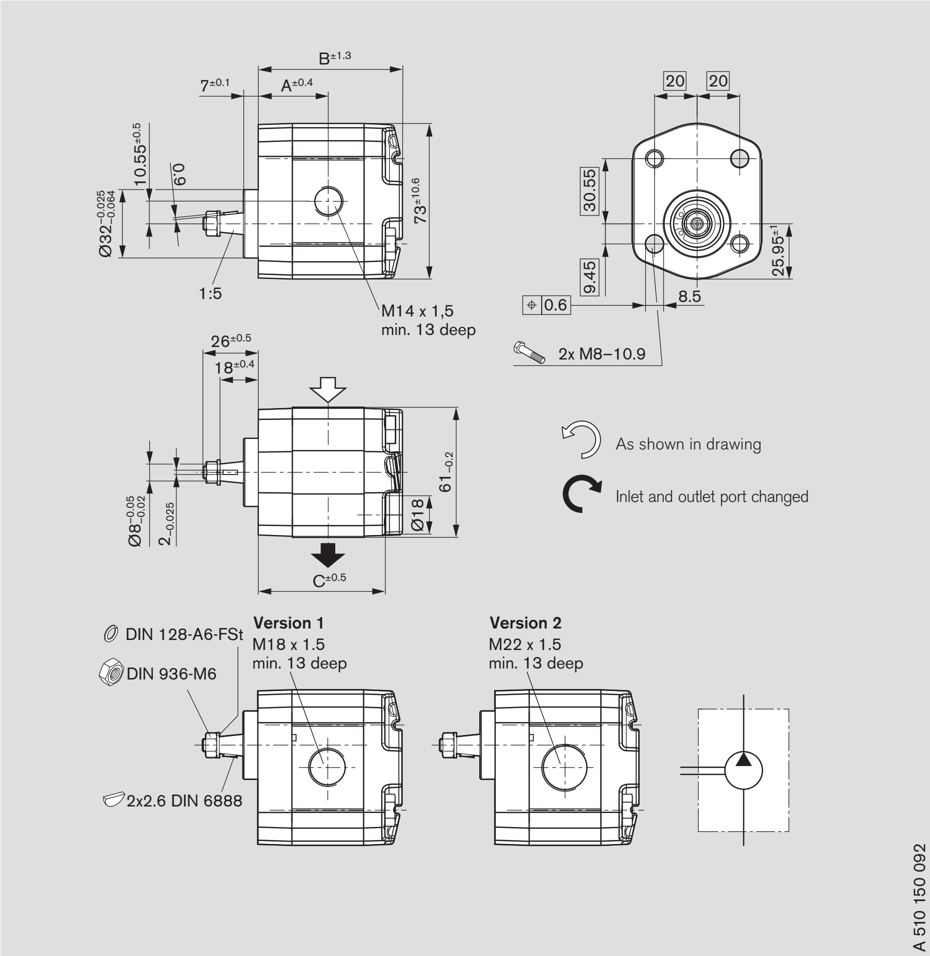


Ordering code:
AZPB – 22 – □□□ □ C P 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	C	D	E
2	**0 510 110 318**	**0 510 110 012**	280	5,000	1.2	32.8	67.9	12	30	59.0
2.5	**0 510 110 319**	**0 510 110 013**	280	5,000	1.3	33.8	69.8	12	30	60.9
3.15	**0 510 112 314**	**0 510 112 011**	280	4,000	1.3	35.0	72.3	12	30	63.4
4	**0 510 114 312**	**0 510 114 009**	280	4,000	1.3	36.6	75.5	15	35	66.6
4.5	**0 510 114 313**	**0 510 114 010**	280	4,000	1.4	37.8	77.4	15	35	68.5
5	**0 510 114 314**	**0 510 114 011**	280	4,000	1.4	38.6	79.5	15	35	70.6
6.3	**0 510 122 308**	**0 510 122 006**	255	3,500	1.4	41.0	84.2	15	35	75.3
7.1	**0 510 122 309**	**0 510 122 007**	230	3,500	1.5	42.5	87.3	15	35	78.4

Unit dimensions

Standard range



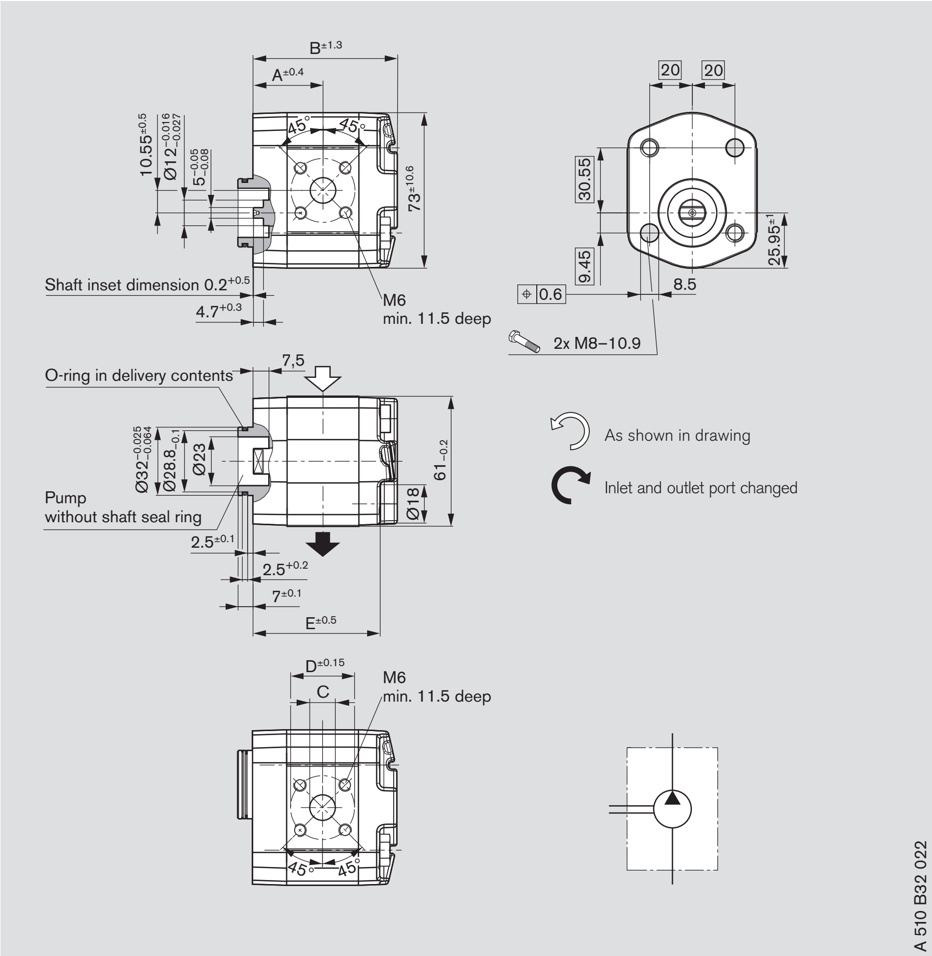
3

Ordering code:
AZPB – 22 – □ □ □ □ C P 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	C	Version
1	**0 510 010 309**	**0 510 010 006**	280	6,000	1.2	30.9	64.1	56.4	1
2	**0 510 110 314**	**0 510 110 008**	280	5,000	1.2	32.8	67.9	59.0	1
2.5	**0 510 110 315**	**0 510 110 009**	280	5,000	1.3	33.8	69.8	60.9	1
3.15	**0 510 112 313**	**0 510 112 010**	280	4,000	1.3	35.0	72.3	63.4	1
4	**0 510 114 309**	**0 510 114 006**	280	4,000	1.3	36.6	75.5	66.5	2
4.5	**0 510 114 310**	**0 510 114 007**	280	4,000	1.4	37.8	77.4	68.5	2
5	**0 510 114 311**	**0 510 114 008**	280	4,000	1.4	38.6	79.5	70.6	2
6.3	**0 510 122 306**	**0 510 122 004**	255	3,500	1.4	41.0	84.2	75.3	2
7.1	**0 510 122 307**	**0 510 122 005**	230	3,500	1.5	42.5	87.3	78.4	2

Unit dimensions

Standard range

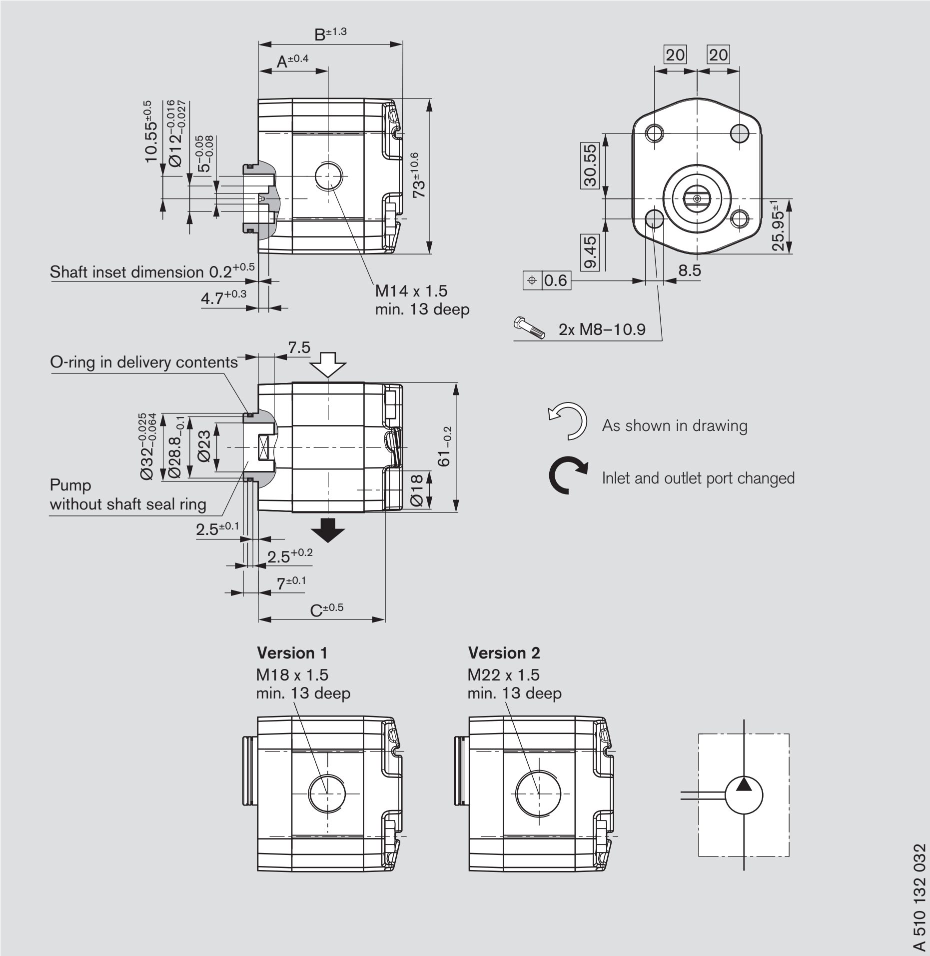


Ordering code:
AZPB – 22 – □□□ □ N M 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	C	D	E
2	**0 510 110 320**	**0 510 110 015**	280	5,000	1.2	32.8	67.9	12	30	59.0
2.5	**0 510 110 321**	**0 510 110 016**	280	5,000	1.3	33.8	69.8	12	30	60.9
3.15	**0 510 112 316**	**0 510 112 013**	280	4,000	1.3	35.0	72.3	15	35	63.4
4	**0 510 114 318**	**0 510 114 015**	280	4,000	1.3	36.6	75.5	15	35	66.6
4.5	**0 510 114 319**	**0 510 114 016**	280	4,000	1.3	37.8	77.4	15	35	68.5
5	**0 510 114 320**	**0 510 114 017**	280	4,000	1.4	38.6	79.5	15	35	70.6
6.3	**0 510 122 312**	**0 510 122 010**	255	3,500	1.4	41.0	84.2	15	35	75.3
7.1	**0 510 122 313**	**0 510 122 011**	230	3,500	1.5	42.5	87.3	15	35	78.4

Unit dimensions

Standard range

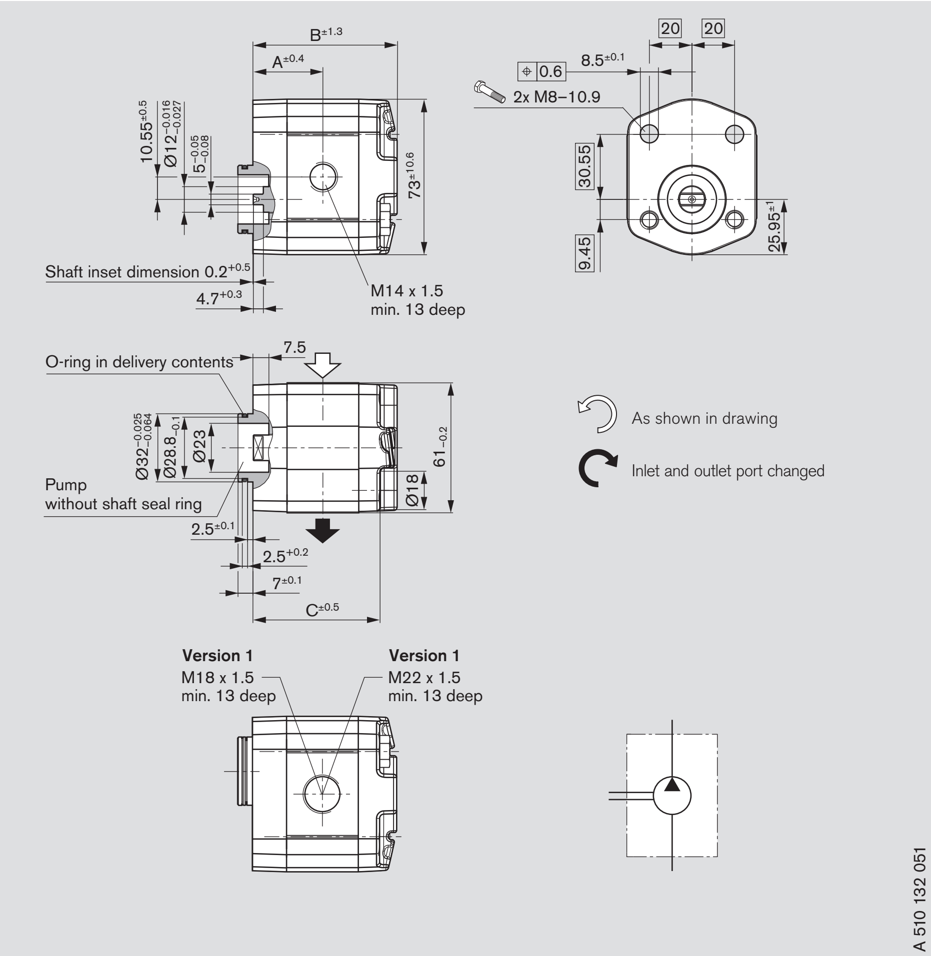


Ordering code:
AZPB – 22 – ☐☐☐ ☐ C P 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	C	Version
1	**0 510 010 310**	**0 510 010 007**	280	6,000	1.2	30.9	64.1	55.2	1
2	**0 510 110 316**	**0 510 110 010**	280	5,000	1.2	32.8	67.9	59.0	1
2.5	**0 510 110 317**	**0 510 110 011**	280	5,000	1.3	33.8	69.8	60.9	1
3.15	**0 510 112 315**	**0 510 112 012**	280	4,000	1.3	35.0	72.3	63.4	1
4	**0 510 114 315**	**0 510 114 012**	280	4,000	1.3	36.6	75.5	66.6	2
4.5	**0 510 114 316**	**0 510 114 013**	280	4,000	1.3	37.8	77.4	68.5	2
5	**0 510 114 317**	**0 510 114 014**	280	4,000	1.4	38.6	79.5	70.6	2
6.3	**0 510 122 310**	**0 510 122 008**	255	3,500	1.4	41.0	84.2	75.3	2
7.1	**0 510 122 311**	**0 510 122 009**	230	3,500	1.5	42.5	87.3	78.4	2

Unit dimensions

Standard range

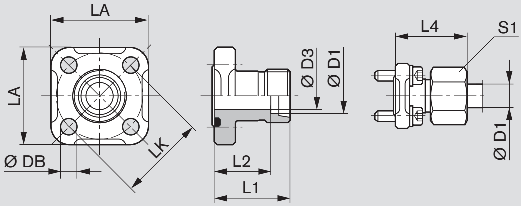


Ordering code:
AZPB – 22 – ☐☐☐ ☐N Y 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass kg	Dimension [mm] A	B	Version
1	**1 519 222 214**	**1 519 222 213**	280	6,000	1.2	30.9	64.1	1
2	**1 519 222 216**	**1 519 222 215**	280	5,000	1.2	32.8	67.9	1
2.5	**1 519 222 218**	**1 519 222 217**	280	5,000	1.3	33.8	69.8	1
3.15	**1 519 222 220**	**1 519 222 219**	280	4,000	1.3	35.0	72.3	1
4	**1 519 222 222**	**1 519 222 221**	280	4,000	1.3	36.6	75.5	2
4.5	**1 519 222 224**	**1 519 222 223**	280	4,000	1.4	37.8	77.4	2
5	**1 519 222 226**	**1 519 222 225**	280	4,000	1.4	38.6	79.5	2
6.3	**1 519 222 228**	**1 519 222 227**	255	3,500	1.4	41.0	84.2	2
7.1	**1 519 222 230**	**1 519 222 229**	230	3,500	1.5	42.5	87.3	2

Fittings

Gear pump flange, straight, for rectangular flange 20 see page 7

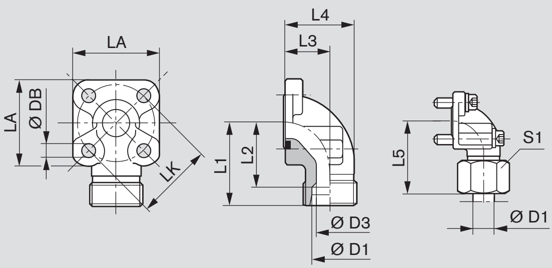


LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws (metr.) 4 pieces	Seal ring	Mass kg	Part number	p (bar)
35	10L	8	30	23.0	39.0	40	19	6.4	M6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M6x22	20x2.5	0.10	**1 515 702 066**	250

Complete fittings with seal ring, metric screw set, nuts and olive.

3

Gear pump flange, 90° angle, for rectangular flange 20 see page 7



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2 pieces	Screws 2 pieces	Seal ring	Mass kg	Part number	p (bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M6x22	M6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M6x22	M6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M6x22	M6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M6x22	M6x45	20x2.5	0.24	**1 515 702 017**	315

Complete fittings with seal ring, metric screw set, nuts and olive.

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated pressure fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles.

We recommend that a full-flow filter always be used.
Basic contamination of the pressure fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
– The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
– Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

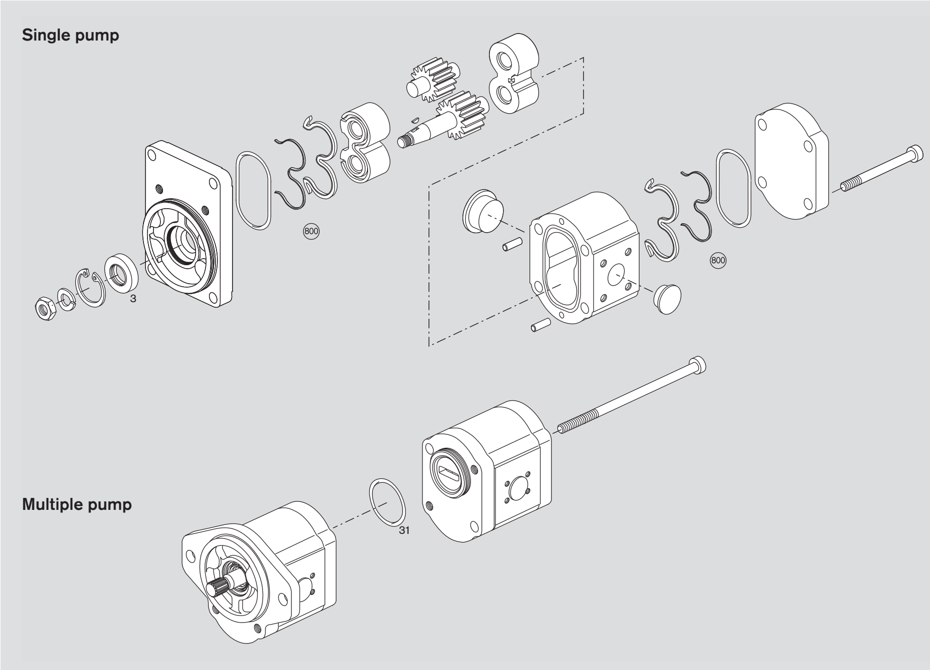
Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 13 to 15.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under device measurements and ordering code, pages 19 – 27, are contained in delivery.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Spare parts, schematic diagram



Page	Ordering code	Seal kit “B” Item 800 NBR	Shaft seal ring Item 3	Dimension	Material
16	AZPB – 22 – □□□ □ H O 20 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
17	AZPB – 22 – □□□ □ H O 01 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
18	AZPB – 22 – □□□ □ C P 20 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
19	AZPB – 22 – □□□ □ C P 02 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
20	AZPB – 22 – □□□ □ N M 20 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
21	AZPB – 22 – □□□ □ N M 02 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR
22	AZPB – 22 – □□□ □ N Y 02 M B	1 517 010 238	1 510 283 074	22 x 12 x 6	NBR

NBR = Perbunan®

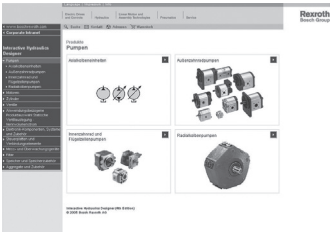
For multiple pumps

Seal ring Item 31 NBR	1 900 210 127

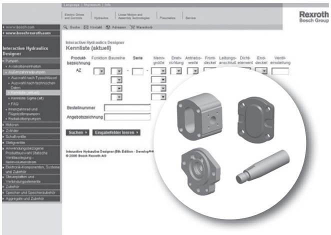
3

The AZ configurator at www.boschrexroth.com/azconfigurator

The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.

If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Ordering-No.

Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page
0 510 010 006	19	0 510 114 016	20	0 510 120 312	16
0 510 010 007	21	0 510 114 017	20	0 510 120 313	16
0 510 010 309	19	0 510 114 309	19	0 510 120 314	16
0 510 010 310	21	0 510 114 310	19	0 510 120 315	16
0 510 020 002	17	0 510 114 311	19	0 510 120 316	16
0 510 020 302	17	0 510 114 312	18	0 510 120 317	16
0 510 110 008	19	0 510 114 313	18	0 510 122 004	19
0 510 110 009	19	0 510 114 314	18	0 510 122 005	19
0 510 110 010	21	0 510 114 315	21	0 510 122 006	18
0 510 110 011	21	0 510 114 316	21	0 510 122 007	18
0 510 110 012	18	0 510 114 317	21	0 510 122 008	21
0 510 110 013	18	0 510 114 318	20	0 510 122 009	21
0 510 110 015	20	0 510 114 319	20	0 510 122 010	20
0 510 110 016	20	0 510 114 320	20	0 510 122 011	20
0 510 110 314	19	0 510 120 004	17	0 510 122 306	19
0 510 110 315	19	0 510 120 005	17	0 510 122 307	19
0 510 110 316	21	0 510 120 006	17	0 510 122 308	18
0 510 110 317	21	0 510 120 007	17	0 510 122 309	18
0 510 110 318	18	0 510 120 008	17	0 510 122 310	21
0 510 110 319	18	0 510 120 009	17	0 510 122 311	21
0 510 110 320	20	0 510 120 010	17	0 510 122 312	20
0 510 110 321	20	0 510 120 011	17	0 510 122 313	20
0 510 112 010	19	0 510 120 012	16	1 519 222 213	22
0 510 112 011	18	0 510 120 013	16	1 519 222 214	22
0 510 112 012	21	0 510 120 014	16	1 519 222 215	22
0 510 112 013	20	0 510 120 015	16	1 519 222 216	22
0 510 112 313	19	0 510 120 016	16	1 519 222 217	22
0 510 112 314	18	0 510 120 017	16	1 519 222 218	22
0 510 112 315	21	0 510 120 018	16	1 519 222 219	22
0 510 112 316	20	0 510 120 019	16	1 519 222 220	22
0 510 114 006	19	0 510 120 302	17	1 519 222 221	22
0 510 114 007	19	0 510 120 303	17	1 519 222 222	22
0 510 114 008	19	0 510 120 304	17	1 519 222 223	22
0 510 114 009	18	0 510 120 305	17	1 519 222 224	22
0 510 114 010	18	0 510 120 306	17	1 519 222 225	22
0 510 114 011	18	0 510 120 307	17	1 519 222 226	22
0 510 114 012	21	0 510 120 308	17	1 519 222 227	22
0 510 114 013	21	0 510 120 309	17	1 519 222 228	22
0 510 114 014	21	0 510 120 310	16	1 519 222 229	22
0 510 114 015	20	0 510 120 311	16	1 519 222 230	22

3

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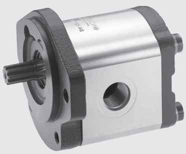
Rexroth
Bosch Group

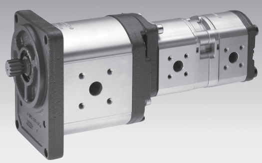
External Gear Pumps Series F

RE 10 089/02.12
Replaces:
RE 10 089/12.10

AZPF-...

Fixed pumps
$V = 4.0...28\ \text{cm}^3/\text{rev}$





Overview of contents

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Features

- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports:
  connection flange or screw thread
- Consistent high quality thru mass production
- Numerous configuration variants available

General

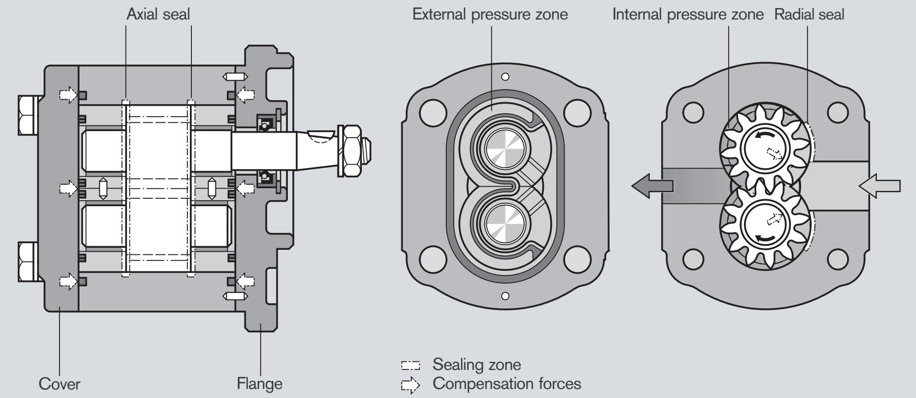
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G and as SILENCE gear pumps in the series of S, T and U, in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

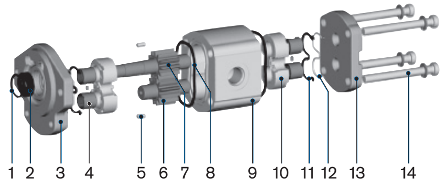
Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearing is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

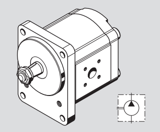
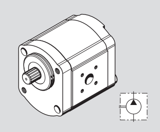
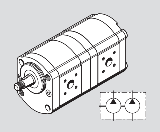
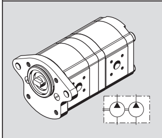
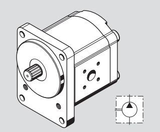
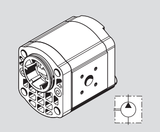
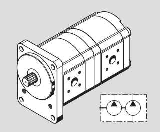
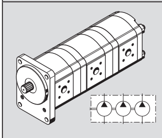
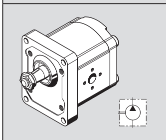
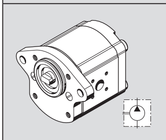
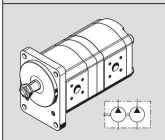
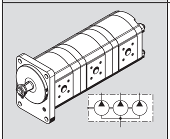
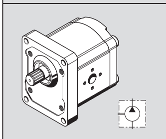
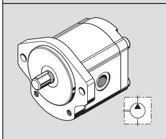
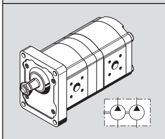
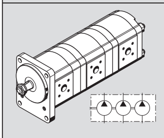
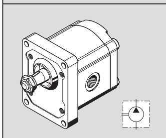
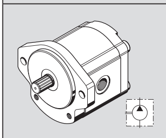
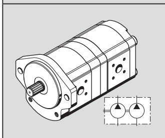
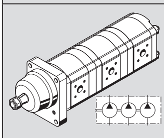
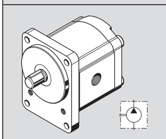
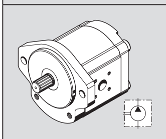
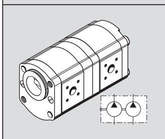
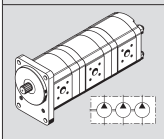
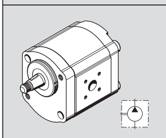
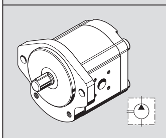
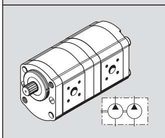
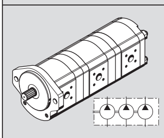
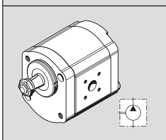
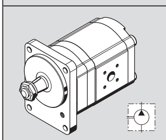
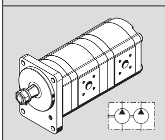
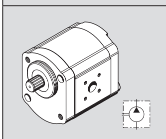
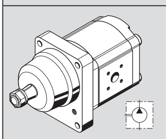
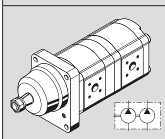
Gear pump axial compensation





1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

Product overview of "Series F" standard types

Version	Page	Version	Page	Version	Page	Version	Page
	20		29		38		52
	21		30		40		53
	22		31		42		54
	23		32		44		55
	24		33		46		56
	25		34		48		57
	26		35		49		58
	27		36		50		
	28		37		51		

3

Ordering code

External gear units, single pumps, standard

AZ	P	F	–	x	x	–	016	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
1 = Standard bearing
2 = Reinforced bearing

Version
0 = Phosphatized
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size (F)
004 = 4.0 cm^3/rev
005 = 5.5 cm^3/rev
008 = 8.0 cm^3/rev
011 = 11.0 cm^3/rev
014 = 14.0 cm^3/rev
016 = 16.0 cm^3/rev
019 = 19.0 cm^3/rev
022 = 22.5 cm^3/rev
025 = 25.0 cm^3/rev
028 = 28.0 cm^3/rev

Direction of rotation
R = Clockwise
L = Counterclockwise

*) Some of the special designs shown on pages 18–55 are not covered in the illustration of the ordering code.

Special design *)

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

Rear cover
B = Standard
D = PRV residual flow internal
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM

Drive shafts

		Suitable front cover	
C	Tapered key shaft 1:5	B	P
H	Tapered key shaft 1:8	O	
N	Dihedral claw	M	
Q	Straight keyed shaft SAE J 744 16-1 A	R	
R	Splined shaft SAE J 744 16-4 9T	R	C
P	Splined shaft SAE J 744 19-4 11T	R	C
F	Splined shaft DIN 5482 B 17 x 14	B	P
S	Tapered key shaft 1:5 for flange A	A	
A	Straight keyed shaft ISO Ø 18 mm	B	

Front cover

Code	Front cover
B	Square flange Centering Ø 80 mm
R	SAE J 744 82-2 A 2-bolt flange Ø 82.55 mm
P	2-bolt mounting Centering Ø 50 mm
O	Square flange Centering Ø 36.47 mm
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm
M	2-bolt mounting Centering Ø 52 mm with seal ring
A	Outboard bearing Ø 80 mm, Type 1
N	2-bolt mounting Centering Ø 50 mm
T	4-bolt mounting Ø 52 mm with seal ring
G	Outboard bearing Ø 80 mm, Type 2

Line ports

Code	Line ports
20	Rectangular flange
12	Thread (UNF-2B) SAE Seal ring BOSS
30	Rectangular flange
01	Pipe thread ISO 228/1
03	Thread, metric ISO 6149 with seal ring

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units, multiple pumps, standard

AZ	P	GGFF	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm³/rev
S = 4.0...28 cm³/rev
F = 4.0...28 cm³/rev
T = 20.0...36 cm³/rev
N = 20.0...36 cm³/rev
U = 22.5...63 cm³/rev
G = 22.5...63 cm³/rev

Series, relates to pump section 1
1x = Standard bearing
2x = Reinforced bearing

Version, relates to pump section 1
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = Clockwise,
L = Counter-clockwise

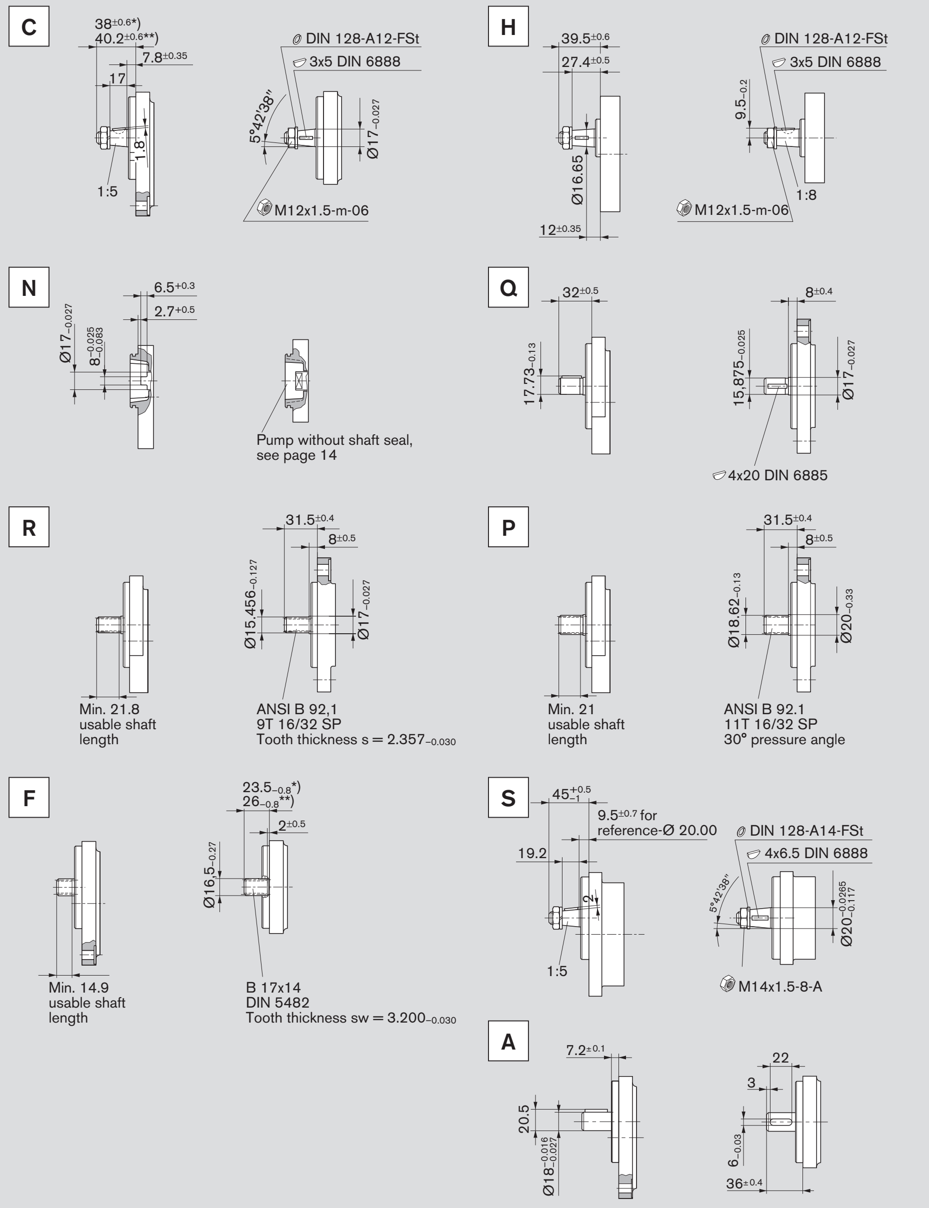
Rear cover
relates to last pump section
B = Standard

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts relates to pump part 1		Suitable front cover	Front cover relates to pump part 1		Line ports every pump parts	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**02**	Thread, metric DIN 3852 T1
Series F, S:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm		
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
N	Dihedral claw	**M**	**M**	Centering Ø 52 mm with seal ring		
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm		

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Drive shafts

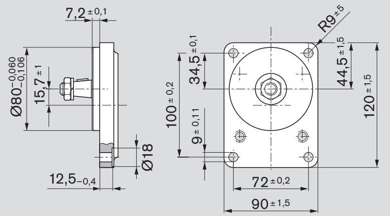


*) in combination with front cover B

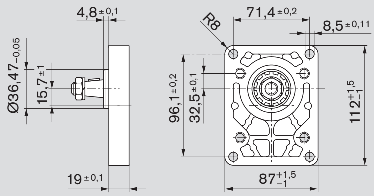
**) in combination with front cover P

Front cover

B



O



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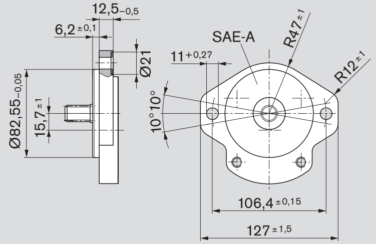

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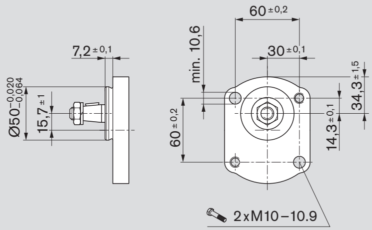

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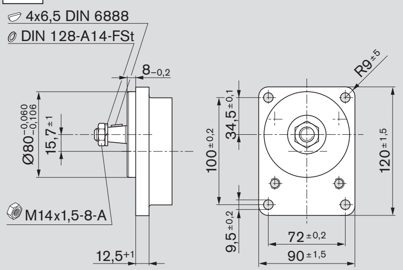

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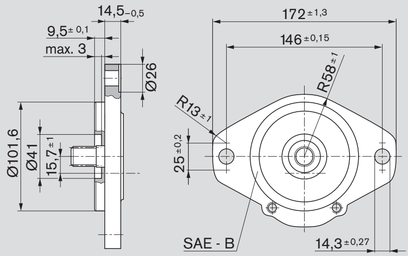

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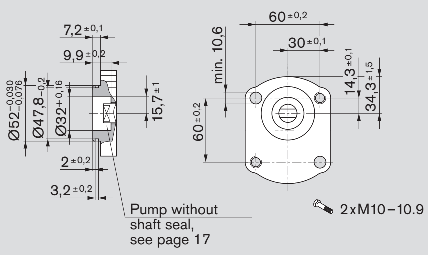

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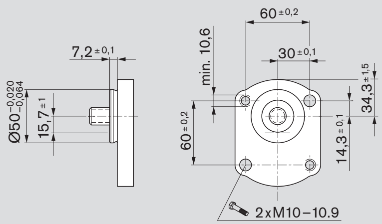
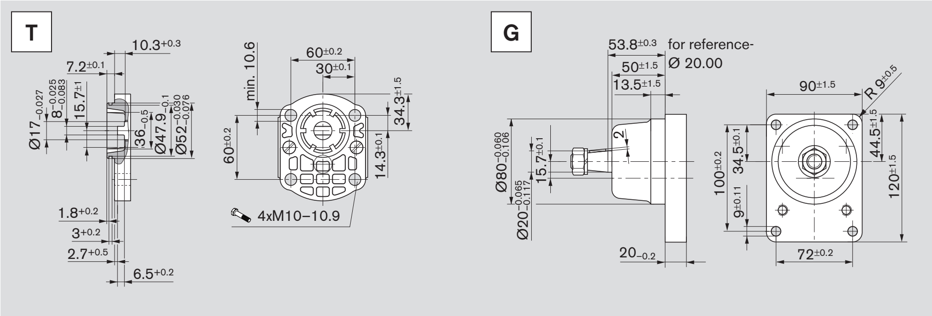
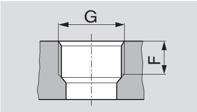


Front cover (continued)



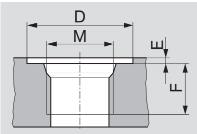
Line ports



01 **Pipe thread ISO 228/1**

At pressures $p_2 > 210$ bar limited fatigue strength

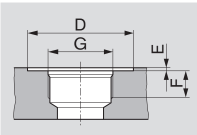
Ordering code	Size	Pressure side		Suction side	
		G	F	G	F
01	4...16 cm³	G 1/2	16	G 3/4	16
	19...28 cm³	G 3/4		G 1	19



03 **Thread, metric ISO 6149 with seal ring**

At pressures $p_2 > 210$ bar limited service life

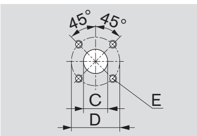
Ordering code	Size	Pressure side				Suction side			
		M	D	E	F	M	D	E	F
03	4...5.5 cm³	M 18 x 1.5	29	0.5	16	M 18 x 1.5	29	0.5	16
	8...16 cm³	M 22 x 1.5	34		18	M 27 x 2	40		19
	19...28 cm³					M 33 x 2	46		22



12 **Thread (UN-2B, UNF-2B) SAE seal ring BOSS**

At pressures $p_2 > 210$ bar limited service life

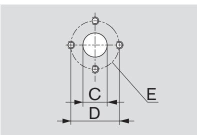
Ordering code	Size	Pressure side				Suction side			
		G	D	E	F	G	D	E	F
12	4...5.5 cm³	9/16–18 UNF-2B	25	0.5	13	9/16–18 UNF-2B	25	0.5	13
	8 cm³	7/8–14 UNF-2B	35		16	7/8–14 UNF-2B	35		16
	11...28 cm³					1 1/16–12 UN-2B	45		19



20 **Rectangular flange**

*) Dimension of Series 2

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
20	4...5.5 cm³	15	35	M 6, depth 13	15	40	M 6, depth 13
	8...22.5 cm³				20		
	19...28 cm³ *)				26	55	M 8, depth 13



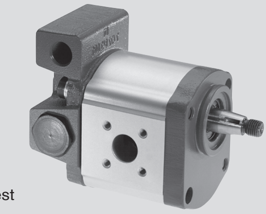
30 **Rectangular flange**

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
30	4...8 cm³	13.5	30.2	M 6, depth 13	13.5	30.2	M 6, depth 13
	11...28 cm³				20.0	39.7	M 8, depth 13

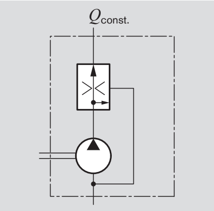
3

Gear pumps with integral valves

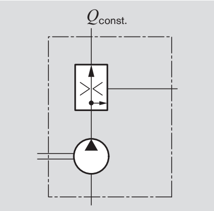
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



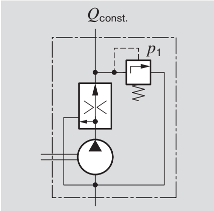
upon request



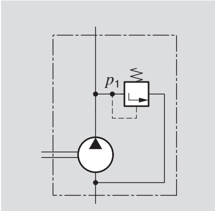
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.} = 2...30$ l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min
$p_1 = 100...180$ bar



Pressure-relief valve.
Discharge returned to suction line
$p_1 = 5...250$ bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

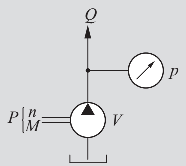
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

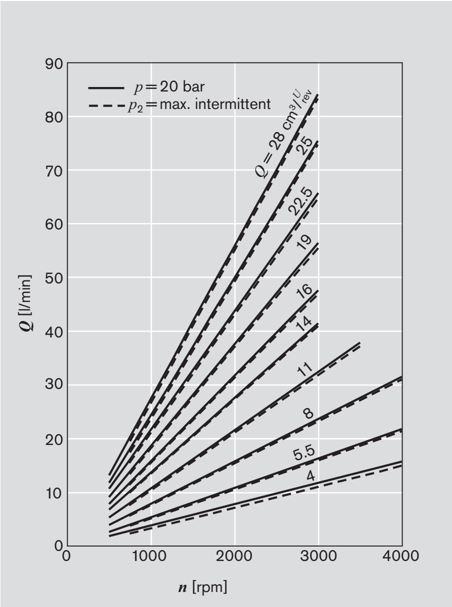
n —— η_v ⟶ Q
M —— η_{hm} ⟶ p
P —— η_t ⟶ $p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

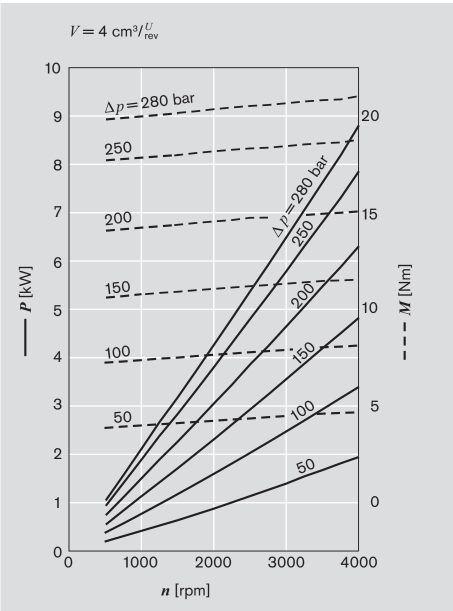
Caution: η [%] e.g. 95 [%]

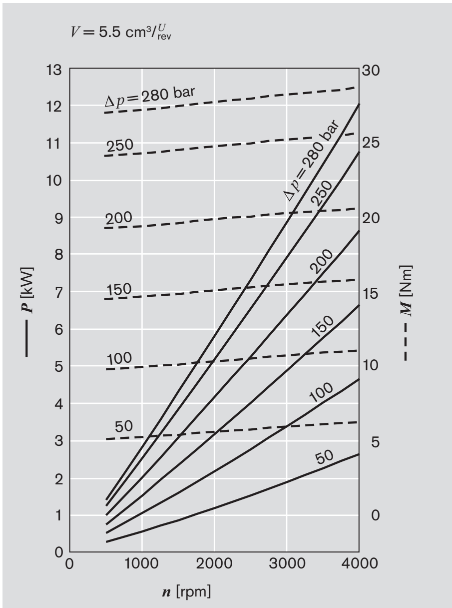
Performance charts

$\nu = 32\ \text{mm}^2/\text{s},\ \vartheta = 50\ °\text{C}$



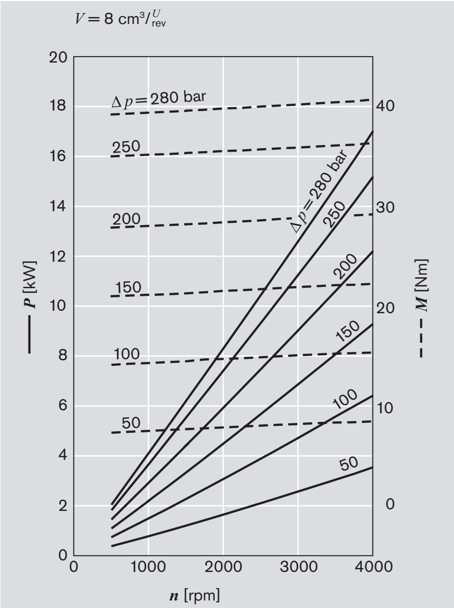
$Q = f\ (n, V)$ incl. η_v
$P = f\ (n, p)$ ——— incl. η_t
$M = f\ (n, p)$ – – – incl. η_{hm}

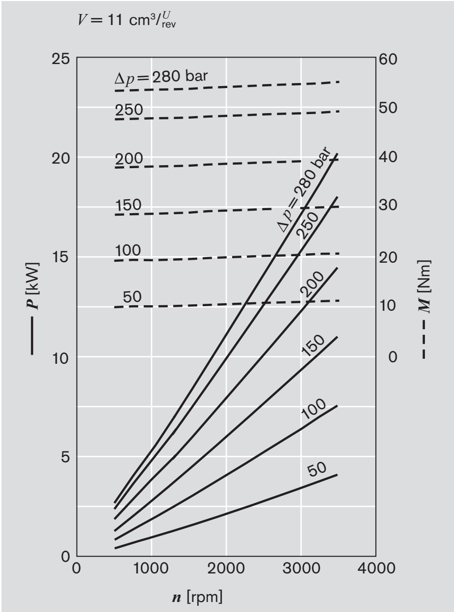


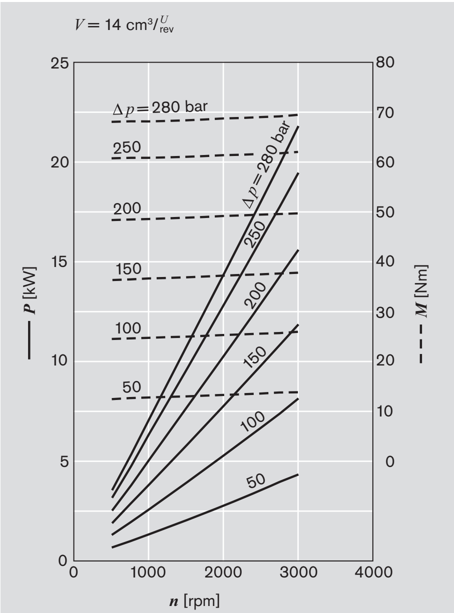


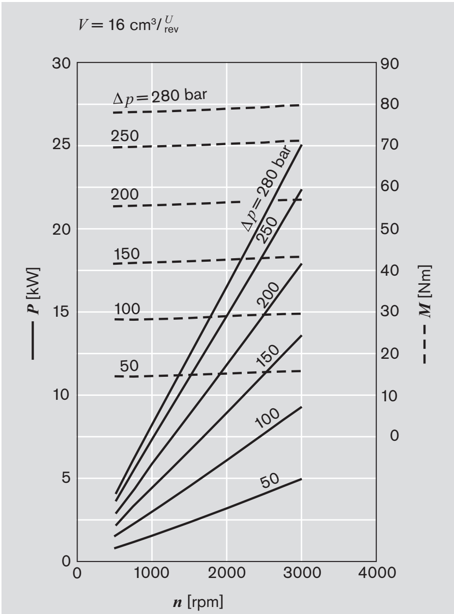
3

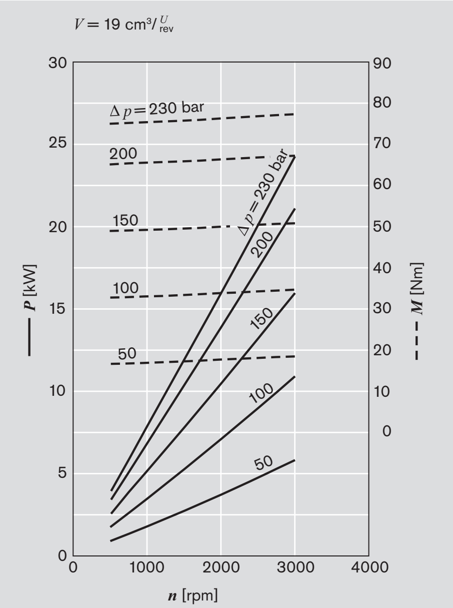
Performance charts (continued)

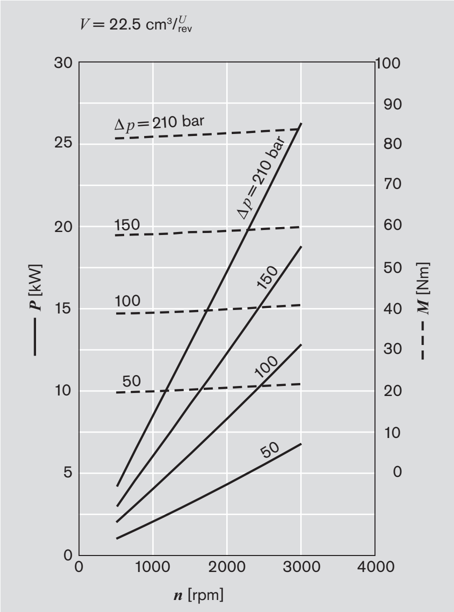


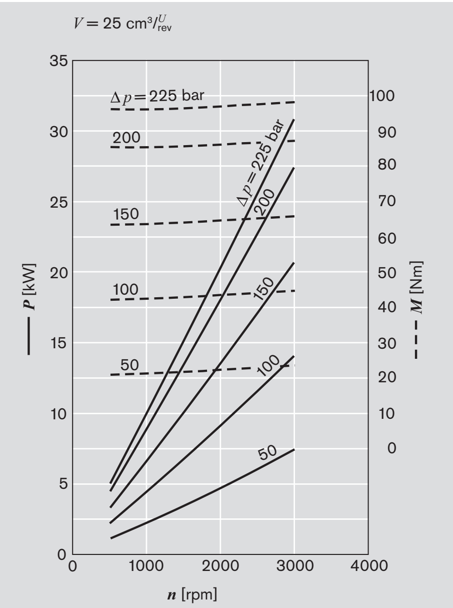


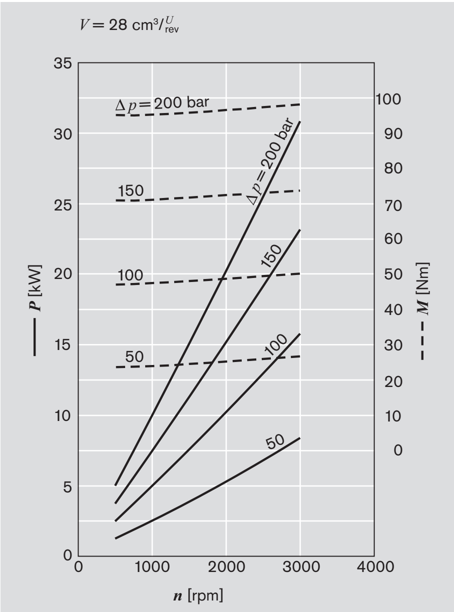





$V = 19\ cm^3/_{rev}^{U}$
Δp = 230 bar
200
150
100
50
Δp = 230 bar
P [kW]
M [Nm]
n [rpm]


$V = 22.5\ cm^3/_{rev}^{U}$
Δp = 210 bar
150
100
50
Δp = 210 bar
P [kW]
M [Nm]
n [rpm]

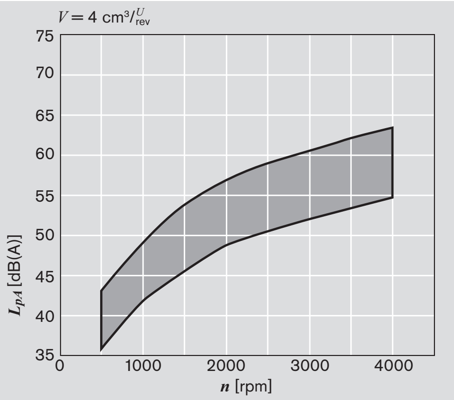

$V = 25\ cm^3/_{rev}^{U}$
Δp = 225 bar
200
150
100
50
Δp = 225 bar
P [kW]
M [Nm]
n [rpm]

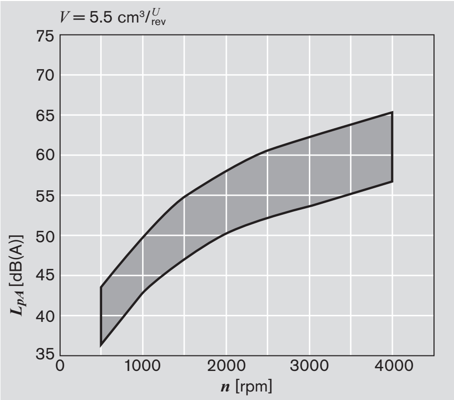

$V = 28\ cm^3/_{rev}^{U}$
Δp = 200 bar
150
100
50
Δp = 200 bar
P [kW]
M [Nm]
n [rpm]

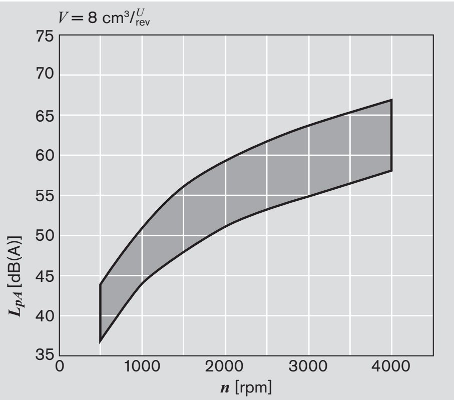
Noise charts

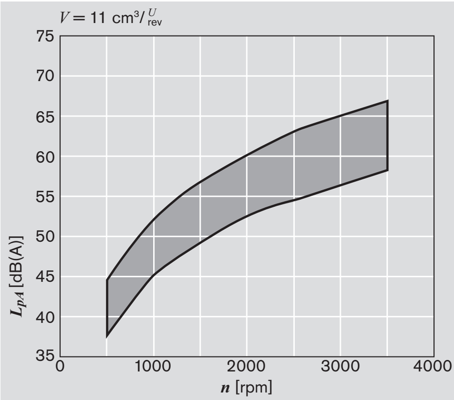
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 16 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45 635, Part 26.
Spacing between measuring sensor – pump: 1 m.

These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

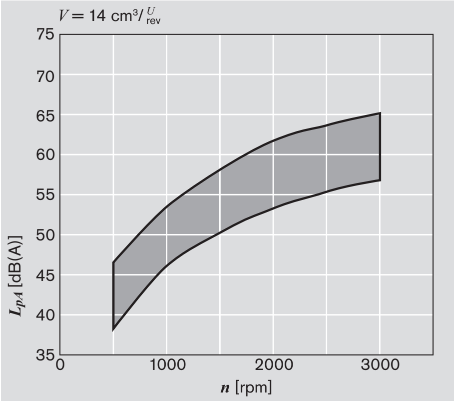


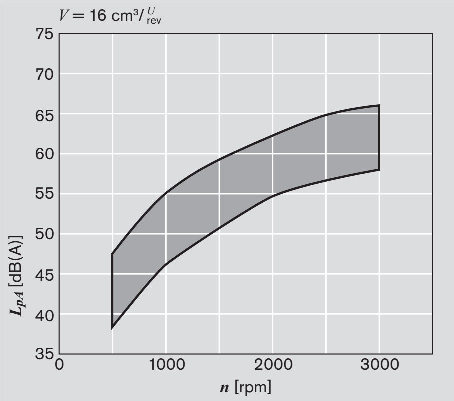


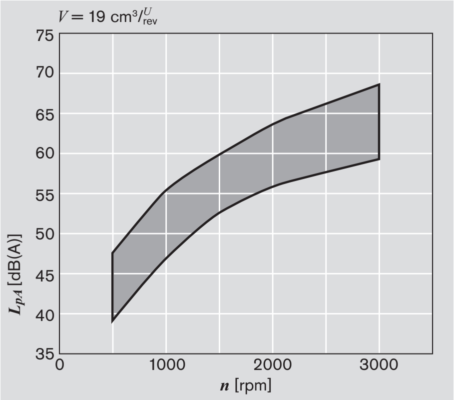


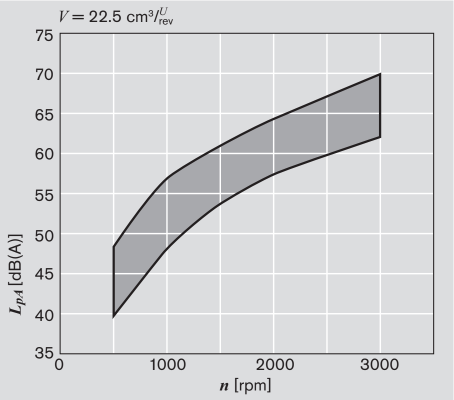


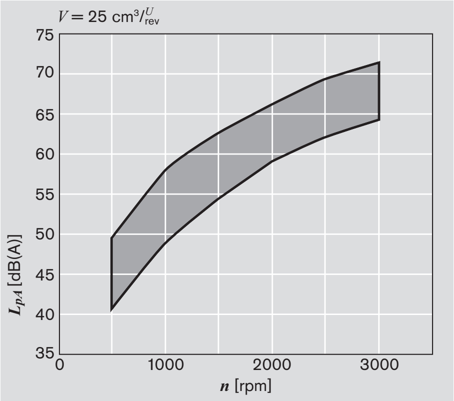
Noise charts (continued)

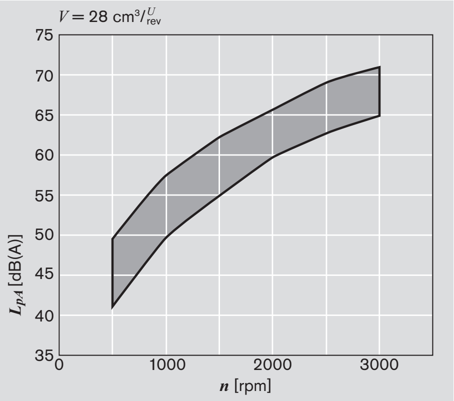












Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Screw, flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C or max. 110 °C with FKM seal
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals*) max. +110 °C with FKM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

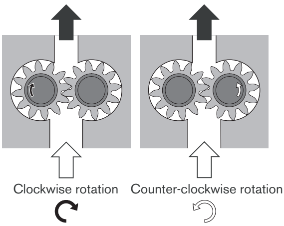
*) NBR = Perbunan®
**) FKM = Viton®
***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

Safety requirements pertaining to the whole systems are to be observed.

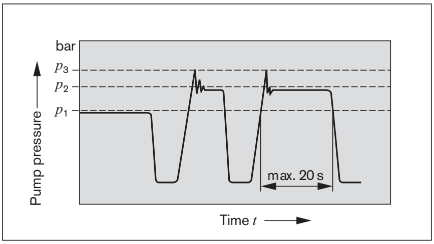
In the case of applications with high numbers of load cycles please consulting.

Definition of direction of rotation

Always look on the drive shaft.
Caution: Dimensions drawings always show clockwise-rotation pumps. On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPF-1x

											*)
Displacement	V	cm³/rev	4	5.5	8	11	14	16	19	22.5	22.5
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)								
Max. continuous pressure	p_1	bar	250						210	180	210
Max. intermittent pressure	p_2	bar	280						230	210	230
Max. peak pressure	p_3	bar	300						250	230	250
Min. rotational speed at bar 12 mm²/s	< 100	rpm	600	500	500	500	500	500	500	500	500
	100...180	rpm	1200	1200	1000	1000	800	800	800	800	800
	180... p_2	rpm	1400	1400	1400	1200	1000	1000	1000	1000	1000
25 mm²/s	p_2	rpm	700	700	700	600	500	500	500	500	500
Max. rotational speed at	p_2	rpm	4000			3500	3000	3000	3000	2500	3000

*) Version with extended bearings

AZPF-2x

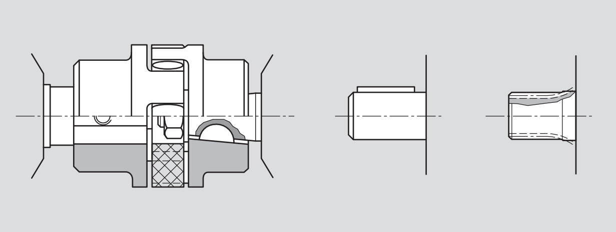
Displacement	V	cm³/rev	4	5.5	8	11	14	16	19	22.5	25	28
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)									
Max. continuous pressure	p_1	bar	250							220	195	170
Max. intermittent pressure	p_2	bar	280							250	225	200
Max. peak pressure	p_3	bar	300							290	265	240
Min. rotational speed at bar 12 mm²/s	< 100	rpm	600	500	500	500	500	500	500	500	500	500
	100...180	rpm	1200	1200	1000	1000	800	800	800	800	800	800
	180... p_2	rpm	1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
25 mm²/s	p_2	rpm	700	700	700	600	500	500	500	500	500	500
Max. rotational speed at	p_2	rpm	4000			3500	3000	3000	3500	3500	3000	3000

Drive arrangements

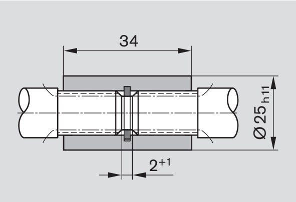
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



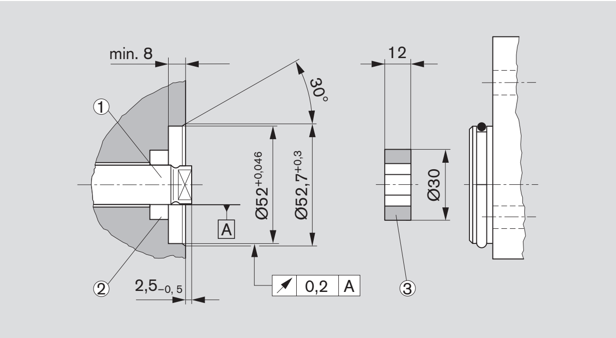
Splined shaft	M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
DIN	100	4...28	p_{max}
SAE 9t	110		
SAE 11t	180		

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc.
The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① Drive shaft
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 0.6 deep; HRC 60 ±3.
Surface for sealing ring
ground without rifling $R_{max.} \leq 4 \mu m$

② Radial shaft seal ring
Rubber-covered seal (see DIN 3760, Type AS or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



Drive with tang

AZPF-1x

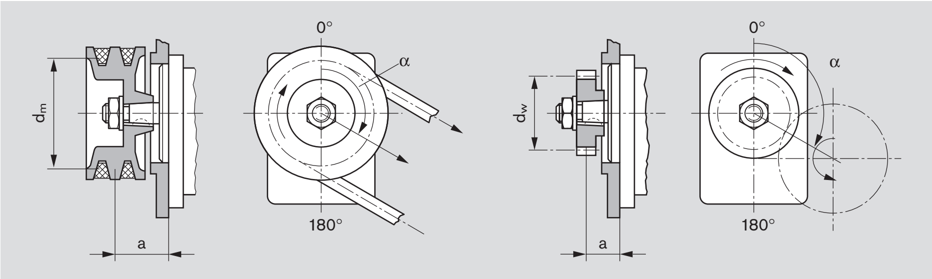
$M_{max.}$ [Nm]	V [cm³/rev]	$p_{max.}$ [bar]
65	4...14	280
	16	230
65	19	190
	22.5	160

AZPF-2x

$M_{max.}$ [Nm]	V [cm³/rev]	$p_{max.}$ [bar]
85	4...14	280
	16	280
	19	250
	22.5	210
	25	190
	28	170

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.

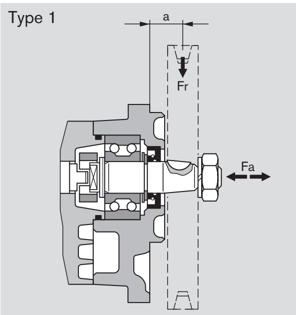


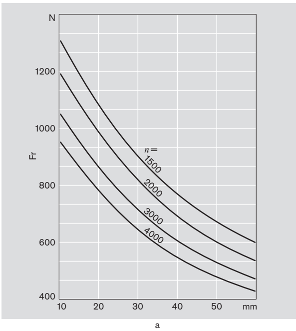
5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of $L_H = 1000$ hours.

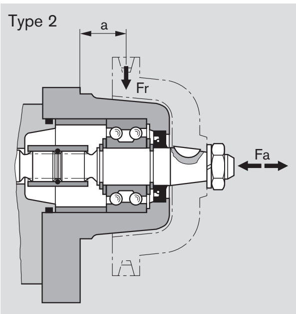
$M_{max.}$ [Nm]	V [cm³/rev]	$p_{max.}$ [bar]
65	16	230
	19	190
	22.5	160

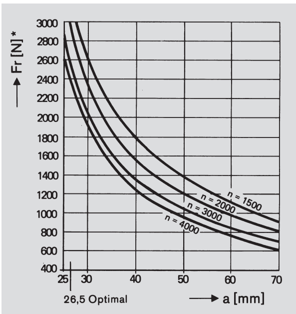
Type 1





Type 2





Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

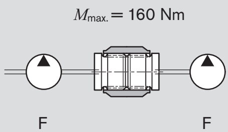
Pressure restrictions during standard through drive
In the case of series S, the driver for the second pumping stage can carry a load of up to $M_{max.}$ = 65 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

$M_{max.}$ [Nm]	V [cm³/rev]	$p_{max.}$ [bar]
65	16	230
	19	190
	22.5	160
	25	140
	28	130

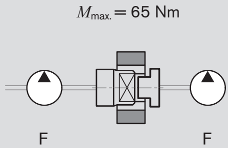
If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

Reinforced through drive



Standard through drive



Combinations

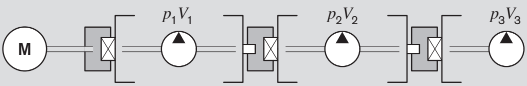
Series pump 1	$M_{max.}$ [Nm]	Series pump 2
F	65	F
F	65	S
F	12	B

Max. transferrable drive torque *

Function	Code letter	Designation	Max. transferrable drive torque * [Nm]
Splined shafts	R	SAE J744 16-4 9T	110
	P	SAE J744 19-4-11T	180
Tapered key shaft	C	1:5	155
	H	1:8	160
Cylinder shafts	G	Shafts Ø 15.875	55
	A	Shafts Ø 18	75
Claw	N	Dihedral claw	65

* These values only apply when the conditions described on page 16 are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

3

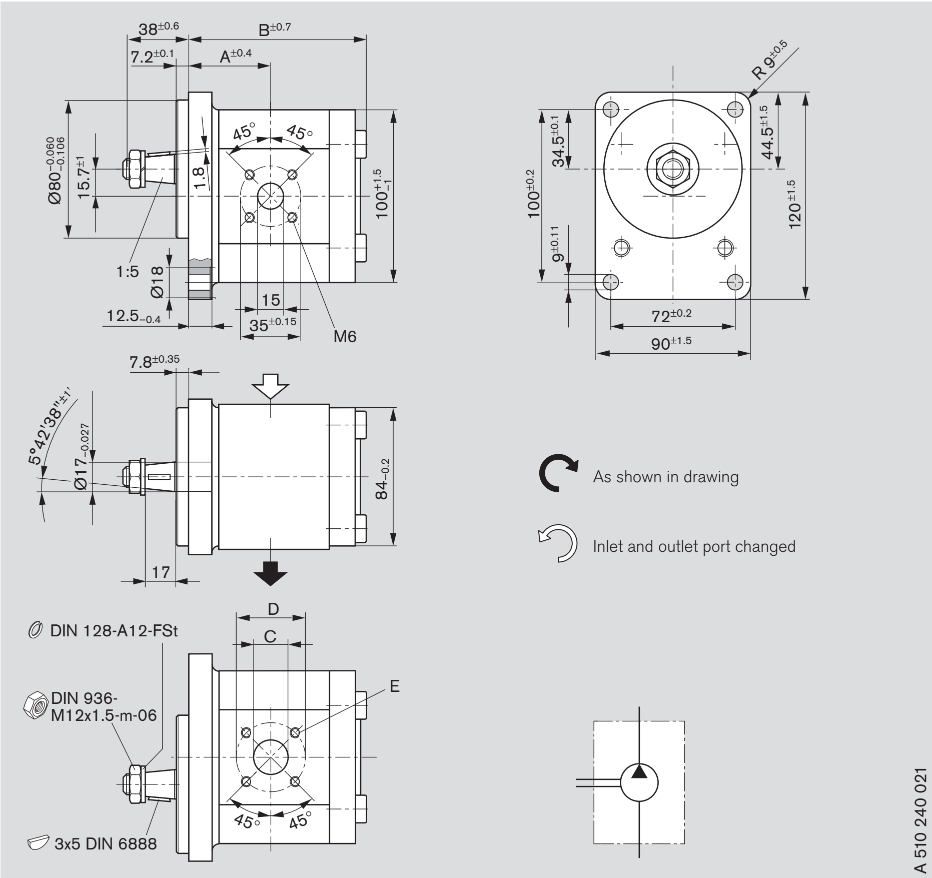


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range



Ordering code

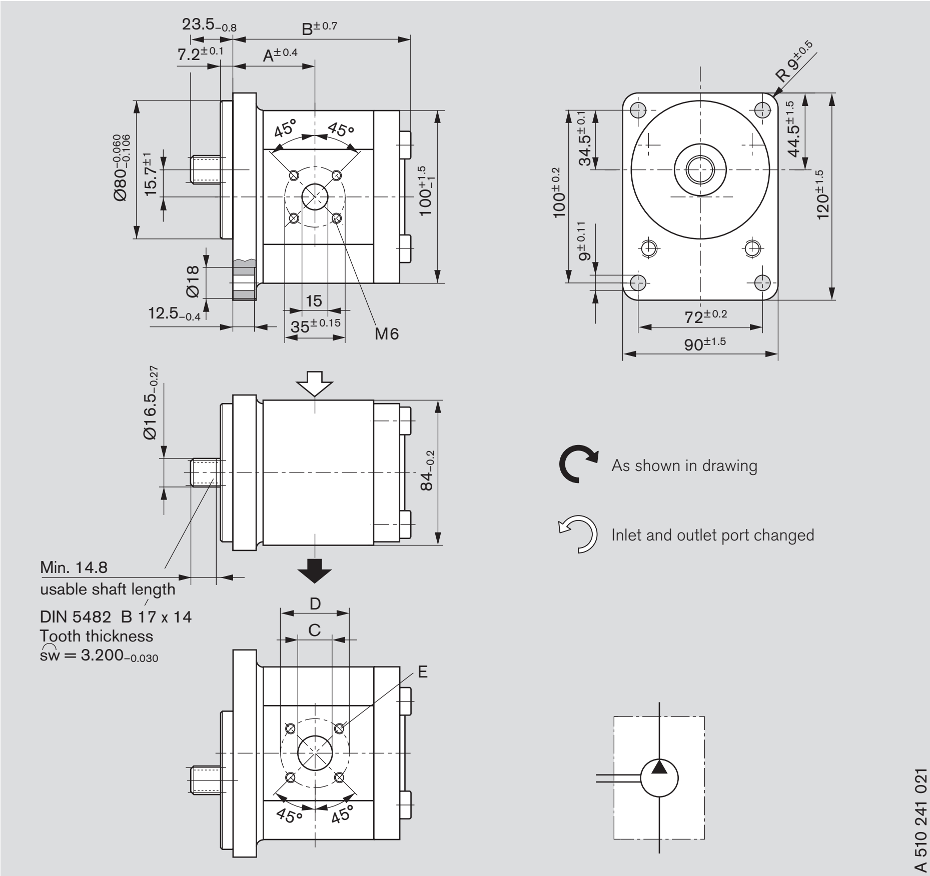
AZPF – 10 – □□□ □C B 20 M B

AZPF – 11 – □□□ □C B 20 M B*

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 306**	**0 510 225 006**	280	4000	3.2	39.9	85.0	15	40	M6 depth 13
5.5	**0 510 325 306**	**0 510 325 006**	280	4000	3.2	41.1	87.5	15	40	
8	**0 510 425 307**	**0 510 425 009**	280	4000	3.3	43.2	91.6	20	40	
11	**0 510 525 311**	**0 510 525 009**	280	3500	3.5	47.0	96.6	20	40	
14	**0 510 525 319**	**0 510 525 018**	280	3000	3.7	47.5	101.6	20	40	
16	**0 510 625 315**	**0 510 625 022**	280	3000	3.7	47.5	105.0	20	40	
19	**0 510 625 314**	**0 510 625 013**	230	3500	3.8	47.5	110.0	20	40	
22.5	**0 510 725 330***	**0 510 725 030**	210	2500	3.8	55.1	115.4	20	40	

Dimensions

Standard range



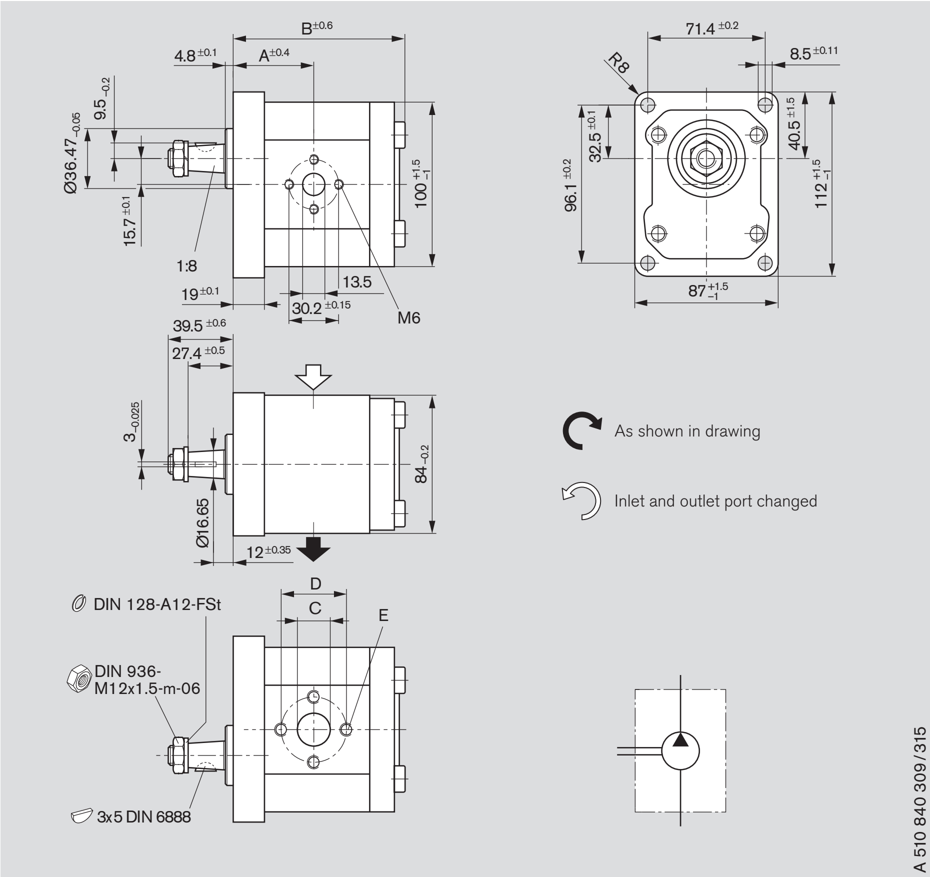
3

Ordering code
AZPF – 10 – ☐☐☐ ☐ F B 20 M B
AZPF – 11 – ☐☐☐ ☐ F B 20 M B*

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 307**	**0 510 225 007**	280	4000	3.1	39.9	85.0	15	40	M6 depth 13
5.5	**0 510 325 307**	**0 510 325 007**	280	4000	3.2	41.1	87.5	15	40	
8	**0 510 425 308**	**0 510 425 010**	280	4000	3.3	43.2	91.6	20	40	
9	**0 510 425 336***	–	280	4000	3.4	43.7	92.4	20	40	
11	**0 510 525 312**	**0 510 525 010**	280	3500	3.5	47.0	96.6	20	40	
14	**0 510 525 328**	**0 510 525 030**	280	3000	3.6	47.5	101.6	20	40	
16	**0 510 625 317**	**0 510 625 015**	280	3000	3.65	47.5	105.0	20	40	
19	**0 510 625 316**	**0 510 625 014**	230	3000	3.8	47.5	110.0	20	40	
22.5	**0 510 725 349**	–	230	3000	4.4	61.1	127.4	20	40	
22.5	–	**0 510 725 062**	210	2500	4.0	55.1	115.4	20	40	

Dimensions

Standard range



Ordering code

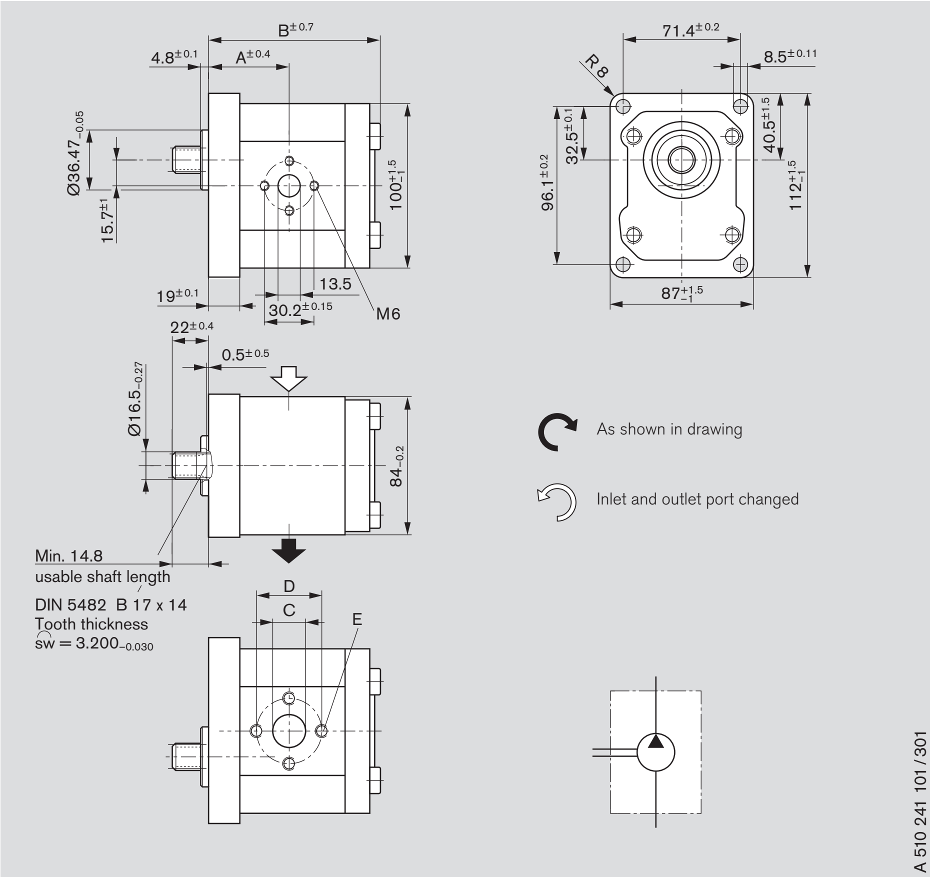
AZPF – 12 – ☐☐☐ ☐ H O 30 K B

AZPF – 22 – ☐☐☐ ☐ H O 30 K B*

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 317**	**0 510 225 022**	280	4000	3.1	41.4	84.1	13.5	30.2	M6 depth 13
5.5	**0 510 325 320**	**0 510 325 025**	280	4000	3.2	42.6	86.6	13.5	30.2	
8	**0 510 425 334**	**0 510 425 043**	280	4000	3.3	44.7	92.5	13.5	30.2	
11	**0 510 525 374**	**0 510 525 074**	280	3500	3.4	48.5	97.5	13.5	30.2	M8 depth 13
14	**0 510 525 375**	**0 510 525 075**	280	3000	3.6	49.0	102.5	13.5	30.2	
16	**0 510 625 381**	**0 510 625 075**	280	3000	3.6	49.0	105.9	13.5	30.2	
19	**0 510 625 386***	**0 510 625 076***	280	3500	4.1	59.9	121.1	20.0	39.7	
22.5	**0 510 725 410***	**0 510 725 112***	250	3500	4.2	62.6	126.5	20.0	39.7	
25	**0 510 725 411***	**0 510 725 113***	225	3000	4.4	64.7	132.5	20.0	39.7	
28	**0 510 725 412***	**0 510 725 114***	200	3000	4.5	67.1	137.3	20.0	39.7	

Dimensions

Standard range

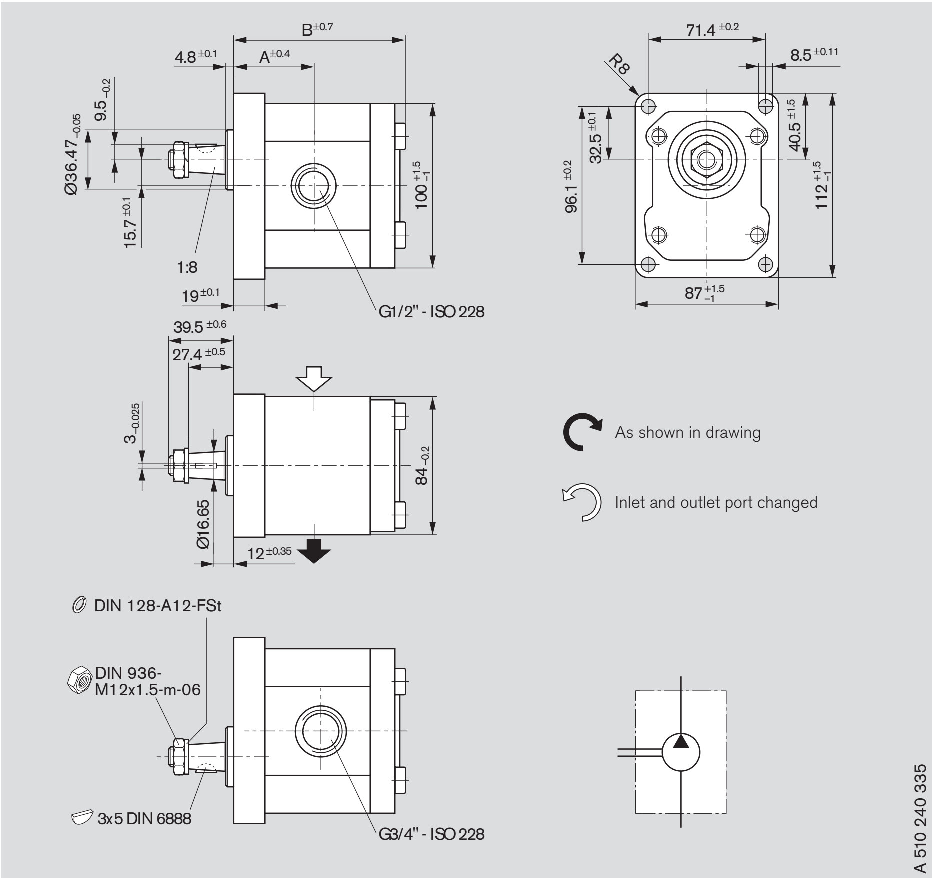


Ordering code
AZPF – 10 – □□□ □ F O 30 M B
AZPF – 10 – □□□ □ F O 30 P B*

Displace-ment [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
8	**0 510 425 315**	**0 510 425 021**	280	4000	3.3	44.7	93.1	13.5	30.2	M6, depth 13
11	**0 510 525 323**	**0 510 525 024**	280	3500	3.4	48.5	98.1	20.0	39.7	M8, depth 13
11	**0 510 525 331***	–	210	3500	3.3	48.5	98.1	20.0	39.7	
14	–	**0 510 525 034***	210	3000	3.4	49.0	103.1	20.0	39.7	
16	**0 510 625 327***	**0 510 625 039***	210	3000	3.5	49.0	106.5	20.0	39.7	
19	–	**0 510 625 049***	210	3000	3.7	49.0	111.5	20.0	39.7	
19	**0 510 625 332***	–	210	3000	4.0	59.9	123.5	20.0	39.7	
22.5	**0 510 725 348***	**0 510 725 076***	210	3000	4.2	62.6	127.8	20.0	39.7	

Dimensions

Standard range

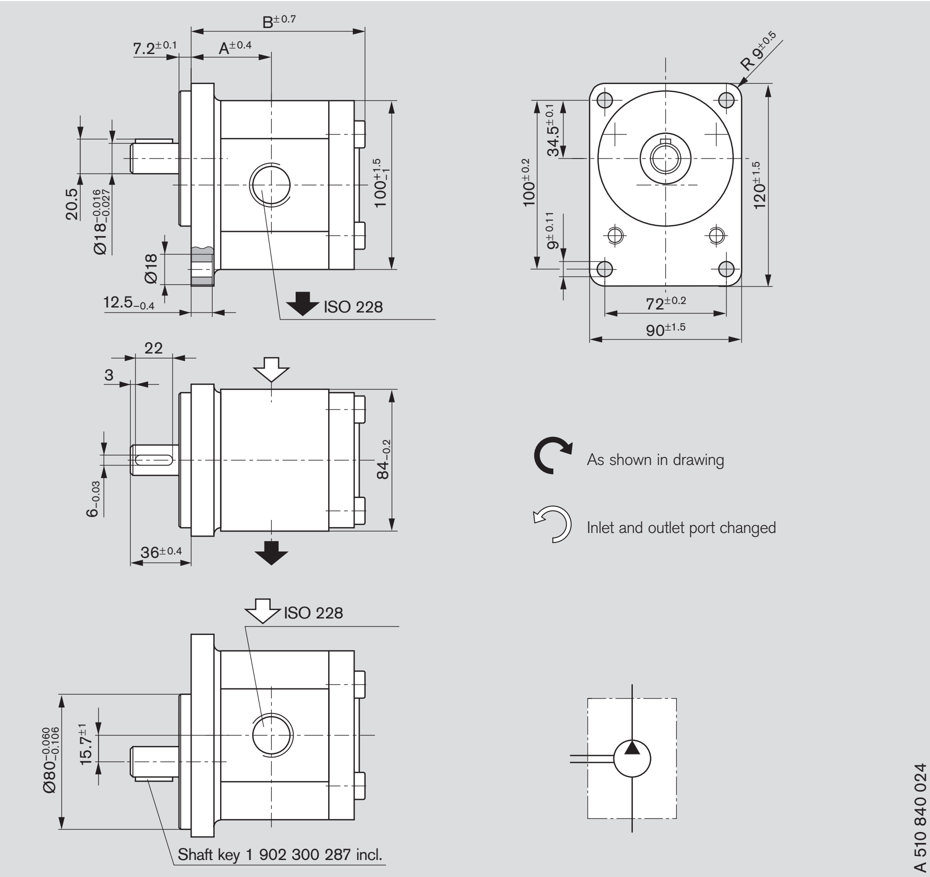


Ordering code
AZPF – 10 – □□□ □ H O 01 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	G
4	–	–	–	–	–	–	–	ISO 228 depth 16
5.5	–	**0 510 325 018**	280	4000	3.1	42.6	89.0	
8	–	**0 510 425 027**	280	4000	3.15	44.7	93.1	
11	–	**0 510 525 039**	280	3500	3.3	48.5	98.1	
14	–	**0 510 525 040**	280	3000	3.4	49.0	103.1	
16	–	**0 510 625 047**	280	3000	3.58	49.0	106.5	
19	–	**0 510 625 052**	230	3000	3.6	49.0	111.5	
22.5	–	**0 510 725 084**	210	2500	3.8	56.6	116.4	

Dimensions

Standard range



3

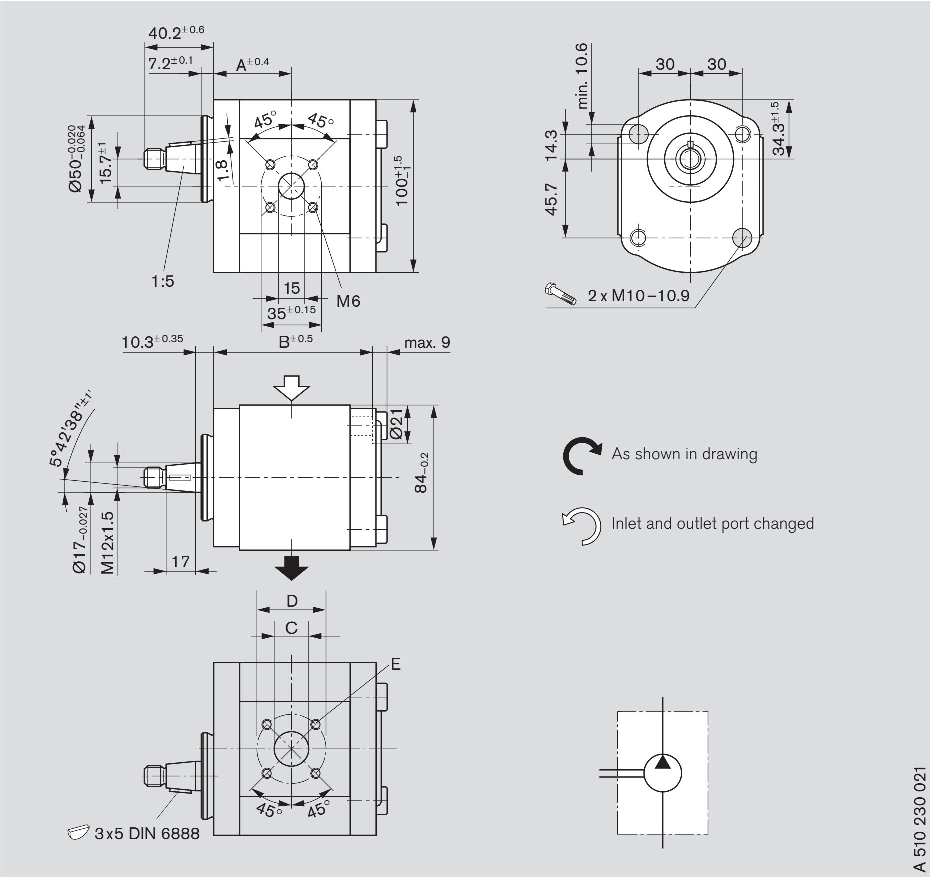
Ordering code

AZPF – 11 – □□□ □ A B 01 M B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	G
4	**0 510 225 318**	**0 510 225 023**	280	4000	3.3	39.9	84.3	G 1/2 – ISO 228 depth 16
5.5	**0 510 325 321**	**0 510 325 026**	280	4000	3.3	41.1	85.2	
8	**0 510 425 335**	**0 510 425 044**	280	4000	3.4	43.2	89.3	
11	**0 510 525 376**	**0 510 525 076**	280	3500	3.6	45.6	94.3	G 3/4 – ISO 228 depth 16
14	–	–	–	–	–	–	–	
16	**0 510 625 382**	**0 510 625 077**	250	3000	3.8	49.9	102.7	
19	–	–	–	–	–	–	–	
22.5	**0 510 725 418**	**0 510 725 120**	180	2500	4.1	55.1	114.7	

Dimensions

Standard range



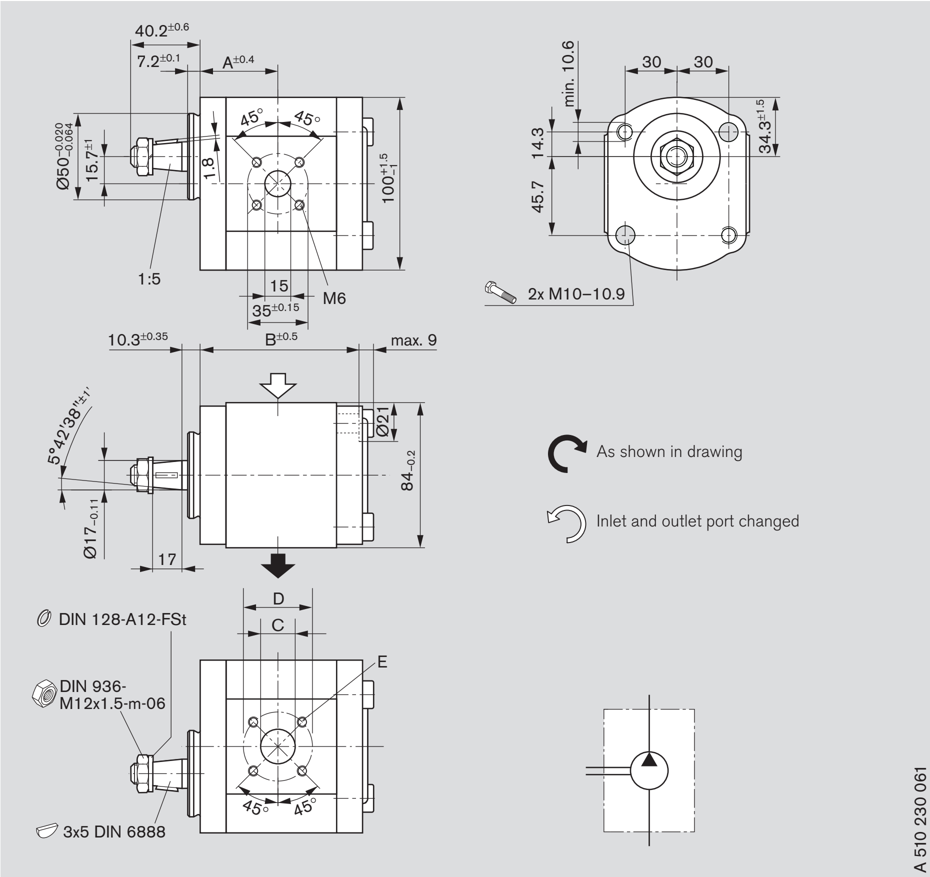
Ordering code

AZPF – 10 – ☐ ☐ ☐ ☐ C P 20 M B
AZPF – 10 – ☐ ☐ ☐ ☐ C P 20 K B*
AZPF – 11 – ☐ ☐ ☐ ☐ C P 20 M B**

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 009**	**0 510 215 309**	280	4000	2.5	37.7	73.7	15	40	M6 depth 13
5.5	**0 510 315 307**	**0 510 315 006**	280	4000	2.65	38.6	76.2	15	40	
8	**0 510 415 316****	–	280	4000	2.7	40.6	80.3	20	40	
11	**0 510 515 309**	**0 510 515 007**	280	3500	2.75	44.5	85.5	20	40	
14	**0 510 515 316**	**0 510 515 018**	280	3000	3.1	45.0	90.3	20	40	
16	**0 510 615 317**	**0 510 615 010**	280	3000	2.9	45.0	93.7	20	40	
19	**0 510 615 318**	**0 510 615 005**	230	3000	3.2	45.0	98.7	20	40	
22.5	**0 510 715 306***	–	210	2500	3.3	52.5	104.1	20	40	

Dimensions

Standard range

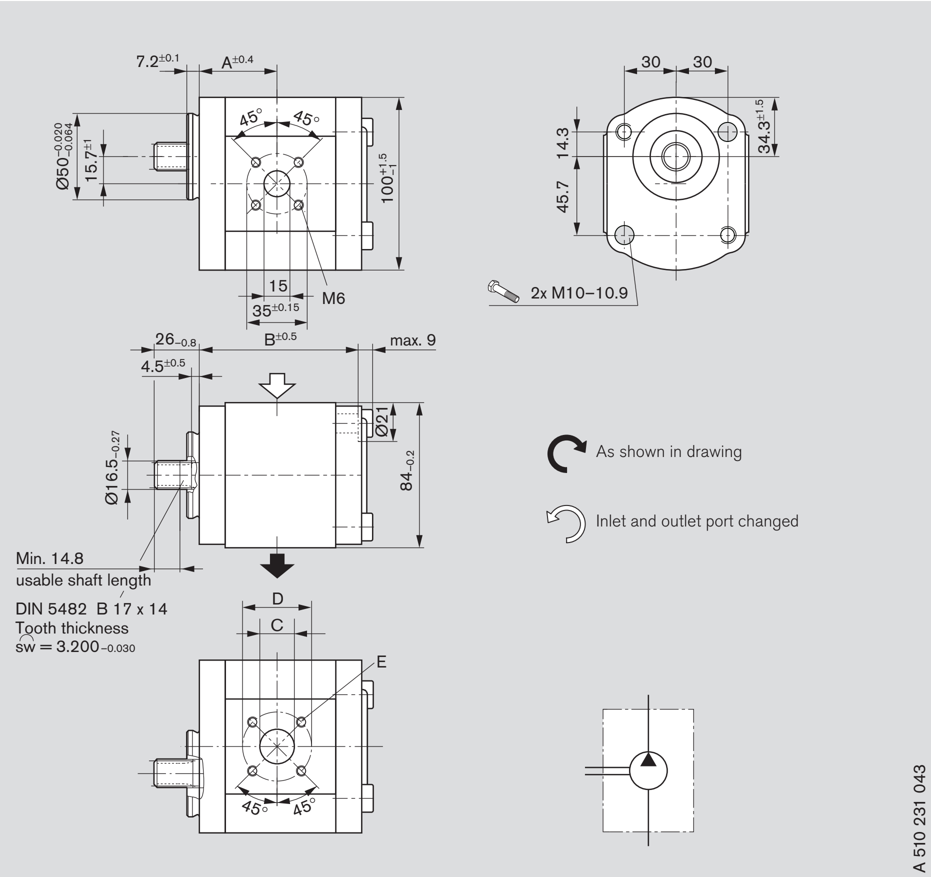


Ordering code
AZPF – 10 – ☐☐☐ ☐ C N 20 M B
AZPF – 11 – ☐☐☐ ☐ C N 20 M B*

Displace-ment [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 306**	**0 510 215 006**	280	4000	2.6	37.4	73.7	15	40	M6 depth 13
5.5	**0 510 315 304**	**0 510 315 004**	280	4000	2.6	38.6	76.2	15	40	
8	**0 510 415 313**	**0 510 415 005**	280	4000	2.8	40.7	80.3	20	40	
11	**0 510 515 310**	**0 510 515 004**	280	3500	2.9	44.5	85.3	20	40	
14	–	**0 510 515 015***	280	3000	3.0	45.0	90.3	20	40	
16	**0 510 615 314**	**0 510 615 006**	280	3000	3.1	45.0	93.7	20	40	
19	**0 510 615 341**	–	230	3000	3.2	45.0	98.7	20	40	

Dimensions

Standard range

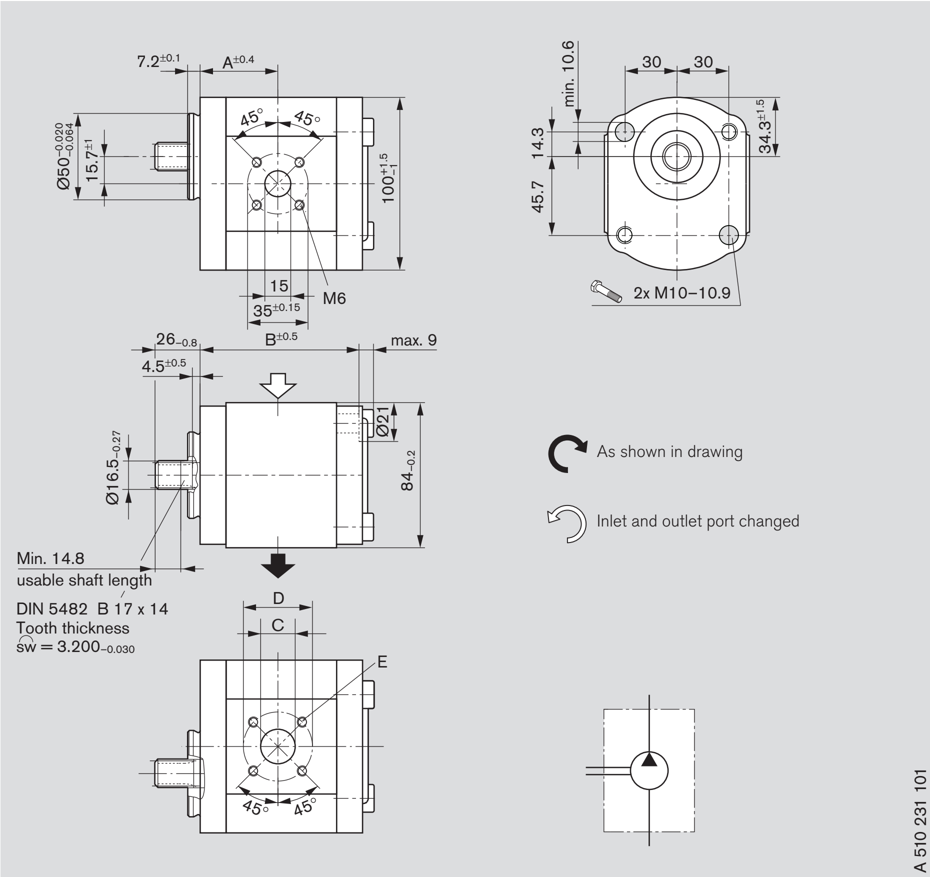


Ordering code
AZPF – 10 – □□□ □ F N 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
5.5	–	**0 510 315 007**	280	4000	2.55	38.6	76.2	15	40	M6 depth 13
8	–	–	–	–	–	–	–	–		
11	–	**0 510 515 011**	280	3500	2.85	44.5	85.3	20	40	
14	–	–	–	–	–	–	–	–		
16	–	–	–	–	–	–	–	–		
19	–	**0 510 615 009**	230	3000	3.2	45.0	98.7	20	40	
19	–	–	–	–	–	–	–	–		
22.5	–	–	–	–	–	–	–	–		

Dimensions

Standard range

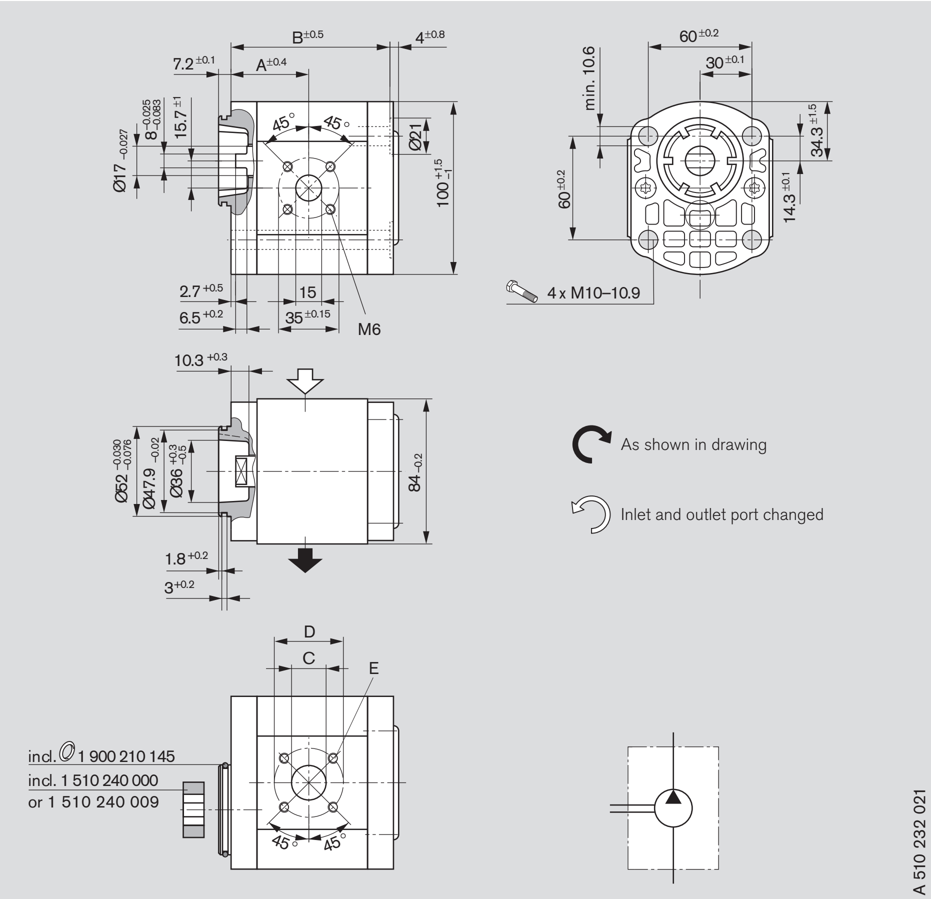


Ordering code
AZPF – 10 – ☐☐☐ ☐ F P 20 P B
AZPF – 12 – ☐☐☐ ☐ F P 20 P B*
AZPF – 12 – ☐☐☐ ☐ F P 20 P B S xxxx**

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
5.5	**–**	**–**	–	–	–	–	–	–	–	M6 depth 13
8	**0 510 415 328**	**–**	210	4000	2.7	40.7	80.3	20	15	
11	**0 510 515 337***	**0 510 515 012**	280	3500	2.8	44.5	85.3	20	15	
14	**0 510 515 338**	**0 510 515 013**	210	3000	3.0	45.0	90.3	20	15	
16	**–**	**–**	–	–	–	–	–	–	–	
19	**–**	**–**	–	–	–	–	–	–	–	
22.5	**0 510 715 320****	**0 510 715 008****	210	3000	3.6	58.6	116.1	20	15	

Dimensions

Standard range

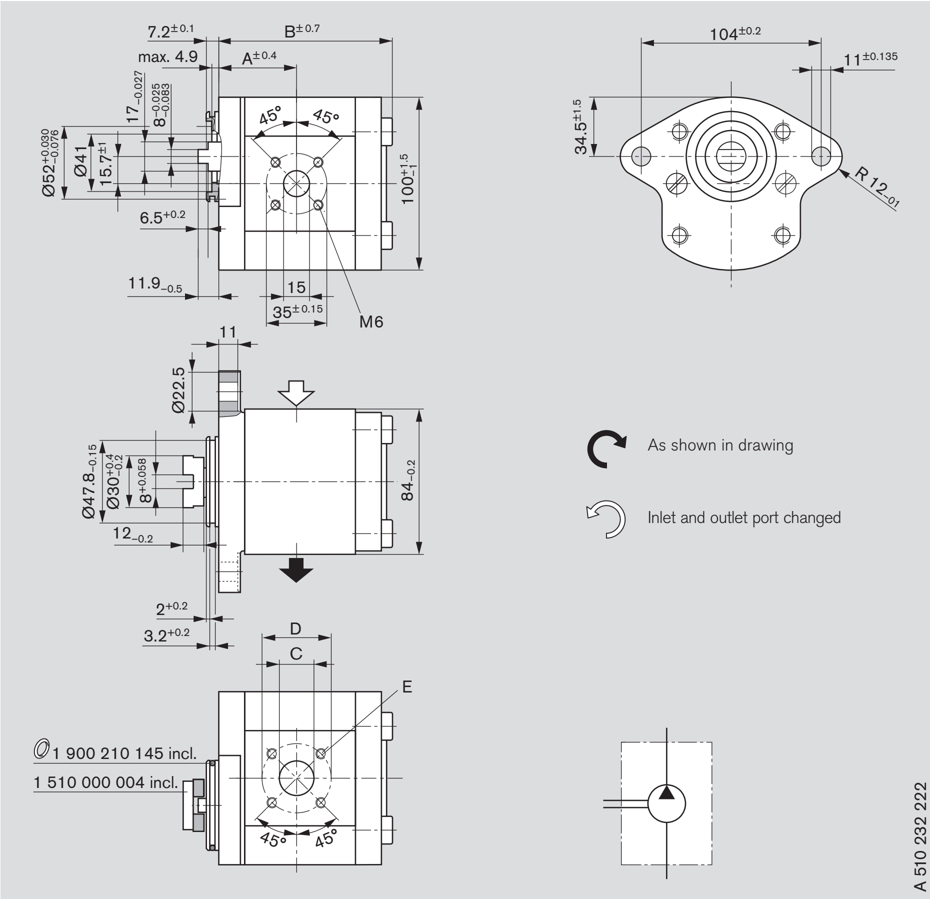


Ordering code
AZPF – XX – ☐☐☐ ☐ N T 20 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 307**	**0 510 215 007**	280	4000	2.5	37.4	73.7	15	40	M6 depth 13
5.5	**0 510 315 305**	**0 510 315 005**	280	4000	2.5	38.6	76.2	15	40	
8	**0 510 415 314**	**0 510 415 006**	280	4000	2.5	40.7	80.3	20	40	
11	**0 510 515 311**	**0 510 515 005**	280	3500	2.6	44.5	85.3	20	40	
14	**0 510 515 340**	**0 510 515 019**	280	3000	2.38	45.0	90.3	20	40	
16	**0 510 615 315**	**0 510 615 007**	230	3000	3.0	45.0	93.7	20	40	
19	**0 510 615 321**	**0 510 615 008**	190	3000	3.0	45.0	98.7	20	40	
22.5	**0 510 715 307**	**0 510 715 004**	160	2500	3.2	52.6	104.1	20	40	

Dimensions

Standard range

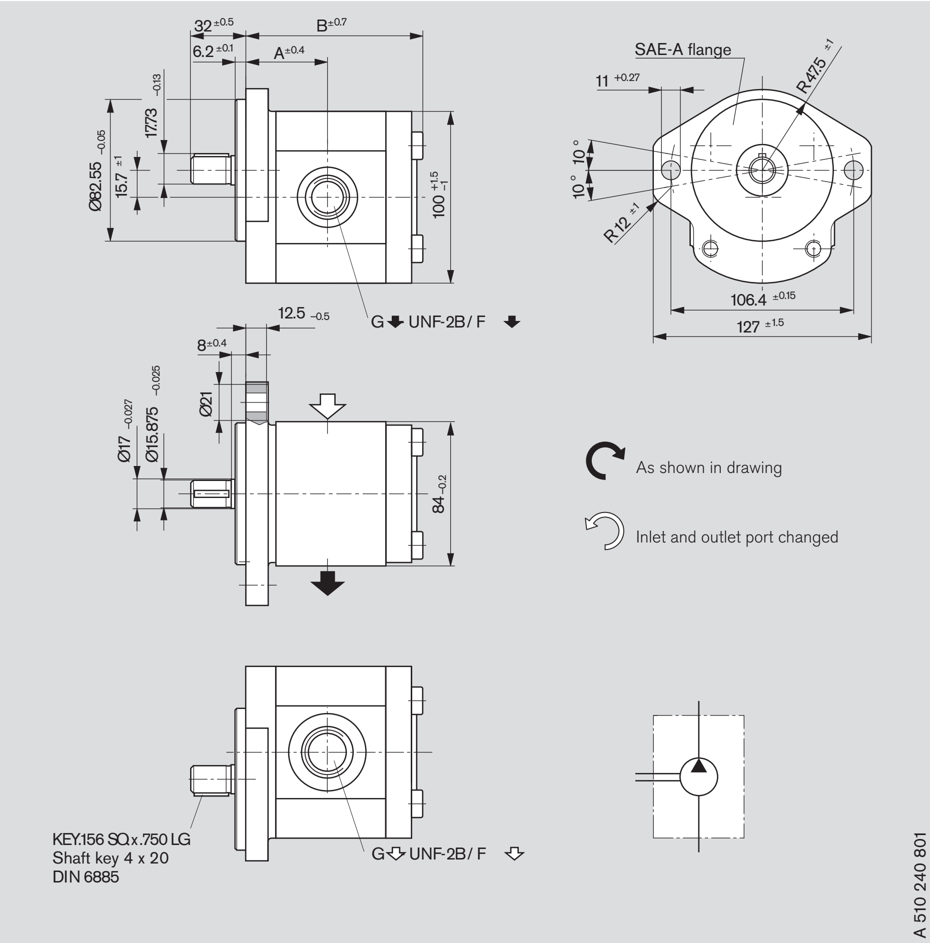


Ordering code
AZPF – 10 – ☐☐☐ ☐ N L 20 K B
AZPF – 11 – ☐☐☐ ☐ N L 20 K B*

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**–**	**0 510 225 012**	280	4000	2.8	37.4	81.7	15	40	M6 depth 13
5.5	**0 510 325 312**	**0 510 325 012**	280	4000	2.82	38.6	84.4	15	40	
8	**0 510 425 331***	**0 510 425 019**	280	4000	3.0	40.7	88.5	20	40	
11	**–**	**0 510 525 025**	280	3500	3.1	44.5	93.3	20	40	
16	**0 510 625 358***	**0 510 625 027***	230	3000	3.3	45.0	101.9	20	40	
19	**0 510 625 368**	**0 510 625 032**	190	3000	3.5	45.0	106.9	20	40	
22.5	**–**	**0 510 725 044***	160	3000	4.0	58.6	122.5	20	40	

Dimensions

Standard range

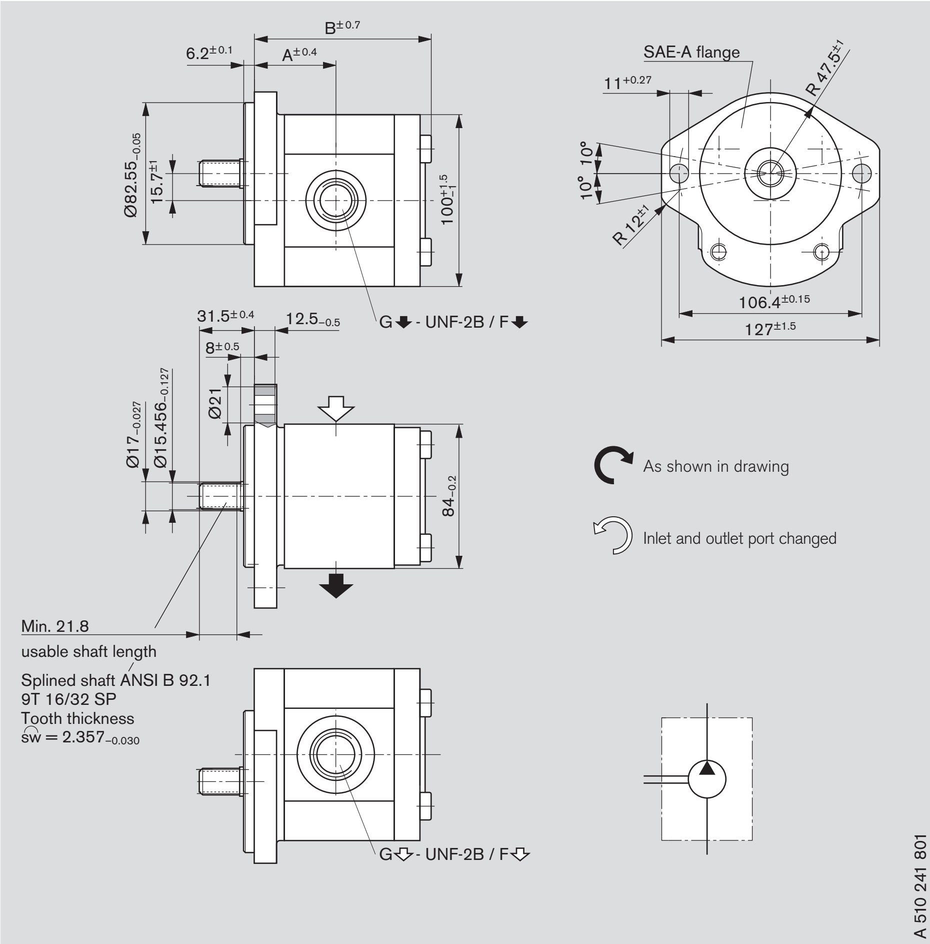


Ordering code
AZPF – 10 – □□□ □ Q R 12 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	G ▽	G ▼	F ▽	F ▼
4	–	**0 510 225 011**	260	4000	3.3	39.9	85.0	9/16-18	9/16-18	13	13
5.5	–	**0 510 325 011**	260	4000	3.3	41.1	87.5	9/16-18	9/16-18	13	13
8	–	**0 510 425 016**	260	4000	3.4	43.2	91.6	7/8-14	7/8-14	16	16
11	–	**0 510 525 015**	260	3500	3.6	47.0	96.6	7/8-14	7/8-14	16	16
14	–	**0 510 525 031**	230	3000	3.65	47.5	101.6	11/16-12	7/8-14	19	16
16	–	**0 510 625 021**	200	3000	3.7	47.5	105.0	11/16-12	7/8-14	19	16
19	–	**0 510 625 041**	170	3500	3.9	47.5	110.0	11/16-12	7/8-14	19	16
22.5	–	**0 510 725 059**	140	2500	4.0	55.1	115.4	11/16-12	7/8-14	19	16

Dimensions

Standard range

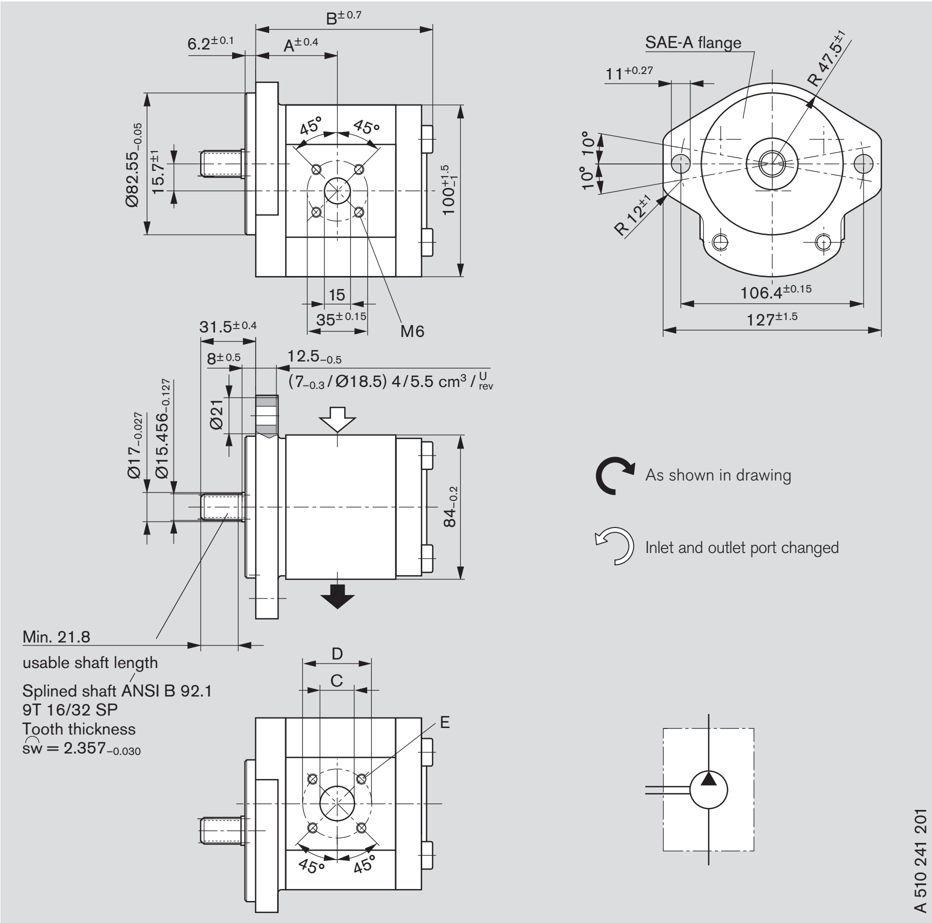


Ordering code
AZPF – 10 – ☐☐☐ ☐ R R 12 M B

Dis-place-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	G ⇩	G ⬇	F ⇩	F ⬇
4	–	**0 510 225 010**	280	4000	3.15	39.9	82.7	9/16-18	9/16-18	13	13
5.5	–	**0 510 325 010**	280	4000	3.2	41.4	85.2	9/16-18	9/16-18	13	13
8	–	**0 510 425 015**	280	4000	3.3	43.2	91.1	7/8-14	7/8-14	16	16
11	**0 510 525 315**	**0 510 525 014**	280	3500	3.4	47.0	96.1	11/16-12	7/8-14	19	16
14	–	**0 510 525 041**	280	3000	3.5	47.5	101.1	11/16-12	7/8-14	19	16
16	–	**0 510 625 020**	280	3000	3.75	47.5	104.5	11/16-12	7/8-14	19	16
19	**0 510 625 346**	**0 510 625 048**	230	3000	3.9	47.5	109.5	11/16-12	7/8-14	19	16
22.5	–	**0 510 725 063**	210	2500	4.0	55.1	114.9	11/16-12	7/8-14	19	16

Dimensions

Standard range

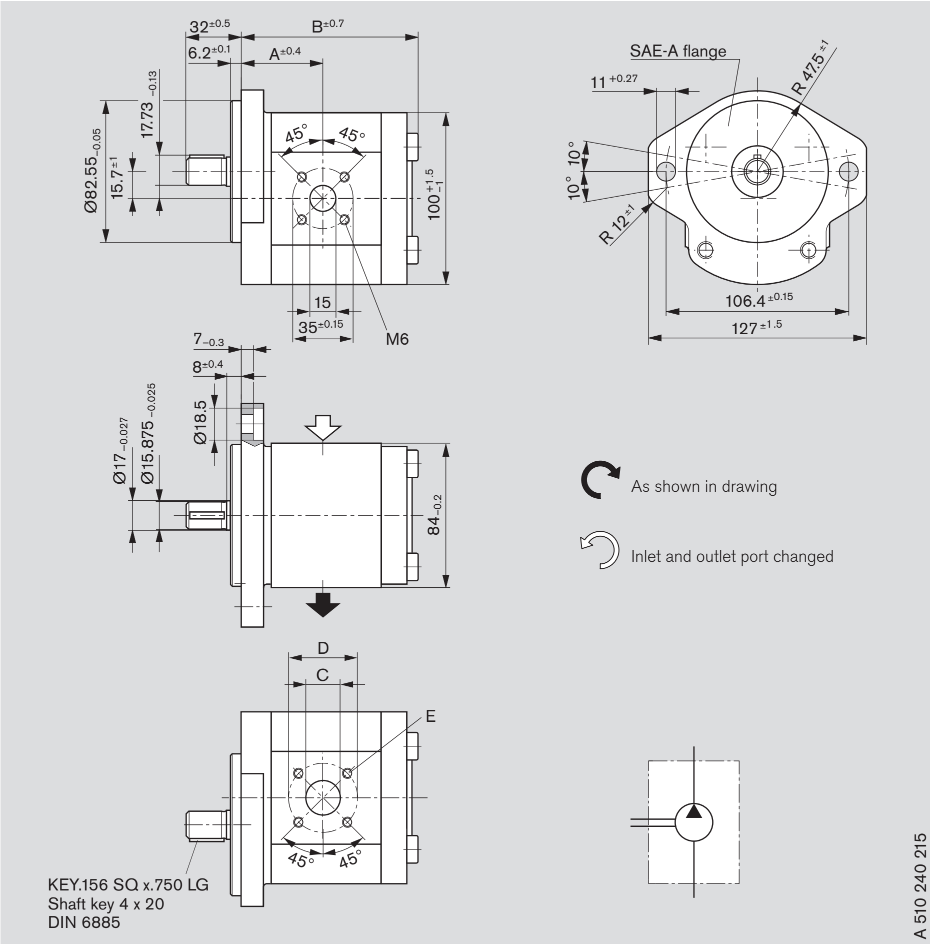


Ordering code
AZPF – 10 – □ □ □ □ R R 20 M B
AZPF – 11 – □ □ □ □ R R 20 K B*

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 314**	**0 510 225 013**	280	4000	3.15	39.9	85.0	15	40	M6 depth 13
5.5	**0 510 325 313**	**0 510 325 013**	280	4000	3.2	41.1	87.5	15	40	
8	**0 510 425 314**	**0 510 425 020**	280	4000	3.3	43.2	91.6	20	40	
11	**0 510 525 324***	**0 510 525 019**	280	3500	3.5	47.0	96.6	20	40	
14	**0 510 525 325**	**0 510 525 020**	280	3000	3.6	47.5	101.6	20	40	
16	**0 510 625 329**	**0 510 625 028**	280	3000	3.8	47.5	105.0	20	40	
19	**0 510 625 330***	**0 510 625 029***	230	3000	3.9	47.5	110.0	20	40	
22.5	**0 510 725 361**	**0 510 725 077***	210	2500	4.1	55.1	115.4	20	40	

Dimensions

Standard range

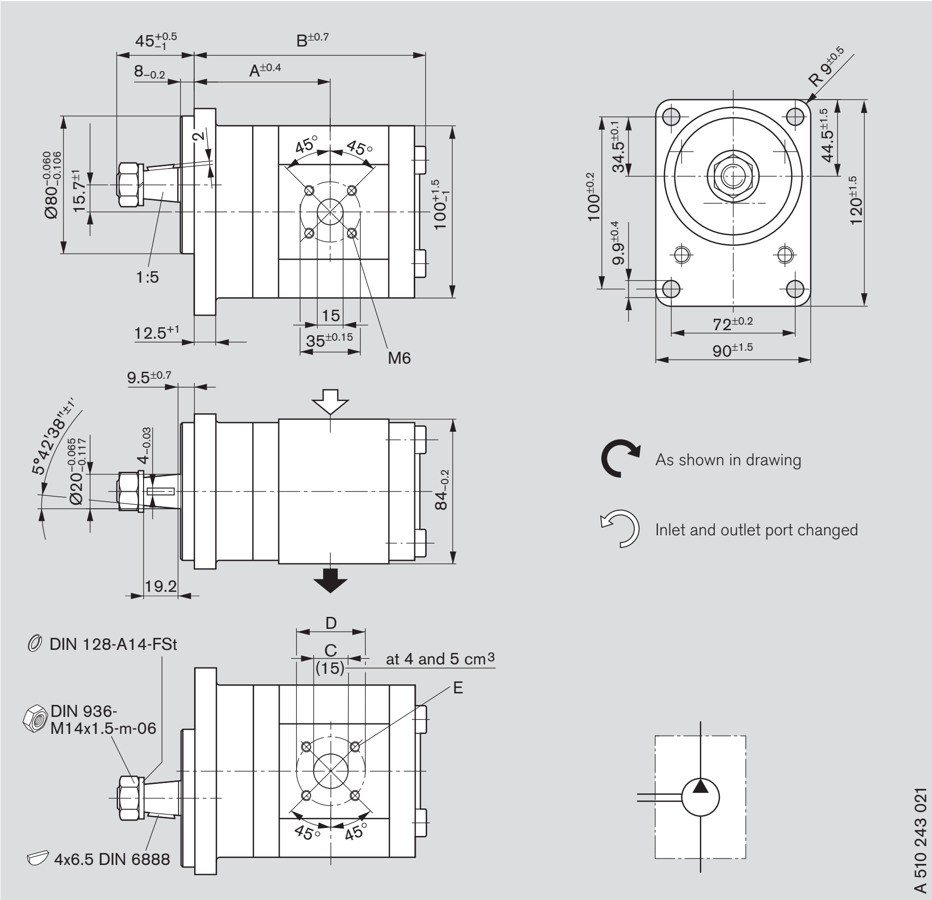


Ordering code
AZPF – 10 – □□□ □ Q R 20 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	–	**0 510 225 014**	280	4000	3.2	39.9	84.5	15	40	M6 depth 13
5.5	–	**0 510 325 016**	280	4000	3.3	41.1	87.0	15	40	
8	–	**0 510 425 025**	280	4000	3.3	43.2	91.1	20	40	
11	–	**0 510 525 033**	280	3500	3.5	47.0	96.1	20	40	
16	–	**0 510 625 042**	200	3000	3.8	47.5	104.5	20	40	
19	–	**0 510 625 043**	170	3000	3.9	47.5	109.5	20	40	
22.5	**0 510 725 396**	**0 510 725 060**	140	2500	3.9	55.1	114.9	20	40	

Dimensions

Standard range



Ordering code

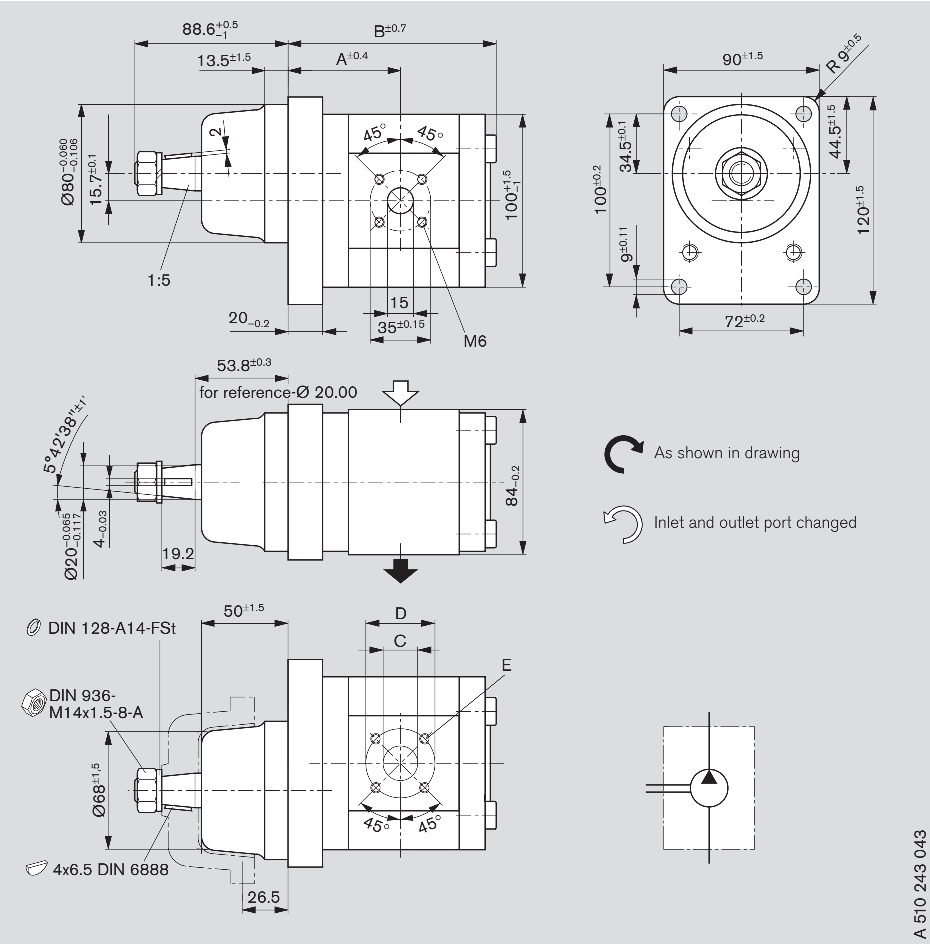
AZPF – 11 – □□□ □ S A 20 M B

AZPF – 11 – □□□ □ S A 20 K B*

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 510 245 300**	**0 510 245 001**	280	4000	3.1	71.1	114.2	15	40	M6 depth 13
5.5	**0 510 345 300**	**0 510 345 001**	280	4000	3.1	72.3	116.7	15	40	
8	**0 510 445 300**	**0 510 445 001***	280	4000	3.3	74.4	120.8	20	40	
11	**0 510 545 300**	**0 510 545 001**	280	3500	3.5	78.2	125.8	20	40	
14			280	3000		78.7	130.8	20	40	
16	**0 510 645 300**	**0 510 645 004**	230	3000	3.6	78.7	134.2	20	40	
19		**0 510 645 002**	190	3000	3.9	78.7	139.2	20	40	
22.5			160	2500		92.3	156.6	20	40	

Dimensions

Standard range



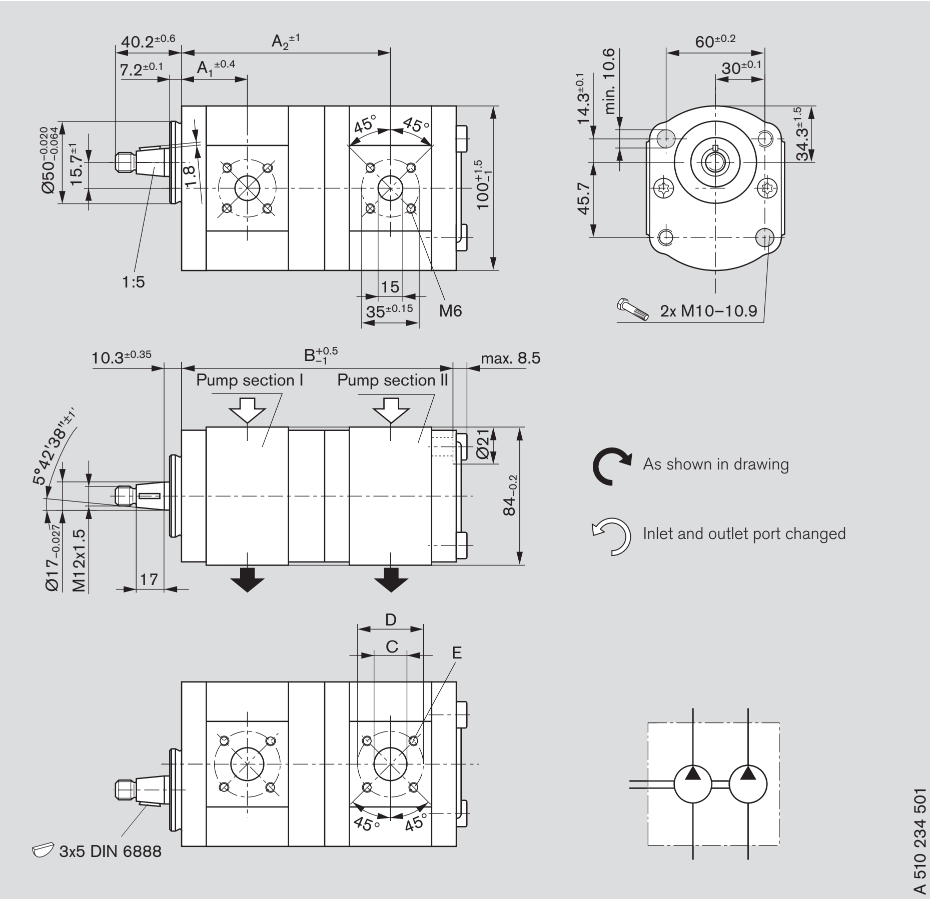
Ordering code

AZPF – 10 – □□□ □ S G 20 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
11	–	**0 510 545 003**	280	3500	3.8	64.5	113.8	20	40	M6 depth 13
14	**0 510 545 302**	**0 510 545 002**	280	3000	4.0	65.0	118.8	20	40	
16	–	**0 510 645 005**	230	3000	4.1	65.0	122.0	20	40	
19	–	**0 510 645 003**	230	3000	4.3	65.0	127.0	20	40	

Dimensions

Standard range



Ordering code
AZPFF – 12 – ☐☐☐/☐☐☐ ☐C P 20 20 K B

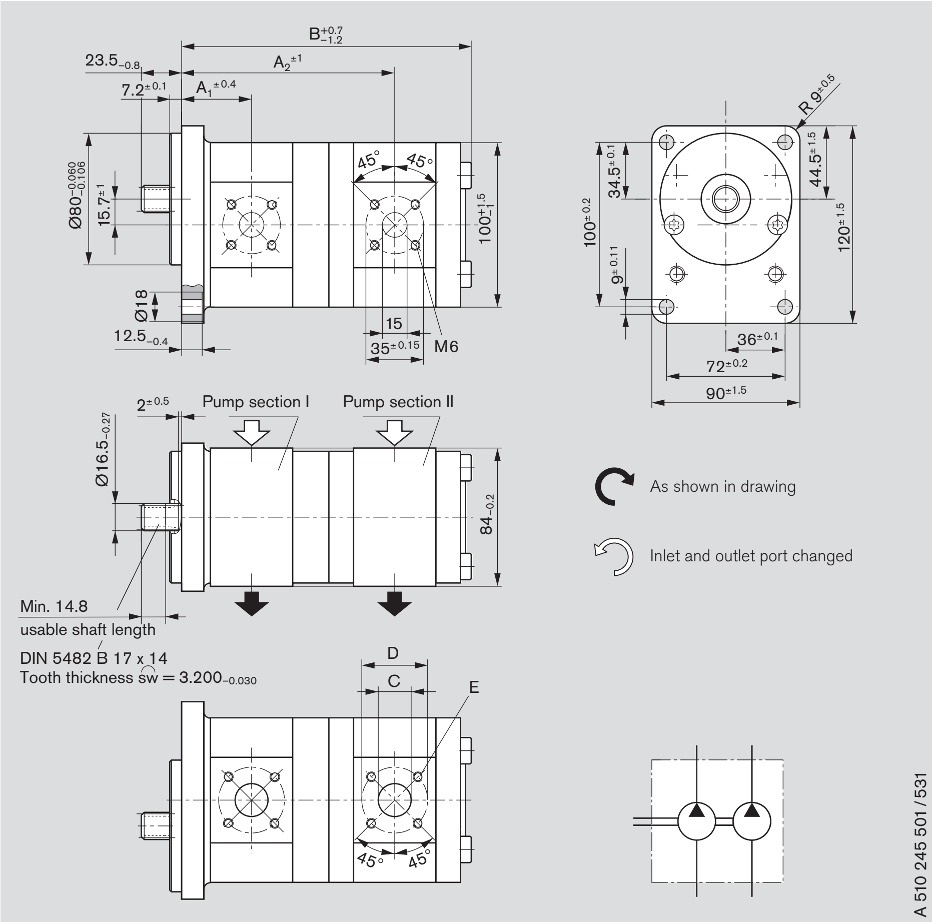
Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	**L**	**R**	P_I	P_{II}			A_1	A_2	B	C [1]	D	E
5.5	4	**0 510 365 305**	–	280	280	4000	4.8	38.6	121.6	157.9	15	40	M6 depth 13
8	4	**0 510 465 324**	**0 510 465 011**	280	280	4000	4.4	40.7	125.7	162.0	20	40	
8	5.5	**0 510 465 344**	**0 510 465 032**	280	280	4000	4.4	40.7	126.9	164.5	20	40	
8	8	**0 510 465 320**	**0 510 465 023**	280	280	4000	5.4	40.7	129.0	168.6	20	40	
11	4	**0 510 565 387**	–	280	280	3500	4.5	44.5	130.7	167.0	20	40	
11	5.5	**0 510 565 319**	**0 510 565 095**	280	280	3500	4.5	44.5	131.9	169.5	20	40	
11	8	**0 510 565 389**	**0 510 565 014**	280	280	3500	4.6	44.5	134.0	173.6	20	40	
11	11	**0 510 565 376**	**0 510 565 061**	280	280	3500	4.8	44.5	137.8	178.6	20	40	
14	4	**0 510 565 406**	–	280	280	3000	4.6	45.0	135.7	172.0	20	40	
14	8	**0 510 565 335**	**0 510 565 072**	280	280	3000	4.8	45.0	139.0	178.6	20	40	
14	11	**0 510 565 393**	–	280	280	3000	5.0	45.0	142.8	183.6	20	40	
14	14	–	**0 510 565 417**	280	280	3000	5.0	45.0	143.3	188.6	20	40	
16	4	**0 510 665 348**	–	280	280	3000	4.75	45.0	139.1	175.4	20	40	
16	5.5	**0 510 665 337**	–	280	280	3000	4.8	45.0	140.3	177.9	20	40	
16	8	**0 510 665 328**	**0 510 665 135**	280	280	3000	6.0	45.0	142.4	182.0	20	40	
16	11	**0 510 665 382**	**0 510 665 152**	280	280	3000	5.0	45.0	146.2	187.0	20	40	
16	14	**0 510 665 381**	**0 510 665 144**	280	280	3000	5.1	45.0	146.7	192.0	20	40	
16	16	**0 510 665 330**	**0 510 665 052**	280	230	3000	6.4	45.0	146.7	195.4	20	40	
19	4	**0 510 665 369**	–	230	280	3000	4.9	45.0	144.1	180.4	20	40	
19	5	**0 510 665 442**	–	230	280	3000	4.8	45.0	145.3	183.2	20	40	
19	11	**0 510 665 368**	–	230	280	3000	5.2	45.0	146.2	192.0	20	40	
19	14	**0 510 665 418**	–	230	280	3000	5.0	45.0	151.7	197.0	20	40	
19	19	**0 510 665 336**	–	230	190	3000	6.6	45.0	151.7	205.4	20	40	
22	8	**0 510 765 345**	**0 510 765 045**	210	280	2500	5.1	52.6	152.8	192.4	20	40	
22	11	**0 510 765 309**	**0 510 765 049**	210	280	2500	5.2	52.6	156.7	197.7	20	40	
22	16	**0 510 765 343**	**0 510 765 028**	210	230	2500	5.5	52.6	157.1	205.8	20	40	

[1]) 4 and 5.5 cm^3 Ø 15

3

Dimensions

Standard range



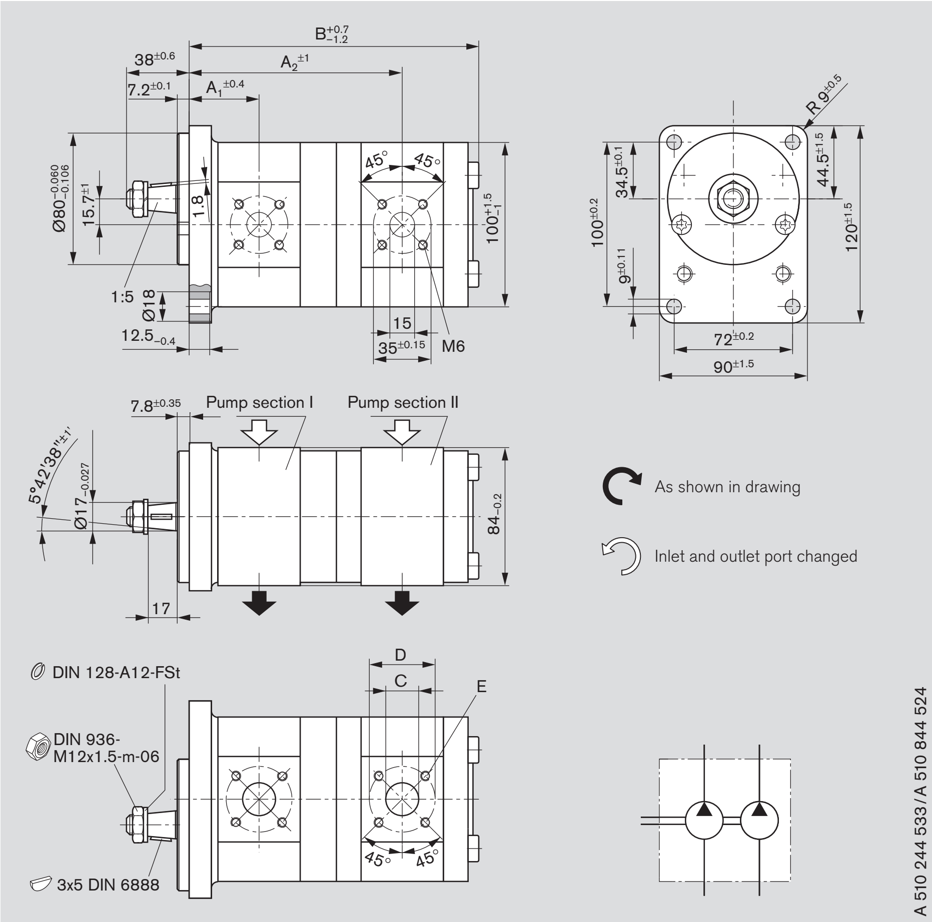
Ordering code
AZPFF – 10 – □ □ □ / □ □ □ □ F B 20 20 M B
AZPFF – 11 – □ □ □ / □ □ □ □ F B 20 20 M B*

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	**L**	**R**	P_I	P_{II}			A_1	A_2	B	C [1]	D	E
8	5.5	**0 510 465 345**	–	280	280	4000	5.1	43.2	129.4	174.0	20	40	M6 depth 13
8	8	**0 510 465 326***	–	280	280	4000	5.1	43.2	131.5	178.1	20	40	
11	4	–	**0 510 565 032**	280	280	3500	6.3	47.0	133.2	176.5	20	40	
11	5.5	**0 510 565 332**	**0 510 565 034**	280	280	3500	6.35	47.0	134.4	179.0	20	40	
11	8	**0 510 565 334***	**0 510 565 018**	280	280	3500	6.4	47.0	136.5	183.1	20	40	
11	11	**0 510 565 328**	**0 510 565 035**	280	280	3500	6.5	47.0	140.3	188.1	20	40	
14	4	**0 510 565 367**	–	280	280	3000	6.4	47.5	138.2	181.5	20	40	
14	5.5	**0 510 565 069**	–	280	280	3500	6.5	47.5	139.4	183.7	20	40	
14	8	**0 510 565 356**	**0 510 565 019**	280	280	3000	6.5	47.5	141.5	188.1	20	40	
16	4	–	**0 510 665 058**	280	280	3000	6.7	47.5	141.6	184.9	20	40	
16	8	**0 510 665 333**	**0 510 665 064**	280	280	3000	6.8	47.5	144.9	191.5	20	40	
16	11	**0 510 665 347**	**0 510 665 036**	280	280	3000	6.9	47.5	148.7	196.5	20	40	
16	16	**0 510 665 334**	**0 510 665 029**	280	230	3000	7.3	47.5	149.2	204.9	20	40	
19	4	–	**0 510 665 115**	230	280	3000	5.5	47.5	146.6	189.0	20	40	
19	11	**0 510 665 375***	–	230	280	3000	5.9	47.5	153.7	201.5	20	40	
19	19	**0 510 665 420**	**0 510 665 097**	230	190	3000	6.3	47.5	154.2	214.9	20	40	
22.5	5.5	**0 510 765 317**	**0 510 765 022**	210	280	2500	5.8	61.1	165.2	209.8	20	40	
22.5	8	**0 510 765 331**	–	210	280	2500	6.18	61.1	167.3	213.9	20	40	
22.5	16	**0 510 765 341**	–	210	230	2500	6.4	61.1	171.6	227.3	20	40	
22.5	22.5	**0 510 765 338**	–	210	160	2500	7.05	61.1	185.2	249.7	20	40	

[1]) 4 and 5.5 cm^3 Ø 15

Dimensions

Standard range



Ordering code
AZPFF – 10 – □□□ / □□□ □ C B 20 20 M B
AZPFF – 11 – □□□ / □□□ □ C B 20 20 M B*

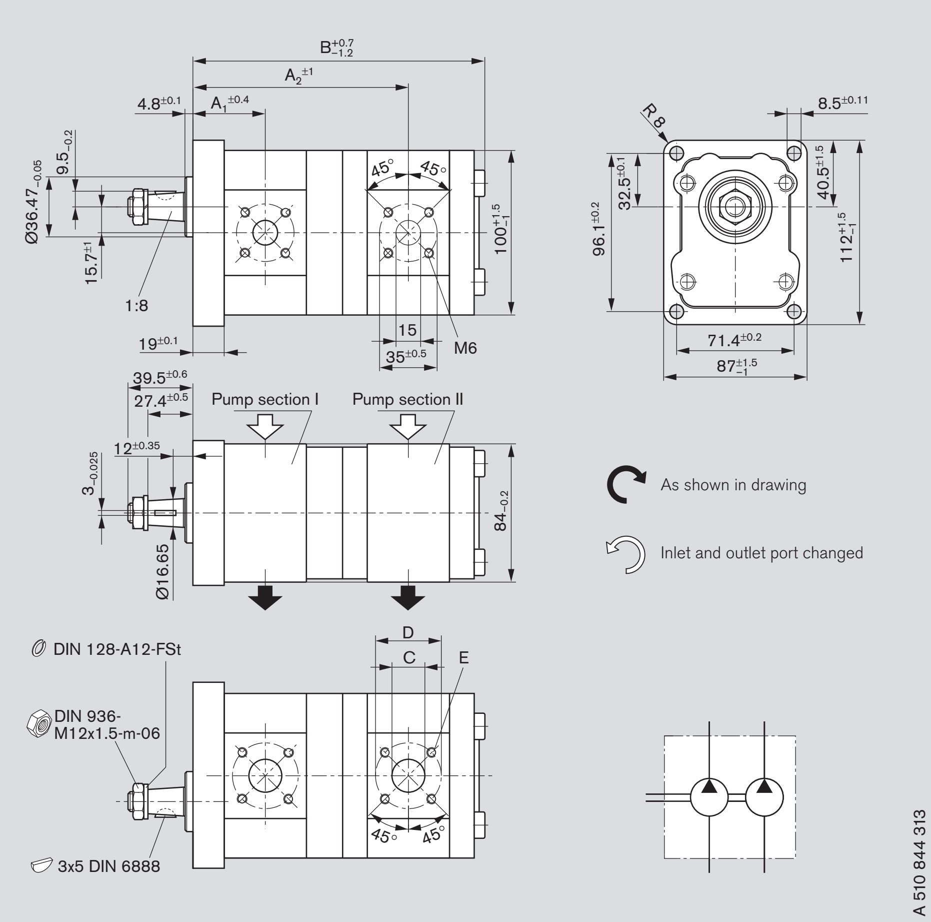
Displacement [cm³/rev] P_I	Displacement [cm³/rev] P_II	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar] P_I	Max. operating pressure [bar] P_II	Max. rotation speed [rpm]	kg	Dimension [mm] A_1	A_2	B	C [1])	D	E
4	4	**0 510 900 002***	**0 510 900 001***	280	280	4000	4.5	39.9	121.6	164.4	15	40	M6 depth 13
5.5	4	**0 510 900 005***	–	280	280	4000	4.9	41.1	124.1	166.9	15	40	
5.5	5.5	**0 510 900 004***	**0 510 900 003***	280	280	4000	5.0	41.1	125.3	169.4	15	40	
8	16	–	**0 510 900 042***	280	230	3000	5.6	43.2	135.8	191.0	20	40	
8	4	**0 510 900 008***	**0 510 900 051***	280	280	4000	5.1	43.2	128.2	171.0	20	40	
8	5.5	**0 510 900 009***	**0 510 900 007***	280	280	4000	5.1	43.2	129.4	173.5	20	40	
8	8	**0 510 900 010***	**0 510 900 006***	280	280	4000	5.2	43.2	131.5	177.6	20	40	
11	4	**0 510 900 015***	**0 510 900 012***	280	280	3500	5.2	47.0	133.2	176.0	20	40	
11	5.5	**0 510 900 017***	**0 510 900 046***	280	280	3500	5.2	47.0	134.4	178.5	20	40	
11	8	**0 510 900 016***	**0 510 900 044***	280	280	3500	5.4	47.0	136.5	182.6	20	40	
11	11	**0 510 900 018***	**0 510 900 039***	280	280	3500	5.5	47.0	140.3	187.6	20	40	
14	4	**0 510 900 036***	–	280	280	3000	5.3	47.5	138.2	181	20	40	
14	5.5	–	**0 510 900 060***	280	280	3000	5.4	47.5	139.4	183.5	20	40	
14	8	**0 510 900 020***	**0 510 900 011***	280	280	3000	5.5	47.5	141.5	187.6	20	40	
14	8	**0 510 565 364**	**0 510 565 012**	280	280	3000	5.6	47.5	141.5	188.1	20	40	
14	11	**0 510 900 019***	**0 510 900 013***	280	280	3000	5.6	47.5	145.3	192.6	20	40	
14	11	**0 510 565 353**	**0 510 565 033**	280	280	3000	5.7	47.5	145.3	193.1	20	40	
14	14	–	**0 510 900 014***	280	280	3000	5.8	47.5	145.8	197.6	20	40	
14	14	–	**0 510 565 037**	280	280	3000	5.9	47.5	145.8	198.1	20	40	
16	4	**0 510 900 059***	**0 510 900 021***	280	280	3000	5.5	47.5	141.6	184.4	20	40	
16	5.5	**0 510 900 028***	–	280	280	3000	5.5	47.5	142.8	186.9	20	40	
16	8	**0 510 900 035***	**0 510 900 022***	280	280	3000	5.6	47.5	144.9	191.0	20	40	
16	11	**0 510 900 029***	**0 510 900 023***	280	280	3000	5.7	47.5	148.7	196.0	20	40	
16	14	–	**0 510 900 061***	280	280	3000	5.9	47.5	149.2	201.0	20	40	
16	16	**0 510 900 030***	**0 510 900 024***	280	230	3000	6.0	47.5	149.2	204.4	20	40	
19	4	**0 510 900 043***	**0 510 900 049***	230	280	3000	5.6	47.5	146.6	189.4	20	40	
19	5.5	–	**0 510 665 067**	230	280	3000	5.6	47.5	147.8	192.4	20	40	
19	5.5	–	**0 510 900 027***	230	280	3000	5.6	47.5	147.8	191.9	20	40	
19	8	**0 510 900 031***	**0 510 900 047***	230	280	3000	5.8	47.5	149.9	196.0	20	40	
19	8	**0 510 665 325***	**0 510 665 024**	230	280	3000	6.7	47.5	149.9	196.5	20	40	
19	11	**0 510 900 032***	**0 510 900 052***	230	280	3000	5.9	47.5	153.7	201.0	20	40	
19	11	**0 510 665 326**	–	230	280	3000	6.9	47.5	153.9	201.5	20	40	
19	14	**0 510 900 053***	–	230	280	3000	6.0	47.5	154.2	206.0	20	40	
19	16	**0 510 665 327**	**0 510 665 053**	230	230	3000	7.1	47.5	154.2	209.9	20	40	
19	16	**0 510 900 033***	**0 510 900 026***	230	230	3000	6.1	47.5	154.2	209.4	20	40	
19	19	**0 510 900 034***	**0 510 900 025***	230	210	3000	6.2	47.5	154.2	214.4	20	40	
19	19	**0 510 665 400**	**0 510 665 025**	230	190	3000	6.2	47.5	154.2	214.9	20	40	
22.5	4	–	**0 510 900 050***	210	280	2500	5.8	55.1	152.0	194.8	20	40	
22.5	5.5	**0 510 900 055***	**0 510 900 045***	210	280	2500	5.8	55.1	153.2	197.3	20	40	
22.5	8	**0 510 900 057***	**0 510 900 040***	210	280	2500	5.9	55.1	155.3	201.4	20	40	
22.5	8	–	**0 510 765 023**	230	280	3000	5.9	61.0	167.3	213.9	20	40	
22.5	11	–	**0 510 900 054***	210	280	2500	6.0	55.1	159.1	206.4	20	40	
22.5	11	**0 510 765 320**	–	210	250	3000	6.3	61.0	171.1	218.9	20	40	
22.5	14	**0 510 900 048***	**0 510 900 058***	210	280	2500	6.2	55.1	159.6	211.4	20	40	
22.5	16	**0 510 900 041***	**0 510 900 037***	210	230	2500	6.2	55.1	159.6	214.8	20	40	
22.5	16	**0 510 765 340**	–	210	230	3000	6.55	61.0	171.6	227.3	20	40	
22.5	22.5	**0 510 900 056***	**0 510 900 038***	210	180	2500	6.5	55.1	167.2	225.2	20	40	
22.5	22.5	–	**0 510 765 012**	210	160	3000	6.5	61.0	185.2	249.7	20	40	

[1]) 4 and 5.5 cm³ Ø 15

3

Dimensions

Standard range



Ordering code
AZPFF – 10 – □□□/□□□ □H O 20 20 M B
AZPFF – 10 – □□□/□□□ □H O 20 20 K B*

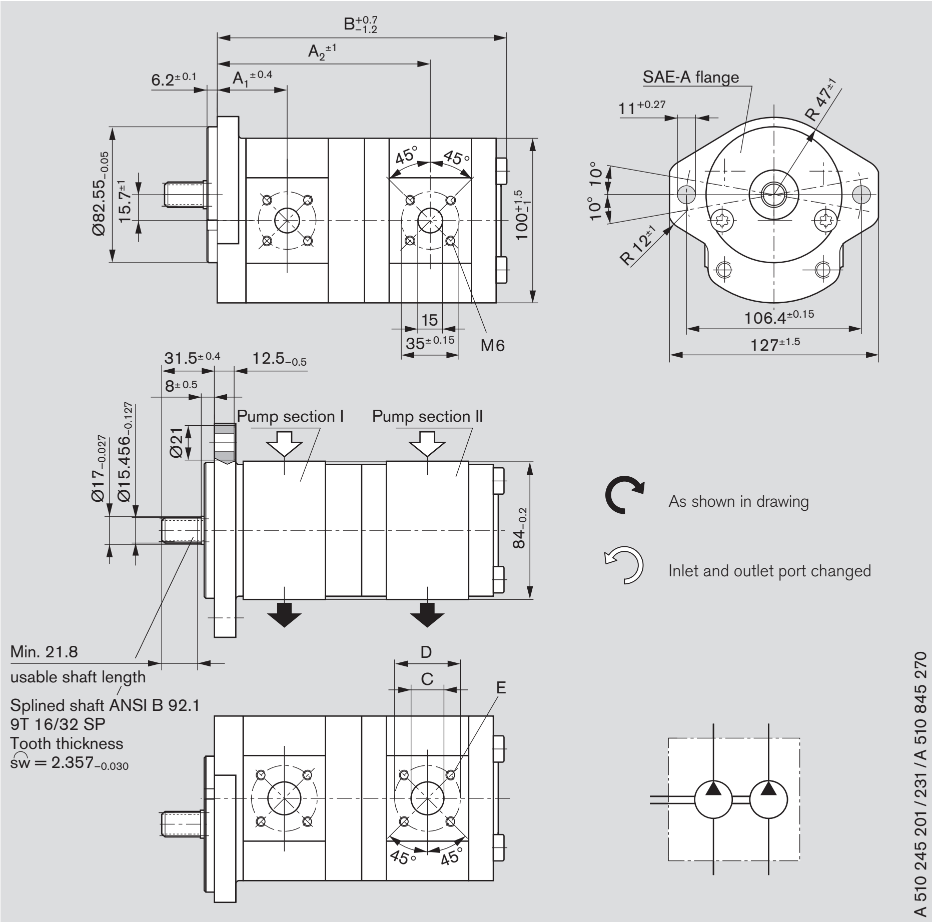
Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	**L**	**R**	P_I	P_{II}			A_1	A_2	B	C 1)	D	E
4	4	–	**0 510 901 500**	280	280	4000	4.7	41.4	123.1	165.9	15	40	M6 depth 13
8	5.5	**0 510 901 512**		280	280	4000	4.9	44.7	130.9	175.0	20	40	
8	8	–	**0 510 901 504**	280	280	4000	5.0	44.7	133.0	179.1	20	40	
11	4	–	**0 510 901 509**	280	280	3500	5.0	48.5	134.7	177.5	20	40	
11	5.5	**0 510 565 436***	**0 510 901 503**	280	280	3500	5.1	48.5	135.9	180.0	20	40	
14	5.5	**0 510 565 435***	–	280	280	3000	5.2	49.0	140.9	185.0	20	40	
14	11	–	**0 510 901 513**	280	280	3000	5.5	49.0	146.8	194.1	20	40	
16	5.5	–	**0 510 901 510**	280	280	3000	5.3	49.0	144.3	188.4	20	40	
16	8	**0 510 901 514**	–	280	280	3000	5.4	49.0	146.4	192.5	20	40	
16	14	–	**0 510 901 515**	280	280	3000	5.7	49.0	150.7	202.5	20	40	
16	16	–	**0 510 901 501**	280	230	3000	5.8	49.0	150.7	205.9	20	40	
19	8	–	**0 510 901 507**	230	280	3000	5.5	49.0	151.4	197.5	20	40	
19	11	–	**0 510 901 508**	230	280	3000	5.6	49.0	155.2	202.5	20	40	
19	16	–	**0 510 901 502**	230	230	3000	5.9	49.0	155.7	210.9	20	40	
19	19	**0 510 901 506**	–	230	190	3000	6.0	49.0	155.7	215.9	20	40	
22.5	16	**0 510 901 511**	–	210	230	2500	6.1	56.6	161.1	216.3	20	40	
22.5	19	–	**0 510 901 505**	210	190	2500	6.2	56.6	161.7	220.3	20	40	

1) 4 and 5.5 cm³ Ø 15

3

Dimensions

Standard range



Ordering code
AZPFF – 10 – □ □ □ / □ □ □ □ R R 20 20 M B
AZPFF – 11 – □ □ □ / □ □ □ □ R R 20 20 M B*
AZPFF – 11 – □ □ □ / □ □ □ □ R R 20 20 K B**

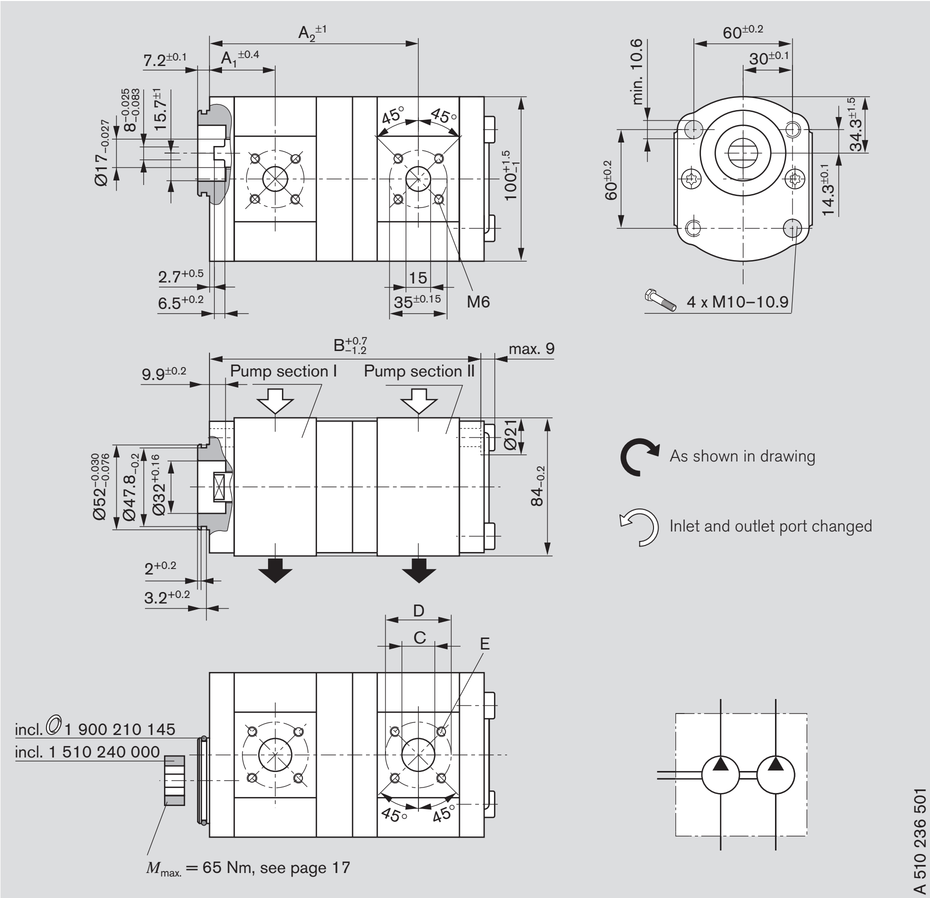
Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	**L**	**R**	P_I	P_{II}			A_1	A_2	B	C 1)	D	E
5.5	4	**0 510 901 029***	**–**	280	280	4000	4.9	41.1	124.1	166.9	15	40	M6 depth 13
5.5	5.5	**–**	**0 510 901 042***	280	280	4000	5.0	41.1	125.3	169.4	15	40	
8	4	**0 510 901 032***	**0 510 901 034***	280	280	4000	5.0	43.2	128.2	171.0	20	40	
8	5.5	**0 510 901 018***	**0 510 901 030***	280	280	4000	5.1	43.2	129.4	173.5	20	40	
8	8	**–**	**0 510 901 021***	280	280	4000	5.1	43.2	131.5	177.6	20	40	
11	4	**–**	**0 510 901 024***	280	280	3500	5.1	47.0	133.2	176.0	20	40	
11	4	**–**	**0 510 565 022**	280	280	3500	5.2	47.0	133.2	176.5	20	40	
11	5.5	**0 510 901 015***	**0 510 901 000***	280	280	3500	5.2	47.0	134.4	178.5	20	40	
11	5.5	**–**	**0 510 565 023**	280	280	3500	5.2	47.0	134.4	179.0	20	40	
11	8	**0 510 901 031***	**0 510 901 037***	280	280	3500	5.3	47.0	136.5	182.6	20	40	
11	11	**0 510 901 009***	**0 510 901 035****	280	280	3500	5.5	47.0	140.3	187.6	20	40	
14	5.5	**0 510 901 033***	**–**	280	280	3000	5.4	47.5	139.4	183.5	20	40	
14	8	**–**	**0 510 901 016***	280	280	3000	5.5	47.5	141.5	187.6	20	40	
14	11	**0 510 565 346**	**–**	280	280	3000	5.7	47.5	145.3	193.1	20	40	
14	11	**0 510 901 001***	**0 510 901 011***	280	280	3000	5.6	47.5	145.3	192.6	20	40	
14	14	**–**	**0 510 901 036***	280	280	3000	5.7	47.5	145.8	197.6	20	40	
16	4	**–**	**0 510 901 028***	280	280	3000	5.4	47.5	141.6	184.4	20	40	
16	5.5	**0 510 901 014***	**0 510 901 008***	280	280	3000	5.4	47.5	142.8	186.9	20	40	
16	8	**0 510 901 006***	**0 510 901 005***	280	280	3000	5.5	47.5	144.9	191.0	20	40	
16	11	**0 510 901 012***	**0 510 901 002***	280	280	3000	5.7	47.5	148.7	196.0	20	40	
16	11	**0 510 665 354**	**0 510 665 042**	280	280	3000	5.8	47.5	148.7	196.0	20	40	
16	16	**0 510 901 027***	**0 510 901 022***	280	280	3000	5.9	47.5	149.2	204.4	20	40	
19	4	**–**	**0 510 901 044***	230	280	3000	5.5	47.5	146.6	189.4	20	40	
19	5.5	**0 510 901 041***	**0 510 901 043***	230	280	3000	5.6	47.5	147.8	191.9	20	40	
19	8	**0 510 901 017***	**0 510 901 003***	230	280	3000	5.7	47.5	149.9	196.0	20	40	
19	8	**–**	**0 510 665 126****	230	280	3000	5.6	47.5	149.9	196.0	20	40	
19	8	**–**	**0 510 665 047**	230	280	3000	5.8	47.5	149.9	196.0	20	40	
19	11	**0 510 665 435**	**0 510 901 004***	230	280	3000	5.8	47.5	153.7	201.0	20	40	
19	14	**0 510 901 040***	**0 510 901 025***	230	280	3000	5.9	47.5	154.2	206.0	20	40	
19	16	**0 510 901 039***	**0 510 901 045***	230	230	3000	6.0	47.5	154.2	209.4	20	40	
19	19	**0 510 901 010***	**–**	230	190	3000	6.2	47.5	154.2	214.4	20	40	
19	19	**–**	**0 510 665 132**	230	190	3000	6.1	47.5	154.2	214.4	20	40	
22.5	4	**–**	**0 510 901 023***	210	280	2500	5.7	55.1	152.0	194.8	20	40	
22.5	5.5	**–**	**0 510 901 020***	210	280	2500	5.7	55.1	153.2	197.3	20	40	
22.5	8	**–**	**0 510 765 016**	180	280	2500	7.6	55.1	155.3	201.4	20	40	
22.5	11	**0 510 901 019***	**0 510 901 026***	210	280	2500	5.9	55.1	159.1	206.4	20	40	
22.5	14	**0 510 901 013***	**0 510 901 007***	210	280	2500	6.1	55.1	159.6	211.4	20	40	
22.5	22.5	**0 510 901 038***	**–**	210	180	2500	6.4	55.1	167.2	225.2	20	40	

1) 4 and 5.5 cm³ Ø 15

3

Dimensions

Standard range



Ordering code

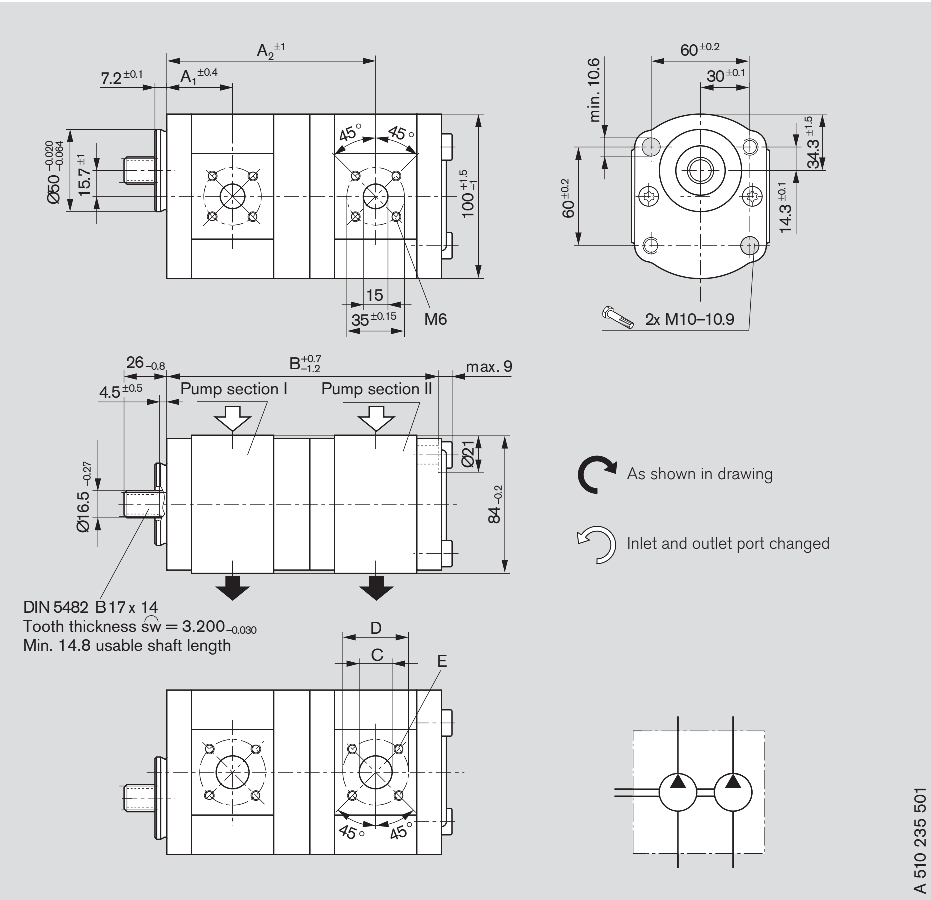
AZPFF – 10 – □□□/□□□ □N M 20 20 M B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	L	R	P_I	P_{II}			A_1	A_2	B	C 1)	D	E
5.5	4	**0 510 365 314**	**0 510 365 010**	280	280	4000	4.2	38.6	121.6	157.9	15	40	M6 depth 13
8	4	–	**0 510 465 012**	280	280	4000	4.4	40.7	125.7	162.0	20	40	
8	5.5	**0 510 465 346**	–	280	280	4000	4.4	40.7	126.9	164.5	20	40	
8	8	–	**0 510 465 008**	280	380	4000	5.6	40.7	129.0	168.6	20	40	
11	4	**0 510 565 329**	**0 510 565 015**	280	280	3500	4.5	44.5	130.7	167.0	20	40	
11	5.5	–	**0 510 565 016**	280	280	3500	4.6	44.5	131.9	169.5	20	40	
11	8	**0 510 565 379**	**0 510 565 078**	280	280	3500	4.65	44.5	134.0	173.6	20	40	
16	16	**0 510 665 339**	**0 510 665 030**	280	230	3000	5.2	45.0	146.7	195.4	20	40	
22.5	8	**0 510 765 312**	–	210	280	2500	5.2	52.5	152.8	192.4	20	40	

1) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code

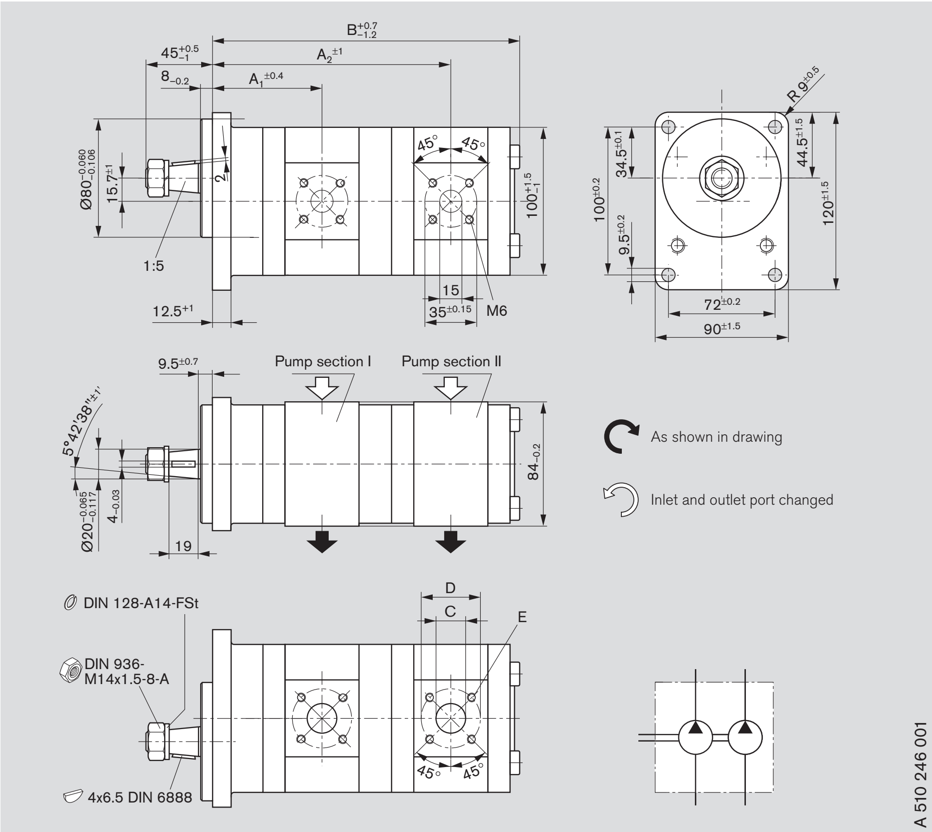
AZPFF – 10 – □□□/□□□ □ F P 20 20 M B
AZPFF – 10 – □□□/□□□ □ F P 20 20 K B*

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	L	R	P_I	P_{II}			A_1	A_2	B	C [1]	D	E
8	4	**0 510 465 355**	–	280	280	4000	4.4	40.7	125.7	162.0	20	40	M6 depth 13
11	8	**0 510 565 385**	–	280	280	3500	4.6	44.5	134.0	173.6	20	40	
16	8	–	**0 510 665 071**	280	280	3000	4.85	45.0	142.4	182.0	20	40	
16	11	–	**0 510 665 076**	280	280	3000	4.98	45.0	146.2	187.0	20	40	
16	14	**0 510 665 404***	–	280	280	3000	5.12	45.0	146.7	192.0	20	40	
16	16	**0 510 665 376**	**0 510 665 062**	280	230	3000	5.2	45.0	146.7	195.4	20	40	

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



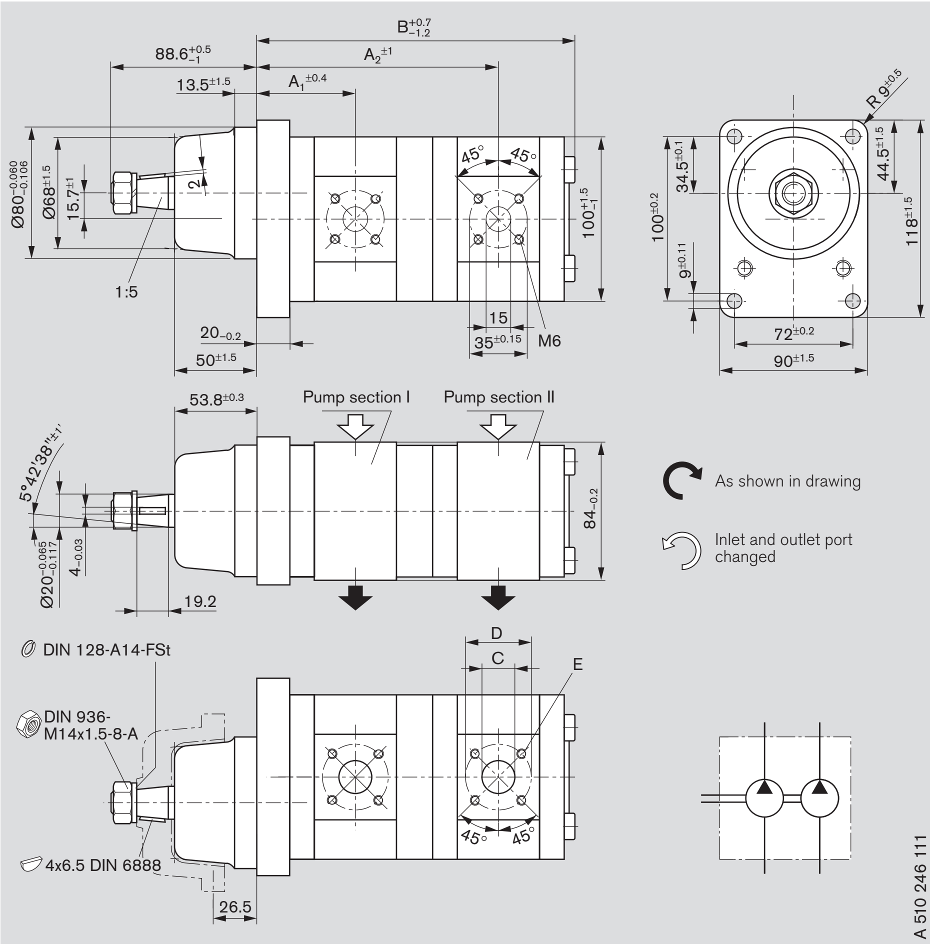
Ordering code
AZPFF – 10 – ☐☐☐ / ☐☐☐ ☐ S A 20 20 M B

Displacement [cm³/rev] P$_{I}$	P$_{II}$	Ordering-No. L	R	Max. operating pressure [bar] P$_{I}$	P$_{II}$	Max. rotation speed [rpm]	kg	Dimension [mm] A$_1$	A$_2$	B	C[1]	D	E
4	4	**0 510 255 300**	–	280	280	4000	4.8	71.3	153.0	197.0	15	40	M6 depth 13
5.5	4	**0 510 355 301**	–	280	280	4000	5.0	72.6	155.5	199.5	15	40	
8	5.5	**0 510 455 300**	**0 510 455 001**	280	280	4000	5.2	74.6	160.8	206.1	20	40	
8	8	**0 510 455 301**	**0 510 455 002**	280	280	4000	5.3	74.6	163.0	210.2	20	40	
11	5.5	**0 510 555 300**	**0 510 555 001**	280	280	3500	5.3	79.0	165.8	211.1	20	40	
11	8	**0 510 555 301**	**0 510 555 002**	280	280	3500	5.4	79.0	168.0	215.2	20	40	
11	11	**0 510 555 302**	**0 510 555 003**	280	280	3500	5.5	79.0	172.3	220.2	20	40	
16	4	**0 510 655 300**	**0 510 655 001**	280	280	3000	6.4	79.0	173.0	217.0	20	40	
16	5.5	**0 510 655 301**	**0 510 655 002**	280	280	3000	5.5	79.0	174.2	219.5	20	40	
16	8	**0 510 655 302**	**0 510 655 003**	280	280	3000	5.6	79.0	176.3	223.6	20	40	
16	11	**0 510 655 303**	**0 510 655 004**	280	280	3000	5.7	79.0	180.7	228.6	20	40	
16	16	**0 510 655 304**	**0 510 655 005**	280	230	3000	6.0	79.0	180.7	237.0	20	40	

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



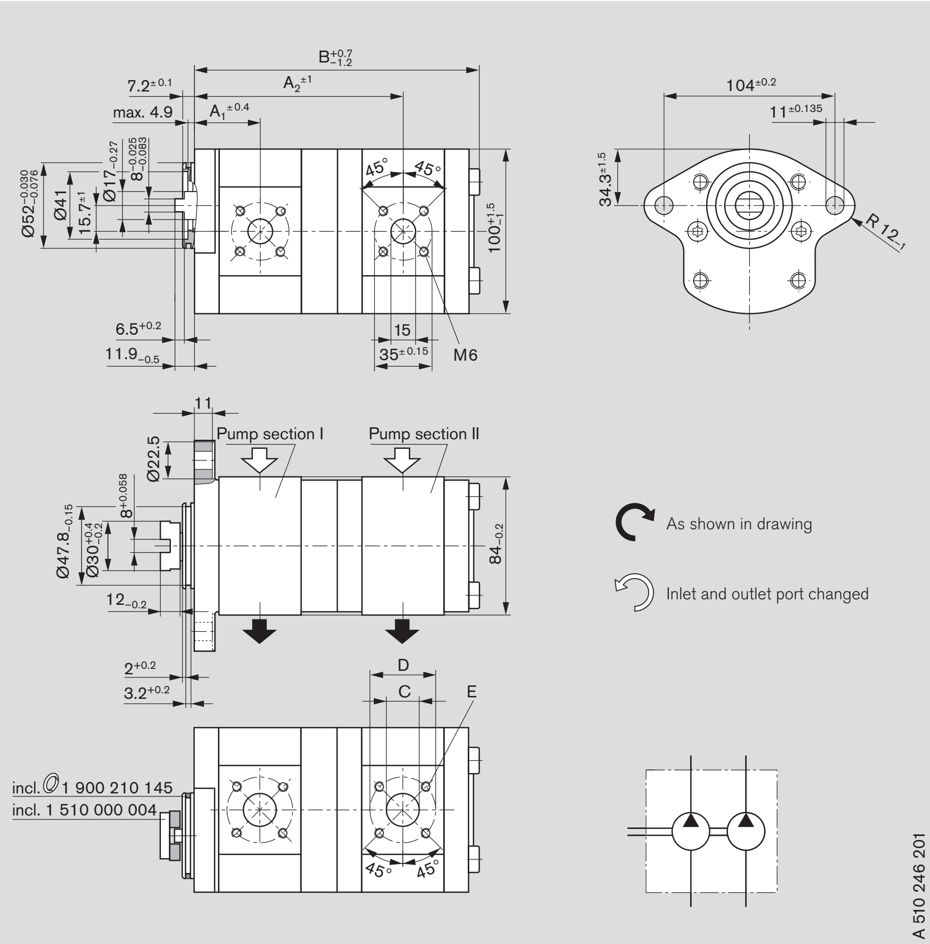
Ordering code:
AZPFF – 10 – □□□/□□□ □S G 20 20 P B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	L	R	P_I	P_{II}			A_1	A_2	B	C [1])	D	E
16	16	–	**0 510 655 007**	280	280	3000	6.2	65.0	166.7	221.9	20	40	M6 depth 13
19	19	–	**0 510 655 011**	230	190	3000	6.6	65.0	171.7	231.9	20	40	

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



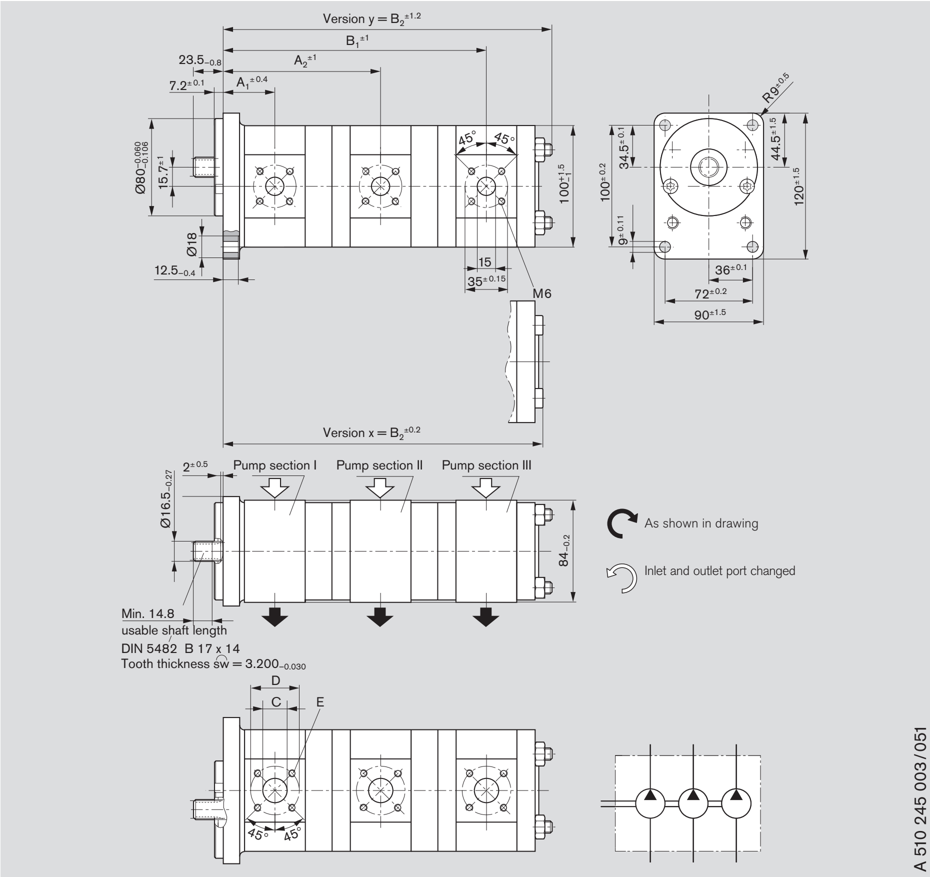
Ordering code
AZPFF – 10 – □□□ / □□□ □ N L 20 20 K B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P_I	P_{II}	L	R	P_I	P_{II}			A_1	A_2	B	C [1]	D	E
5.5	5.5	–	**0 510 365 009**	280	280	4000	4.65	38.6	122.8	169.2	15	40	M6 depth 13
11	11	–	**0 510 565 043**	280	280	3500	5.2	44.5	137.5	187.4	20	40	
16	8	**0 510 665 449**	–	280	280	3000	5.2	45.0	142.4	188.4	20	40	
16	22.5	**0 510 665 068**	–	280	160	2500	6.17	45.0	160.3	226.6	20	40	

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code

AZPFFF – 10 – □□□/□□□/□□□ □ F B 20 20 20 M B

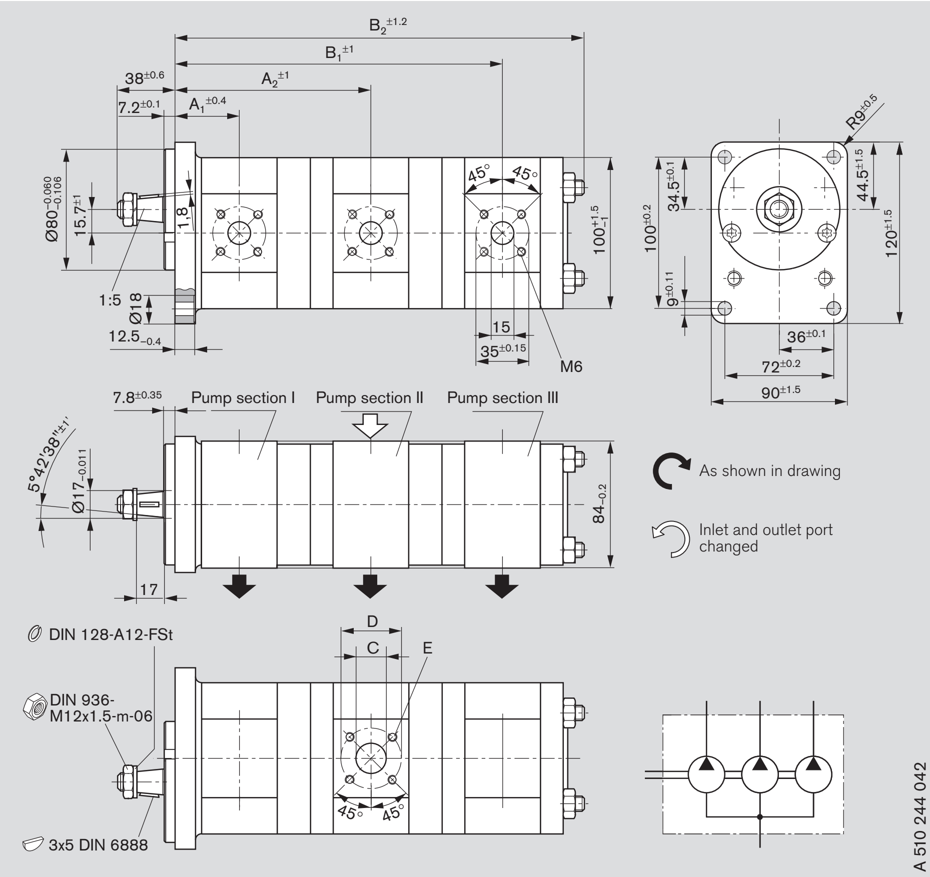
AZPFFF – 11 – □□□/□□□/□□□ □ F B 20 20 20 M B*

Displacement [cm³/rev]			Ordering-No.		Max. operating pressure [bar]			Max. rotation speed [rpm]	kg	Dimension [mm]							Version
P_I	P_{II}	P_{III}	L	R	P_I	P_{II}	P_{III}			A_1	A_2	B_1	B_2	C [1])	D	E	
11	4	4	**0 510 565 371**	–	280	280	280	3500	6.9	47.0	133.2	214.9	259.0	20	40	M6	y
14	4	8	**0 510 565 408**	–	280	280	280	3000	7.2	47.5	138.2	223.2	270.6	20	40	depth 13	x
14	8	8	**0 510 565 422**	–	280	280	280	3000	7.3	47.5	141.5	229.8	275.9	20	40		x
16	4	4	**0 510 665 379**	–	280	280	280	3000	7.2	47.5	141.6	223.3	267.4	20	40		x
16	5.5	5.5	**0 510 665 416**	**0 510 665 061**	280	280	280	3000	7.4	47.5	142.8	227.0	272.4	20	40		x
16	11	4	**0 510 665 372**	–	280	210	210	3000	7.5	47.5	148.7	234.9	276.5	20	40		x
16	11	5.5	–	**0 510 665 092***	280	210	120	3000	7.6	47.5	148.7	236.1	280.2	20	40		x
16	16	11	**0 510 665 371**	–	280	120	120	3000	8.1	47.5	149.2	250.4	302.5	20	40		x
19	8	5.5	–	**0 510 665 111***	230	250	160	3000	7.5	47.5	149.2	236.1	280.2	20	40		x
19	11	5.5	–	**0 510 665 112***	230	230	230	3000	7.6	47.5	153.7	241.1	285.2	20	40		x

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code

AZPFFF – 11 – □□□/□□□/□□□ □C B 20 20 20 M B

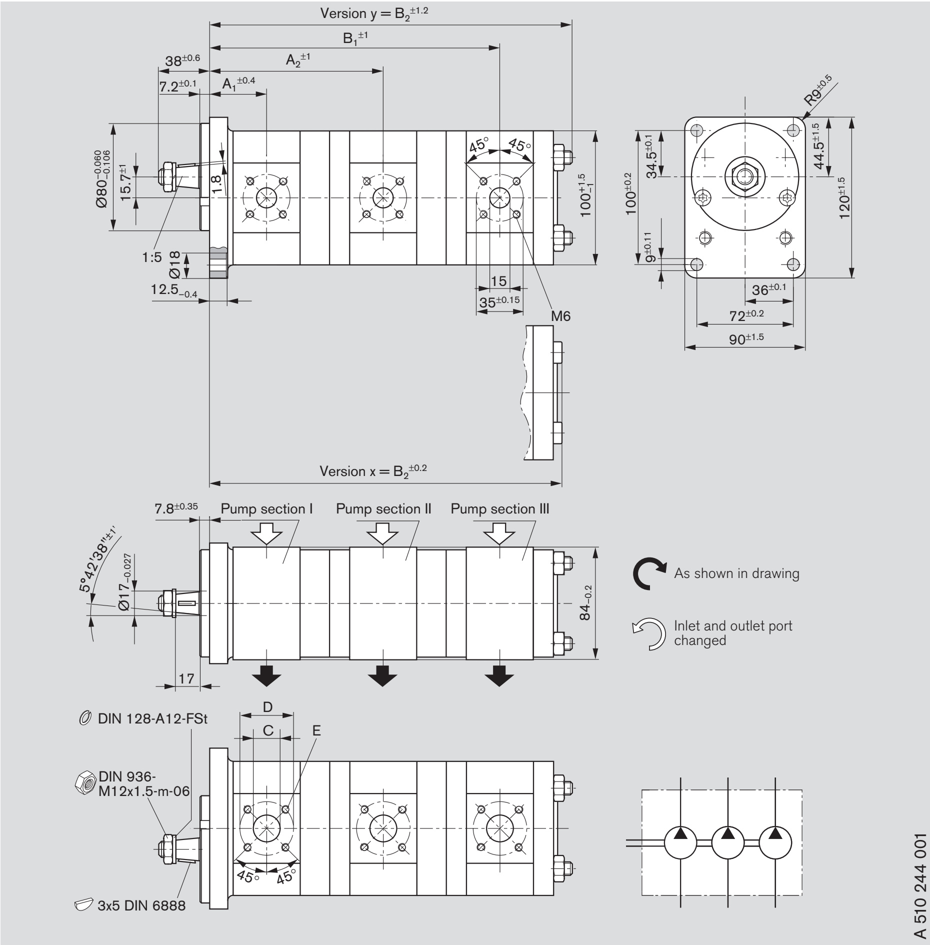
Displacement [cm³/rev]			Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]			Max. rotation speed [rpm]	kg	Dimension [mm]						
P_I	P_{II}	P_{III}			P_I	P_{II}	P_{III}			A_1	A_2	B_1	B_2	C [1]	D	E
8	8	5.5	–	**0 510 465 031**	230	230	230	4000	6.5	43.2	119.5	193.7	238.1	20	40	M6 depth 13
11	11	8	–	**0 510 565 065**	230	230	230	3500	6.8	47.0	128.3	205.8	251.9	20	40	
11	11	8	–	**0 510 565 080**[2]	280	280	280	3500	6.8	47.0	128.3	205.8	251.9	20	40	

[1]) 4 and 5.5 cm³ Ø 15

[2]) heavy through drive

Dimensions

Standard range



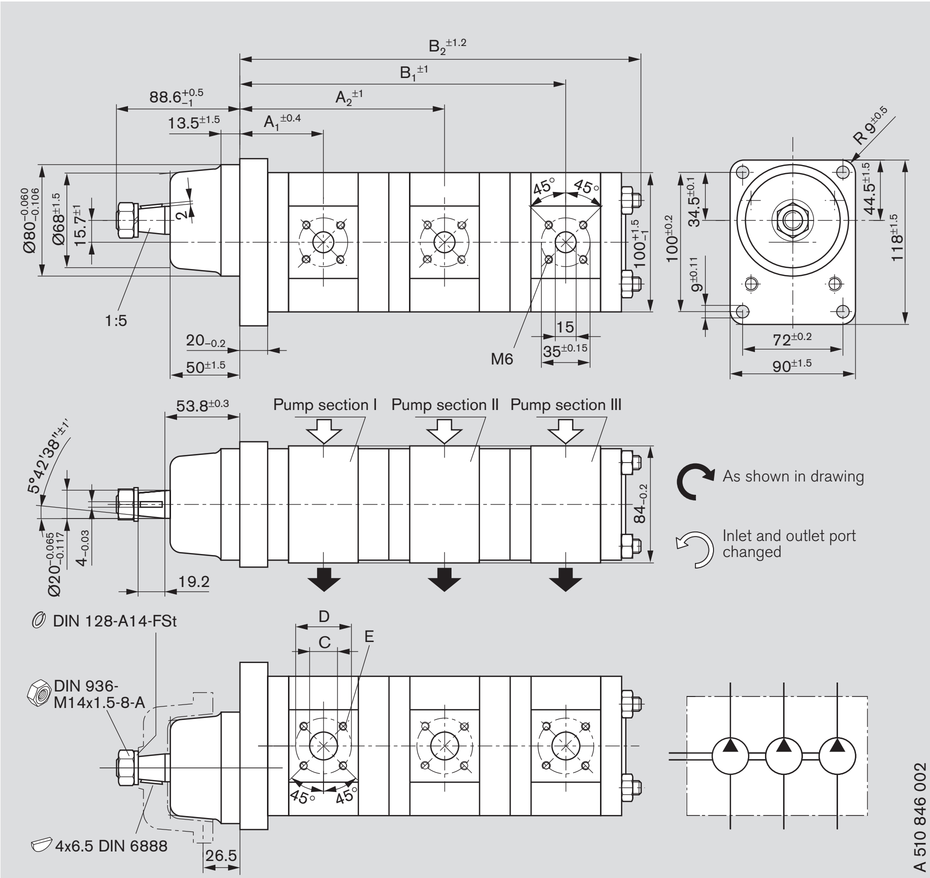
Ordering code
AZPFFF – 10 – □□□ / □□□ / □□□ □C B 20 20 20 M B
AZPFFF – 11 – □□□ / □□□ / □□□ □C B 20 20 20 K B*

Displacement [cm³/rev]			Ordering-No.		Max. operating pressure [bar]			Max. rotation speed	kg	Dimension [mm]							Version
P_I	P_{II}	P_{III}	L	R	P_I	P_{II}	P_{III}	[rpm]		A_1	A_2	B_1	B_2	C 1)	D	E	
8	8	4	–	**0 510 465 027**	280	280	280	4000	7.0	43.2	131.5	216.5	260.6	20	40	M6 depth 13	x
11	8	8	–	**0 510 565 081**	280	230	230	3500	7.2	47.0	136.5	224.8	272.2	20	40		x
16	4	4	**0 510 665 419***	–	280	280	280	3000	7.1	47.5	141.6	223.3	267.4	20	40		x
16	8	4	–	**0 510 665 134**	280	280	280	3000	7.3	47.5	144.9	229.9	272.7	20	40		x
22.5	8	9	**0 510 765 334***	–	230	210	210	3000	8.15	61.6	167.3	255.6	307.5	20	40		y

1) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code

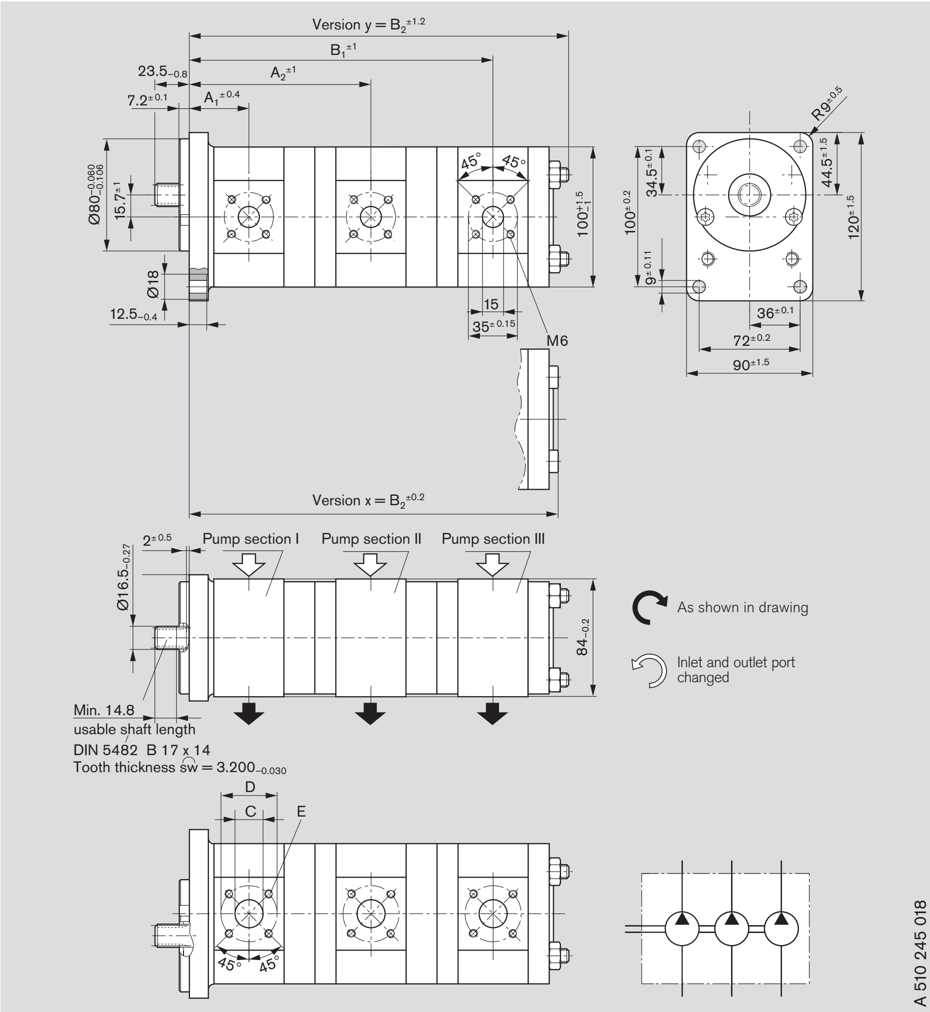
AZPFFF – 10 – □□□/□□□/□□□ □S G 20 20 20 M B

Displacement [cm³/rev]			Ordering-No.		Max. operating pressure [bar]			Max. rotation speed	kg	Dimension [mm]						
P_I	P_{II}	P_{III}	L	R	P_I	P_{II}	P_{III}	[rpm]		A_1	A_2	B_1	B_2	C [1])	D	E
8	8	5.5	–	**0 510 455 004**	280	250	250	4000	7.4	60.7	149.0	235.2	284.0	20	40	M6 depth 13
14	14	5.5	–	**0 510 555 007**	280	210	210	3000	7.9	65.0	163.3	255.3	304.0	20	40	

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code

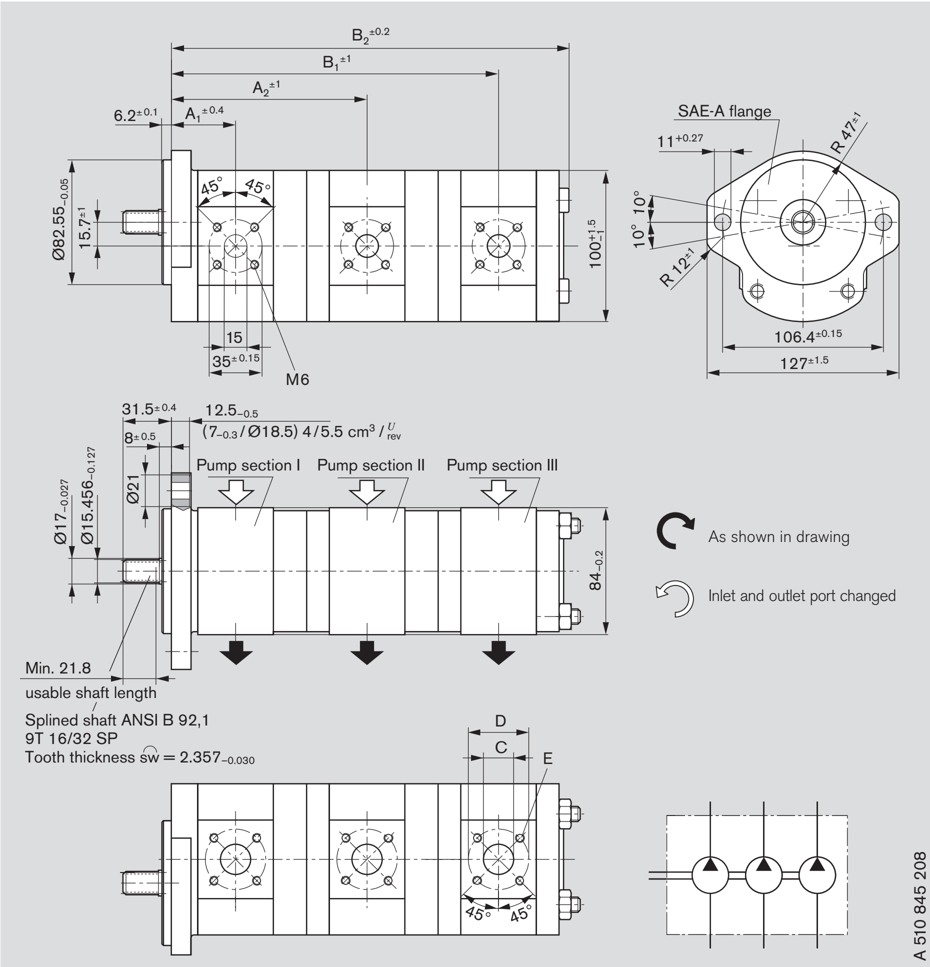
AZPFFF – 10 – □□□/□□□/□□□ □F B 20 20 20 M B

Displacement [cm³/rev]			Ordering-No.		Max. operating pressure [bar]			Max. rotation speed [rpm]	kg	Dimension [mm]							Version
P_I	P_{II}	P_{III}	L	R	P_I	P_{II}	P_{III}			A_1	A_2	B_1	B_2	C [1])	D	E	
8	8	4	–	**0 510 465 019**	280	280	280	4000	7.0	43.2	131.5	216.5	260.8	20	40	M6	x
19	16	4	**0 510 665 380**	–	230	190	190	3000	7.8	47.5	154.2	248.3	297.5	20	40	depth 13	y

[1]) 4 and 5.5 cm³ Ø 15

Dimensions

Standard range



Ordering code:

AZPFFF – 10 – □□□/□□□/□□□ □RR 20 20 20 M B

Displacement [cm³/rev]			Ordering-No.		Max. operating pressure [bar]			Max. rotation speed	kg	Dimension [mm]						
P_I	P_{II}	P_{III}	L	R	P_I	P_{II}	P_{III}	[rpm]		A_1	A_2	B_1	B_2	C [1]	D	E
8	5.5	5.5	–	**0 510 465 025**	280	280	280	4000	7.0	43.2	129.4	213.6	257.7	20	40	M6 depth 13

[1]) 4 and 5.5 cm³ Ø 15

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 20 – 58, are contained in delivery.

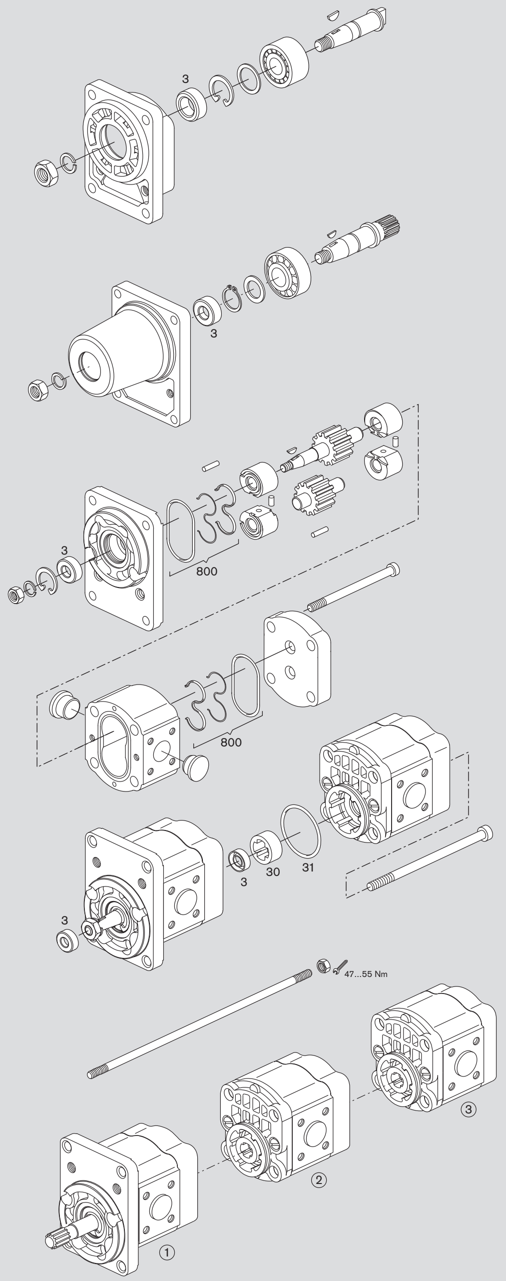
You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Service parts

Page	Ordering code	Seal kit Pos. 800 1 517 010 ...		Shaft seal ring Pos. 3 1 510 283 ...	Mate- rial	Dimension	Seal ring Pos. 31 1 900 210 ...	Mate- rial	Dimen- sion
20	AZPF – 1x – □□□ □ CB 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
21	AZPF – 1x – □□□ □ FB 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
22	AZPF – 1x – □□□ □ HO 30 **KB**	152	NBR	044	FKM	18 x 30 x 7			
23	AZPF – 1x – □□□ □ FO 30 **MB**	152	NBR	008	NBR	17 x 30 x 7			
23	AZPF – 1x – □□□ □ FO 30 **PB**	193	FKM	027	FKM	17 x 30 x 7			
24	AZPF – 1x – □□□ □ HO 01 **MB**	152	NBR	008	NBR	17 x 30 x 7			
25	AZPF – 1x – □□□ □ AB 01 **MB**	208	FKM	037	NBR	18 x 30 x 6			
26	AZPF – 1x – □□□ □ CP 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
26	AZPF – 1x – □□□ □ CP 20 **KB**	152	NBR	027	FKM	17 x 30 x 7			
27	AZPF – 1x – □□□ □ CN 20 **MB**	152	NBR	008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
28	AZPF – 1x – □□□ □ FN 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
29	AZPF – 1x – □□□ □ FP 20 **PB**	193	FKM	027	FKM	17 x 30 x 7			
30	AZPF – 1x – □□□ □ NT 20 **MB**	152	NBR	008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
31	AZPF – 1x – □□□ □ NL 20 **KB**	152	NBR	027	FKM	17 x 30 x 7	145	NBR	45 x 2.5
32	AZPF – 1x – □□□ □ QR 12 **MB**	152	NBR	008	NBR	17 x 30 x 7			
33	AZPF – 1x – □□□ □ RR 12 **MB**	152	NBR	008	NBR	17 x 30 x 7			
34	AZPF – 1x – □□□ □ RR 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
34	AZPF – 1x – □□□ □ RR 20 **KB**	152	NBR	027	FKM	17 x 30 x 7			
35	AZPF – 1x – □□□ □ QR 20 **MB**	152	NBR	008	NBR	17 x 30 x 7			
36	AZPF – 1x – □□□ □ SA 20 **MB**	152	NBR	008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
36	AZPF – 1x – □□□ □ SA 20 **KB**	152	NBR	015	FKM	17 x 30 x 7	145	NBR	45 x 2.5
37	AZPF – 1x – □□□ □ SG 20 **MB**	152	NBR	009	NBR	20 x 40 x 7	145	NBR	45 x 2.5
39	AZPF – 1x – □□□ □ CP 20 20 **KB**	152	NBR	027/008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
41	AZPFF – 1x – □□□ / □□□ □ FB 20 20 **MB**	152 (2x)	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
43	AZPFF – 1x – □□□ / □□□ □ CB 20 20 **MB**	152 (2x)	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
45	AZPFF – 1x – □□□ / □□□ □ HO 20 20 **MB**	152 (2x)	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
45	AZPFF – 1x – □□□ / □□□ □ HO 20 20 **KB**	152 (2x)	NBR	027/008	FKM/ NBR	17 x 30 x 7	145	NBR	45 x 2.5
47	AZPFF – 1x – □□□ / □□□ □ RR 20 20 **MB**	152 (2x)	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
47	AZPFF – 1x – □□□ / □□□ □ RR 20 20 **KB**	152 (2x)	NBR	027 (2x)	FKM	17 x 30 x 7	145	NBR	45 x 2.5
48	AZPFF – 1x – □□□ / □□□ □ NM 20 20 **MB**	152 (2x)	NBR	008	NBR	17 x 30 x 7	145	NBR	45 x 2.5
49	AZPFF – 1x – □□□ / □□□ □ FP 20 20 **MB**	152	NBR	008 (2x)	NBR	17 x 30 x 7	145	NBR	45 x 2.5
49	AZPFF – 1x – □□□ / □□□ □ FP 20 20 **KB**	152 (2x)	NBR	027	FKM	17 x 30 x 7	145	NBR	45 x 2.5
50	AZPFF – 1x – □□□ / □□□ □ SA 20 20 **MB**	152 (2x)	NBR	008/009	NBR	17 x 30 x 7	145	NBR	45 x 2.5
51	AZPFF – 1x – □□□ / □□□ □ SG 20 20 **PB**	193 (2x)	FKM	015/027	FKM	17 x 30 x 7	1 520 210 101	FKM	45 x 2.5
52	AZPFF – 1x – □□□ / □□□ □ NL 20 20 **KB**	152 (2x)	NBR	027 (2x)	FKM	17 x 30 x 7	145	NBR	45 x 2.5
53	AZPFFF – 1x – □□□ / □□□ / □□□ □ FB 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
54	AZPFFF – 1x – □□□ / □□□ / □□□ □ CB 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
55	AZPFFF – 1x – □□□ / □□□ / □□□ □ CB 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
55	AZPFFF – 1x – □□□ / □□□ / □□□ □ CB 20 20 20 **KB**	152 (3x)	NBR	027/008 (2x)	FKM/ NBR	17 x 30 x 7	145	NBR	45 x 2.5
56	AZPFFF – 1x – □□□ / □□□ / □□□ □ SG 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
57	AZPFFF – 1x – □□□ / □□□ / □□□ □ FB 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5
58	AZPFFF – 1x – □□□ / □□□ / □□□ □ RR 20 20 20 **MB**	152 (3x)	NBR	008 (3x)	NBR	17 x 30 x 7	145 (2x)	NBR	45 x 2.5

NBR = Perbunan® FKM = Viton®

For further service parts refer to CD-ROM HYparts 1 987 760 010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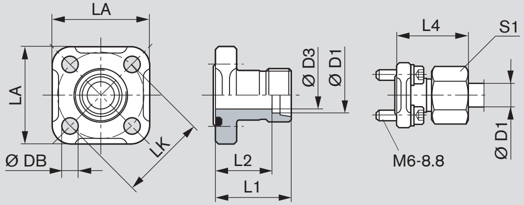
Fittings

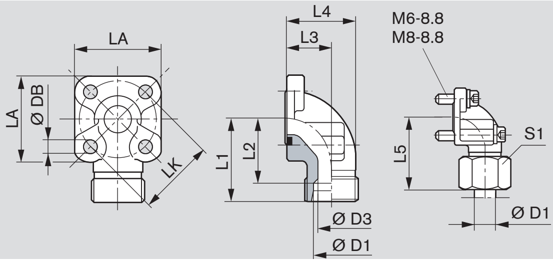
Gear pump flange, straight, for rectangular flange 20 see page 9



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws 4x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M6x22	20x2.5	0.10	**1 515 702 066**	250
40	15L	12	35	28.0	43.0	42	27	6.4	M6x22	24x2.5	0.12	**1 515 702 067**	100
40	18L	15	35	27.5	44.0	42	32	6.4	M6x22	24x2.5	0.13	**1 515 702 068**	100
40	22L	19	35	27.5	44.5	42	36	6.4	M6x22	24x2.5	0.12	**1 515 702 069**	100
40	28L	24	42	27.5	34.5	42	41	6.4	M6x22	24x2.5	0.15	**1 515 702 008**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

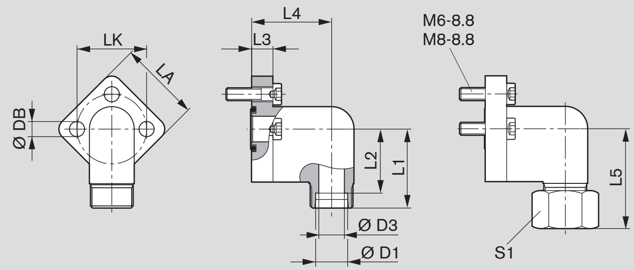
Gear pump flange, 90° angle, for rectangular flange 20 see page 9



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws		Seal ring NBR *)	Mass [kg]	Part number	p (bar)
											2x	2x				
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M6x22	M6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M6x22	M6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M6x22	M6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M6x22	M6x45	20x2.5	0.24	**1 515 702 017**	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M6x22	M6x22	24x2.5	0.15	**1 515 702 073**	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 074**	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M6x22	M6x45	24x2.5	0.20	**1 515 702 011**	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 075**	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M6x20	M6x50	24x2.5	0.24	**1 515 702 010**	100
40	35L	31	41	30.5	34.0	55.0	52.0	42	50	6.4	M6x22	M6x60	24x2.5	0.33	**1 515 702 018**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Gear pump flange, 3-hole, 90° angle, for rectangular flange 30 see page 9



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 3x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
30	12L	10	37	30.0	10	37.5	46	38	22	6.4	M6x22	16x2.5	0.13	**1 515 702 146**	250
30	15L	12	37	30.0	10	37.5	47	38	27	6.4	M6x22	16x2.5	0.14	**1 515 702 147**	250
30	18L	15	37	30.0	10	37.5	47	38	32	6.4	M6x22	16x2.5	0.17	**1 515 702 148**	160
40	22L	19	43	35.5	14	41.0	53	48	36	8.4	M8x30	24x2.5	0.29	**1 515 702 149**	160
40	28L	24	43	35.5	14	41.0	53	48	41	8.4	M8x30	24x2.5	0.40	**1 515 702 150**	160

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Note
You can find the permissible tightening torques in our publication:
“General Operating Instructions for External Gear Units”
RE 07 012-B1.

3

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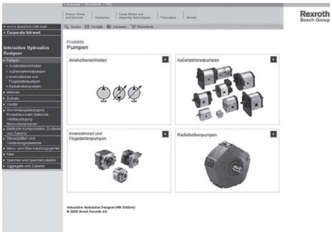
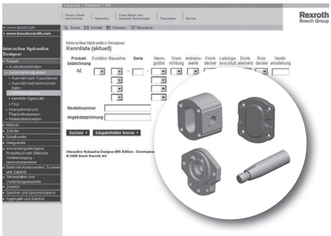
The AZ configurator at www.boschrexroth.com/azconfigurator

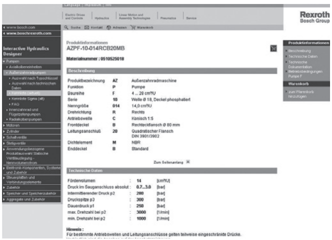
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Bosch Rexroth AG
External Gear Units
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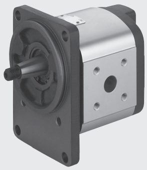
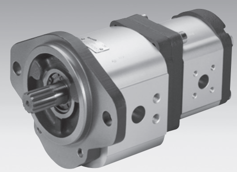
Rexroth
Bosch Group

External Gear Pumps Series N

RE 10 091/02.12
Replaces:
RE 10 091/11 .10

AZPN-...





Fixed pumps
V = 20...36 cm^3/rev

Overview of contents

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Features

- Nominal pressure 250 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports: connection flanges
- Consistent high quality thru mass production
- Numerous configuration variants available

General

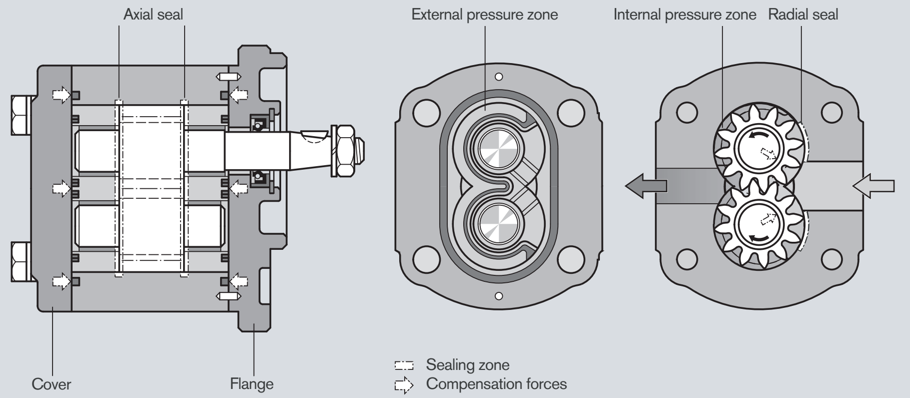
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G and as SILENCE gear pumps in the series of S, T and U, in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

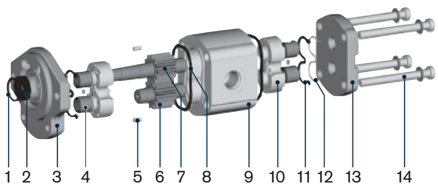
Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings or bearing, dependent on the series, and the case with a front and rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

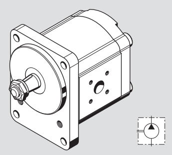
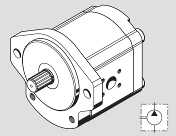
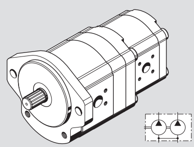
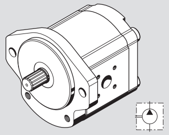
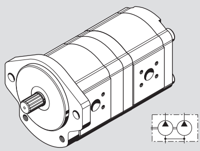
Gear pump axial compensation





1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

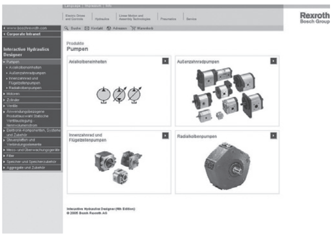
Overview of “Series N” standard types

Version	Page	Version	Page	Version	Page
	16		18		20
	17		19		

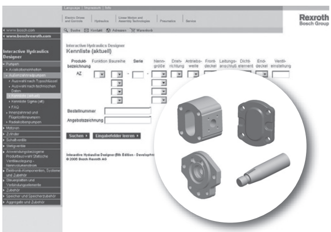
3

The AZ configurator at www.boschrexroth.com/azconfigurator

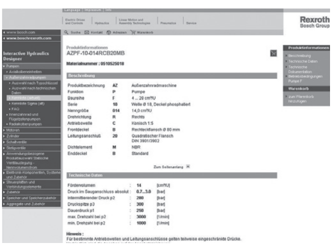
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Ordering code

External gear units, single pumps, standard

AZ	P	N	–	x	x	–	020	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
1 = Case width 92 mm
2 = Case width 110 mm

Version
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size N
020 = 20.0 cm³/rev
022 = 22.5 cm³/rev
025 = 25.0 cm³/rev
028 = 28.0 cm³/rev
032 = 32.0 cm³/rev
036 = 36.0 cm³/rev

Direction of rotation
R = Clockwise
L = Counterclockwise

*) Some of the special designs shown on pages 16–21 are not covered in the illustration of the ordering code.

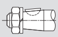
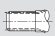
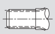
Special design *)

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

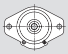
Rear cover
B = Standard
D = PRV residual flow internal
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
K = NBR, SSR in FKM

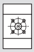
Drive shafts

			Suitable front cover
C	Tapered key shaft 1 : 5		**B**
N	Dihedral claw		**M**
D	Splined shaft SAE J 744 22-4 13T		**C**
P	Splined shaft SAE J 744 19-4 11T		**C**

Front cover

B	Square flange Centering Ø 100 mm	
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm	
M	2-bolt mounting Centering Ø 52 mm with seal ring	

Line ports

07	Square flange SAE Thread, metric	
20	Rectangular flange	

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units, multiple pumps, standard

AZ	P	NNFF	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0... 7.1 cm³/rev
S = 4.0...28.0 cm³/rev
F = 4.0...28.0 cm³/rev
N = 20.0...36.0 cm³/rev
G = 22.5...56.0 cm³/rev

Series,
relates to pump section 1
1 = Case width 92 mm
2 = Case width 110 mm

Version,
relates to pump section 1
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = Clockwise
L = Counterclockwise

Rear cover
relates to last pump section
B = Standard

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts – relates to pump part 1

Series	Code	Drive shaft	Suitable front cover
Series B:	**H**	Tapered key shaft 1 : 8	**O**
Series F, S:	**C**	Tapered key shaft 1 : 5	**B**
	H	Tapered key shaft 1 : 8	**O**
	R	Splined shaft SAE J 744 16-4 9T	**R**
Series N, T:	**C**	Tapered key shaft 1 : 5	**B**
	D	Splined shaft SAE J 744 22-4 13T	**C**
	N	Dihedral claw	**M**
Series G, U:	**C**	Tapered key shaft 1 : 5	**B**
	D	Splined shaft SAE J 744 22-4 13T	**C**
	H	Tapered key shaft 1 : 8	**O**

Front cover – relates to pump part 1

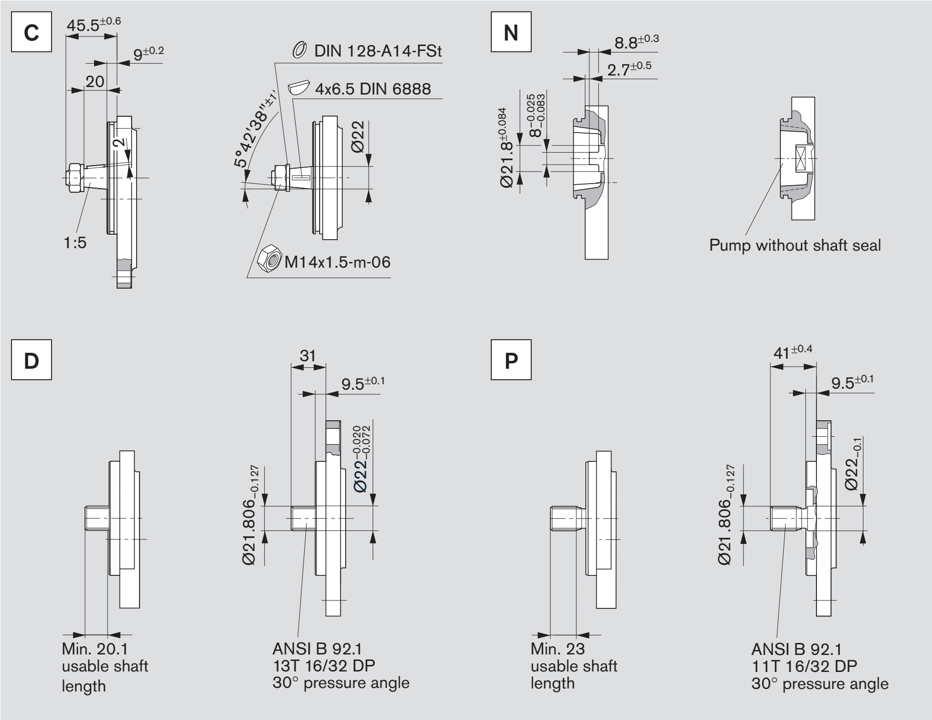
		Front cover
Series B	**O**	Square flange Centering Ø 25.38 mm
Series F, S	**B**	Square flange Centering Ø 80 mm
	O	Square flange Centering Ø 36.47 mm
	R	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting
Series N, T	**B**	Square flange Centering Ø 100 mm
	C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting
	M	Centering Ø 52 mm with seal ring
Series G, U	**B**	Square flange Centering Ø 105 mm
	C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting
	O	Square flange Centering Ø 50.78 mm

Line ports – every pump parts

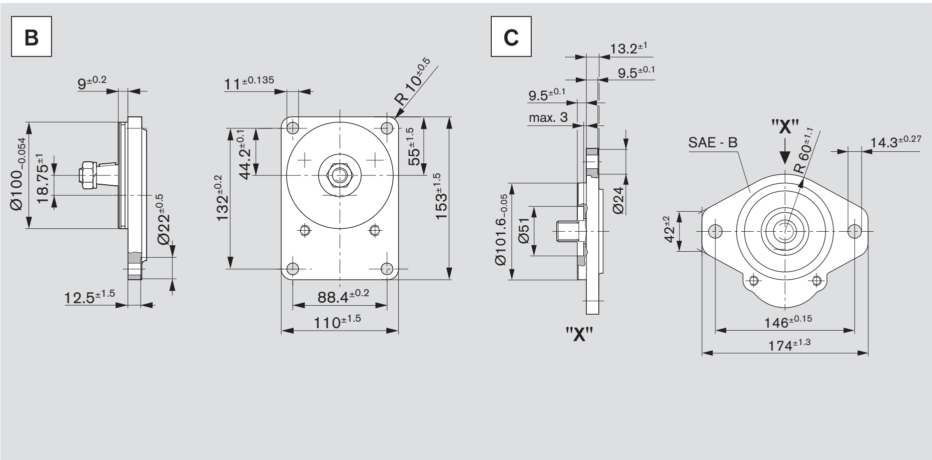
		Line ports
Series B	**02**	Thread, metric DIN 3852 T1
Series F, S	**20**	Rectangular flange
Series N, T	**07**	Square flange SAE Thread, metric
	20	Rectangular flange
Series G, U	**07**	Square flange SAE Thread, metric
	20	Rectangular flange

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

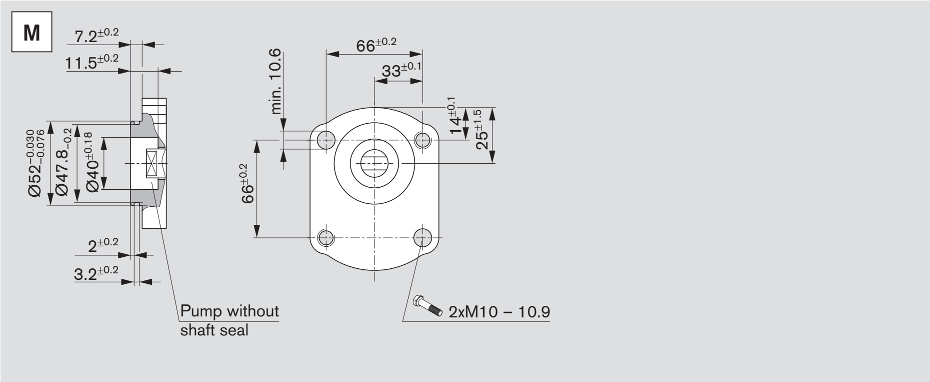
Drive shafts



Front cover



Front cover (continued)



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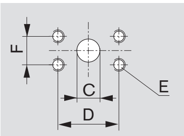
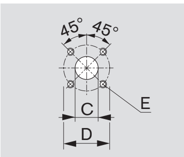
Line ports



07 **Square flange SAE, thread, metric**

Ordering code	Size	Pressure side C	D	E	F	Suction side C	D	E	F
07	20 cm^3	18	47.6	M10 depth 14	22.2	18	47.6	M10 depth 14	22.2
	22.5...36 cm^3				26.2	26	52.4		26.2

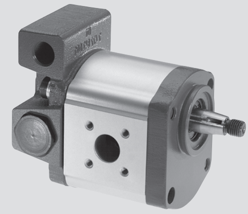


20 **Rectangular flange**

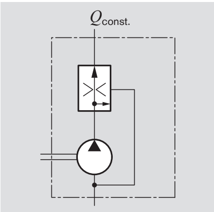
Ordering code	Size	Pressure side C	D	E	Suction side C	D	E
20	20...36 cm^3	18	55	M8 depth 13	26	55	M8 depth 13

Gear pumps with integral valves

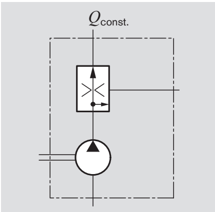
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



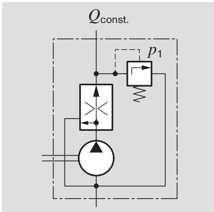
upon request



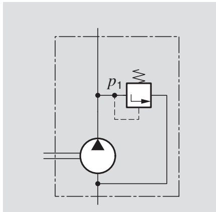
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.} = 2...30$ l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min
$p_1 = 100...180$ bar



Pressure-relief valve.
Discharge returned to suction line
$p_1 = 5...250$ bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

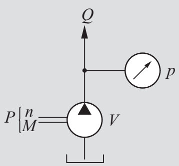
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

n —— $\eta_v \longrightarrow Q$
M —— $\eta_{hm} \longrightarrow p$
P —— $\eta_t \longrightarrow p \cdot Q$

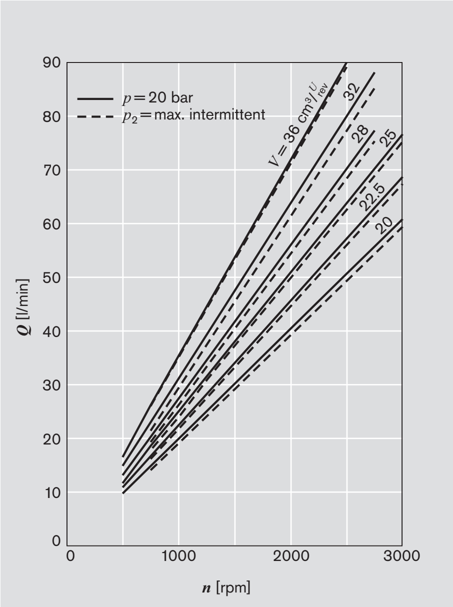
V [cm³/rev] Q [l/min] p [bar]

n [rev/min] P [kW] M [Nm]

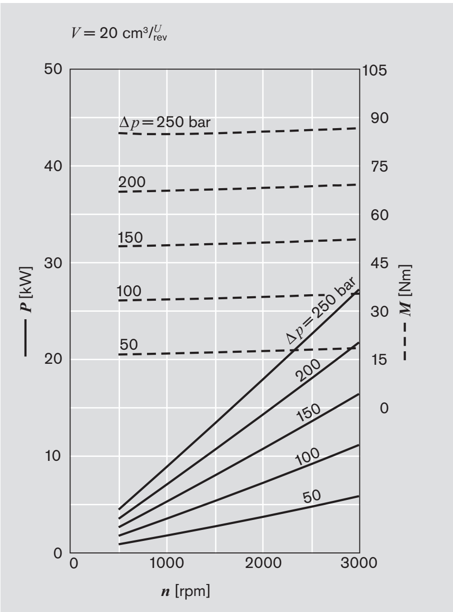
Caution: η [%] e.g. 95 [%]

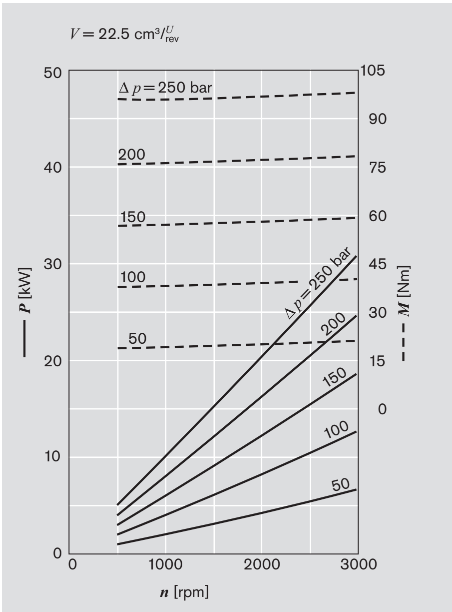
Performance charts

$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$



$Q = f\ (n, V)$ incl. η_v
$P = f\ (n, p)$ ——— incl. η_t
$M = f\ (n, p)$ – – – incl. η_{hm}





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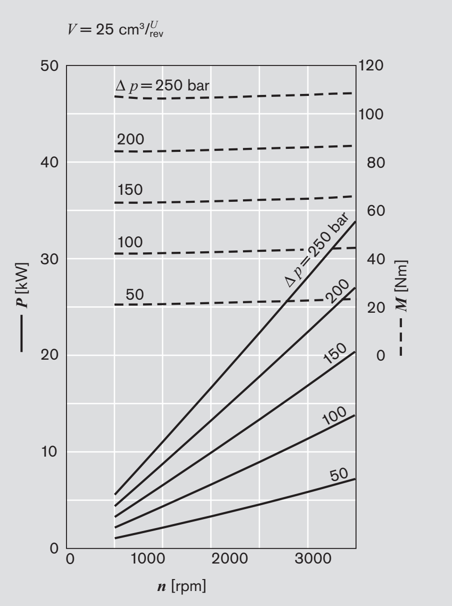
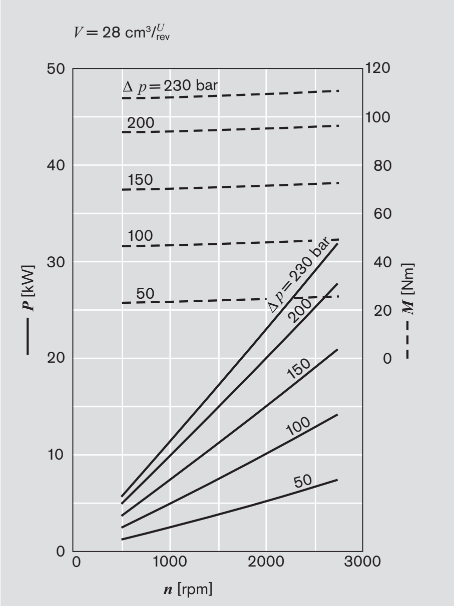
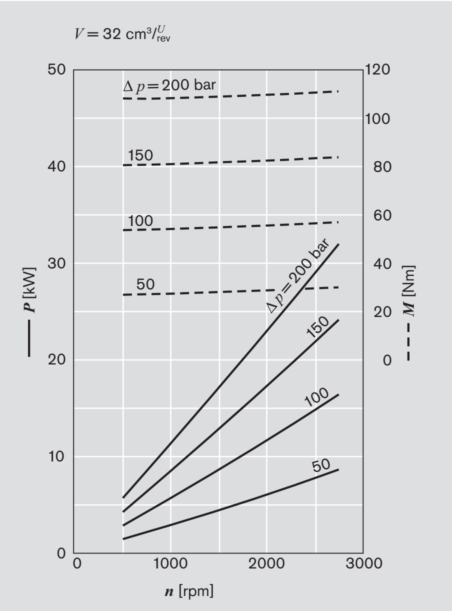
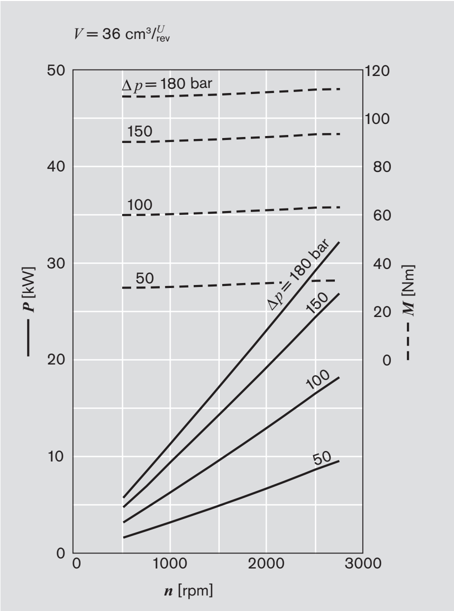
Performance charts (continued)





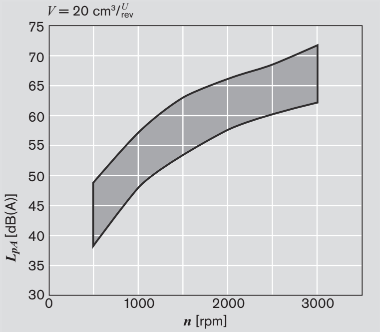


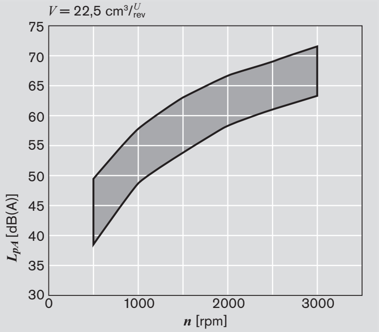


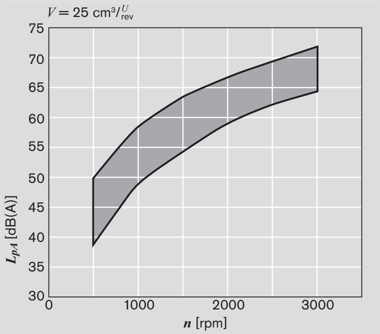
Noise charts

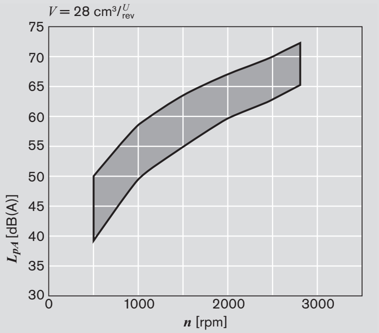
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 12/13 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

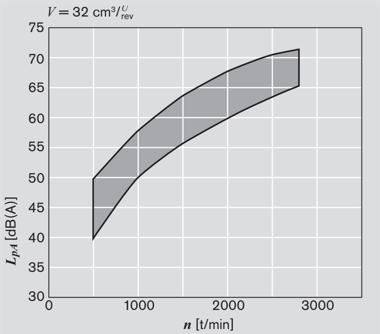
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

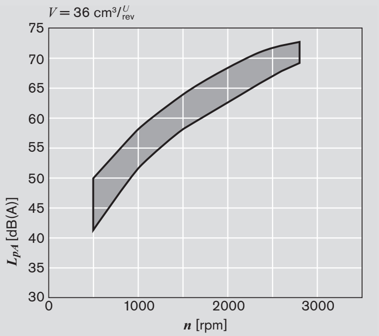












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Specifications

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange
Direction of rotation (looking on shaft)	Clockwise or counterclockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C or max. 110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals *) max. +110 °C with FKM seals **)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) During the application of hydraulic systems or devices with critical counter-reaction, such as steering and counterbalance valves, the type of filtration selected must be adapted to the sensitivity of these devices.

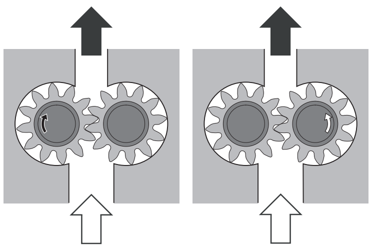
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

Definition of direction of rotation

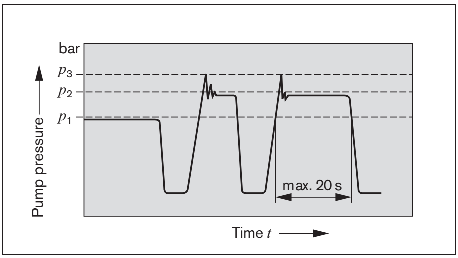
Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps. On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Clockwise rotation Counter-clockwise rotation

Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPN-1x

Displacement	V	cm³/rev	20	22.5	25	28	32	36
Suction pressure	p_e	0.7...3 (absolute), with tandem pumps p_e (p_2) = max. 0.5 p_e (p_1)						
Max. continuous pressure	p_1	bar	230	230	230	210	180	160
Max. intermittent pressure	p_2		250	250	250	230	200	180
Max. peak pressure	p_3		270	270	270	250	220	200
Min. rotational speed	< 100	rpm	500	500	500	500	500	500
at bar 12 mm²/s	100...180		600	600	600	600	600	600
	180... p_2		800	800	800	800	800	800
25 mm²/s	p_2		500	500	500	400	400	400
Max. rotational speed at	p_2		3000	3000	3000	2800	2800	2800

AZPN-2x (only upon request)

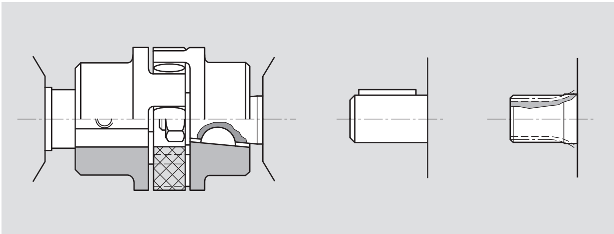
Displacement	V	cm^3/rev	20	22.5	25	28	32	36
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps p_e (p_2) = max. 0.5 p_e (p_1)					
Max. continuous pressure	p_1	bar	250	250	250	230	210	180
Max. intermittent pressure	p_2	bar	280	280	280	260	240	210
Max. peak pressure	p_3	bar	300	300	300	280	260	230
Min. rotational speed at bar	< 100	rpm	500	500	500	500	500	500
12 mm^2/s	100...180	rpm	600	600	600	600	600	600
	180... p_2	rpm	800	800	800	800	800	800
25 mm^2/s	p_2	rpm	500	500	500	500	500	500
Max. rotational speed at	p_2	rpm	3000	3000	3000	2800	2800	2800

Drive arrangements

1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



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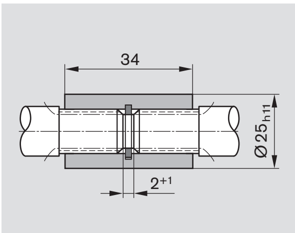
2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



Splined shaft profile	Ordering code	M_{max} [Nm]
SAE-B 13 teeth	D	300
SAE-C 11 teeth	P	n. n.

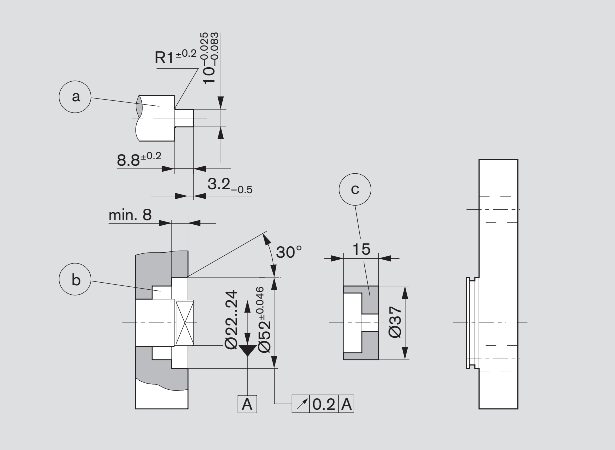
3. Drive shaft with tang

For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ⓒ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

ⓐ Drive shaft
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm2}$
Surface for sealing ring
ground without rifling $R_t \leq 4\mu m$

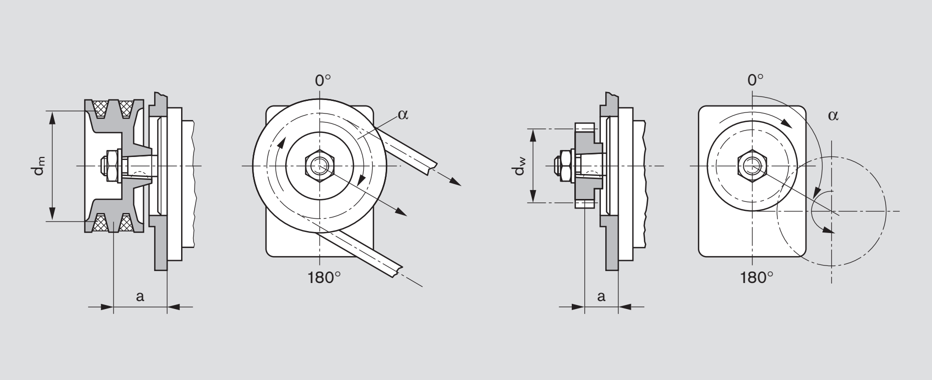
ⓑ Radial shaft seal ring
Rubber-covered seal (see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
95	20	270
	22.5	240
	25	220
	28	190
	32	170
	36	150

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.



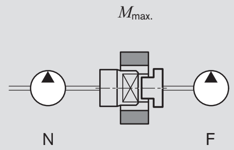
Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series N, the driver for the second pumping stage can carry a load of up to $M_{max.}$ = 95 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		Max. transferrable drive torque * [Nm]
C	1:5	200
N	Claw	95
D	SAE 13t	320
P	SAE 11t	180

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.



Combinations

Series pump 1	$M_{max.}$ [Nm]	Series pump 2
N	95	N
N	65	F

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

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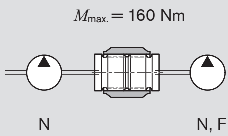
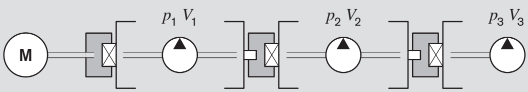
If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.



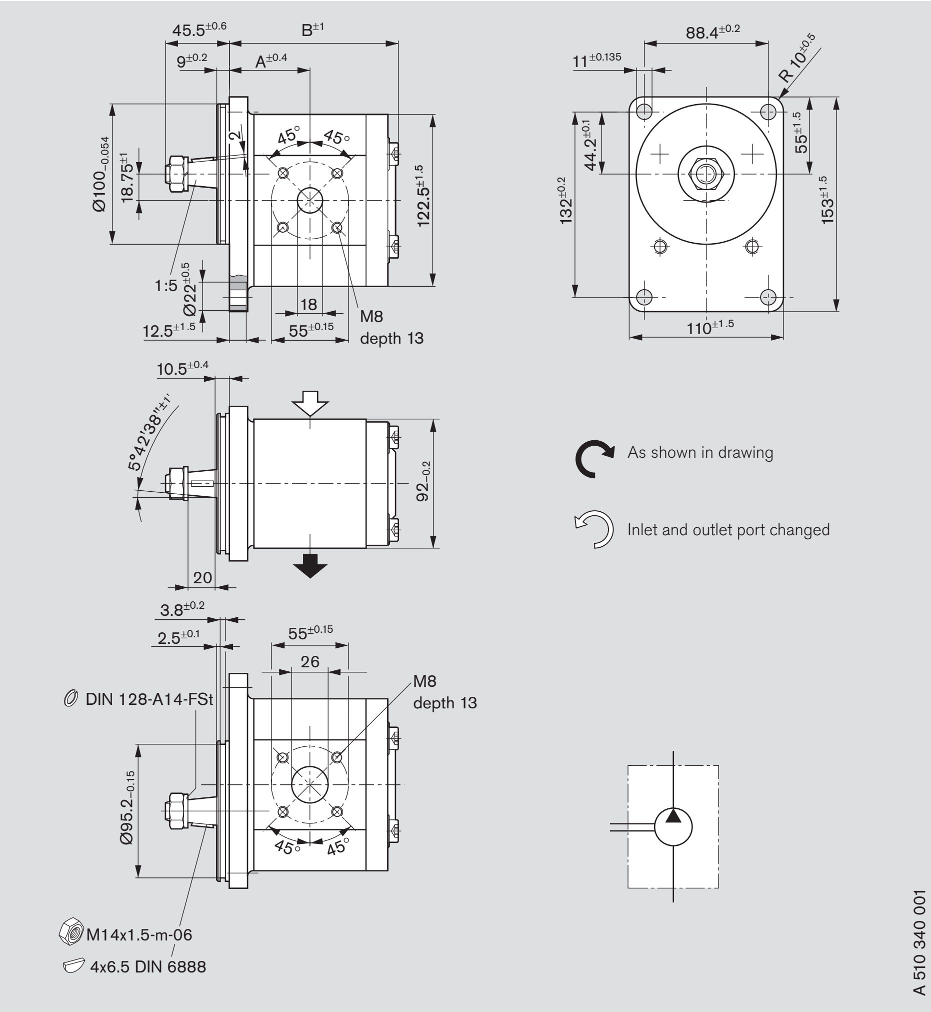


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm^3/rev]

Dimensions

Standard range

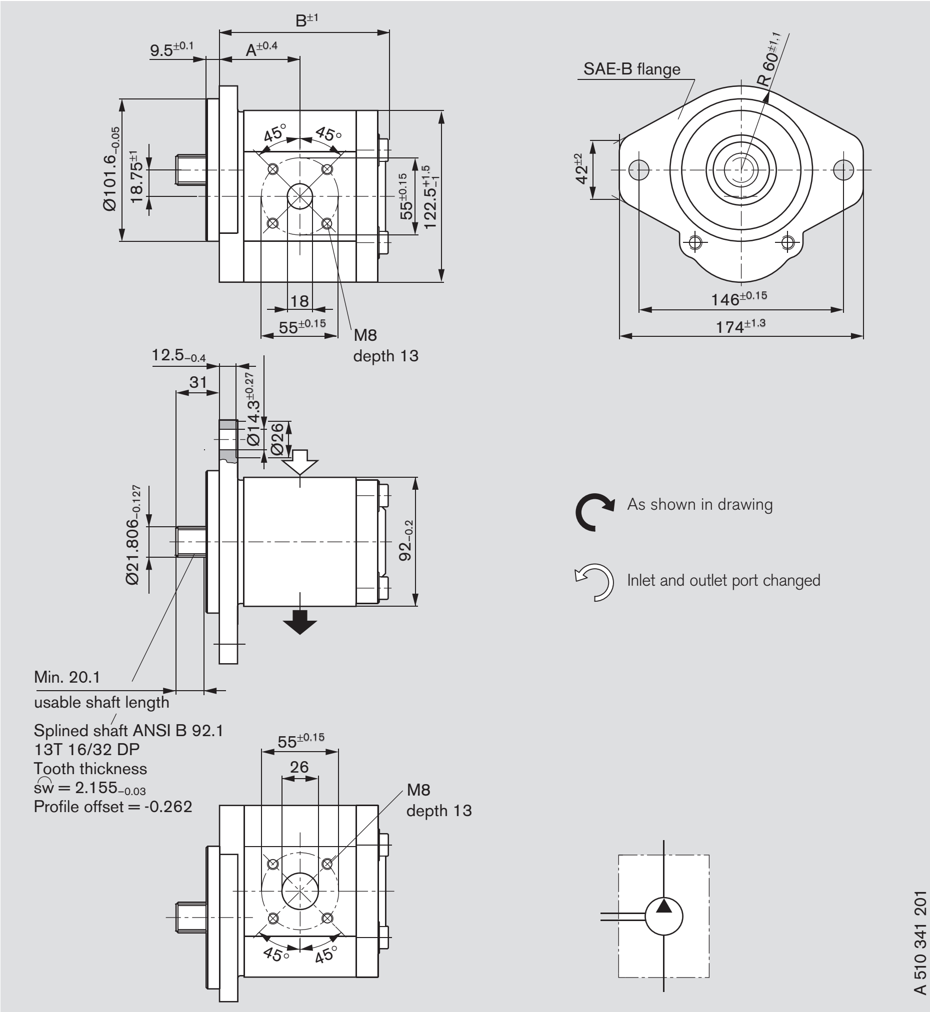


Ordering code:
AZPN – 11 – ☐☐☐ ☐C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
20	**0 510 625 335**	**0 510 625 035**	250	3000	5.4	52	109.8
22.5			250	3000		53.5	112.8
25	**0 510 725 352**	**0 510 725 047**	250	3000	5.6	55	115.8
28	**0 510 725 364**	**0 510 725 055**	230	2800	5.7	56.5	118.8
32	**0 510 725 353**	**0 510 725 048**	200	2800	5.9	59	123.3

Dimensions

Standard range



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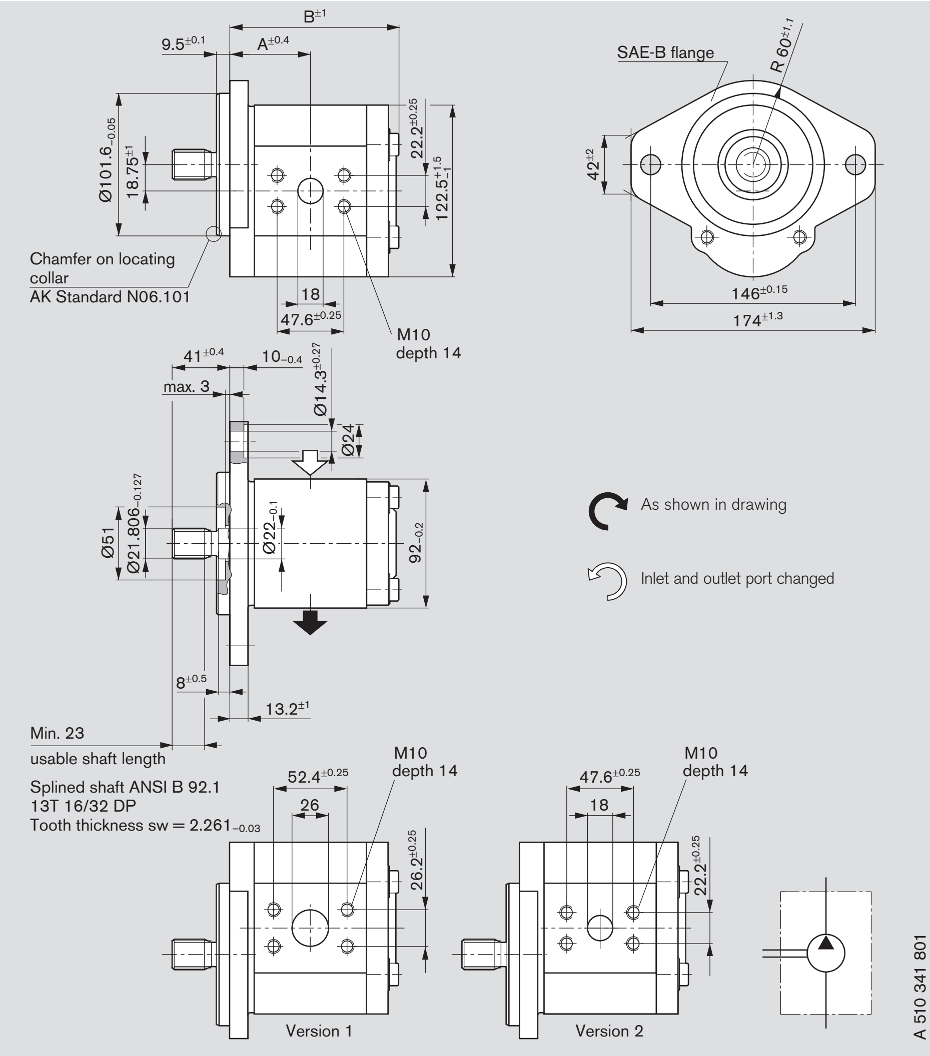
Ordering code:
AZPN – 1X – □□□ □ D C 20 M B
AZPN – 1X – □□□ □ D C 20 K B*

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
20			3000	250		52	110.1
22.5			3000	250		53.5	112.6
25	**0 510 725 377**	**0 510 725 057**	3000	250	5.5	55	115.3
25		**0 510 725 094***	3000	250	5.5	55	115.3
28	**0 510 725 431**	**0 510 725 058***	2800	230	5.7	56.5	118.3
36	**0 510 725 363**	**0 510 725 155**	2600	180	6.0	61	127.3

Dimensions

Standard range

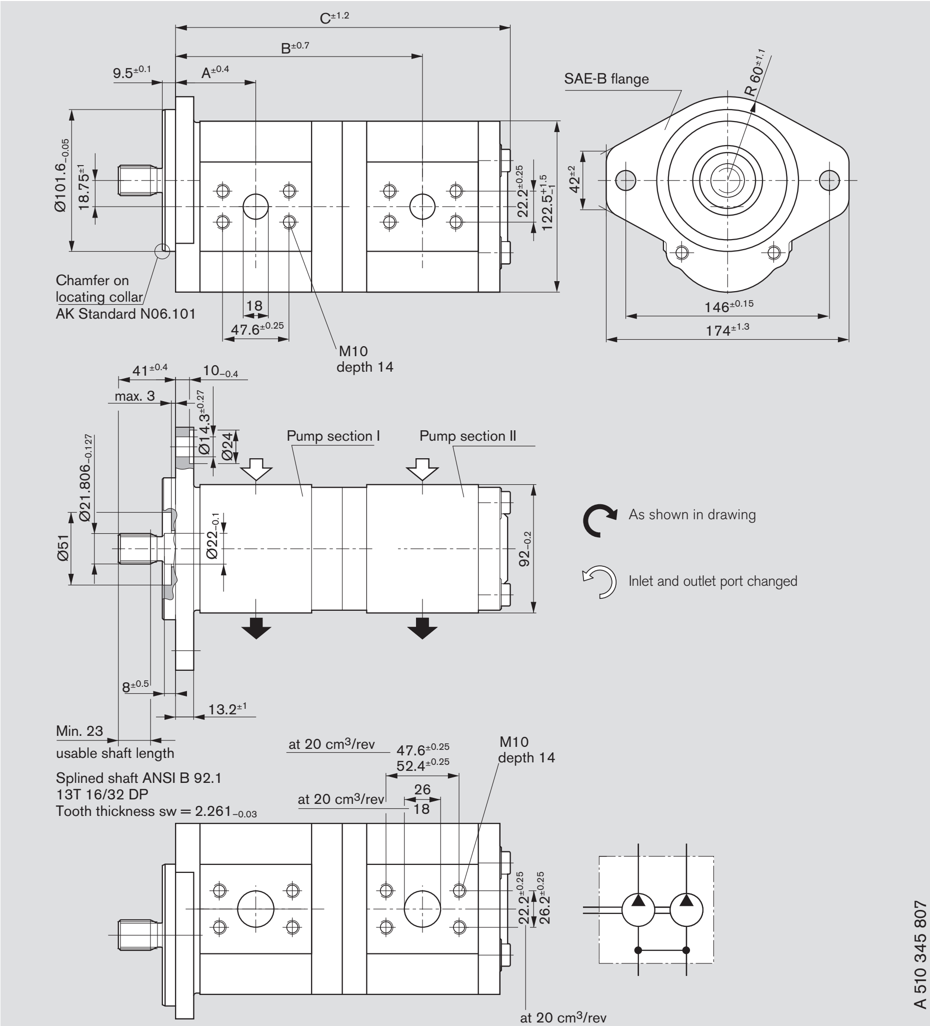


Ordering code:
AZPN – 11 – ☐ ☐ ☐ ☐ D C 07 K B S0023

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B	Version
20	**0 510 625 380**	**0 510 625 073**	250	3000	5.3	52	109.8	2
22.5	**0 510 725 404**	**0 510 725 103**	250	3000	5.4	52	112.8	1
25	**0 510 725 405**	**0 510 725 104**	250	3000	5.5	55	115.8	1
28	**0 510 725 406**	**0 510 725 105**	230	2800	5.7	56.5	118.8	1
32	**0 510 725 407**	**0 510 725 106**	200	2800	5.8	59	123.3	1
36			180	2600		61	127.8	1

Dimensions

Standard range

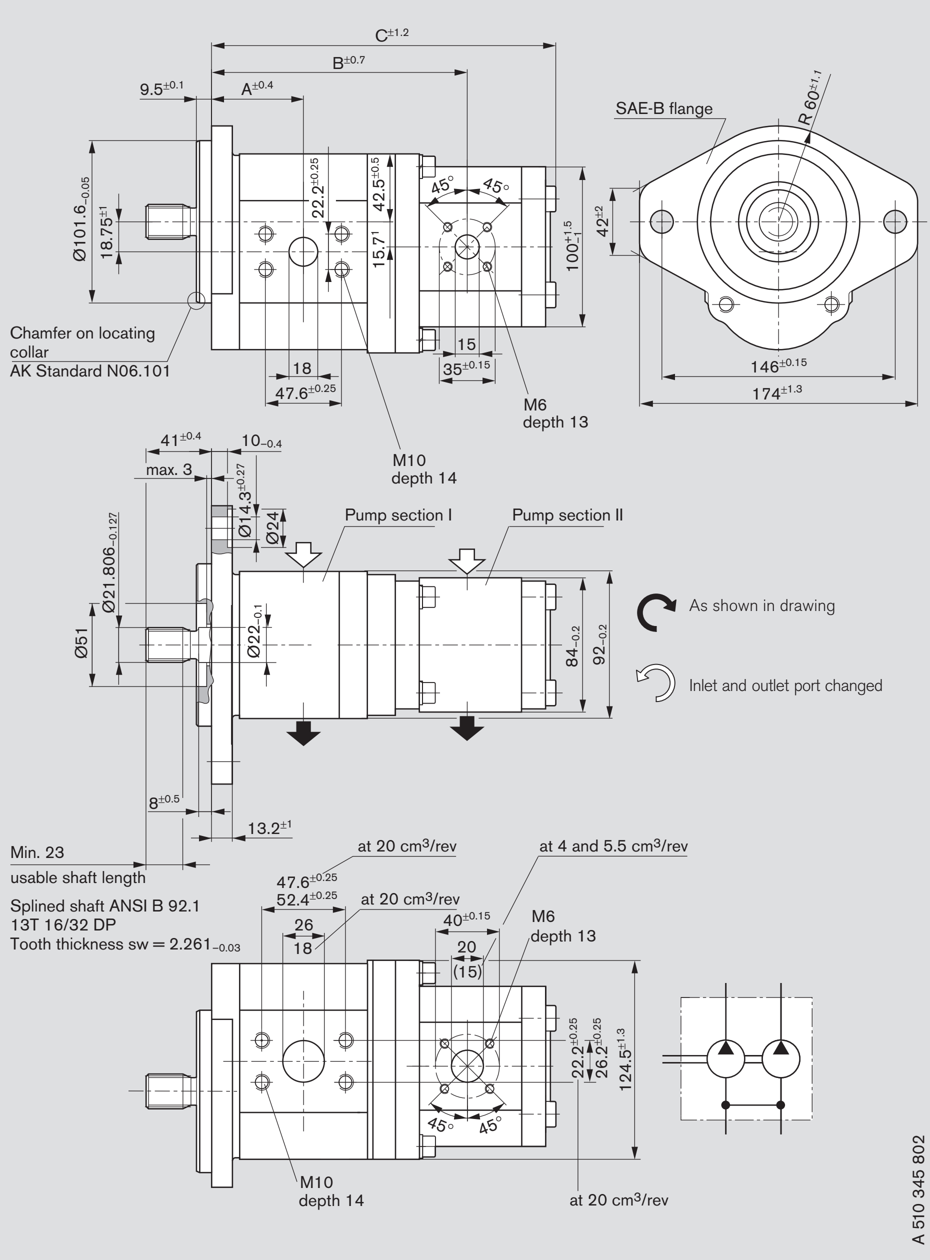


Ordering code:
AZPNN – 11 – ☐☐☐ ☐ D C 07 07 K B S0023

Displacement [cm³/rev] P I	Displacement [cm³/rev] P II	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar] P I	Max. operating pressure [bar] P II	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C
20	20	**0 510 665 461**	**0 510 665 149**	250	250	2000	9.9	52.0	160.7	217.9
22.5	20	**0 510 765 369**		250	250	2000	10.0	53.5	163.6	222.7
22.5	22.5	**0 510 765 380**	**0 510 765 086**	250	230	3000	10.1	53.5	165.2	225.7
25	20		**0 510 765 067**	250	250	2000	10.1	55.0	166.6	225.7
25	22.5		**0 510 765 068**	250	230	3000	10.2	55.0	168.2	228.7
25	25	**0 510 766 315**	**0 510 765 069**	250	200	3000	10.3	55.0	169.7	229.9
32	32	**0 510 765 370**	**0 510 768 034**	200	160	2500	10.9	29.0	181.2	244.9

Dimensions

Standard range



Ordering code:
AZPNF – 1X – ☐☐☐ ☐ D C 07 20 K B S0023
AZPNF – 1X – ☐☐☐ ☐ D C 07 20 K B S0081*
AZPNF – 1X – ☐☐☐ ☐ D C 07 20 M B S0081**

Displacement [cm³/rev] P I	Displacement [cm³/rev] P II	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar] P I	Max. operating pressure [bar] P II	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C
20	4		**0 510 665 181**	250	280	3000	–	52.0	141.5	184.2
22.5	8	**0 510 765 387***	**0 510 765 078**	250	280	3000	8.4	53.5	147.9	193.8
22.5	11	**0 510 765 381**	**0 510 765 062**	250	280	3000	8.5	53.5	151.7	200.6
25	4	**0 510 766 316**		250	280	3000	–	55.0	147.6	190.2
25	11	**0 510 765 377**	**0 510 765 079**	250	280	3000	8.6	55.0	154.7	203.6
25	14		**0 510 766 014****	250	250	3000	8.7	55.0	155.2	206.8
25	16		**0 510 765 080**	250	230	3000	8.8	55.0	155.2	210.2
28	11		**0 510 765 092**	230	280	2800	8.7	56.5	157.7	206.6
28	16	**0 510 765 384**	**0 510 765 063**	230	230	2800	8.9	56.5	158.2	213.2
28	19	**0 510 766 314**	**0 510 767 058**	200	200	2800	9.0	56.5	158.2	219.8
28	22.5		**0 510 767 045**	230	200	2100	9.2	56.5	165.8	223.6
28	22.5	**0 510 767 322***		230	150	2100	9.3	56.5	165.8	223.6
32	8		**0 510 765 064**	200	280	2500	8.8	59.0	158.4	204.3
32	11	**0 510 768 320**	**0 510 765 065**	200	280	2500	8.9	59.0	162.2	211.1
32	14	**0 510 765 378**		200	250	2500	9.0	59.0	162.7	216.1
32	16		**0 510 765 066**	200	230	2500	9.1	59.0	162.7	217.7
32	22.5	**0 510 768 318***		200	150	2100	–	59.0	170.3	229.9

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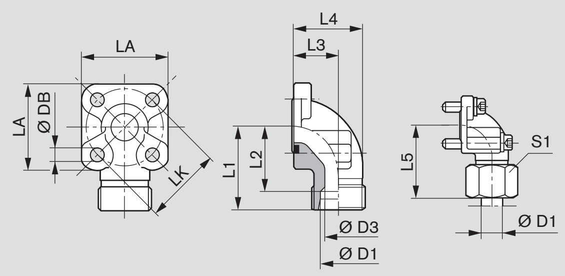
Fittings

Fittings can be used for rectangular flange 20 **see page 7**

Gear pump flange, 90° angle

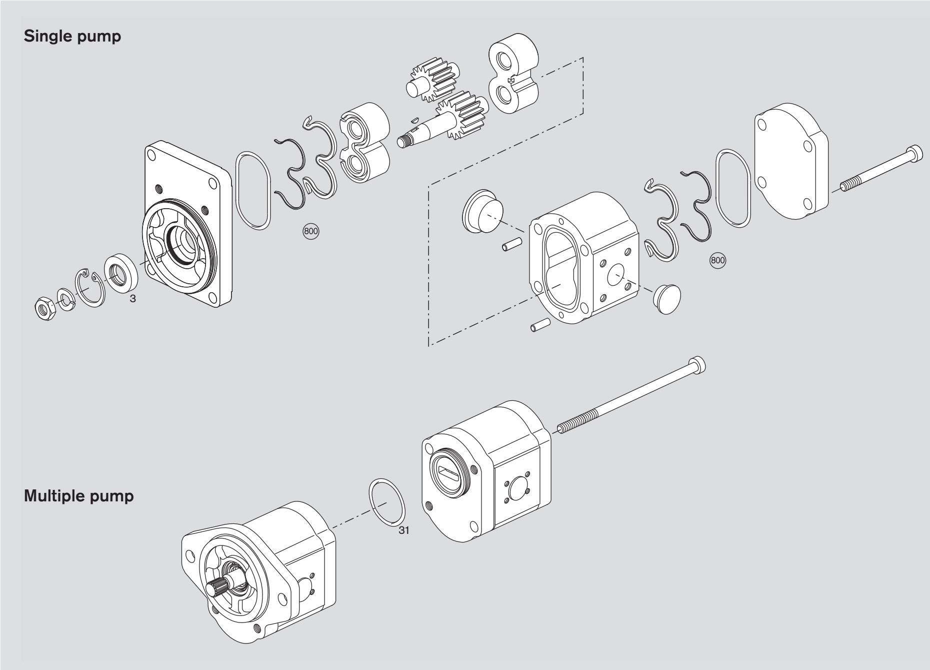


LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	Screws 2x	Seal ring	Mass kg	Part number	p (bar)
55	20S	17	45	34.5	24.0	40.0	56.0	58	36	8.4	M8x25	M8x50	33x2.5	0.44	**1 515 702 004**	250
55	30S	26	49	35.5	32.0	50.0	62.0	58	50	8.4	M8x25	M8x50	33x2.5	0.50	**1 515 702 006**	250
55	35L	31	49	38.5	32.0	51.5	62.0	58	50	8.4	M8x25	M8x60	32x2.5	0.47	**1 515 702 005**	100
55	42 L	38	49	38.0	40.0	64.5	61.0	58	60	8.4	M8x25	M8x70	32x2.5	0.60	**1 515 702 019**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Note
You can find the permissible tightening torques in our publication:
"General Operating Instructions for External Gear Units"
RE 07 012-B1.

Service parts



Page	Ordering code	Seal kit “N” Pos. 800 NBR	Seal kit “F” Pos. 800 NBR	Shaft seal ring Pos. 3	Dimen-sion	Seal ring Pos. 3.1	Material	Dimension
16	AZPN – 1X – □□□ □ C B 20 M B	1517010226		1510283023	40x22x7		NBR	
17	AZPN – 1X – □□□ □ D C 20 M B	1517010226		1510283023	40x22x7		NBR	
17	AZPN – 1X – □□□ □ D C 20 K B	1517010226		1510283028	40x22x7		FKM (SSR)	
18	AZPN – 1X – □□□ □ D C 07 K B S0023	1517010226		1510283028	40x22x7		FKM (SSR)	
19	AZPNF – 1X – □□□ □ D C 07 07 K B S0023	1517010226	1517010208	1510283028	40x22x7	1510210043	FKM (SSR)	60x2.5 FPM
20	AZPNF – 1X – □□□ □ D C 07 20 K B S0081	1517010226	1517010208	1510283028	40x22x7	1510210043	FKM (SSR)	60x2.5 FPM
20	AZPNF – 1X – □□□ □ D C 07 20 M B S0081	1517010226	1517010208	1510283028	40x22x7	1510210043	FKM (SSR)	60x2.5 FPM
20	AZPNN – 1X – □□□ □ D C 07 20 K B S0023	1517010226	1517010226	1510283028	40x22x7	1900210145	FKM (SSR)	45x2.5 NBR

NBR = Perbunan® FKM = Viton®

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
– The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
– Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 16 – 20, are contained in delivery.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

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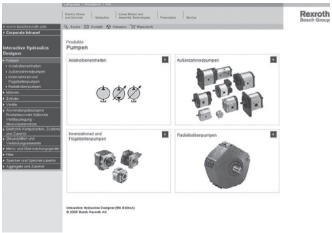
Ordering-No.

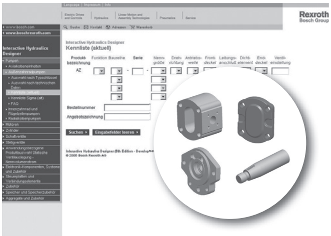
Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page
0 510 625 035	16	0 510 725 105	18	0 510 765 064	21	0 510 765 380	19
0 510 625 073	18	0 510 725 106	18	0 510 765 065	21	0 510 765 381	21
0 510 625 335	16	0 510 725 155	17	0 510 765 066	21	0 510 765 384	21
0 510 625 380	18	0 510 725 352	16	0 510 765 067	19	0 510 765 387	21
0 510 665 149	19	0 510 725 353	16	0 510 765 068	19	0 510 766 014	21
0 510 665 181	21	0 510 725 363	17	0 510 765 069	19	0 510 766 314	21
0 510 665 461	19	0 510 725 364	16	0 510 765 078	21	0 510 766 315	19
0 510 725 047	16	0 510 725 377	17	0 510 765 079	21	0 510 766 316	21
0 510 725 048	16	0 510 725 404	18	0 510 765 080	21	0 510 767 045	21
0 510 725 055	16	0 510 725 405	18	0 510 765 086	19	0 510 767 058	21
0 510 725 057	17	0 510 725 406	18	0 510 765 092	21	0 510 767 322	21
0 510 725 058	17	0 510 725 407	18	0 510 765 369	19	0 510 768 034	19
0 510 725 094	17	0 510 725 431	17	0 510 765 370	19	0 510 768 318	21
0 510 725 103	18	0 510 765 062	21	0 510 765 377	21	0 510 768 320	21
0 510 725 104	18	0 510 765 063	21	0 510 765 378	21		

The AZ configurator at www.boschrexroth.com/azconfigurator

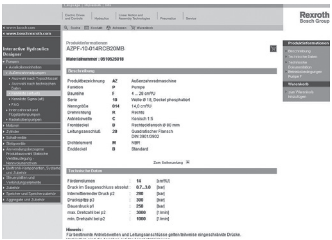
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Bosch Rexroth AG
External Gear Units
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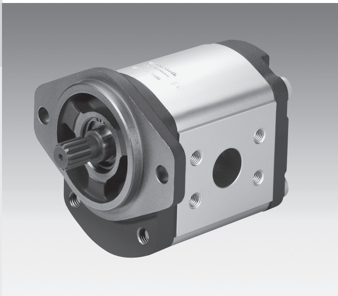
brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Rexroth
Bosch Group

External gear pump
Series G

RE 10 093/05.12
Replace
RE 10 093/08.07

AZPG-22



Fixed pumps
$V = 22.5...100\ cm^3/\ rev$

Overview of contents

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Features

– Nominal pressure 280 bar
– Slide bearings for heavy duty applications
– Drive shafts to ISO or SAE
– Combination of several pumps possible
– Line ports: connection flanges
– Consistent high quality thru mass production
– Numerous configuration variants available
– Cast case available on request

General

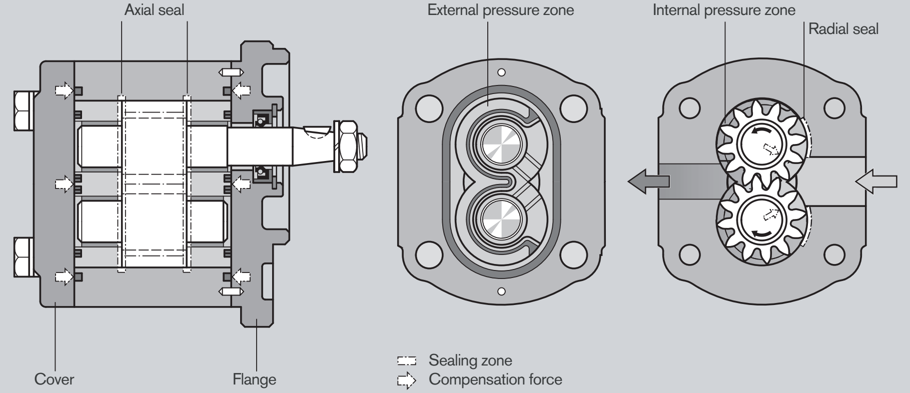
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G, as SILENCE gear pumps in the S, T and U series, and as the SILENCE PLUS version in the J series in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

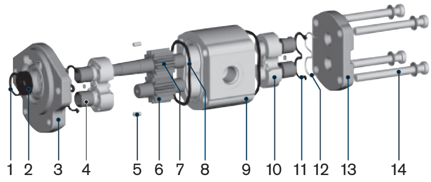
Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings or bearing, dependent on the series, and the case with a front and rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special slide bearings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. This ensures optimum efficiency. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

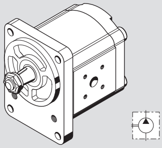
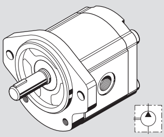
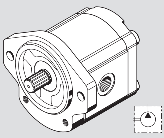
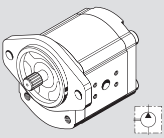
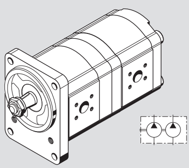
Axial and radial compensation for gear pump





1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

Overview of “Series G” standard program

Version	Page
	18
	23 24 25
	32 33 34
	40 41 42 43 44 45
	54

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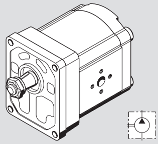
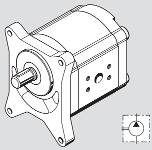
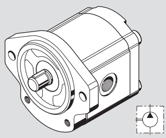
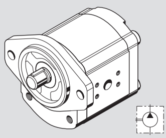
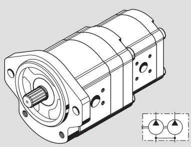
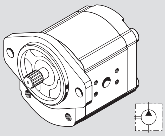
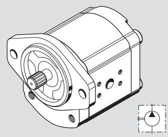
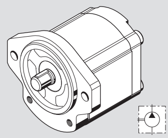
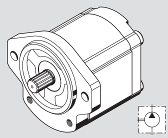
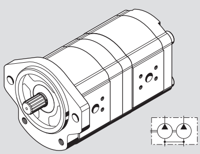
	19
	26 27 28
	35 36 37
	46 47 48 49 50 51
	55 57

Version	Page
	20 21 22
	29 30 31
	38 39
	52 53
	56

Ordering code

External gear units Single pumps Standard

AZ	P	G	–	2	2	–	063	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
1 = Reinforced baring
2 = Standard bearing
3 = in GJS-400 execution

Version
2 = corrosion-resistant, pinned

Size G
022 = 22.5 cm³/rev
025 = 25.0 cm³/rev
028 = 28.0 cm³/rev
032 = 32.0 cm³/rev
036 = 36.0 cm³/rev
040 = 40.0 cm³/rev
045 = 45.0 cm³/rev
050 = 50.0 cm³/rev
056 = 56.0 cm³/rev
063 = 63.0 cm³/rev
070 = 70.0 cm³/rev
080 = 80.0 cm³/rev
100 = 100.0 cm³/rev

Direction of rotation
R = Clockwise
L = Counterclockwise

*) Some of the special designs shown on pages 18–57 are not covered in the illustration of the ordering code.

Special design *)

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

Rear cover
A = with inlet and outlet port
B = Standard
D = PRV residual flow internal
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM

Drive shafts

Code	Drive shaft	Suitable front cover
C	Tapered key shaft 1 : 5	B
H	Tapered key shaft 1 : 8	O
D	Splined shaft SAE J 744 22-4 13T	C
E	Splined shaft SAE J 744 15T	C
Q	Straight keyed shaft SAE J 744 22-1	C

Front cover

Code	Front cover
B	Rectangular flange Centering Ø 105 mm
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm
O	Rectangular flange Centering Ø 50.78 mm

Line ports

Code	Line ports
07	Square flange SAE thread, metric
20	Rectangular Flange
30	Rectangular Flange
40	Square flange SAE thread, UNC
12	Thread (UN-2B) SAE seal ring BOSS

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units Multiple pumps

AZ	P	GGSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series

B = 1.0...7.1 cm³/rev	*) Standard
F = 4.0...28 cm³/rev	
N = 20.0...36 cm³/rev	
G = 22.5...100 cm³/rev	
S = 4.0...28 cm³/rev	**) SILENCE
T = 20.0...36 cm³/rev	
U = 22.5...63 cm³/rev	
J = 12.0...16 cm³/rev	***) SILENCE PLUS

Series, relates to pump section 1
1x = Standard bearing
2x = Reinforced bearing

Version, relates to pump section 1
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = cw, **L** = ccw

Rear cover
relates to last pump section
B = Standard

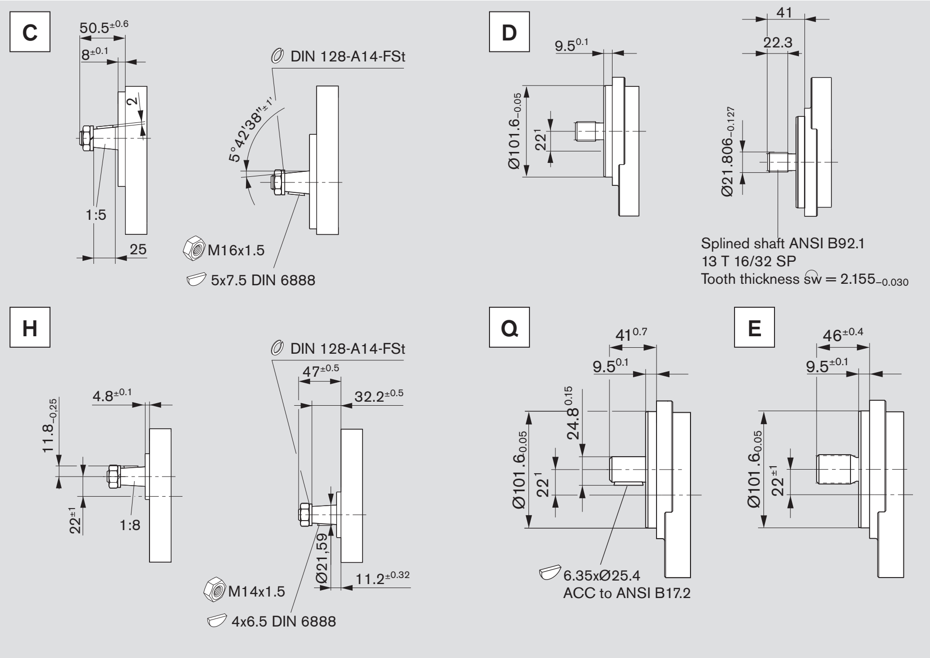
Seals
M = NBR
P = FKM
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts relates to pump part 1		Suitable front cover	Front cover relates to pump part 1		Line ports every pump parts	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**02**	Thread, metric DIN 3852 T1
Series F, S, J:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm	**30**	Rectangular flange
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
N	Dihedral claw	**M**	**M**	Centering Ø 52 mm with seal ring		
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm		

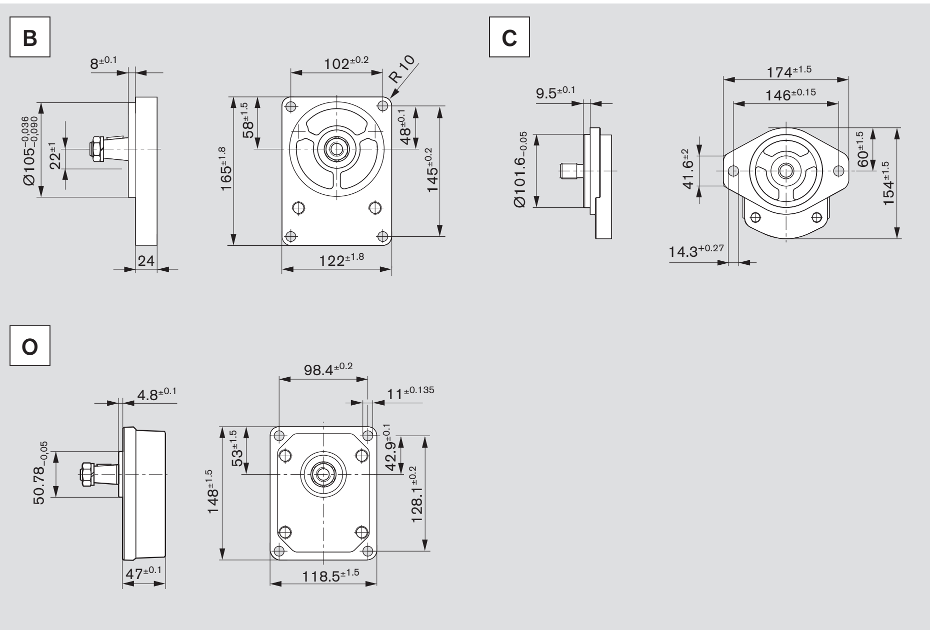
Not all variants can be selected by using ordering code! Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth! Special options are possible upon request.

3

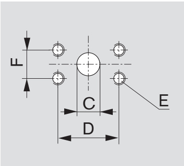
Drive shafts



Front cover

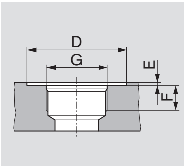


Line port



07 Square flange SAE, thread metric

Ordering code	Size	Delivery side C	D	E	F	Suction side C	D	E	F
07	22.5...28 cm^3	18	47.6	M10 depth 18	22.2	25	52.4	M10 depth 14	26.2
	32.0...50 cm^3	25	52.4		26.2	32	58.7		30.2
	56.0...63 cm^3	32	58.7		30.2	38	69.8		35.8

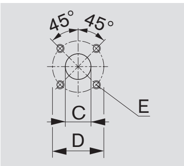


12 Thread (UN-2B, UNF-2B) SAE O Ring BOSS

At pressures $p_2 > 210$ bar limited service life

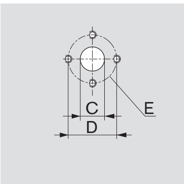
Ordering code	Size	Delivery side G	D	E	F	Suction side G	D	E	F
07	022...028	11/16"-12 UN-2B	45	0.5	19	15/16"-12 UN-2B	50	0.5	19
	032...045	15/16"-12 UN-2B	50			15/18"-12 UN-2B	58		
	050...063	15/18"-12 UN-2B	58			17/18"-12 UN-2B	68		

3



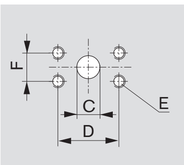
20 Rectangular flange

Ordering code	Size	Delivery side C	D	E	Suction side C	D	E
20	22.5...63 cm^3	18	55	M8 depth 13	26	55	M8 depth 13



30 Rectangular flange

Ordering code	Size	Delivery side C	D	E	Suction side C	D	E
30	22.5...56 cm^3	18	39.7	M8 depth 13	26	50.8	M10 depth 13
30	63 cm^3	26	50.8	M10 depth 13	36	62	M10 depth 13

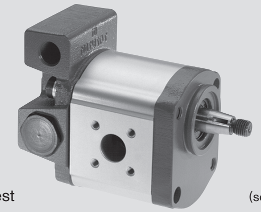


40 Rectangular flange SAE, thread UNC

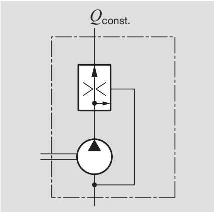
Ordering code	Size	Delivery side C	D	E	F	Suction side C	D	E	F
40	22.5...36 cm^3	19	47.6	3/8"-16 UNC-2B depth	22.2	25	52.4	3/8"-16 UNC-2B depth	26.2
	32.0...50 cm^3	25	52.4		26.2	32	58.7		30.2
	56.0...63 cm^3	32	58.7		30.2	38	69.8		35.8

Gear pumps with integral valves

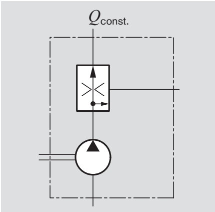
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



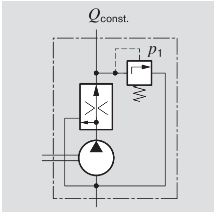
On request (schematic diagram)



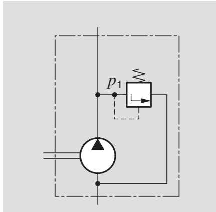
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.} = 2...30$ l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min
$p_1 = 100...180$ bar



Pressure-relief valve.
Discharge returned to suction line
$p_1 = 5...250$ bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

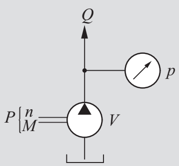
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

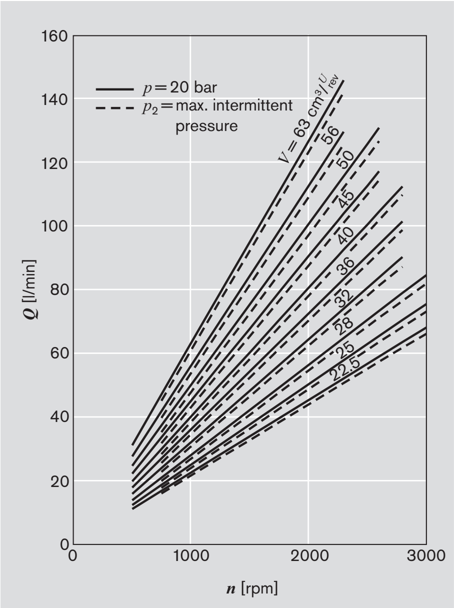
n — $\eta_v \longrightarrow Q$
M — $\eta_{hm} \longrightarrow p$
P — $\eta_t \longrightarrow p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

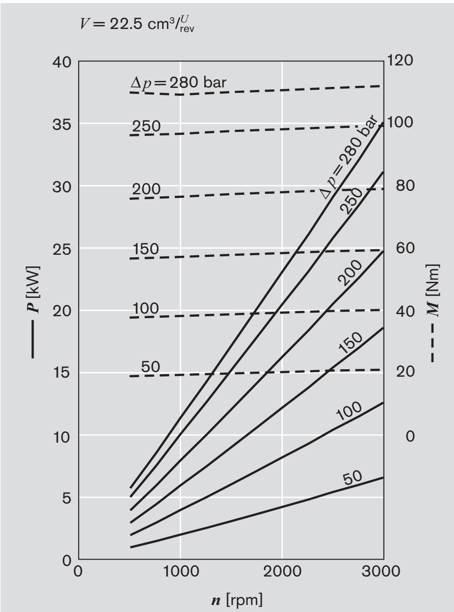
Caution: η [%] e.g. 95 [%]

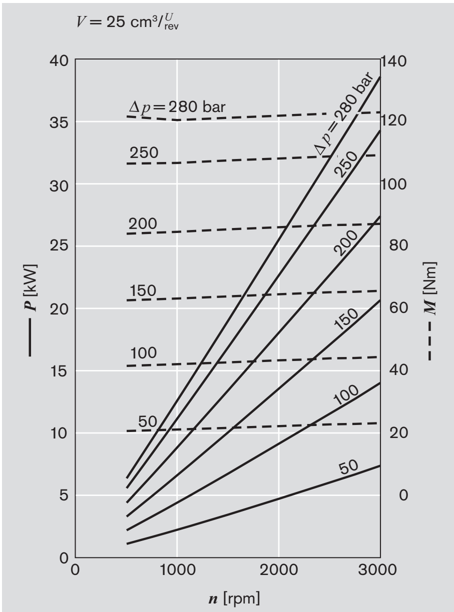
Performance charts

$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$



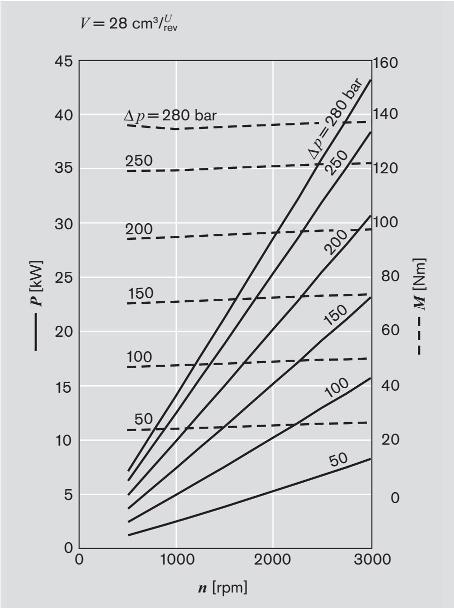
$Q = f(n, V)$ incl. η_v
$P = f(n, p)$ ——— incl. η_t
$M = f(n, p)$ – – – incl. η_{hm}

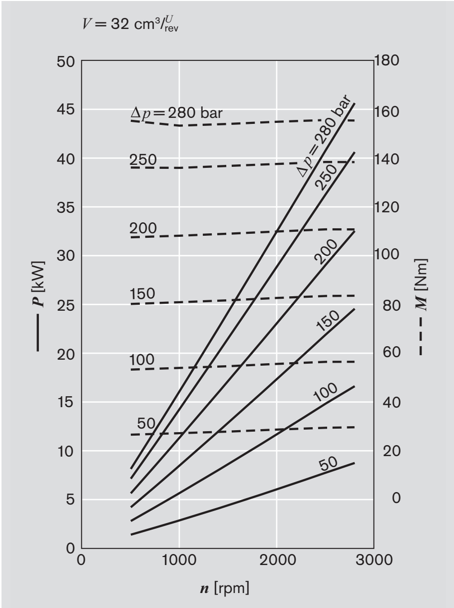


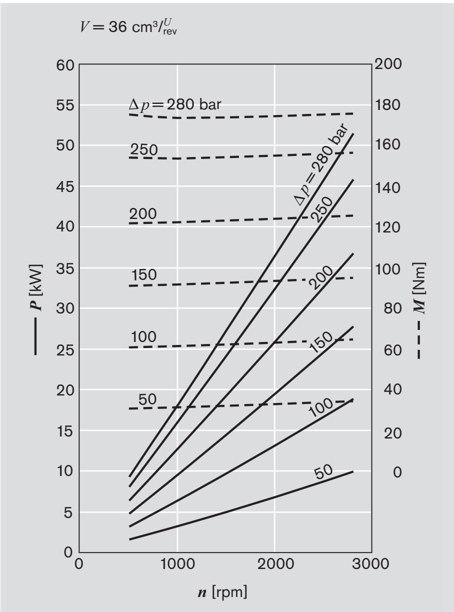


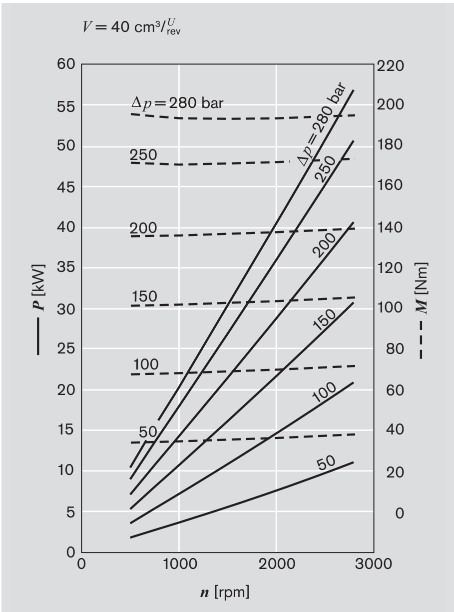
3

Performance charts (continued)

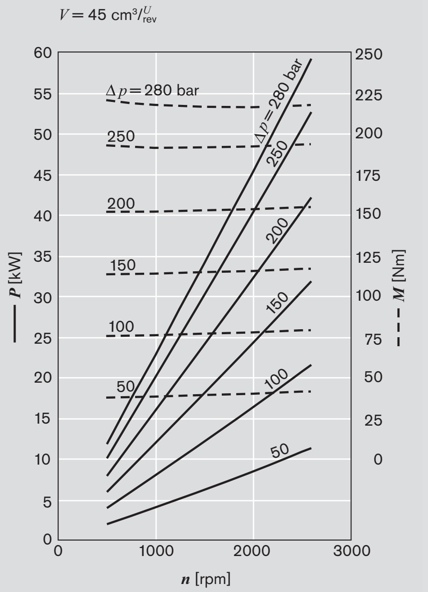


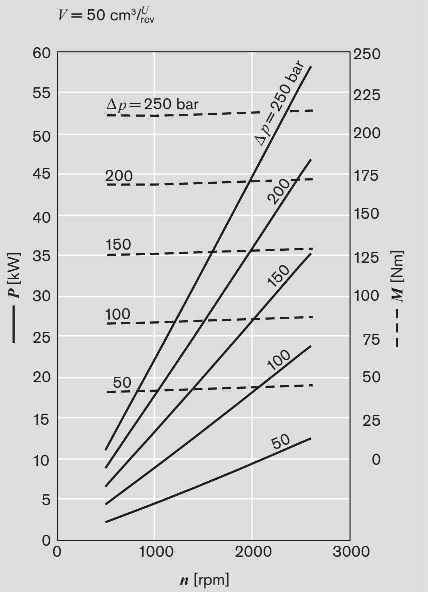


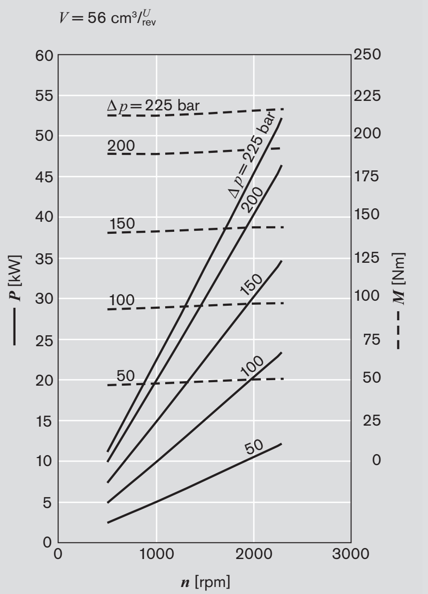


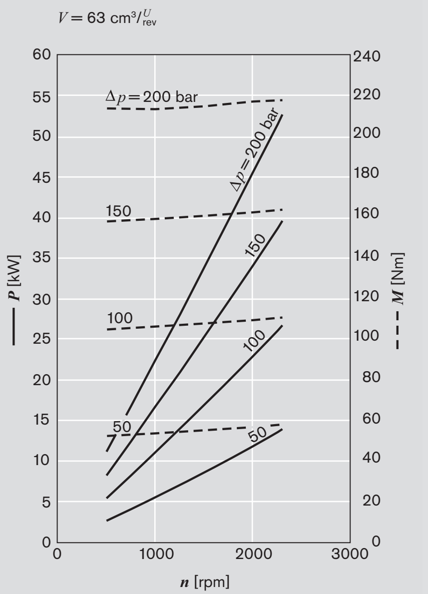


Performance charts (continued), $V = 70, 80, 100\ cm^3/_{rev}^{U}$ on request







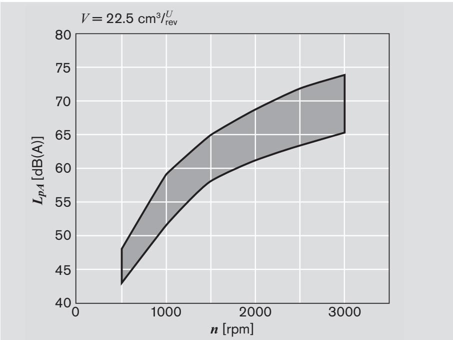


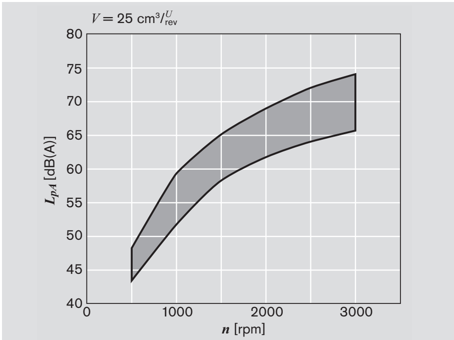
3

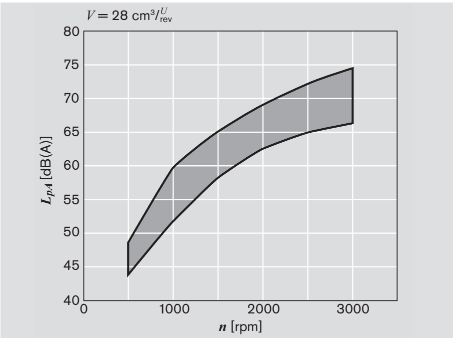
Noise charts

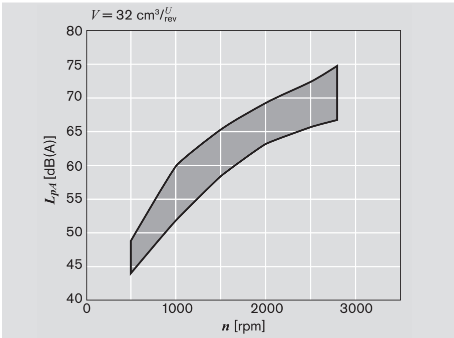
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 14 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45 635, Part 26.
Spacing between measuring sensor – pump: 1 m.

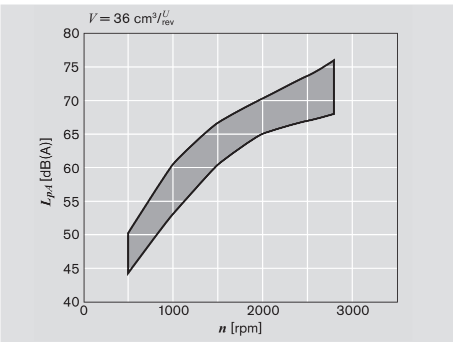
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

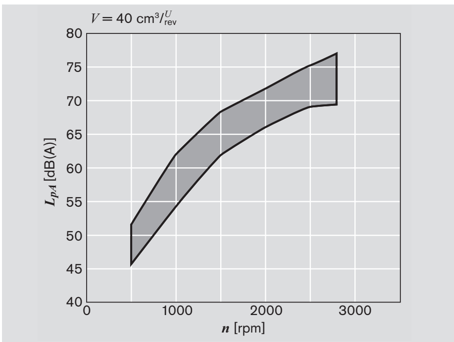




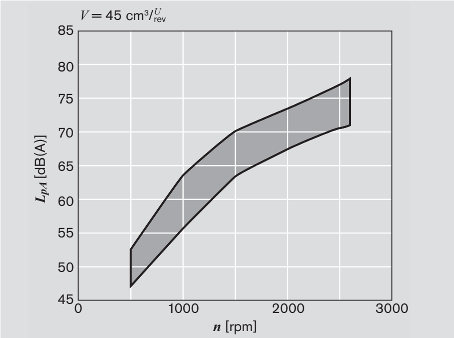


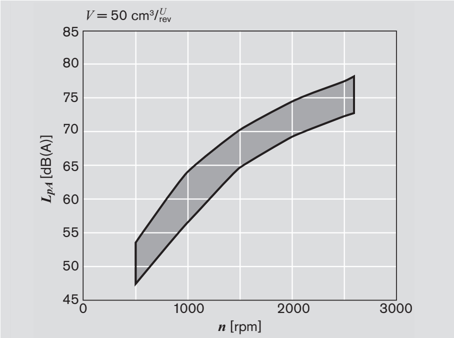


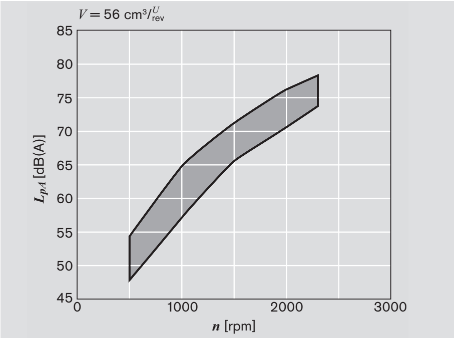


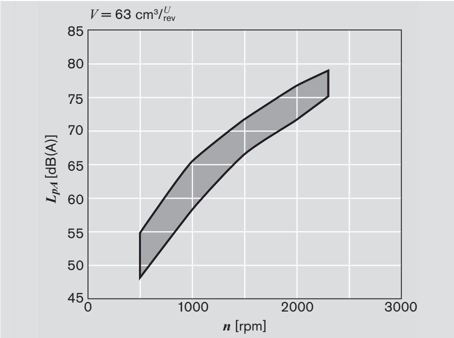


Noise charts (continued), $V = 70, 80, 100\ \text{cm}^3/_{rev}^{U}$ on request









Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C with NBR seals or –20 °C...+110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals *) max. +110 °C with FKM seals **)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) On hydraulic systems or devices with critical counter-reaction, such as steering and counterbalance valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

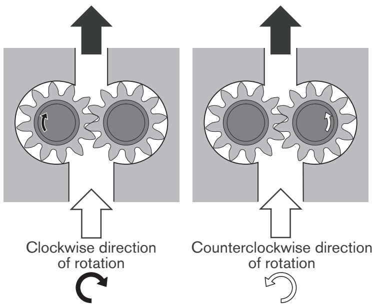
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

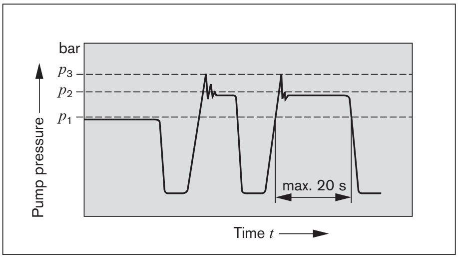
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps. On counterclockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

Model AZPG

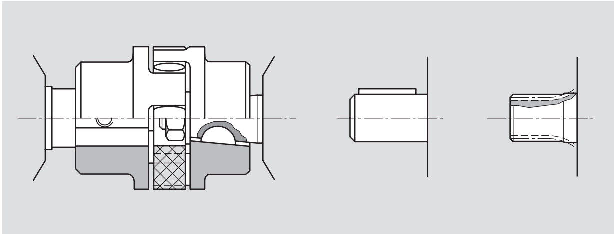
Displacement	V	cm³/rev	22.5	25	28	32	36	40	45	50	56	63	70	80	100
Suction pressure	p_e		0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)												
max. continuous pressure	p_1	bar	250							220	195	170	120	90	80
max. intermittent pressure	p_2		280							250	225	200	150	120	100
max. peak pressure	p_3		300							280	250	230	180	150	120
min. rpm at bar 12 mm²/s	<100	rpm	500	500	500	500	500	500	500	500	500	500	500	500	500
	100...180		1200	1200	1000	1000	1000	800	800	800	800	800	800	800	800
	180... p_2		1400	1400	1400	1400	1200	1200	1000	1000	1000	1000	1000	1000	1000
25 mm²/s	p_2		600	600	500	500	500	500	500	500	500	500	500	600	800
max. rpm at	p_2		3000	3000	3000	2800	2800	2800	2600	2600	2300	2300	2200	2000	1700

Drive arrangement

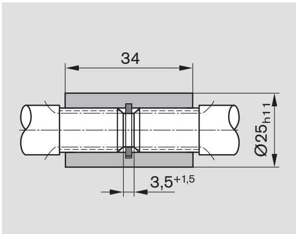
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be $3.5^{+1.5}$. Oil-bath or oil-mist lubrications is necessary.



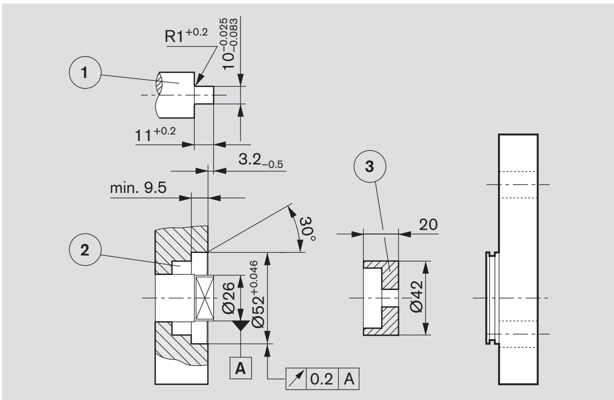
Splined shaft	M_{max} [Nm]	V [cm³/rev]
SAE-B 13 teeth	300	12.5...100
SAE-C 15 teeth	450	

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply). There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm 2}$
Surface for sealing ring
ground without rifling $R_t \leq 4\mu m$

② **Radial shaft seal**
with rubber covered seal
(see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



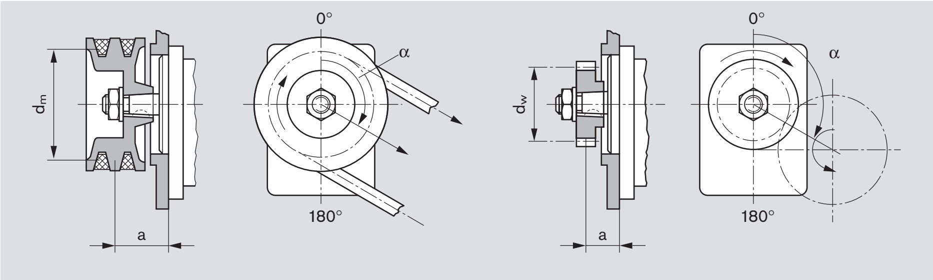
Drive with special tang

M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
130	28	270
	36	210
	40	190
	45	160
	50	150
	56	135
	63	120
	70	110
	80	95
	100	75

For drive shaft with tang

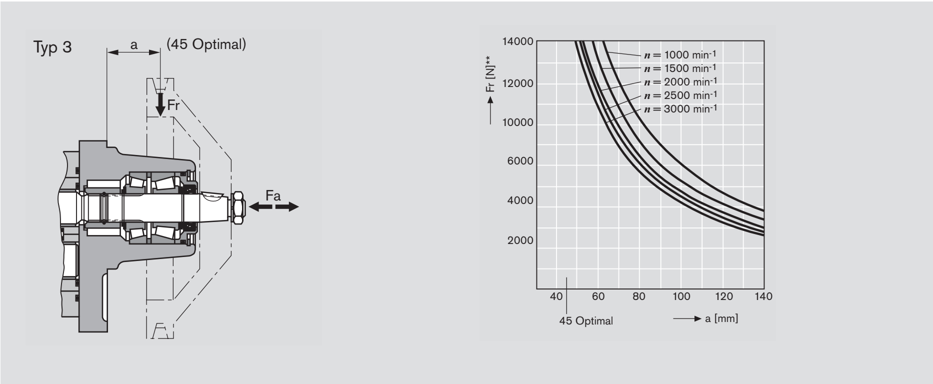
4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.



5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of $L_H = 1000$ h.



Multiple gear pumps

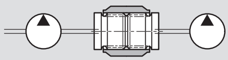
Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps. In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series G, the driver for the second pumping stage can carry a load of up to $M_{max.}$ = 130 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

$M_{max.}$ [Nm]	V [cm³/rev]	p_{max} [bar]
65 Series F, S	16	230
	19	190
	22.5	160
	25	140
130 Series G, U	22.5	280
	25	280
	28	260
	32	230
	36	200
	40	180
	45	160
	50	150
	56	130
	63	110
	70	100
	80	90
	100	70

Reinforced through drive

$M_{max.}$ = 320 Nm

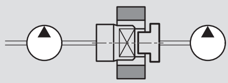


G G

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

$M_{max.}$ = 130 Nm



G G

Combinations

Series pump 1	$M_{max.}$ [Nm]	Series pump 2
G	130	G, U
G	65	F
G	65	S

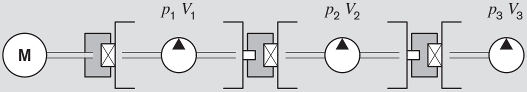
For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

Max. transferrable drive torque

Function	Code letter	Designation	Max. transferrable drive torque* [Nm]
Splined shafts	D	SAE J744 22-4 (13T 16/32 DL)	300
	E	SAE J744 22-4 (15T 16/32 DL)	450
Tapered key shaft	C	1:5	290
	H	1:8	240

* These figures are valid providing the conditions defined on pages 15 and 16 are observed. Bosch Rexroth is to be consulted if the stated values are exceeded.

3

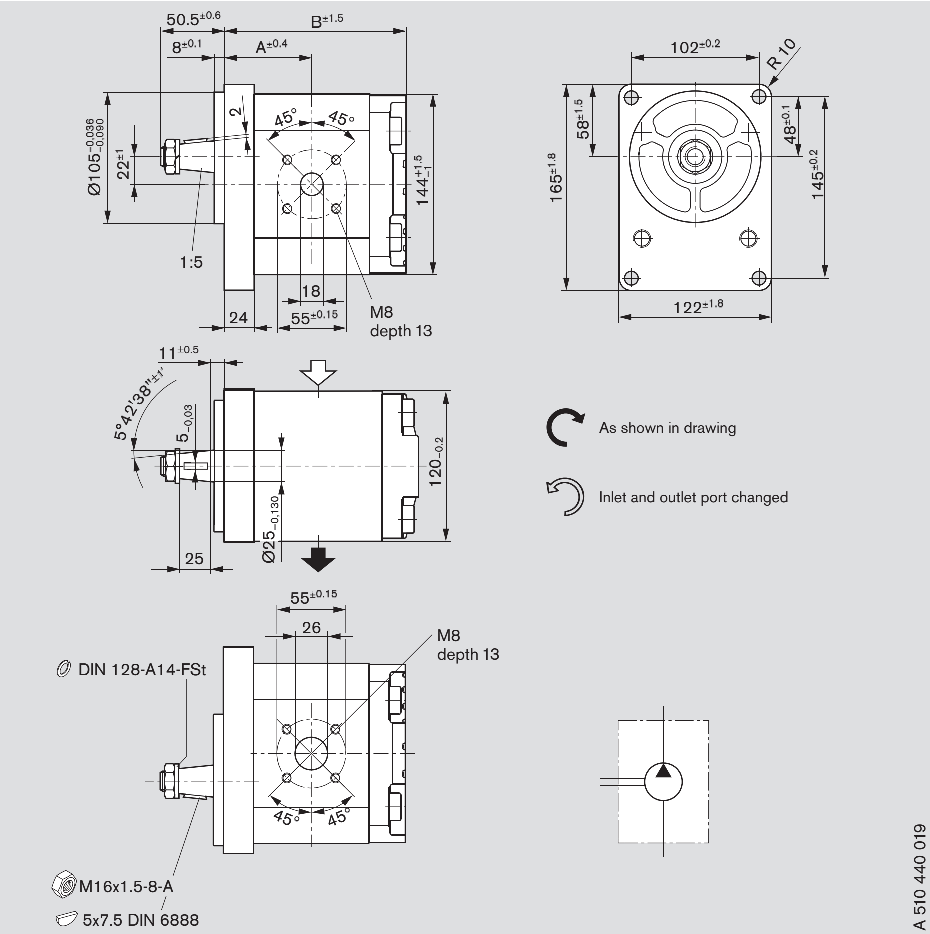


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range

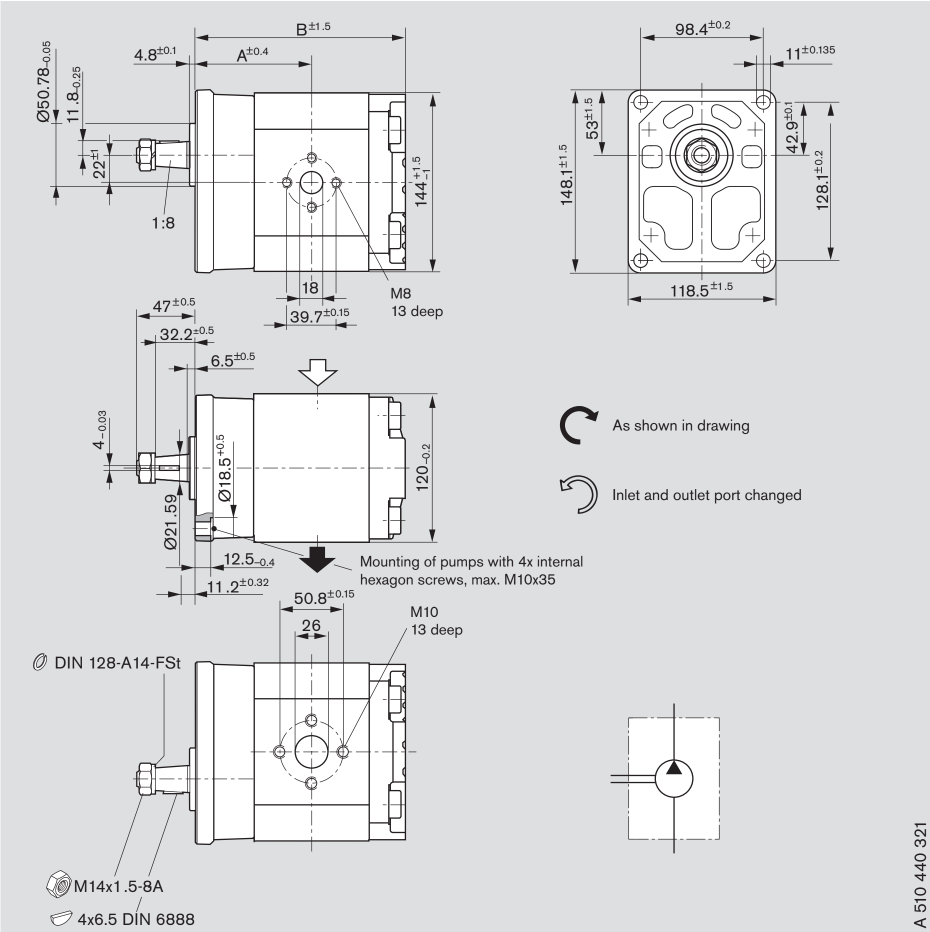


Ordering code:
AZPG – 22 – □ □ □ □ C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
22.5	**0 510 725 441**	**0 510 725 164**	280	3000	10.3	60.9	124.6
25	**0 510 725 442**	**0 510 725 165**	280	3000	10.4	61.9	126.6
28	**0 510 725 443**	**0 510 725 166**	280	3000	10.5	63.2	129.1
32	**0 510 725 444**	**0 510 725 167**	280	2800	10.7	64.8	132.4
36	**0 510 725 445**	**0 510 725 168**	280	2800	10.9	66.4	135.7
40	**0 510 725 446**	**0 510 725 169**	280	2800	11.0	68.1	139.0
45	**0 510 725 447**	**0 510 725 170**	280	2600	11.2	70.1	143.1
50	**0 510 825 324**	**0 510 825 024**	250	2600	11.4	72.2	147.2
56	**0 510 825 325**	**0 510 825 025**	225	2300	11.7	74.7	152.2
63	**0 510 825 326**	**0 510 825 026**	200	2300	12.0	77.6	158.0

Dimensions

Standard range

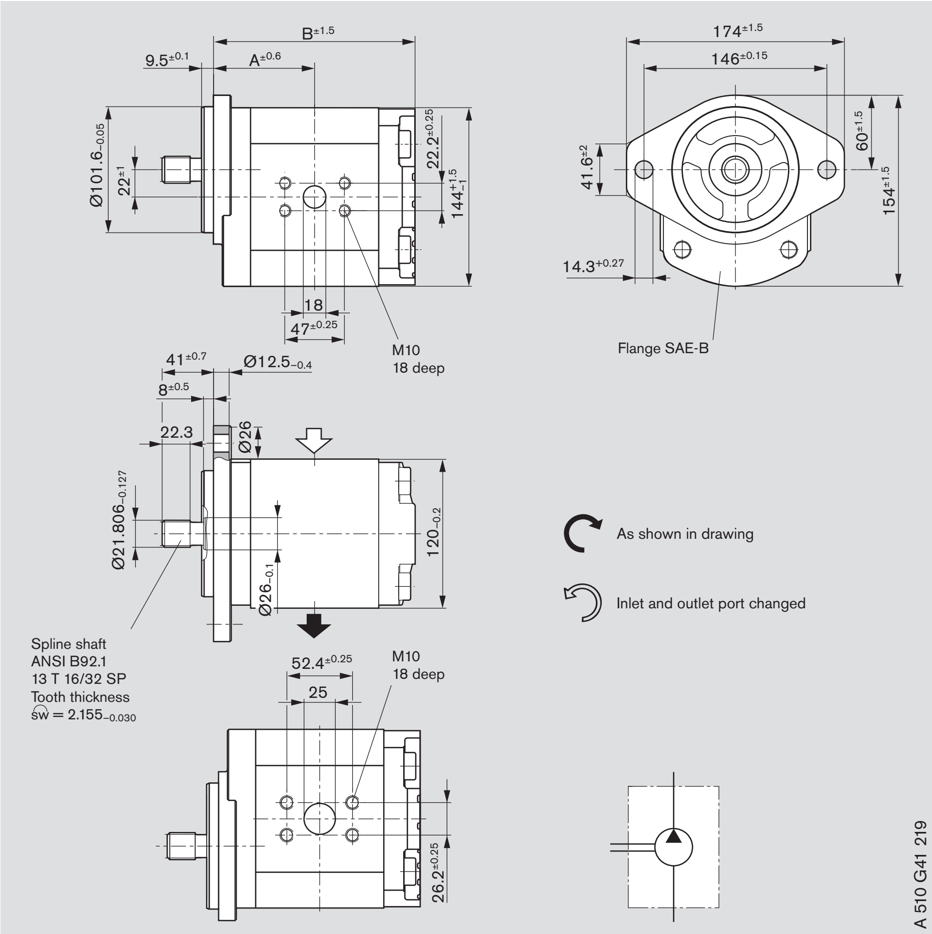


Ordering code:
AZPG – 22 – □ □ □ □ H O 30 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
22.5	**0 510 725 448**	**0 510 725 171**	280	3000	9.6	63.9	147.8
25	**0 510 725 449**	**0 510 725 172**	280	3000	9.7	84.9	149.8
28	**0 510 725 450**	**0 510 725 173**	280	3000	9.8	86.2	152.3
32	**0 510 725 451**	**0 510 725 174**	280	2800	10.0	87.8	155.6
36	**0 510 725 452**	**0 510 725 175**	280	2800	10.1	89.4	158.9
40	**0 510 725 453**	**0 510 725 176**	280	2800	10.3	91.1	162.3
45	**0 510 725 454**	**0 510 725 177**	280	2600	10.5	93.1	166.3
50	**0 510 825 327**	**0 510 825 027**	250	2600	10.7	95.2	170.5
56	**0 510 825 328**	**0 510 825 028**	225	2300	11.0	97.7	175.4
63	**0 510 825 329**	**0 510 825 029**	200	1800	11.2	100.6	181.3

Dimensions

Standard range

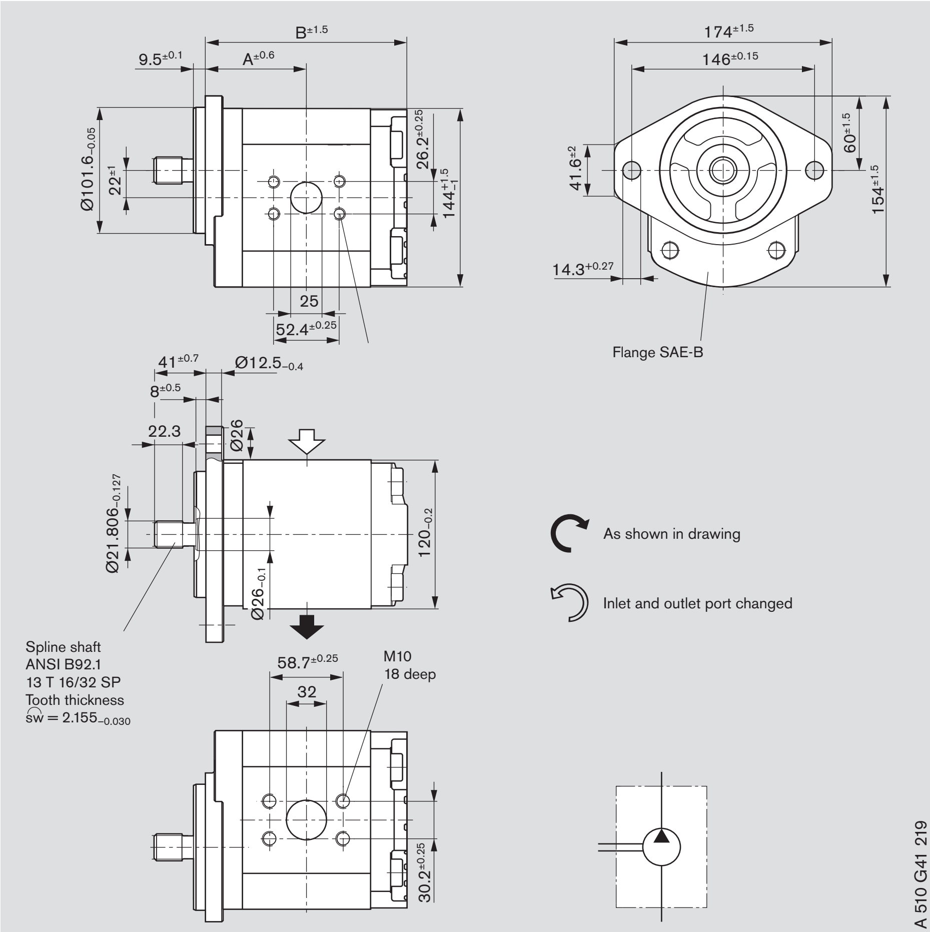


Ordering code:
AZPG – 22 – □ □ □ □ D C 07 K B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
22.5	**0 510 725 434**	**0 510 725 157**	280	3000	9.6	66.4	130.1
25	**0 510 725 435**	**0 510 725 158**	280	3000	9.7	67.4	132.1
28	**0 510 725 436**	**0 510 725 159**	280	3000	9.8	68.7	134.6

Dimensions

Standard range

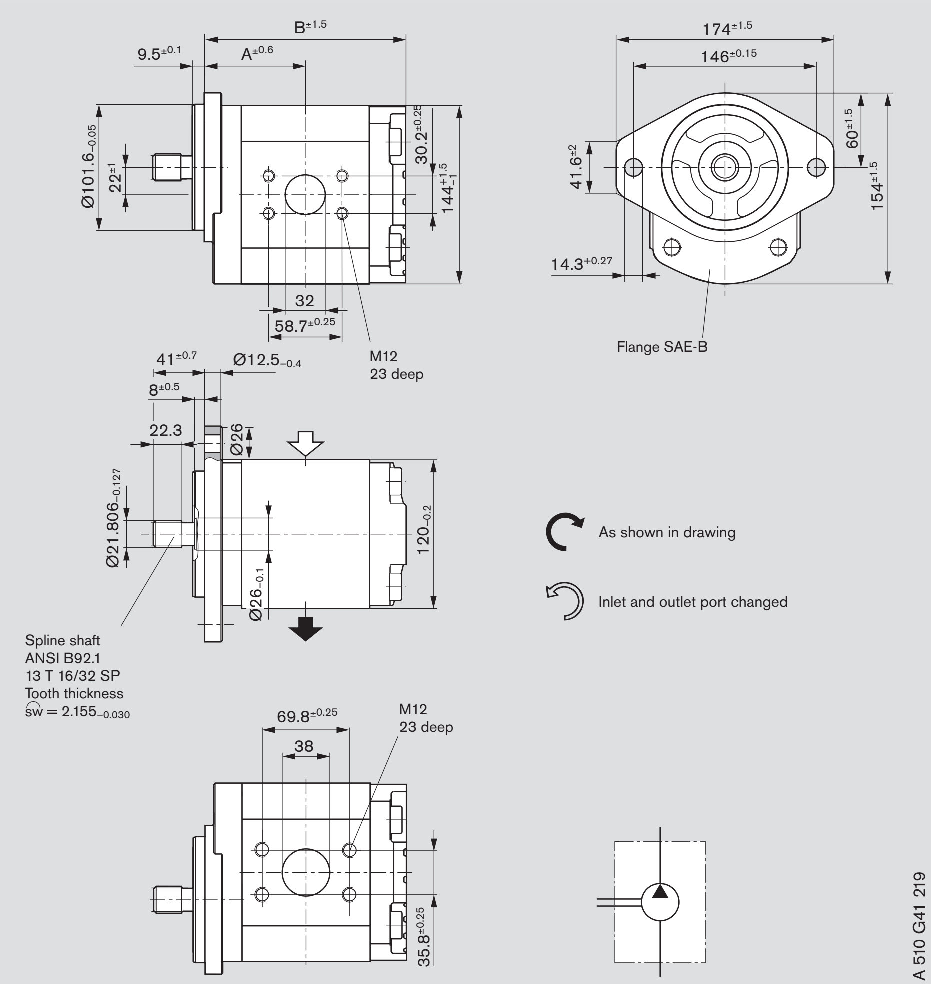


Ordering code:
AZPG – 22 – □ □ □ □ D C 07 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
32	**0 510 725 437**	**0 510 725 160**	280	2800	10.0	70.3	137.9
36	**0 510 725 438**	**0 510 725 161**	280	2800	10.1	71.9	141.2
40	**0 510 725 439**	**0 510 725 162**	280	2800	10.3	73.6	144.5
45	**0 510 725 440**	**0 510 725 163**	280	2600	10.5	75.6	148.6
50	**0 510 825 321**	**0 510 825 021**	250	2600	10.7	77.7	152.7

Dimensions

Standard range

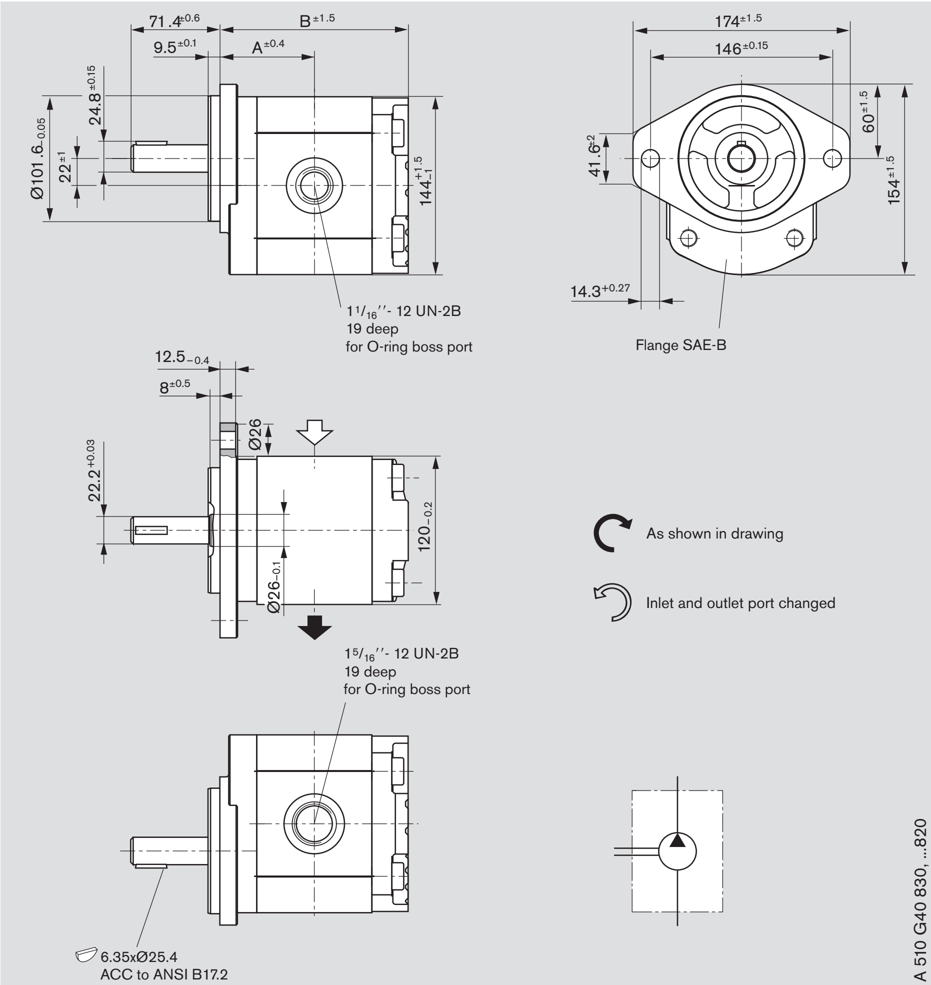


Ordering code:
AZPG – 22 – □ □ □ □ D C 07 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B
56	**0 510 825 322**	**0 510 825 022**	225	2300	11.0	80.2	157.7
63	**0 510 825 323**	**0 510 825 023**	200	2300	11.3	83.1	163.5

Dimensions

Standard range



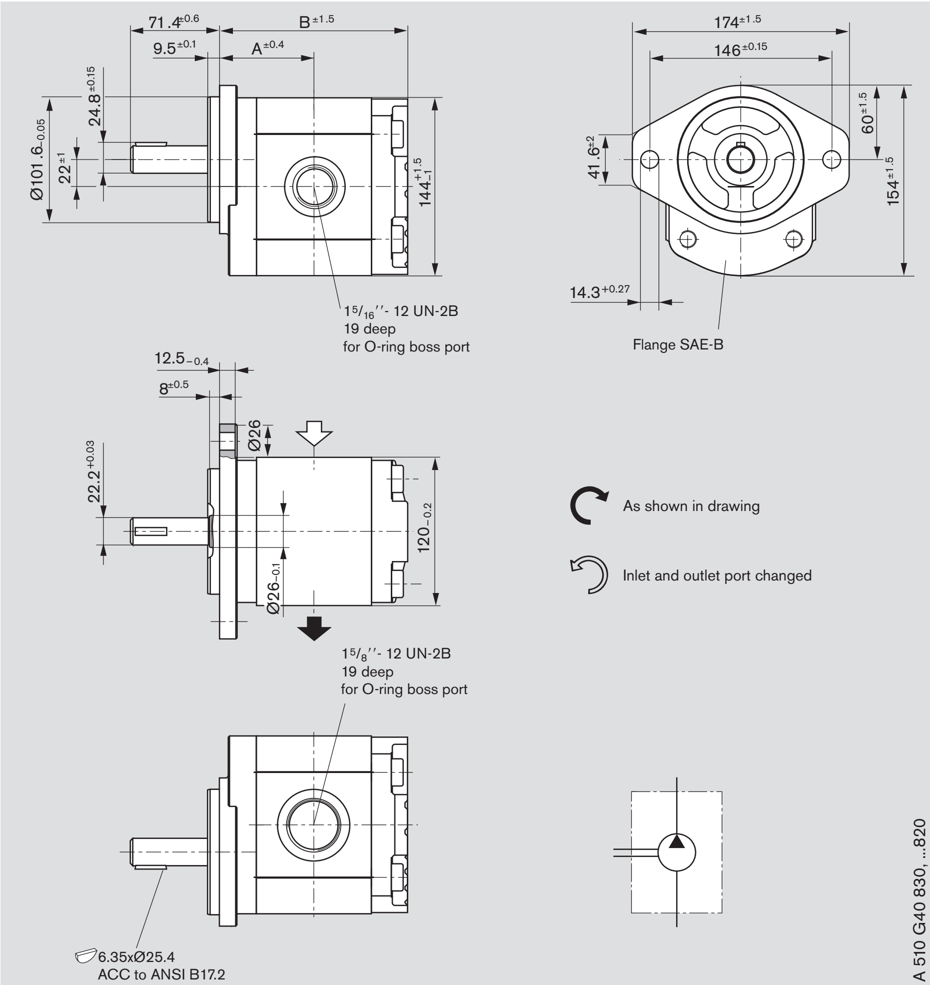
Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ Q C 12 M B – S 0662

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
22.5	**9 510 490 132**	**9 510 490 122**	250	3000	66.4	130.3	S1	P1
25	**9 510 490 133**	**9 510 490 123**	250	3000	67.4	132.3	S1	P1
28	**9 510 490 134**	**9 510 490 124**	250	3000	68.7	134.8	S1	P1

3

Dimensions

Standard range

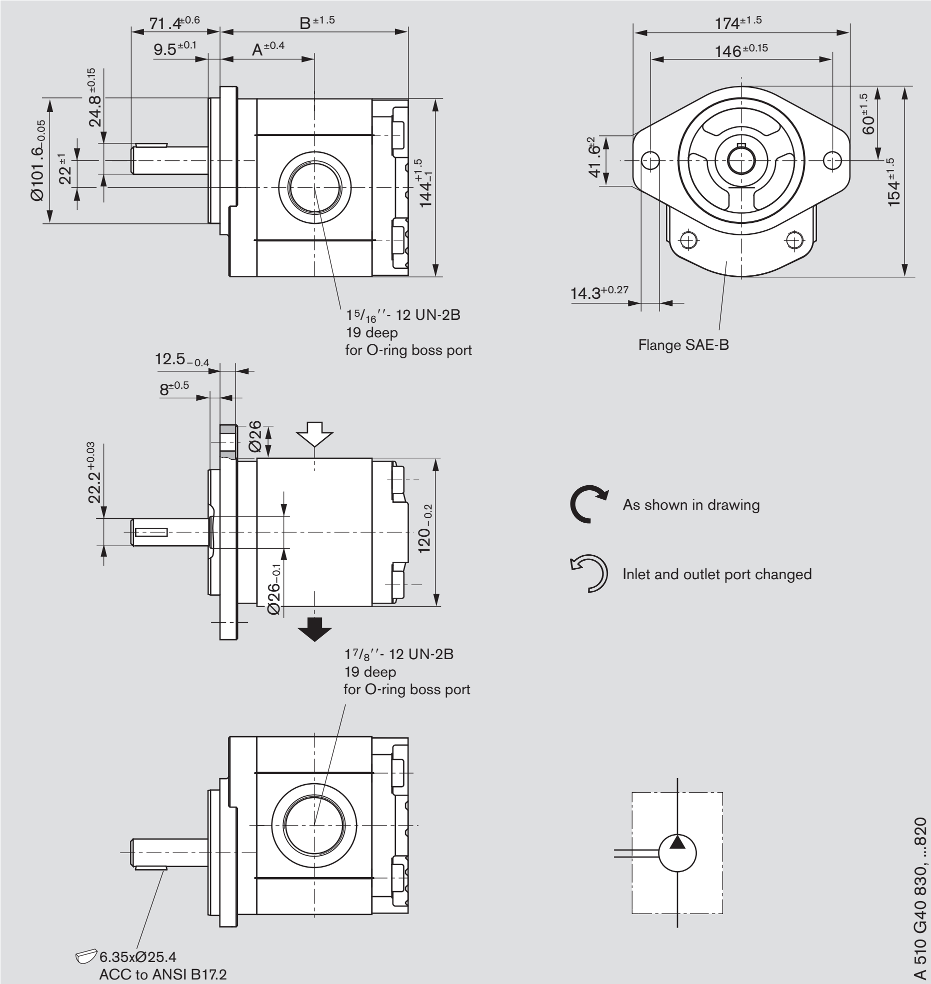


Ordering code:
AZPG – 22 – □ □ □ □ Q C 12 M B – S 0662

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
32	**9 510 490 135**	**9 510 490 125**	250	2800	70.3	138.1	S2	P2
36	**9 510 490 136**	**9 510 490 126**	250	2800	71.9	141.5	S2	P2
40	**9 510 490 137**	**9 510 490 127**	250	2800	73.6	144.8	S2	P2
45	**9 510 490 138**	**9 510 490 128**	250	2600	75.6	148.8	S2	P2

Dimensions

Standard range



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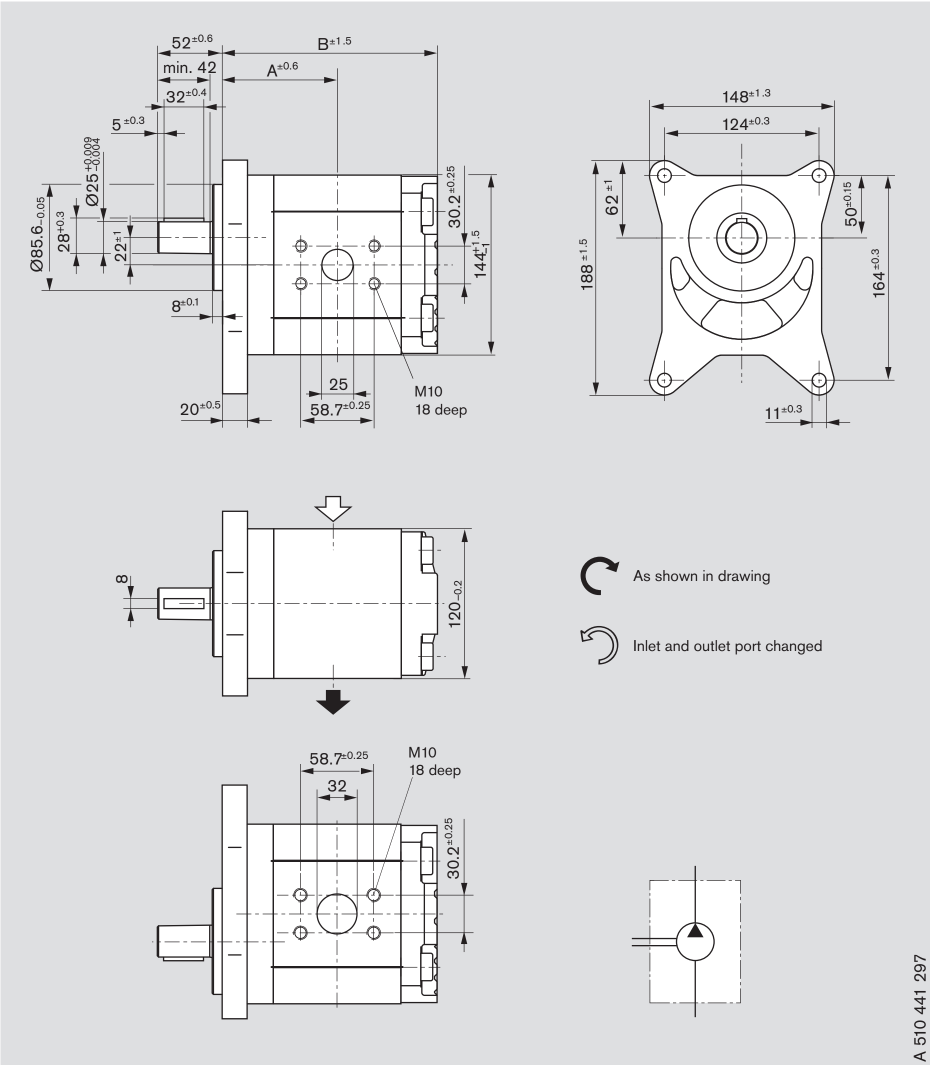
Ordering code:
AZPG – 22 – □ □ □ □ Q C 12 M B – S 0662

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
50	**9 510 490 139**	**9 510 490 129**	220	2600	77.7	153.0	S3	P3
56	**9 510 490 140**	**9 510 490 130**	195	2300	80.2	157.9	S3	P3
63	**9 510 490 141**	**9 510 490 131**	170	2300	83.1	163.8	S3	P3

Dimensions

Standard range

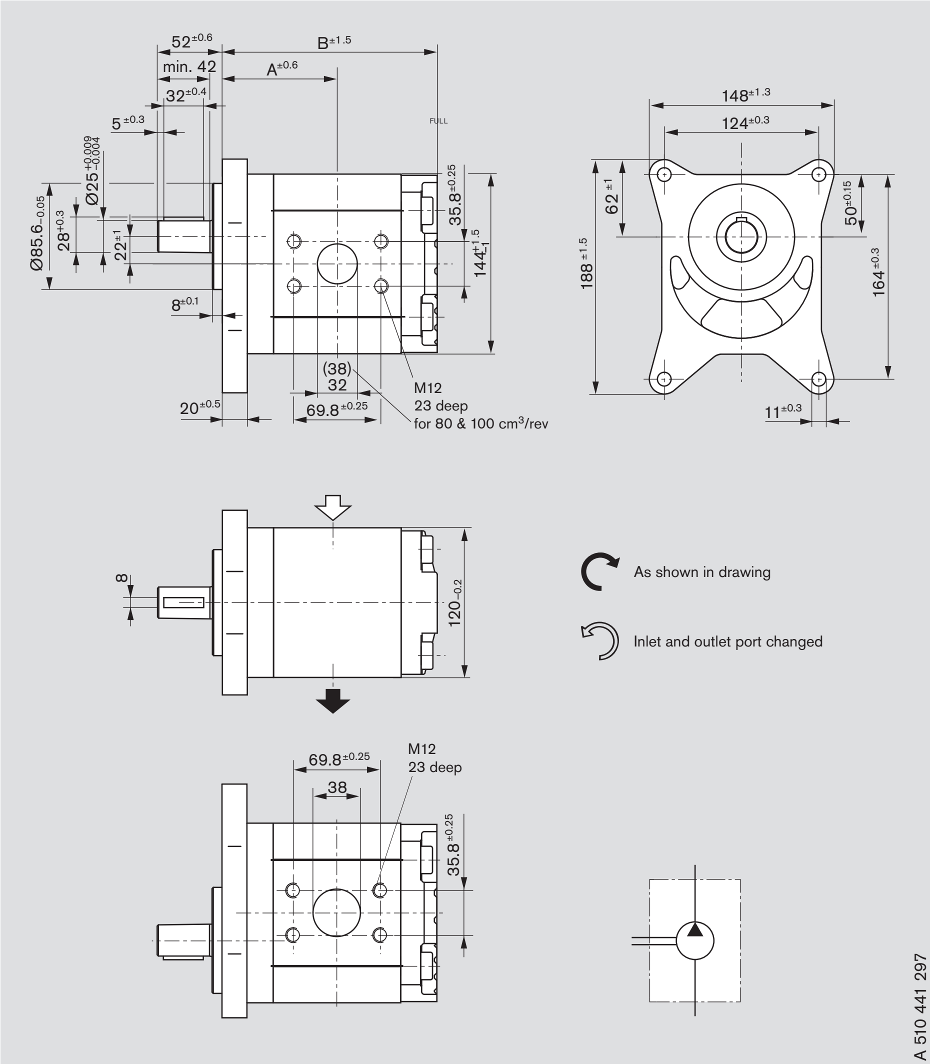


Ordering code:
AZPG – 22 – □ □ □ □ A X 07 K B – S 0303

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
40	**0 510 725 432**	**0 510 725 147**	280	2800	85.1	157.7	S1	P1
50	**0 510 825 314**	**0 510 825 015**	250	2600	89.2	165.9	S1	P1

Dimensions

Standard range

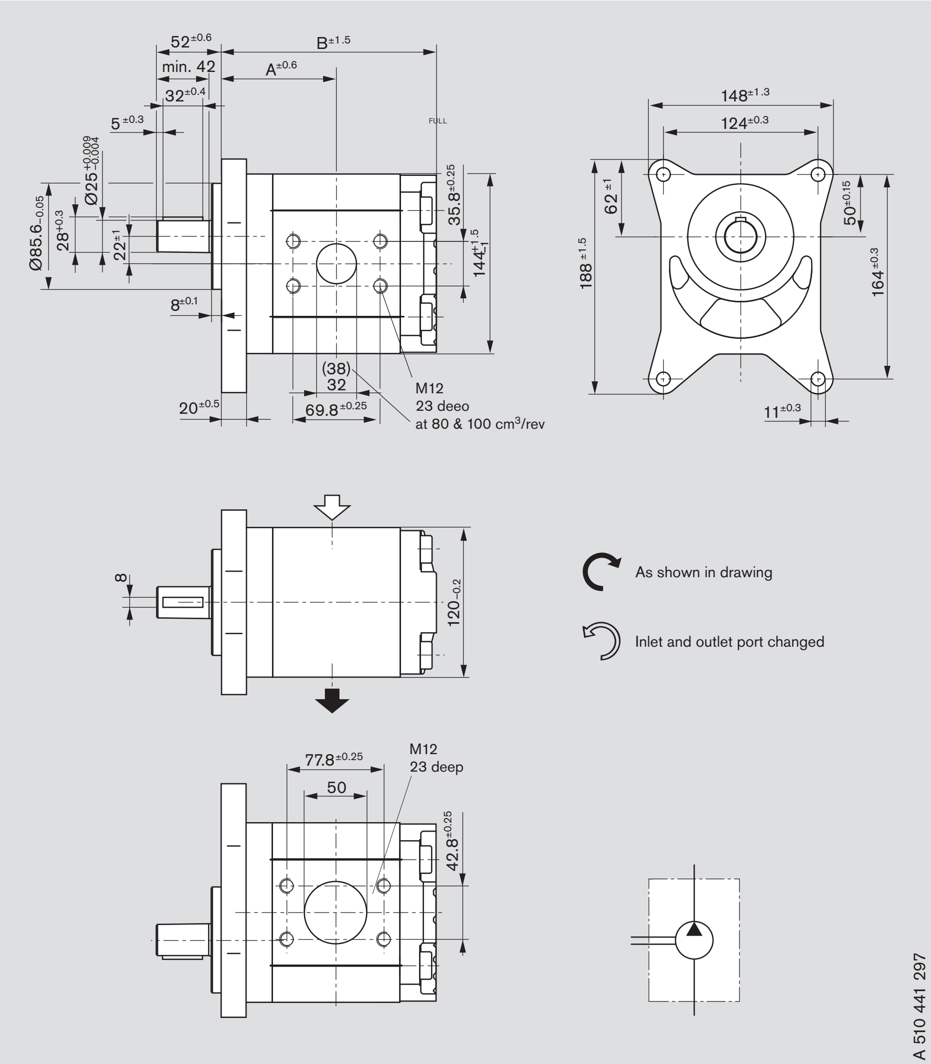


Ordering code:
AZPG – 22 – □ □ □ □ A X 07 K B – S 0303

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
63	**0 510 825 315**	**0 510 825 016**	200	2300	94.6	176.7	S2	P2
70	**0 510 825 316**	**0 510 825 017**	150	2200	97.5	182.5	S2	P2

Dimensions

Standard range

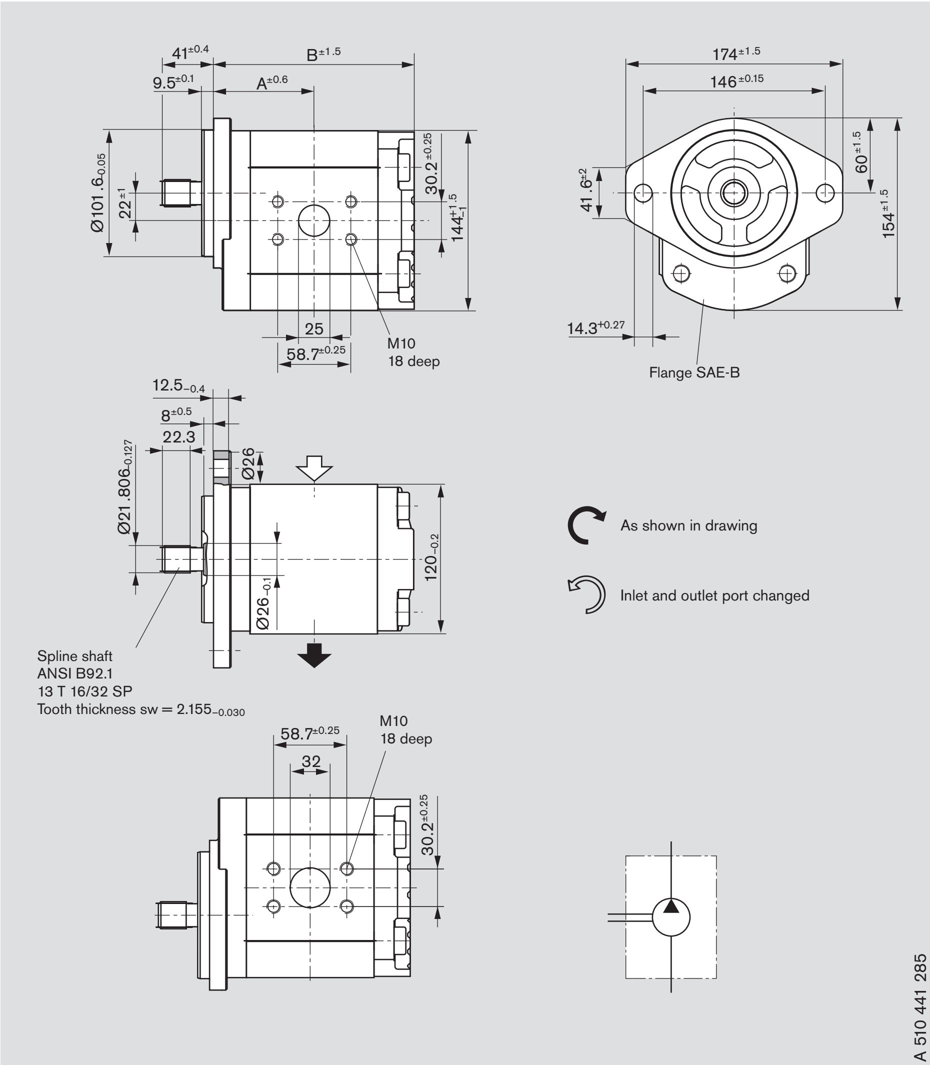


Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ A X 07 K B – S 0303

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
80	**0 510 825 317**	**0 510 825 018**	120	2200	100.6	190.7	S3	P2
100	**0 510 825 318**	**0 510 825 019**	100	1700	109.8	207.2	S3	P2

Dimensions

Standard range

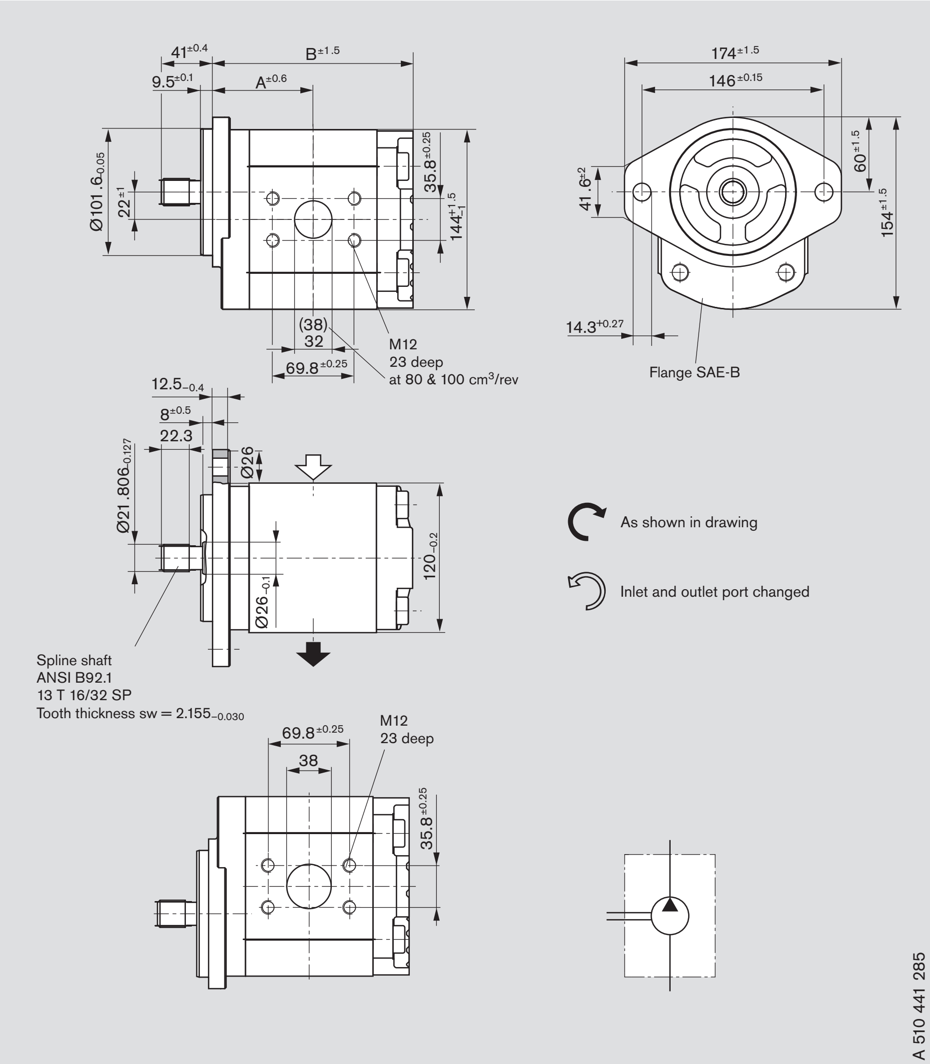


Ordering code:
AZPG – 22 – □ □ □ □ D C 07 K B – S 0039

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
40	**0 510 725 421**	**0 510 725 136**	280	2800	73.6	144.8	S1	P1
50	**0 510 725 420**	**0 510 725 135**	250	2600	77.7	153.0	S1	P1

Dimensions

Standard range

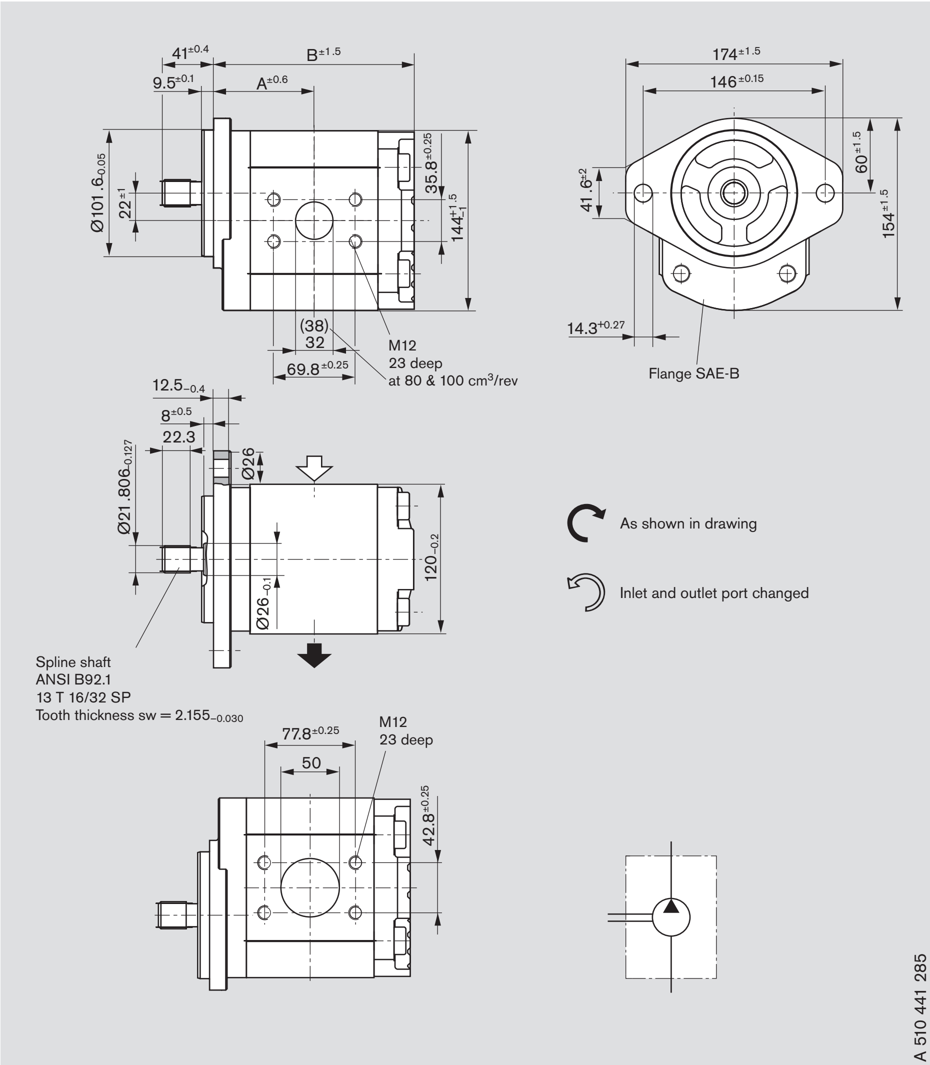


Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ D C 07 K B – S 0039

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
63	**0 510 825 313**	**0 510 825 011**	200	2300	83.1	163.8	S2	P2
70	**0 510 825 312**	**0 510 825 014**	150	2200	86.0	169.5	S2	P2

Dimensions

Standard range



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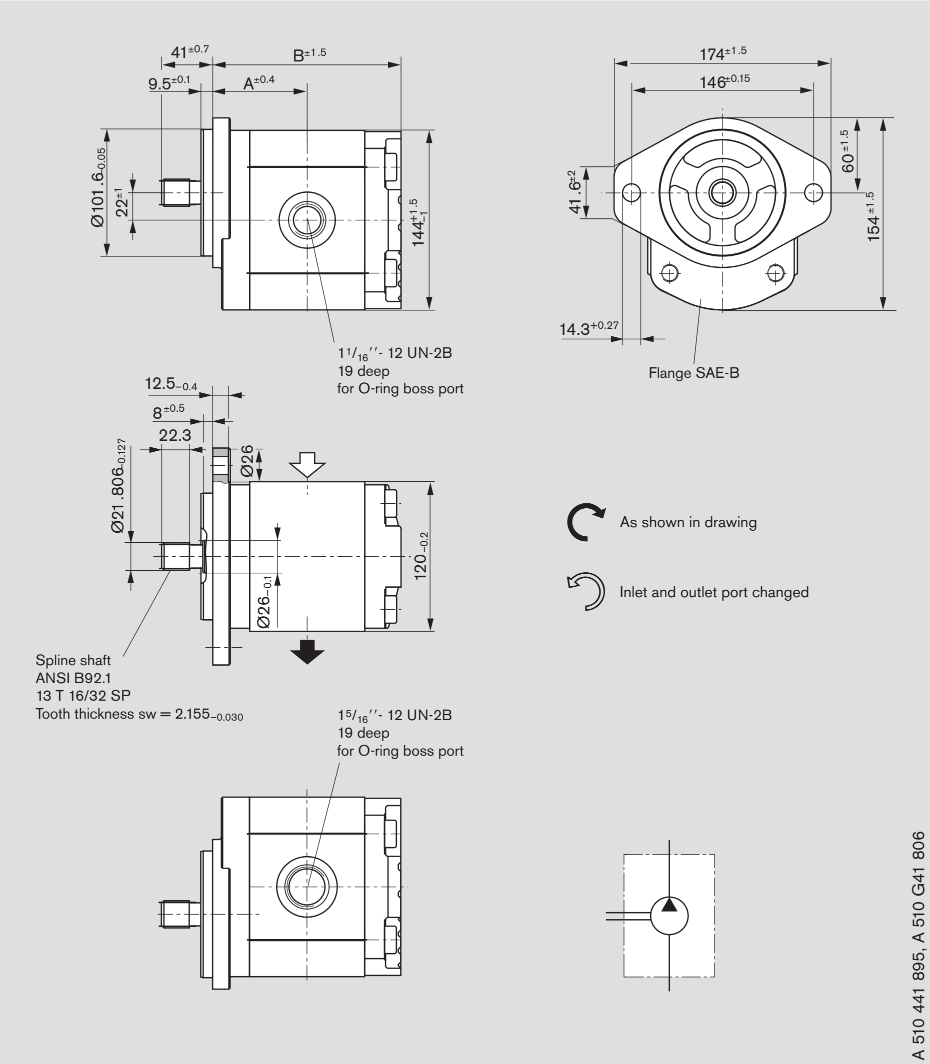
Ordering code:
AZPG – 22 – □ □ □ □ D C 07 K B – S 0039

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
80	**0 510 825 311**	**0 510 825 012**	120	2200	90.1	177.8	S3	P2
100	**0 510 825 310**	**0 510 825 013**	100	1700	98.3	194.3	S3	P2

Dimensions

Standard range

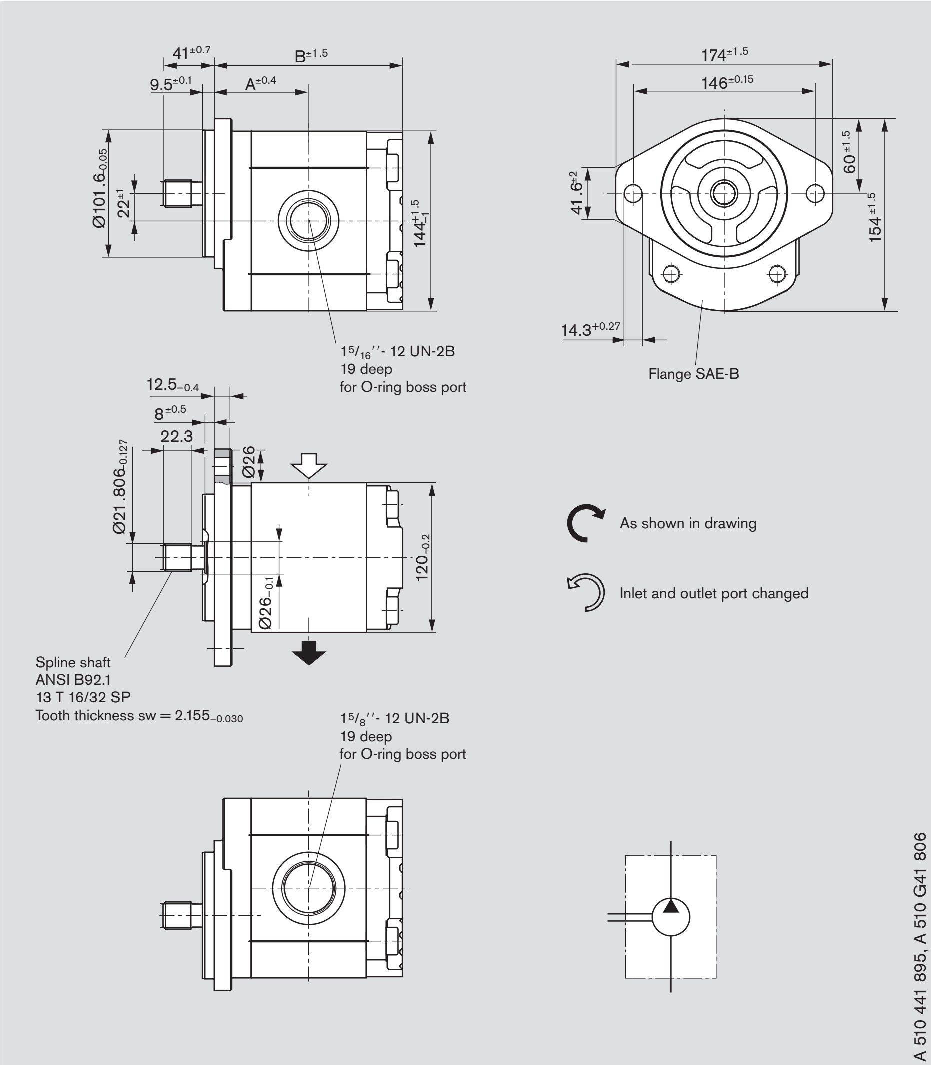


Ordering code:
AZPG – 22 – □ □ □ □ D C 12 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
22.5	**9 510 490 011**	**9 510 490 001**	250	3000	66.4	130.3	S1	P1
25	**9 510 490 012**	**9 510 490 002**	250	3000	67.4	132.3	S1	P1
28	**9 510 490 013**	**9 510 490 003**	250	3000	68.7	134.8	S1	P1

Dimensions

Standard range

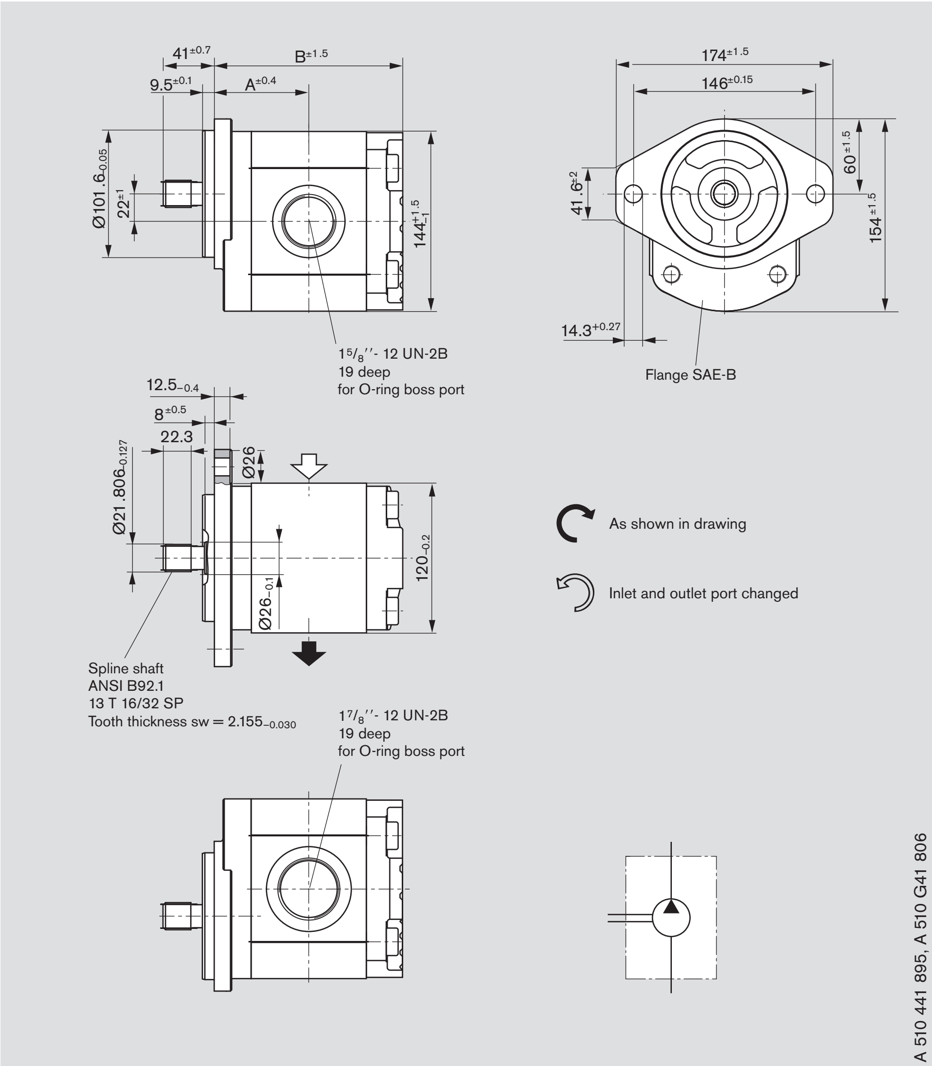


Ordering code:
AZPG – 22 – □ □ □ □ D C 12 M B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
32	**9 510 490 014**	**9 510 490 004**	250	2800	70.3	138.1	S2	P2
36	**9 510 490 015**	**9 510 490 005**	250	2800	71.9	141.5	S2	P2
40	**9 510 490 016**	**9 510 490 006**	250	2800	73.6	144.8	S2	P2
45	**9 510 490 017**	**9 510 490 007**	250	2600	75.6	148.8	S2	P2

Dimensions

Standard range

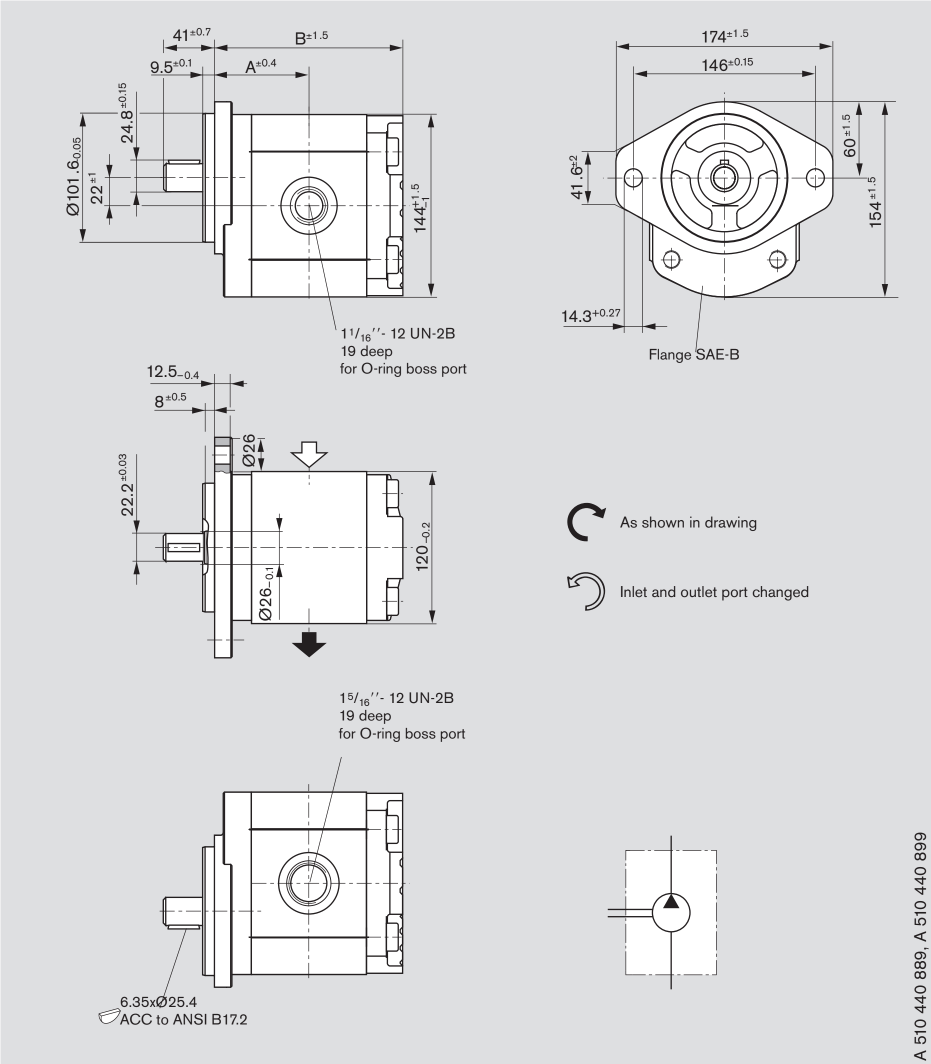


Ordering code:
AZPG – 22 – □ □ □ □ D C 12 M B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
50	**9 510 490 018**	**9 510 490 008**	220	2600	77.7	153.0	S3	P3
56	**9 510 490 019**	**9 510 490 009**	195	2300	80.2	157.9	S3	P3
63	**9 510 490 020**	**9 510 490 010**	170	2300	63.1	163.8	S3	P3

Dimensions

Standard range

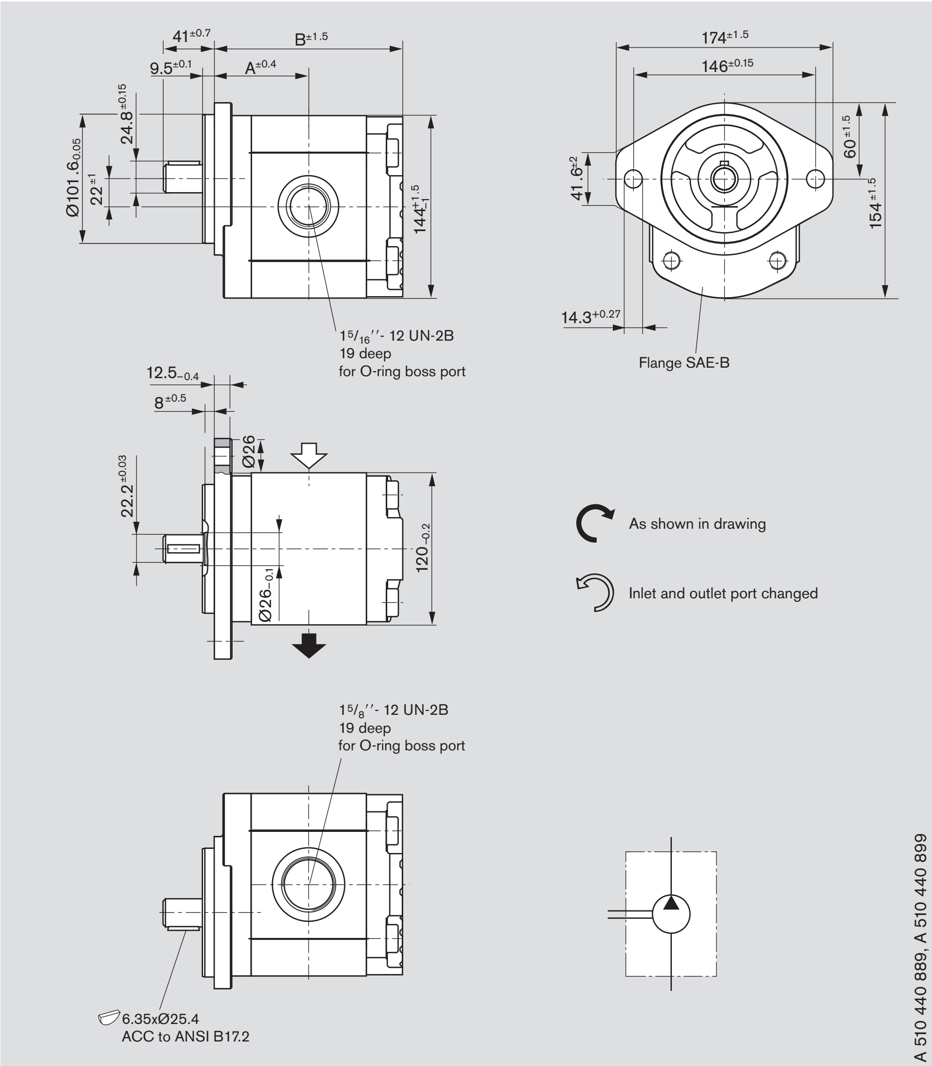


Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ Q C 12 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
22.5		**9 510 490 021**	250	3000	66.4	130.3	S1	P1
25		**9 510 490 022**	250	3000	67.4	132.3	S1	P1
28		**9 510 490 023**	250	3000	68.7	134.8	S1	P1

Dimensions

Standard range

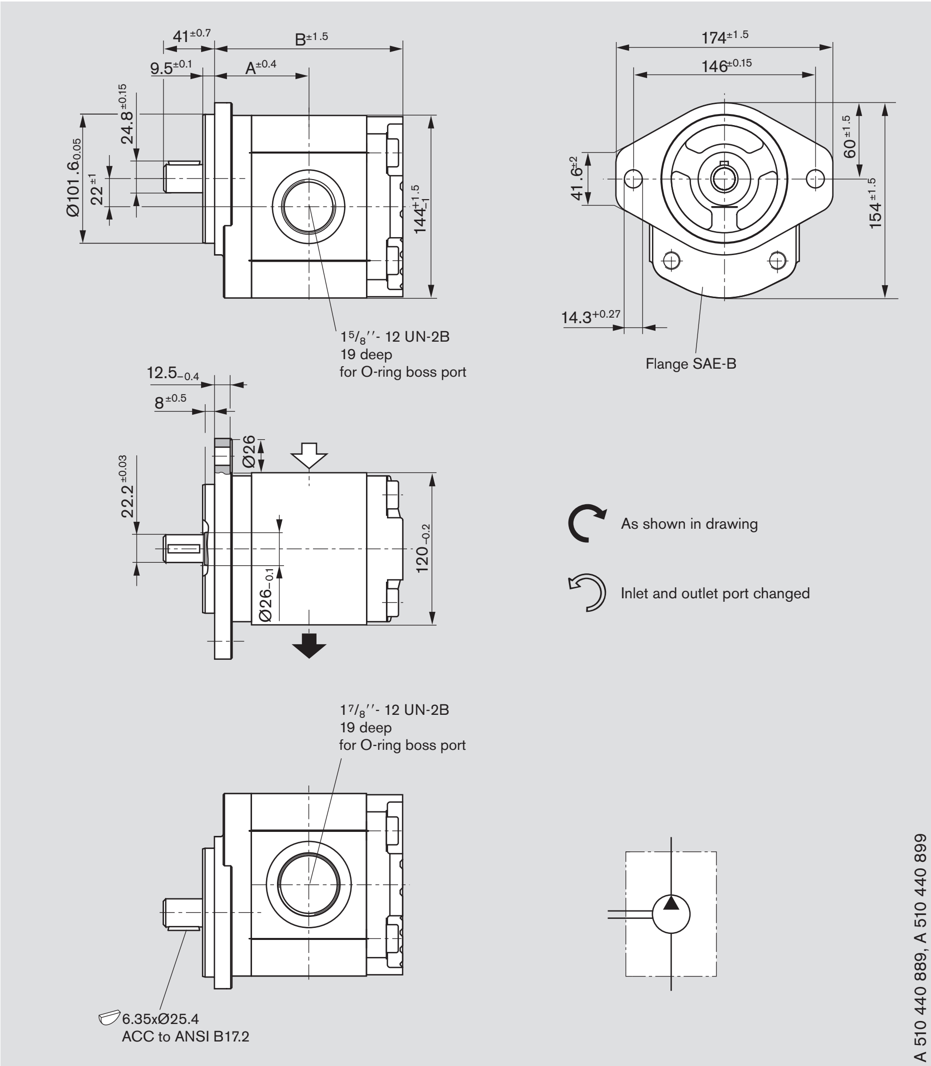


Ordering code:
AZPG – 22 – □ □ □ □ Q C 12 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
32	**9 510 490 034**	**9 510 490 024**	250	2800	70.3	138.1	S2	P2
36	**9 510 490 035**	**9 510 490 025**	250	2800	71.9	141.5	S2	P2
40		**9 510 490 026**	250	2800	73.6	144.8	S2	P2
45	**9 510 490 037**	**9 510 490 027**	250	2600	75.6	148.8	S2	P2

Dimensions

Standard range

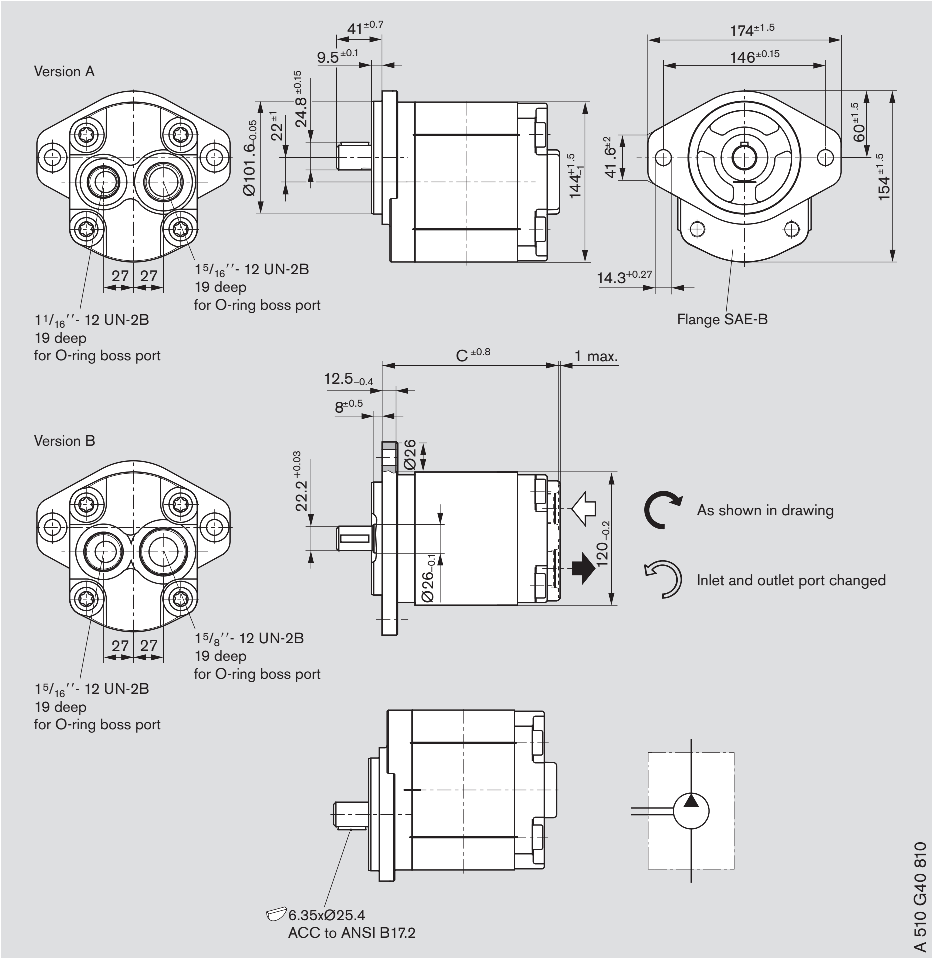


Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ Q C 12 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B	Execution Suction port	Execution Pressure port
50	**9 510 490 038**	**9 510 490 028**	220	2600	77.7	153.0	S3	P3
56	**9 510 490 039**	**9 510 490 029**	195	2300	80.2	157.9	S3	P3
63	**9 510 490 040**	**9 510 490 030**	170	2300	63.1	163.8	S3	P3

Dimensions

Standard range

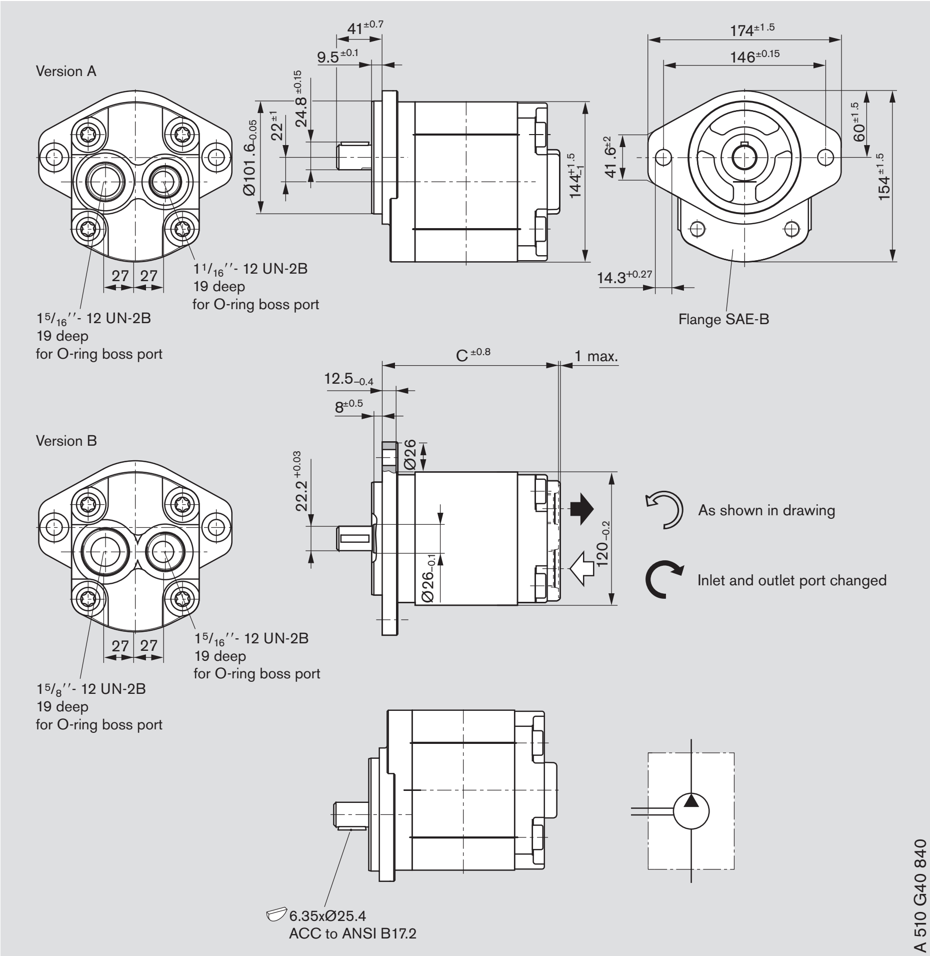


Ordering code:
AZPG – 22 – □ □ □ R Q C 12 M A

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] C	Version
22.5		**9 510 490 101**	250	3000	141.2	A
25		**9 510 490 102**	250	3000	143.2	A
28		**9 510 490 103**	250	3000	145.7	A
32		**9 510 490 104**	250	2800	149.0	B
36		**9 510 490 105**	250	2800	152.4	B
40		**9 510 490 106**	250	2800	155.7	B
45		**9 510 490 107**	250	2600	159.7	B
50		**9 510 490 108**	220	2600	163.9	B
56		**9 510 490 109**	195	2300	169.8	B
63		**9 510 490 110**	170	2300	174.7	B

Dimensions

Standard range

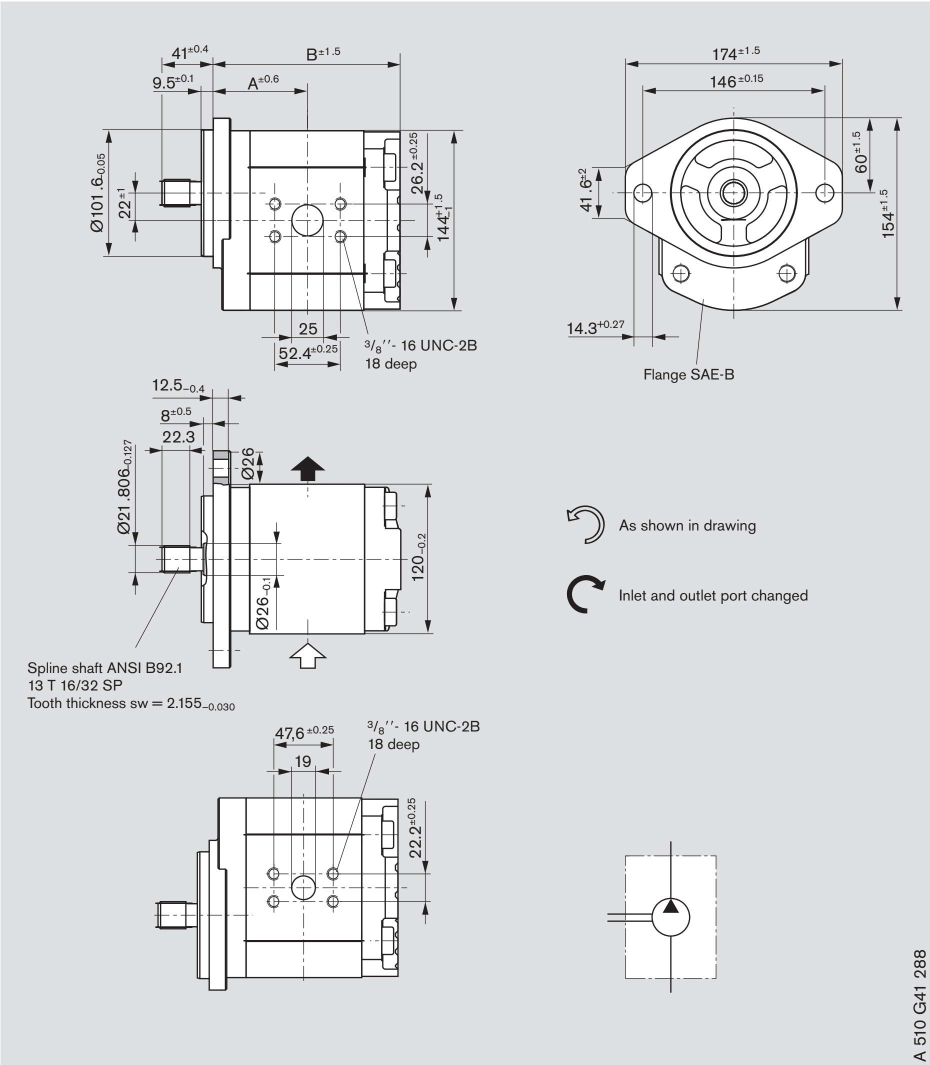


Ordering code:
AZPG – 22 – ☐ ☐ ☐ L Q C 12 M A

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] C	Version
22.5	**9 510 490 111**		250	3000	141.2	A
25	**9 510 490 112**		250	3000	143.2	A
28	**9 510 490 113**		250	3000	145.7	A
32	**9 510 490 114**		250	2800	149.0	B
36	**9 510 490 115**		250	2800	152.4	B
40	**9 510 490 116**		250	2800	155.7	B
45	**9 510 490 117**		250	2600	159.7	B
50	**9 510 490 118**		220	2600	163.9	B
56	**9 510 490 119**		195	2300	169.8	B
63	**9 510 490 120**		170	2300	174.7	B

Dimensions

Standard range

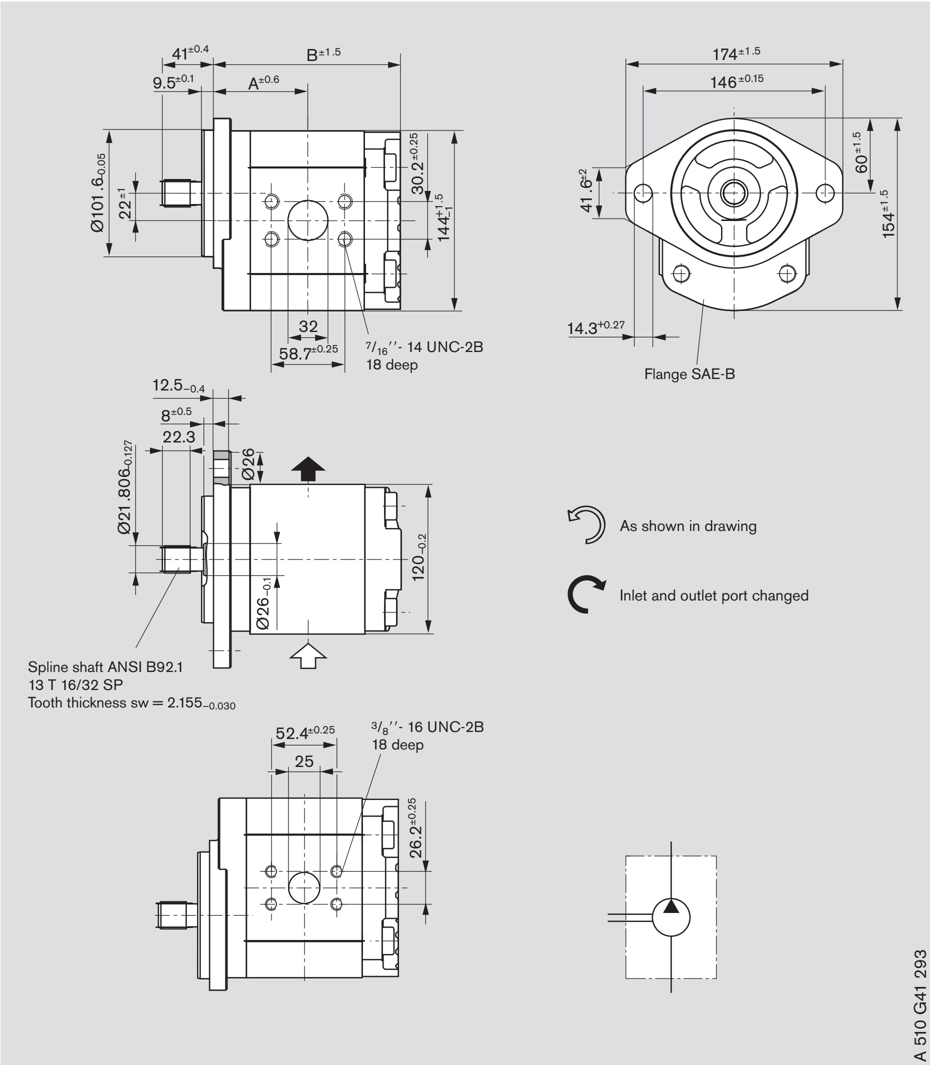


Ordering code:
AZPG – 22 – □ □ □ L D C 40 M B

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	B
22.5	**9 510 490 051**		250	3000	66.4	130.3
25	**9 510 490 052**		250	3000	67.4	132.3
28	**9 510 490 053**		250	3000	68.7	134.8
32	**9 510 490 054**		250	2800	70.3	138.1
36	**9 510 490 055**		250	2800	71.9	141.5

Dimensions

Standard range



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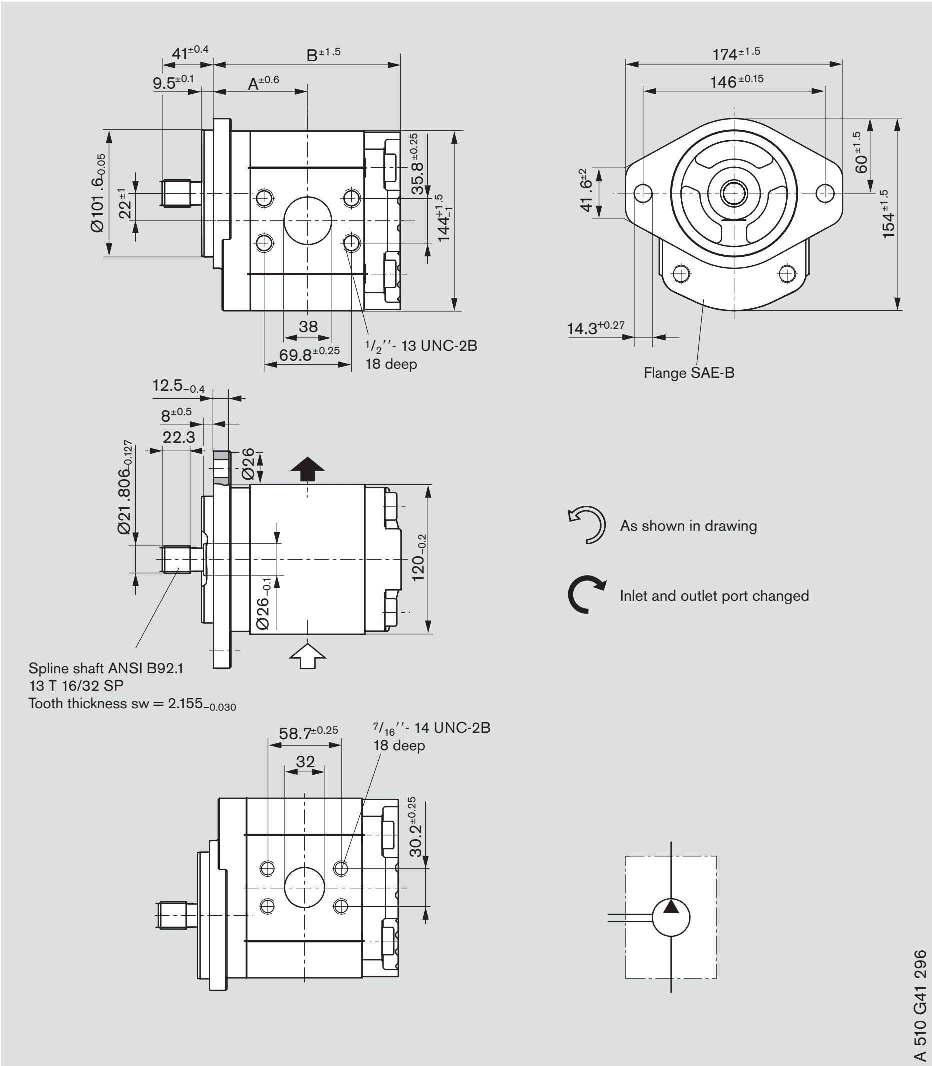
Ordering code:
AZPG – 22 – □ □ □ L D C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
40	**9 510 490 056**		250	2800	73.6	144.8
45	**9 510 490 057**		250	2600	75.6	148.8
50	**9 510 490 058**		220	2600	77.7	153.0

Dimensions

Standard range

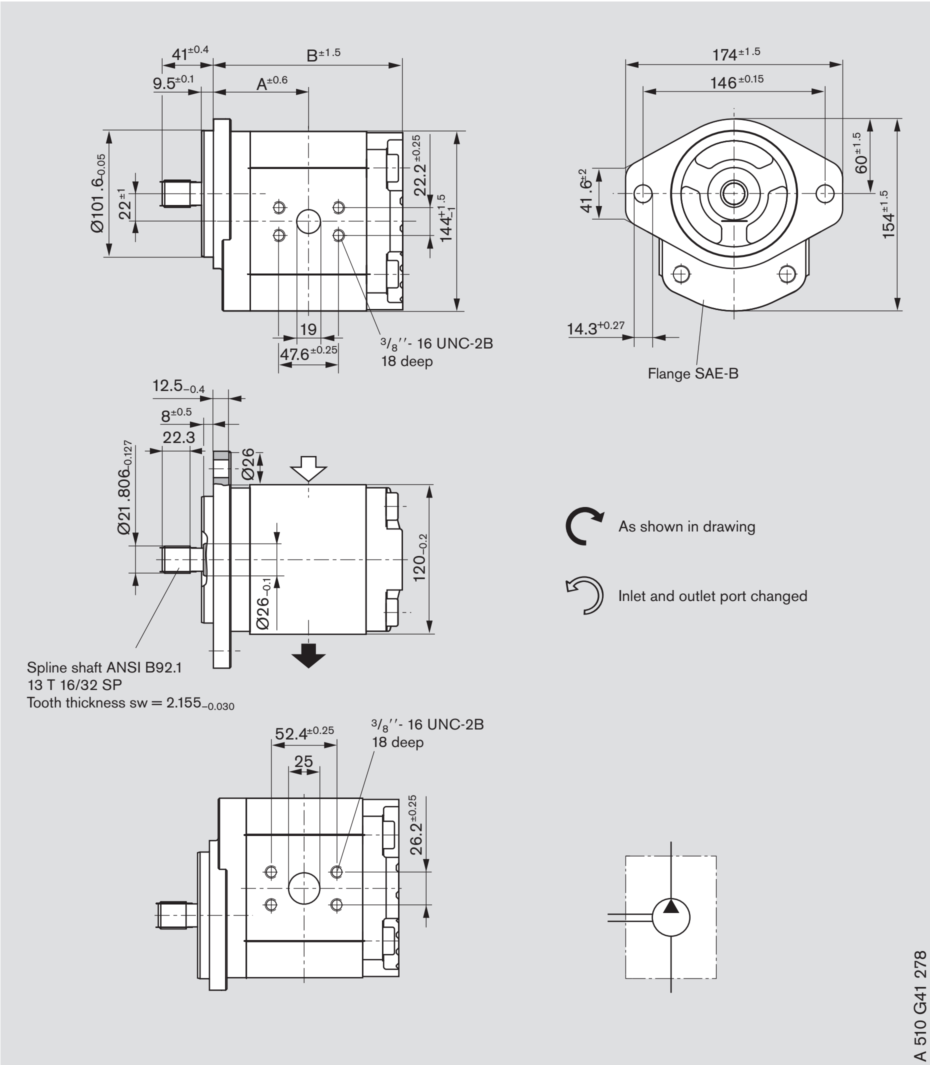


Ordering code:
AZPG – 22 – □ □ □ L D C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
56	**9 510 490 059**		195	2300	80.2	157.9
63	**9 510 490 060**		170	2300	83.1	163.8

Dimensions

Standard range

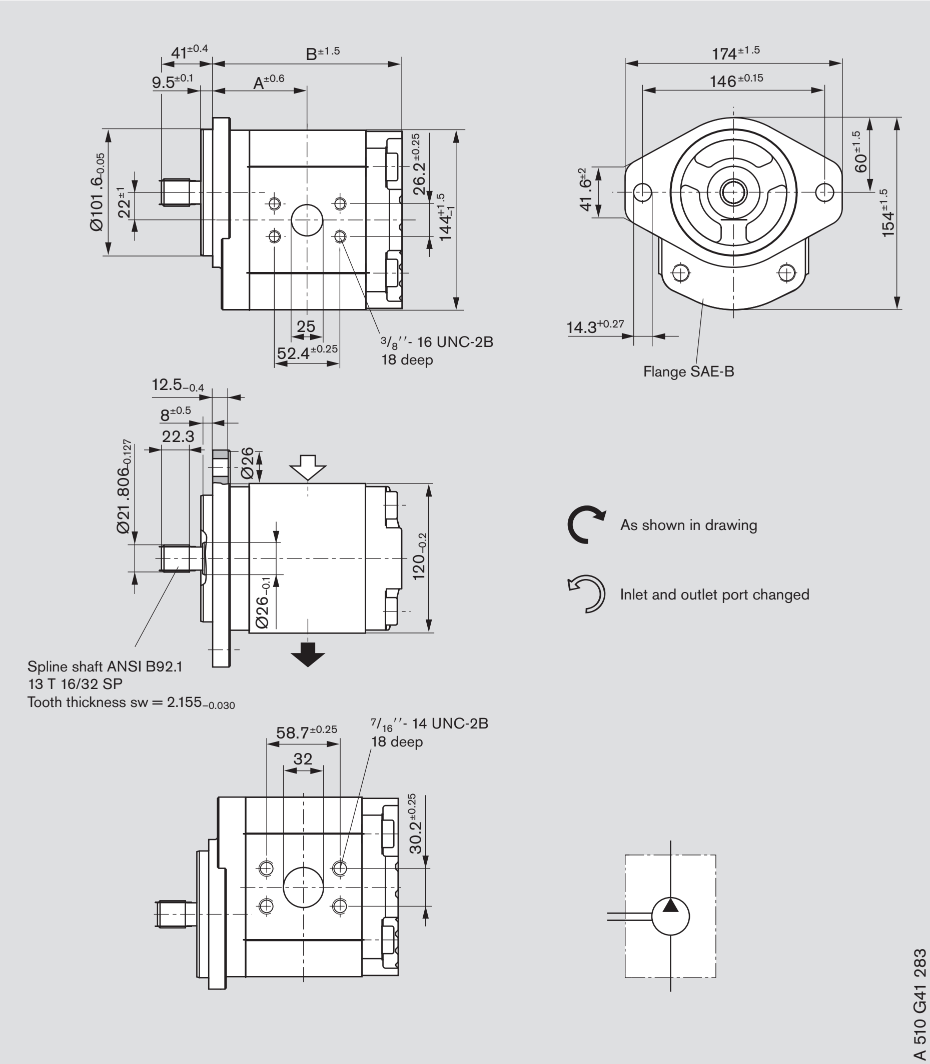


Ordering code:
AZPG – 22 – □ □ □ R D C 40 M B

Displacement [cm^3/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
22.5		**9 510 490 041**	250	3000	66.4	130.3
25		**9 510 490 042**	250	3000	67.4	132.3
28		**9 510 490 043**	250	3000	68.7	134.8
32		**9 510 490 044**	250	2800	70.3	138.1
36		**9 510 490 045**	250	2800	71.9	141.5

Dimensions

Standard range

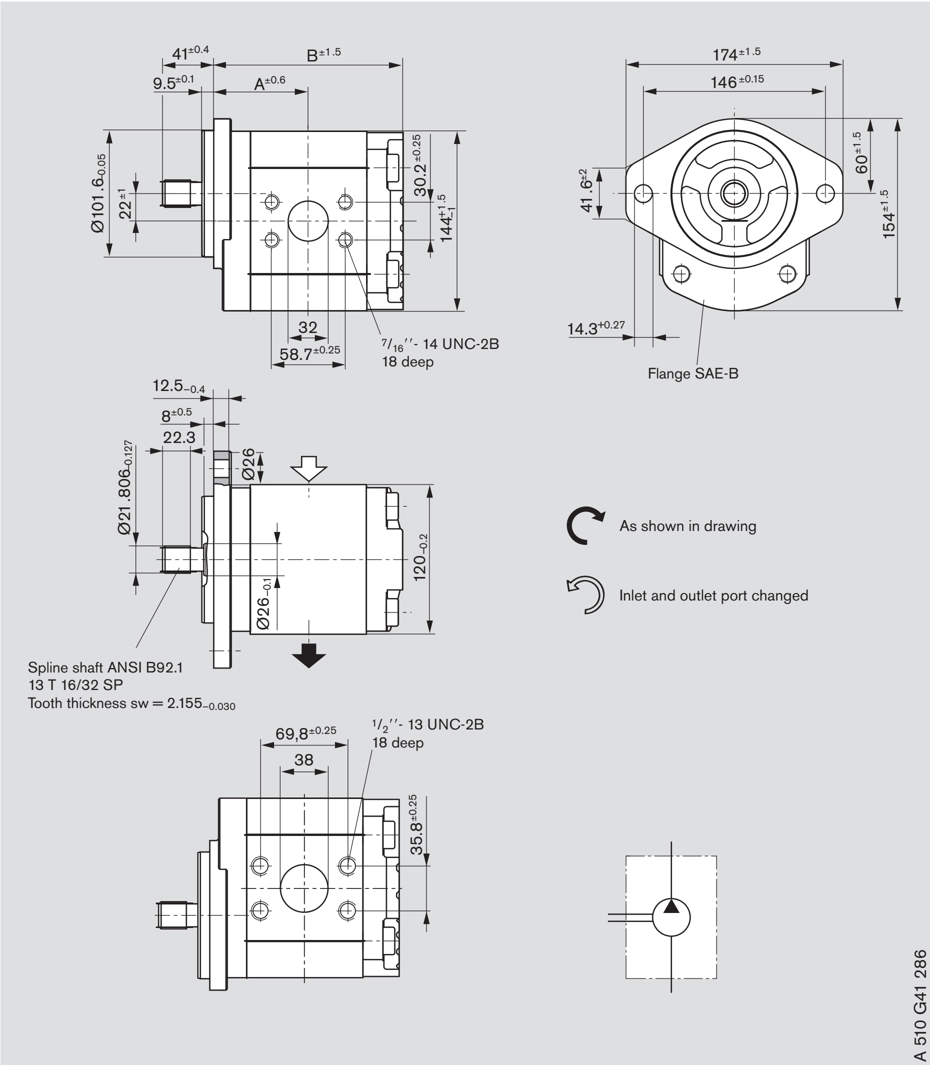


Ordering code:
AZPG – 22 – ☐ ☐ ☐ R D C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
40		**9 510 490 046**	250	2800	73.6	144.8
45		**9 510 490 047**	250	2600	75.6	148.8
50		**9 510 490 048**	220	2600	77.7	153.0

Dimensions

Standard range



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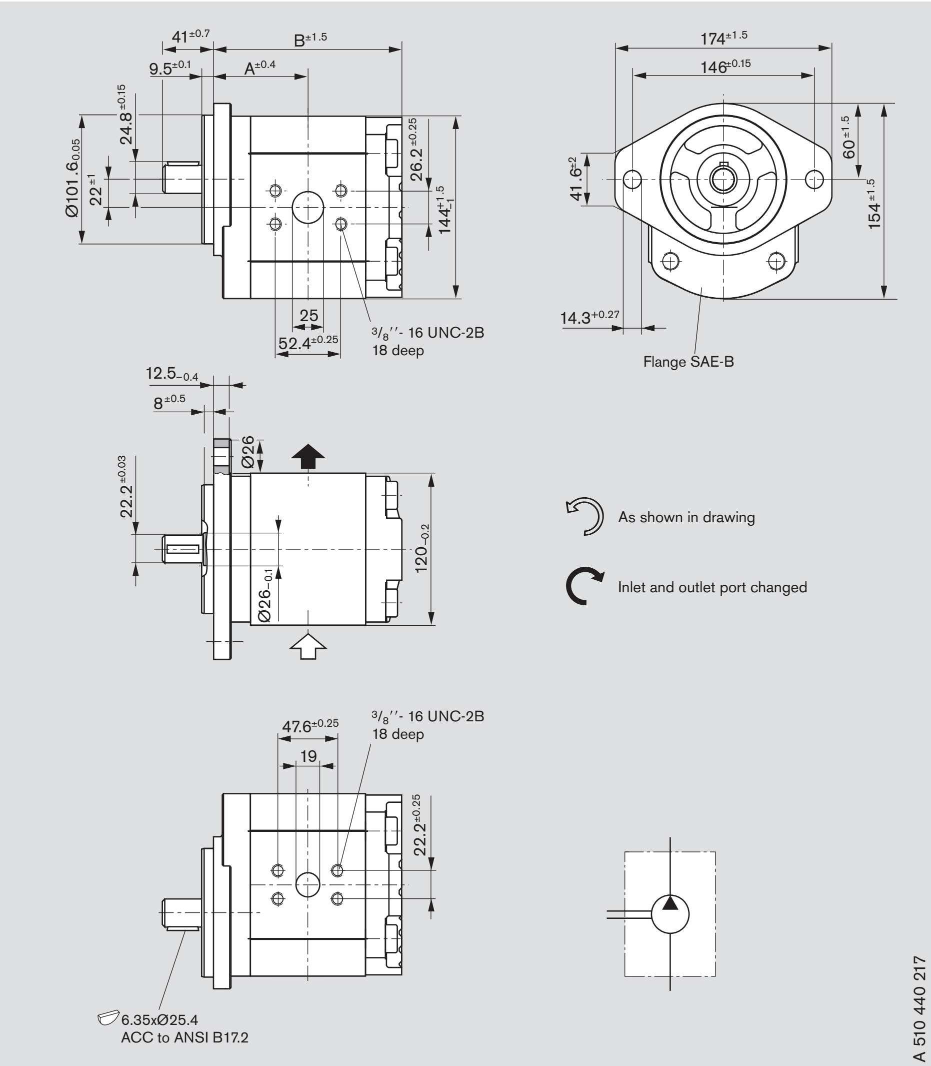
Ordering code:
AZPG – 22 – ☐ ☐ ☐ ☐ D C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	B
56		**9 510 490 049**	195	2300	80.2	157.9
63		**9 510 490 050**	170	2300	83.1	163.8

Dimensions

Standard range

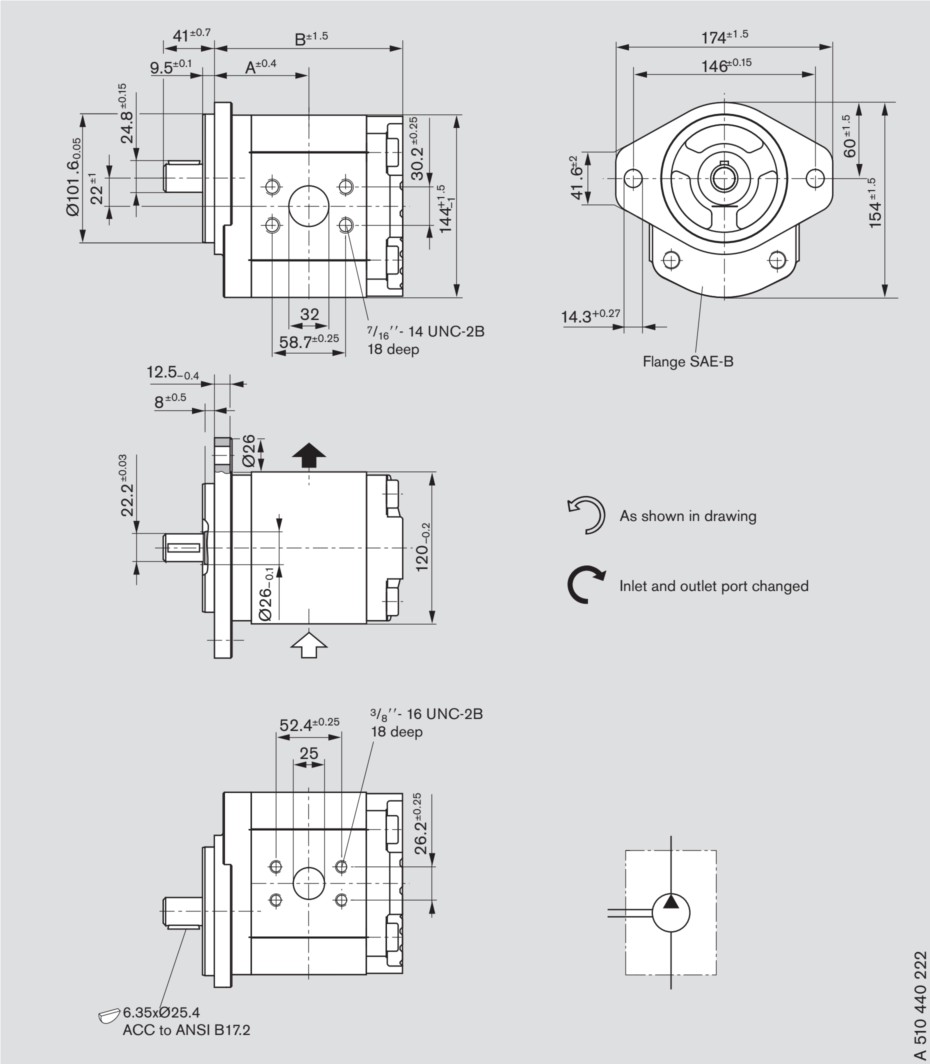


Ordering code:
AZPG – 22 – ☐ ☐ ☐ L Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	B
22.5	**9 510 490 091**		250	3000	66.4	130.3
25	**9 510 490 092**		250	3000	67.4	132.3
28	**9 510 490 093**		250	3000	68.7	134.8
32	**9 510 490 094**		250	2800	70.3	138.1
36	**9 510 490 095**		250	2800	71.9	141.5

Dimensions

Standard range



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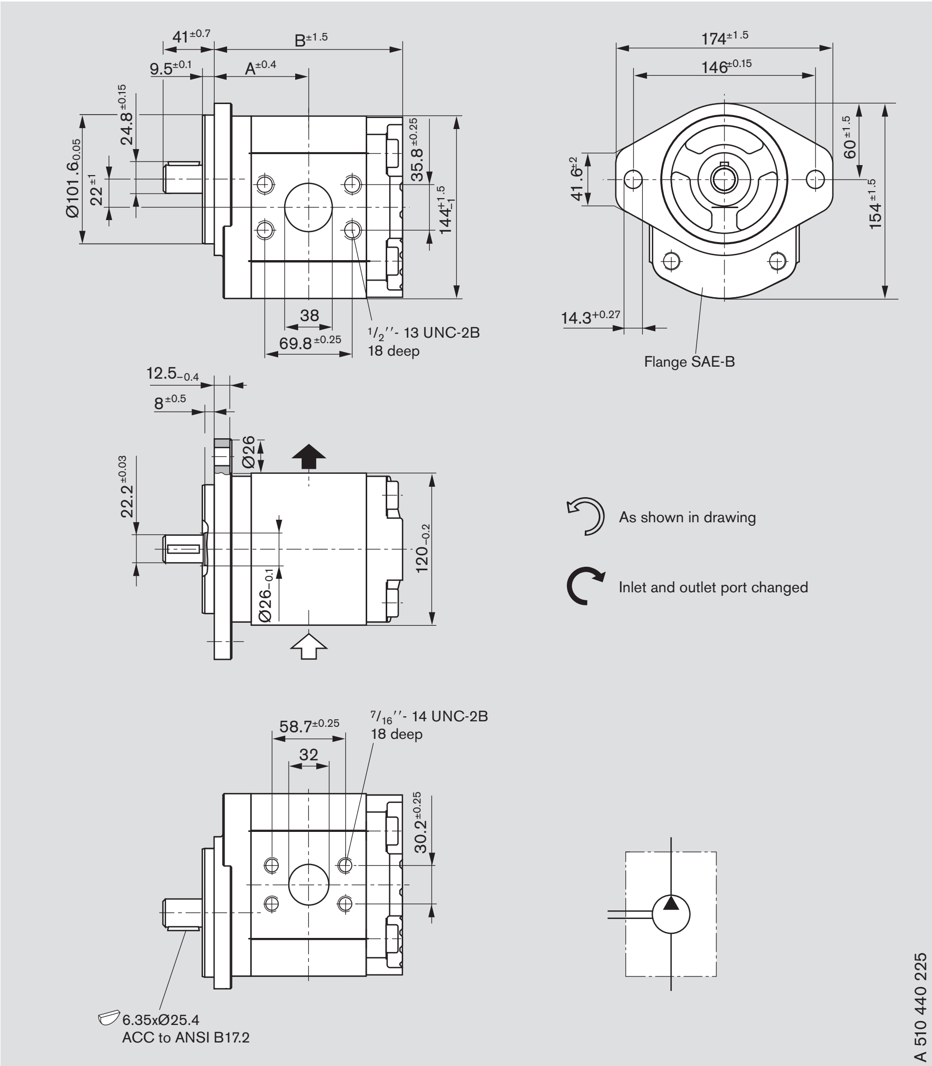
Ordering code:
AZPG – 22 – ☐ ☐ ☐ L Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	B
40	**9 510 490 096**		250	2800	73.6	144.8
45	**9 510 490 097**		250	2600	75.6	148.8
50	**9 510 490 098**		220	2600	77.7	153.0

Dimensions

Standard range

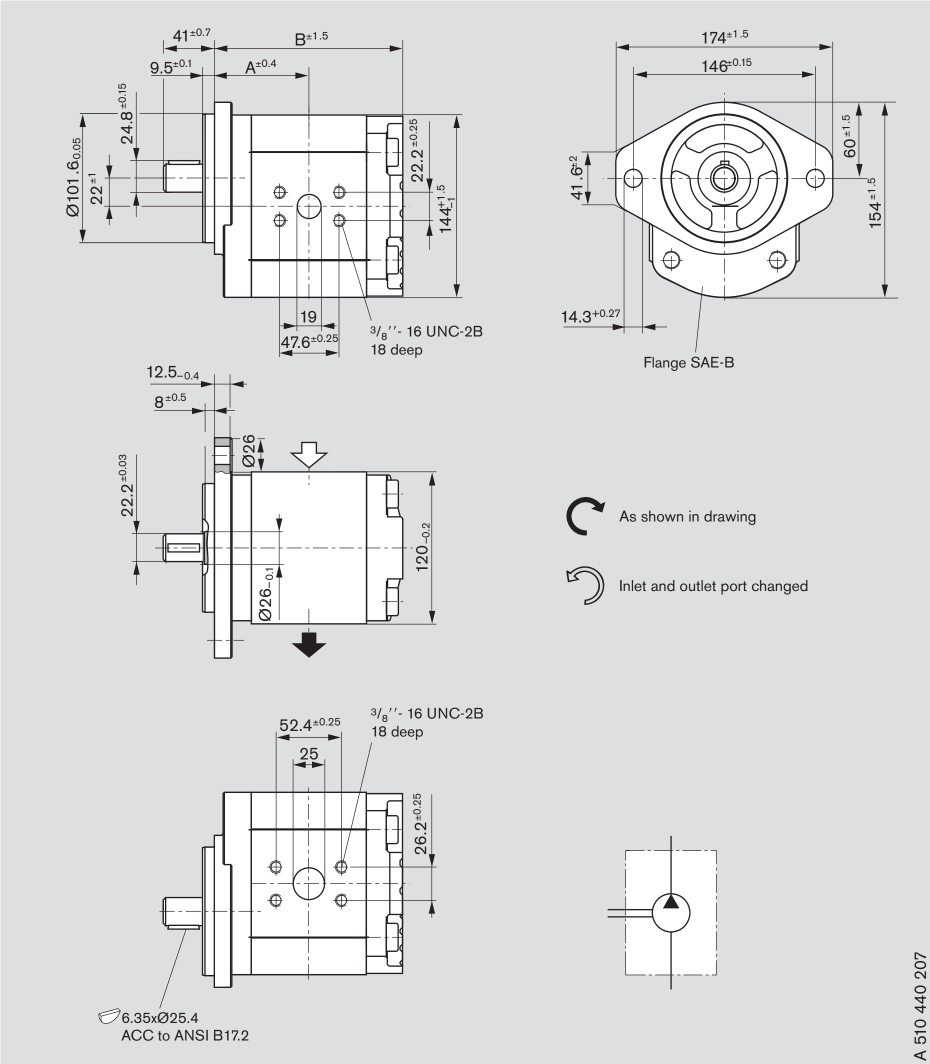


Ordering code:
AZPG – 22 – ☐ ☐ ☐ L Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
56	**9 510 490 099**		195	2300	80.2	157.9
63	**9 510 490 100**		170	2300	83.1	163.8

Dimensions

Standard range

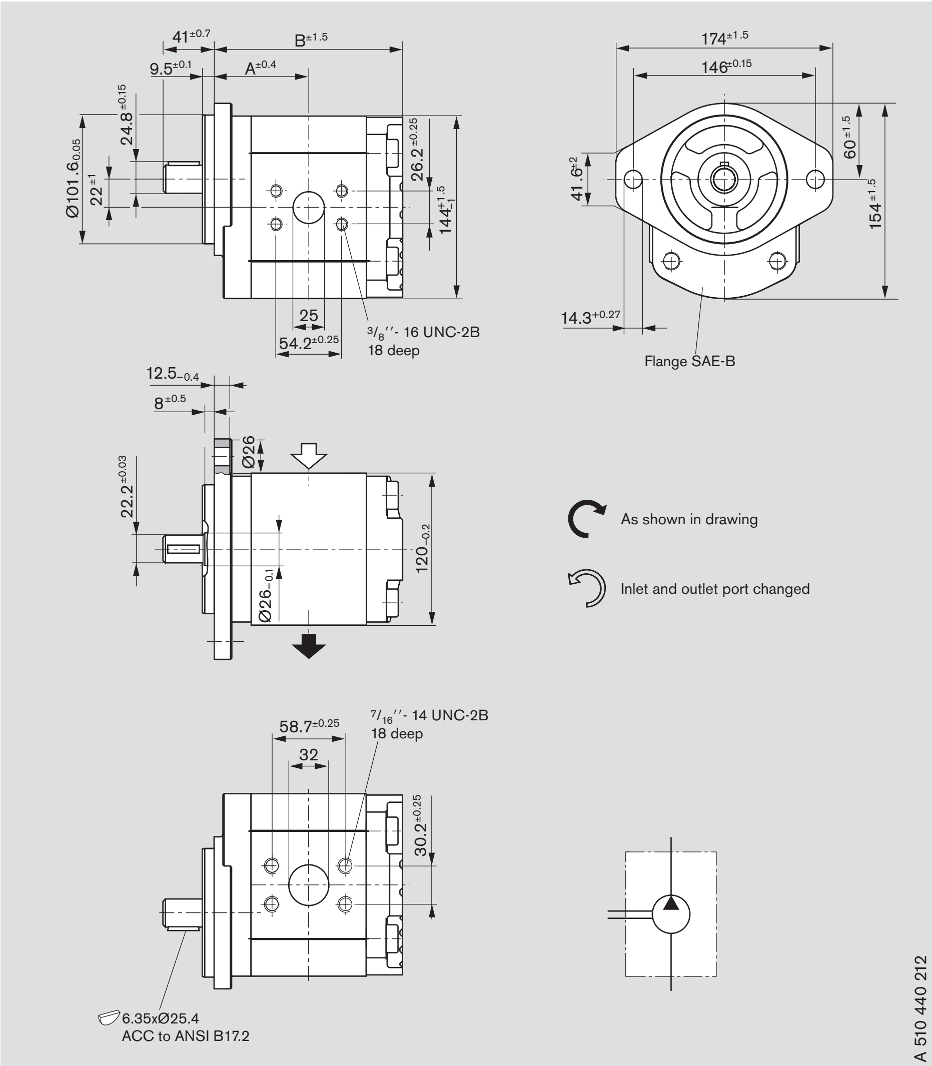


Ordering code:
AZPG – 22 – ☐ ☐ ☐ R Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	B
22.5		**9 510 490 081**	250	3000	66.4	130.3
25		**9 510 490 082**	250	3000	67.4	132.3
28		**9 510 490 083**	250	3000	68.7	134.8
32		**9 510 490 084**	250	2800	70.3	138.1
36		**9 510 490 085**	250	2800	71.9	141.5

Dimensions

Standard range

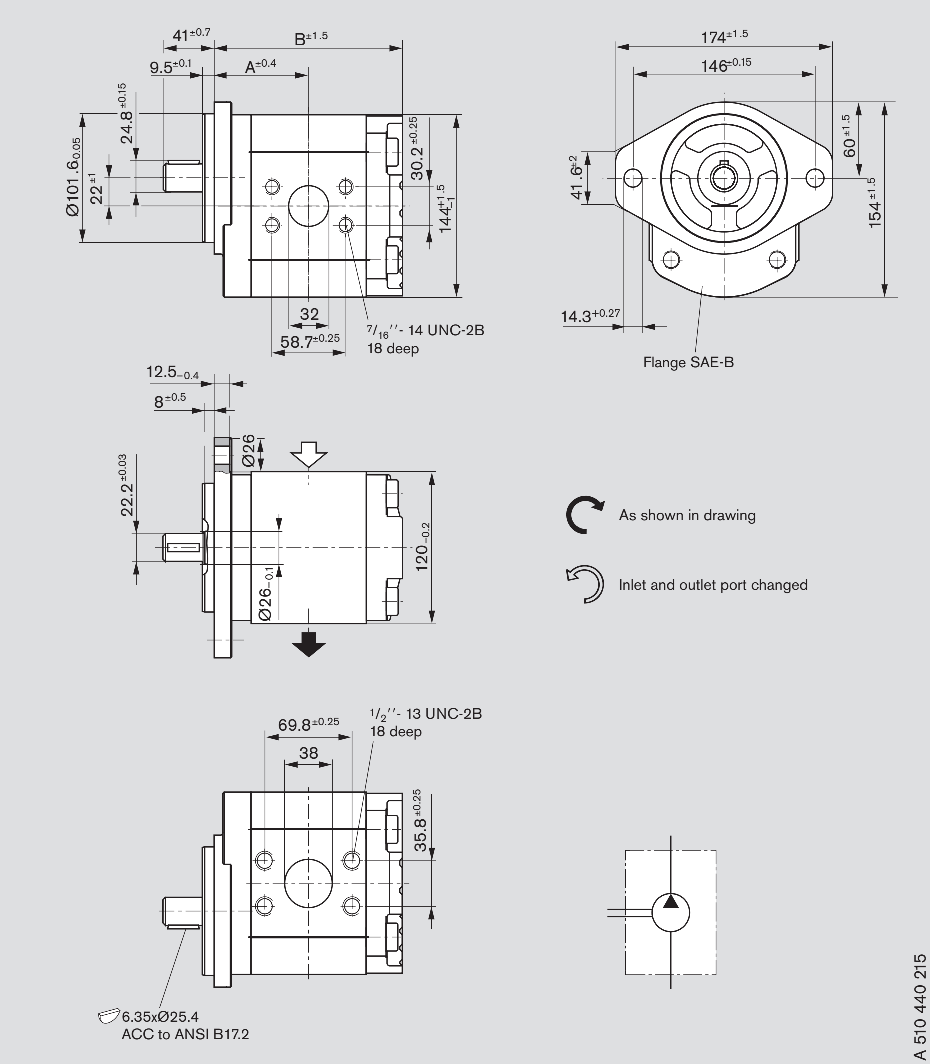


Ordering code:
AZPG – 22 – ☐ ☐ ☐ R Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
40		**9 510 490 086**	250	2800	73.6	144.8
45		**9 510 490 087**	250	2600	75.6	148.8
50		**9 510 490 088**	220	2600	77.7	153.0

Dimensions

Standard range



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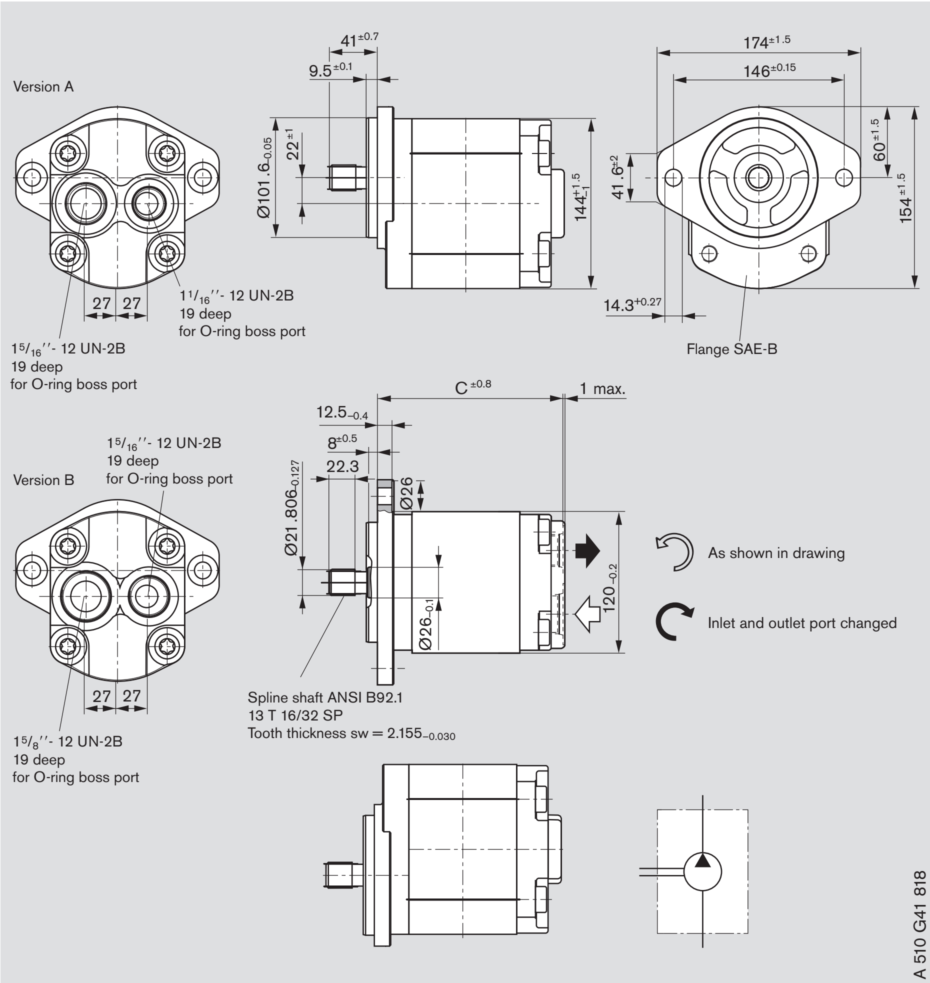
Ordering code:
AZPG – 22 – ☐ ☐ ☐ R Q C 40 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] A	Dimension [mm] B
56		**9 510 490 089**	195	2300	80.2	157.9
63		**9 510 490 090**	170	2300	83.1	163.8

Dimensions

Standard range

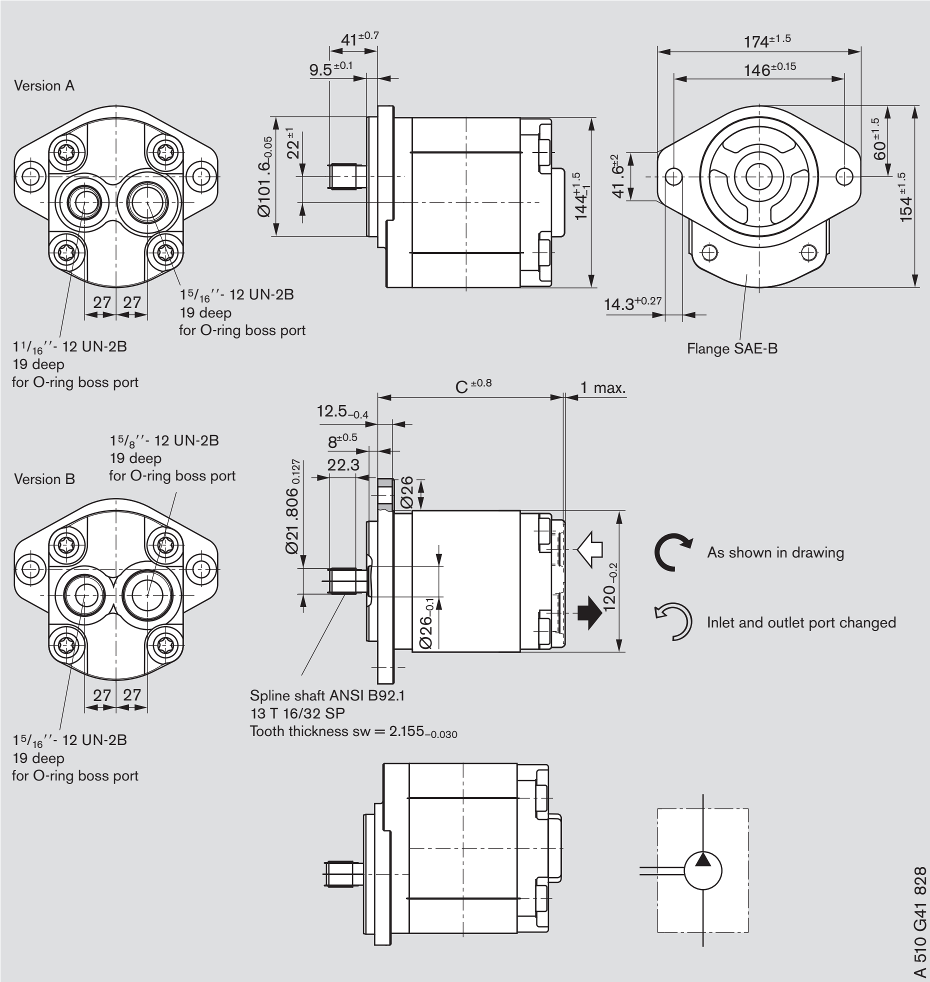


Ordering code:
AZPG – 22 – □ □ □ L D C 12 M A

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] C	Version
22.5	**9 510 490 071**		250	3000	141.2	A
25	**9 510 490 072**		250	3000	143.2	A
28	**9 510 490 073**		250	3000	145.7	A
32	**9 510 490 074**		250	2800	149.0	B
36	**9 510 490 075**		250	2800	152.4	B
40	**9 510 490 076**		250	2800	155.6	B
45	**9 510 490 077**		250	2600	159.7	B
50	**9 510 490 078**		220	2600	163.9	B
56	**9 510 490 079**		195	2300	169.8	B
63	**9 510 490 080**		170	2300	174.6	B

Dimensions

Standard range

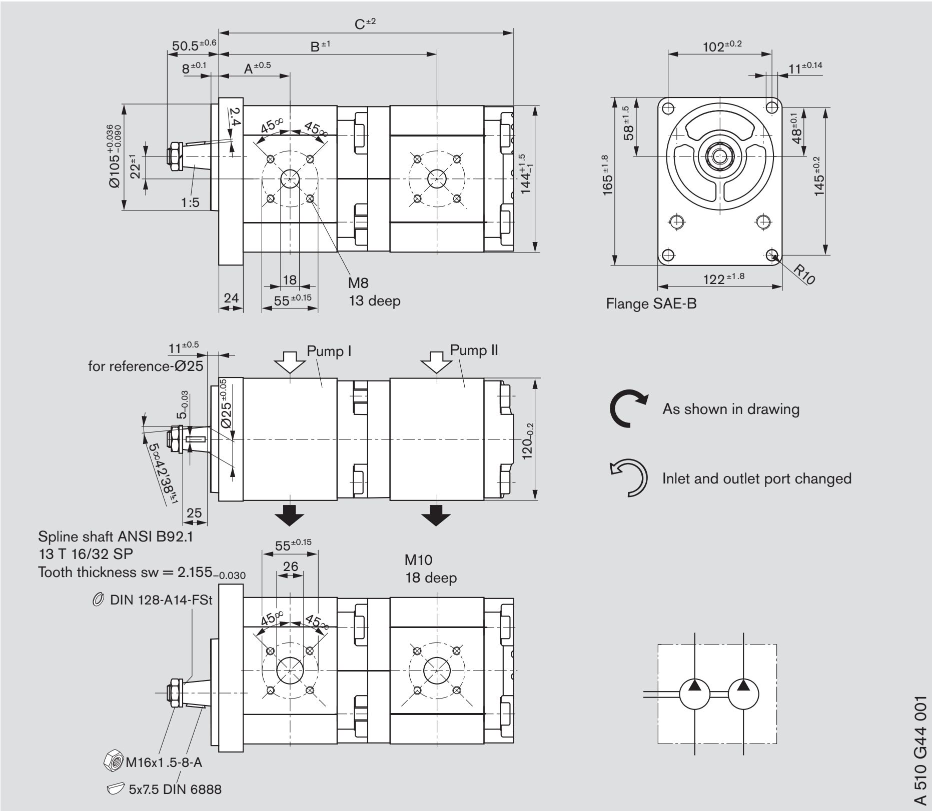


Ordering code:
AZPG – 22 – ☐ ☐ ☐ R D C 12 M A

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	Dimension [mm] C	Version
22.5		**9 510 490 061**	250	3000	141.2	A
25		**9 510 490 062**	250	3000	143.2	A
28		**9 510 490 063**	250	3000	145.7	A
32		**9 510 490 064**	250	2800	149.0	B
36		**9 510 490 065**	250	2800	152.4	B
40		**9 510 490 066**	250	2800	155.6	B
45		**9 510 490 067**	250	2600	159.7	B
50		**9 510 490 068**	220	2600	163.9	B
56		**9 510 490 069**	195	2300	169.8	B
63		**9 510 490 070**	170	2300	174.6	B

Dimensions

Standard range

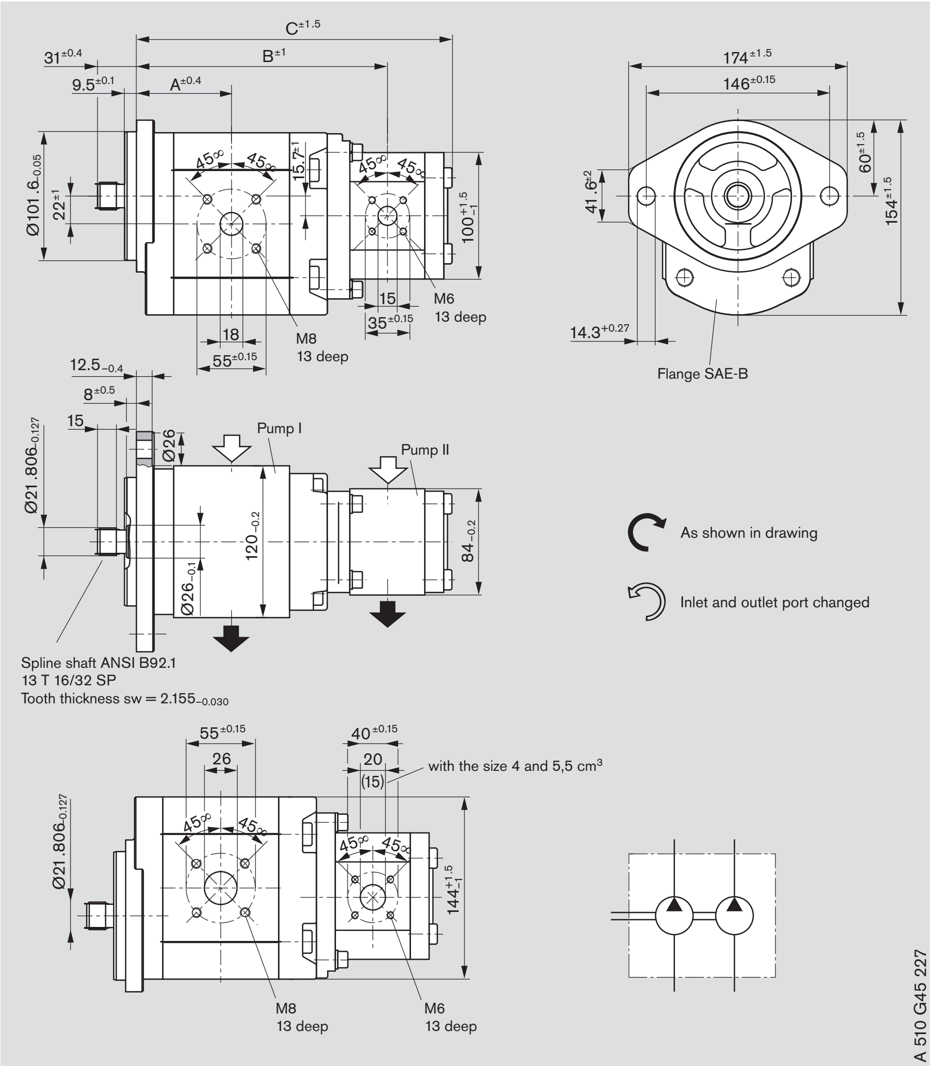


Ordering code:
AZPGG – 22 – □ □ □ / □ □ □ □ C B 20 20 M B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed	Dimension [mm]		
PI	PII	L	R	PI	PII	[rpm]	A	B	C
22.5	22.5		**0 510 765 115**	280	280	3000	60.9	186.4	250.4
22.5	22.5	**0 510 765 430**		280	280	3000	60.9	186.4	250.4
32	22.5		**0 510 767 079**	280	280	2800	64.8	194.2	258.2
32	22.5	**0 510 767 337**		280	280	2800	64.8	194.2	258.2
32	32		**0 510 767 078**	280	230	2800	64.8	198.1	266.0
32	32	**0 510 767 336**		280	230	2800	64.8	198.1	266.0
40	22.5		**0 510 768 051**	260	280	2800	68.1	200.9	264.8
40	22.5	**0 510 768 332**		260	280	2800	68.1	200.9	264.8
40	32		**0 510 768 050**	230	230	2800	68.1	204.8	272.6
40	32	**0 510 768 331**		230	230	2800	68.1	204.8	272.6
40	40		**0 510 768 049**	230	180	2800	68.1	208.1	279.3
40	40	**0 510 768 330**		230	180	2800	68.1	208.1	279.3
45	22.5		**0 510 769 033**	230	280	2600	70.1	204.9	268.9
45	32		**0 510 769 032**	200	230	2600	70.1	208.9	276.7
45	45	**0 510 769 325**		200	160	2600	70.1	214.2	287.4
45	45		**0 510 769 030**	200	160	2600	70.1	214.2	287.4
45	40		**0 510 769 031**	200	180	2600	70.1	212.2	283.3
56	40		**0 510 865 013**	170	180	2300	74.7	221.3	292.4

Dimensions

Standard range

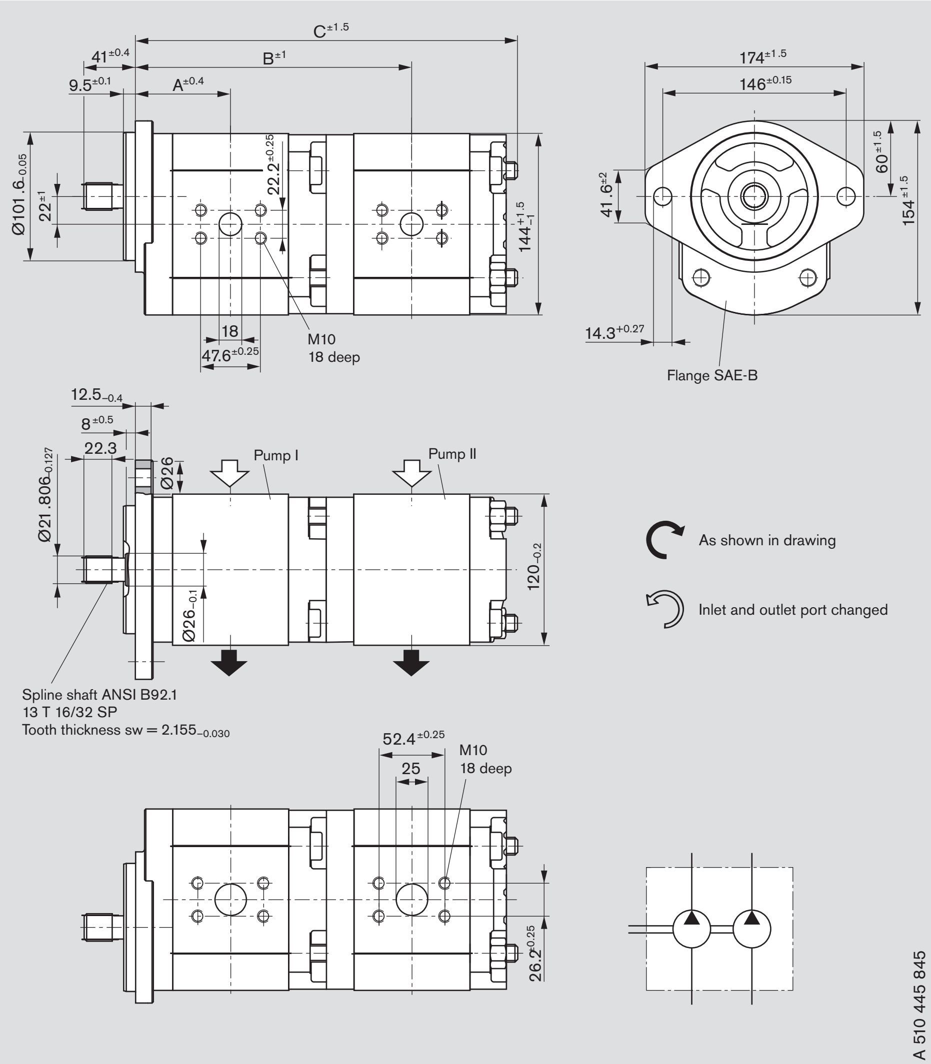


Ordering code:
AZPGF – 22 – □ □ □ / □ □ □ □ D C 20 20 M B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed	Dimension [mm]		
PI	PII	L	R	PI	PII	[rpm]	A	B	C
22.5	16		**0 510 765 118**	250	230	3000	66.4	181.2	236.2
32	16		**0 510 767 067**	250	230	2800	70.3	189.0	244.0
56	16	**0 510 665 320**		200	230	2300	80.2	208.8	263.8
56	19	**0 510 865 319**		200	190	2300	80.2	208.8	268.8
56	22.5		**0 510 865 016**	200	160	2300	80.2	216.4	274.2

Dimensions

Standard range

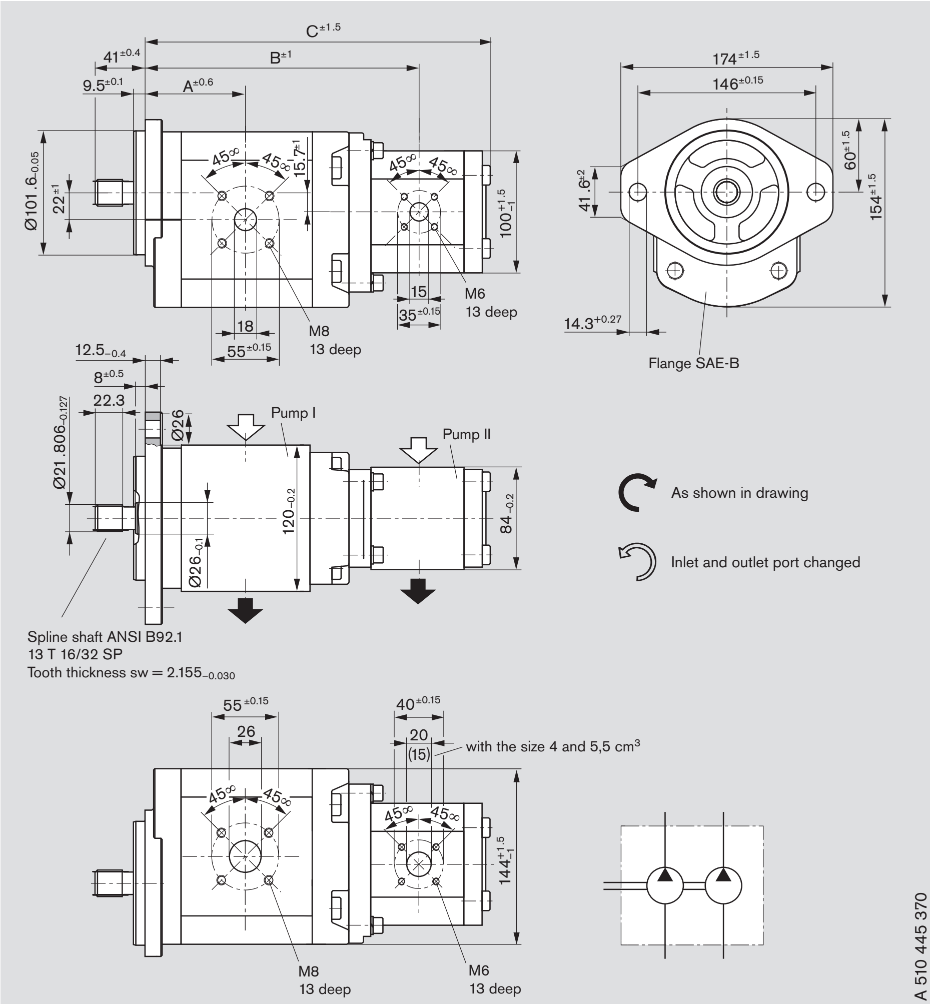


Ordering code:
AZPGG – 22 – □ □ □ □ □ □ □ D C 07 07 M B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed	Dimension [mm]		
PT 1	PT 2	L	R	PT 1	PT 2	[rpm]	A	B	C
28	28		**0 510 766 016**	260	260	2500	68.7	198.7	269.2

Dimensions

Standard range



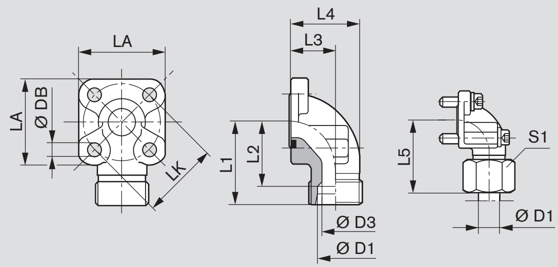
Ordering code:
AZPGF – 22 – □ □ □ □ □ □ □ D C 20 20 M B
AZPGF – 22 – □ □ □ □ □ □ □ D C 20 20 K B*

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed	Dimension [mm]		
PT 1	PT 2	L	R	PT 1	PT 2	[rpm]	A	B	C
32	11	**0 510 767 324***		280	280	1700	70.3	188.5	235.6
32	14		**0 510 767 066**	280	260	2800	70.3	189.0	240.6
32	16	**0 510 767 330**		280	230	2800	70.3	189.0	244.0
32	16	**0 510 767 328***	**0 510 767 064***	280	230	2800	70.3	189.0	244.0
40	14		**0 510 768 043**	280	260	2800	73.6	195.6	247.3
45	11	**0 510 769 318***		250	280	1700	75.6	199.2	246.4
45	16	**0 510 769 319***		250	230	1700	75.6	199.7	254.8
45	16		**0 510 769 022**	280	230	2600	75.6	199.7	254.8
45	19	**0 510 769 321**	**0 510 769 023**	280	190	2600	75.6	199.7	259.8

Fittings

Fittings can be used for rectangular flange 20 see page 7

Gear pump flange, 90° angle

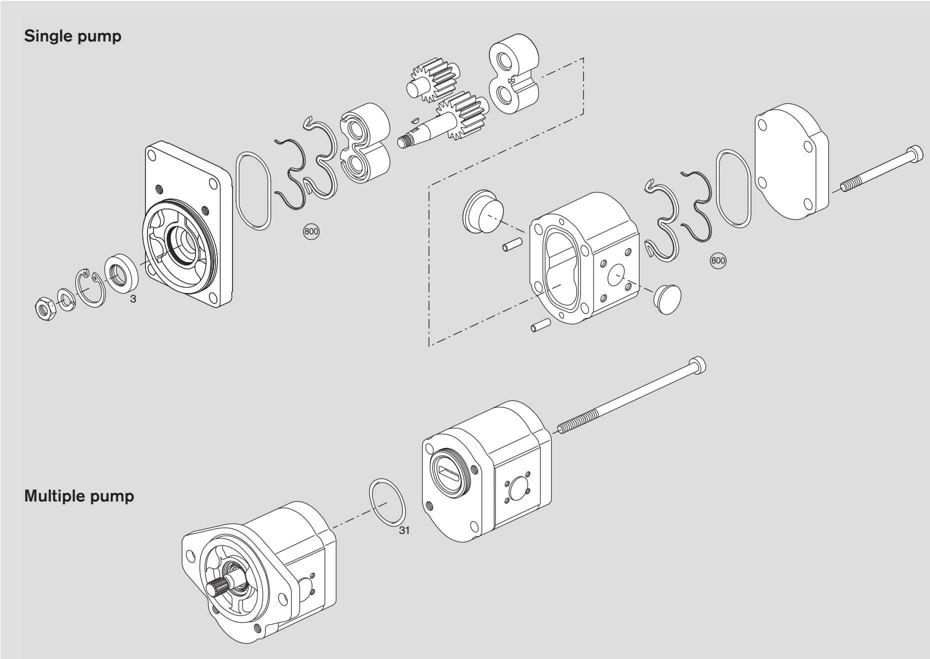


LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	2x	Seal ring	Mass kg	Part number	*p* (bar)
55	20S	17	45	34.5	24.0	40.0	56.0	58	36	8.4	M8x25	M8x50	33x2.5	0.44	**1 515 702 004**	250
55	30S	26	49	35.5	32.0	50.0	62.0	58	50	8.4	M8x25	M8x50	33x2.5	0.50	**1 545 719 006**	250
55	35L	31	49	38.5	32.0	51.5	62.0	58	50	8.4	M8x25	M8x60	32x2.5	0.47	**1 515 702 005**	100
55	42L	38	49	38.0	40.0	64.5	61.0	58	60	8.4	M8x25	M8x70	32x2.5	0.60	**1 515 702 019**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Note
The permissible tightening torques can be found in our publication:
"General operating instructions for external gear units"
RE 07 012-B1.

Spare parts



Page	Ordering code	Seal kit „G“ NBR	Shaft seal ring Pos. 3	Qty.	Dimension	Material
18	AZPG – 22 – □□□ □ C B 20 M B	1517010231	1510283072	1	42 x 26 x 7	NBR
19	AZPG – 22 – □□□ □ H O 30 M B	1517010231	1510283072	1	42 x 26 x 7	NBR
20, 21, 22	AZPG – 22 – □□□ □ D C 07 K B	1517010231	1510283069	1	42 x 26 x 7	FKM
23, 24, 25	AZPG – 22 – □□□ □ Q C 12 M B – S 06 62	1517010231	1510283072	1	42 x 26 x 7	NBR
26, 27, 28	AZPG – 22 – □□□ □ X 07 K B – S 03 03	1517010231	1510283069	1	42 x 26 x 7	FKM
29, 30, 31	AZPG – 22 – □□□ □ D C 07 K B – S 00 39	1517010231	1510283069	1	42 x 26 x 7	FKM
32, 33, 34, 35, 36, 37	AZPG – 22 – □□□ □ D C 12 M B	1517010231	1510283072	1	42 x 26 x 7	NBR
38, 39	AZPG – 22 – □□□ □ Q C 12 M A	1517010234	1510283072	1	42 x 26 x 7	NBR
40, 41, 42, 43, 44, 45 46, 47, 48, 49, 50, 51	AZPG – 22 – □□□ □ D C 40 M B	1517010231	1510283072	1	42 x 26 x 7	NBR
52, 53	AZPG – 22 – □□□ □ D C 12 M A	1517010234	1510283072		42 x 26 x 7	NBR
54	AZPG – 22 – □□□ / □□□ □ C B 20 20 M B					
	Pump section 1	1517010231	1510283072	1	42 x 26 x 7	NBR
			1510283075	1	42 x 26 x 7	FKM
	Pump section 2	1517010208				
55	AZPG – 22 – □□□ / □□□ □ D C 20 20 K B					
	Pump section 1	1517010231	1510283069	2	42 x 26 x 7	FKM
	Pump section 2	1517010208				
56	AZPG – 22 – □□□ / □□□ □ D C 07 07 M B					
	Pump section 1	1517010231	1510283072	1	42 x 26 x 7	NBR
			1510283075	1	42 x 26 x 7	FKM
	Pump section 2	1517010231				
57	AZPG – 22 – □□□ / □□□ □ D C 20 20 M B					
	Pump section 1	1517010231	1510283069	2	42 x 26 x 7	FKM
	Pump section 2	1517010208				

NBR = Perbunan® FKM = Viton®

For multiple pumps

Seal ring Item 31 NBR	1 900 210 145

3

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 14 – 17).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 9 – 11 .

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 18 – 57, are contained in delivery.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

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0 510 665 320	55
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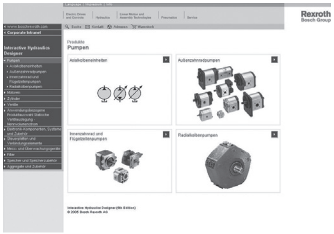
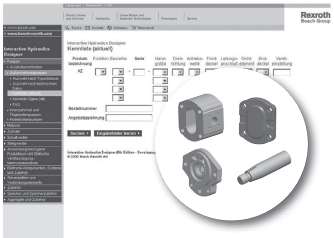
9 510 490 140	25
9 510 490 141	25

The AZ configurator at www.boschrexroth.com/azconfigurator

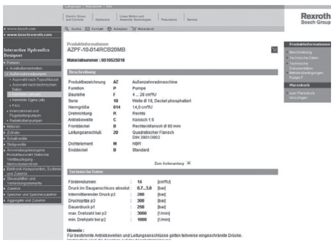
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Bosch Rexroth AG
External Gear Units
Robert-Bosch-Straße 2
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brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Rexroth
Bosch Group

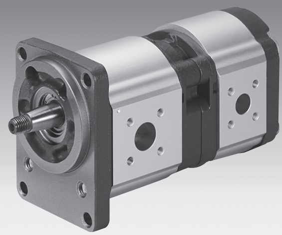
External Gear Pumps
Series S

RE 10 095/02.12
Replaces:
RE 10 095/09.09

AZPS-...

Fixed pumps
$V = 4.0...28\ cm^3/rev$

SILENCE



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Features

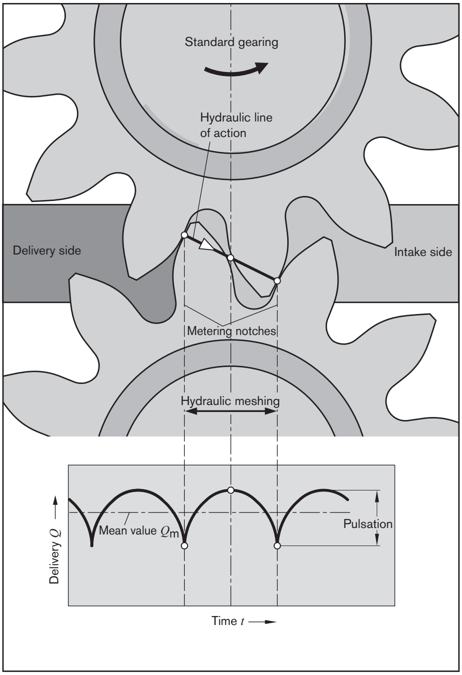
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports:
  connection flange or screw thread
- Optimized pressure pulsation with reduced noise emissions and vibration excitation in the system
- Consistent high quality
- Considerably longer service life due to reinforced shaft and case

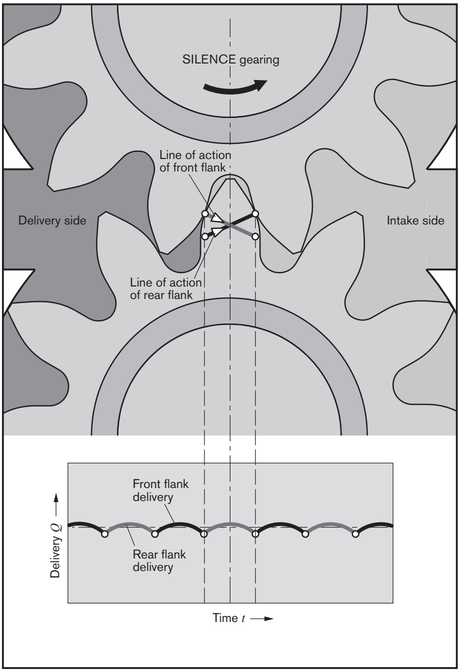
General

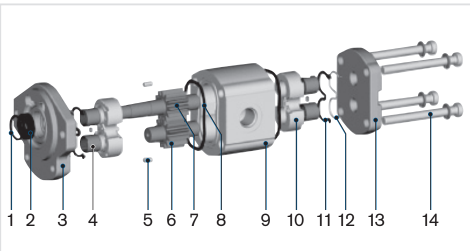
The key task of external gear units is to convert mechanical energy (torque and rotational speed) into hydraulic energy (flow and pressure). In external gear motors this is the other way round. These machines are required to be highly efficient in order to avoid unnecessary heat. This efficiency is achieved by means of precision production engineering and pressure-sensitive gap sealing.

Moreover, in the low-noise SILENCE pumps, the dual-flank principle helps to reduce flow pulsation by up to 75 %.

The displacement method







1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

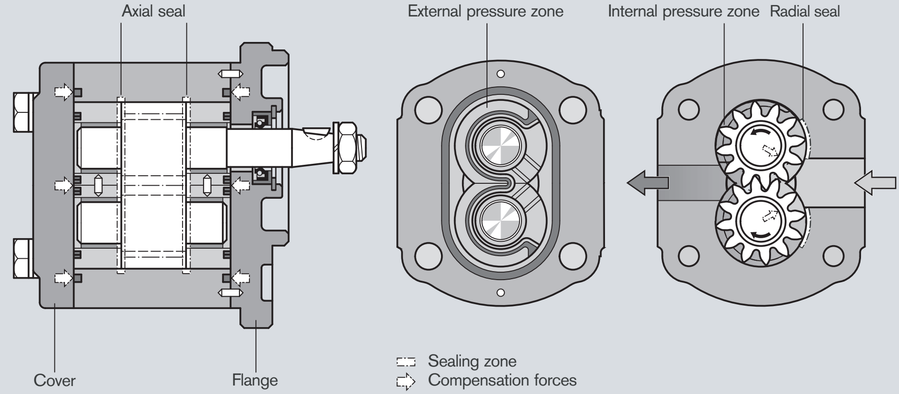
The geometry of the displacement gearing, matched in form by the rotation of the drive shaft, results in the parabolic flow characteristic shown here on the left. In a standard pump, this characteristic is repeated each time a gear tooth meshes. With their dual-flank system, the flow pulsation of SILENCE pumps is reduced by 75 % – with correspondingly lower excitation of downstream system components – at double the fundamental frequency. During this process, the gear pair exhibits an extremely reduced rear flank backlash, so that hydraulic sealing is provided not just by the front flank of the driven gear, but also by the rear flanks. In this way, the front and rear flanks alternately contribute to flow displacement. And by adapting the shape of the metering notches, the expansion of the hydraulic line of action is half that of the standard pump.

Construction

The external gear unit consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

Gear pump axial compensation



3

Product overview of “SILENCE standard range”

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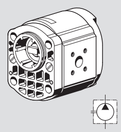
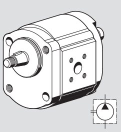
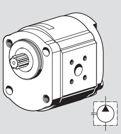
	19
	20
	21

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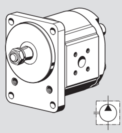
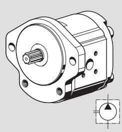
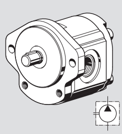
	22
	23
	24

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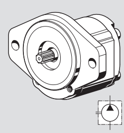
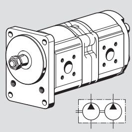
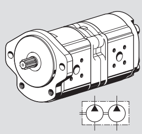
	25
	26
	27

Ordering code

External gear units Single pumps “SILENCE”

AZ	P	S	–	x	x	–		016	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
1x = Standard bearing
2x = Reinforced bearing

Version
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size (S)
004 = 4.0 cm³/rev
005 = 5.5 cm³/rev
008 = 8.0 cm³/rev
011 = 11.0 cm³/rev
014 = 14.0 cm³/rev
016 = 16.0 cm³/rev
019 = 19.0 cm³/rev
022 = 22.5 cm³/rev
025 = 25.0 cm³/rev
028 = 28.0 cm³/rev

Direction of rotation
R = Clockwise
L = Counter-clockwise

*) Some of the special designs shown on pages 19–27 are not covered in the illustration of the ordering code.

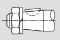
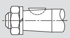
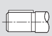
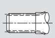
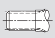
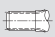
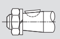
Special design *)

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

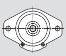
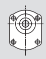
Rear cover
B = Standard
D = PRV residual flow internal
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM

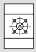
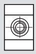
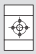
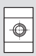
Drive shafts

			Suitable front cover
C	Tapered key shaft 1 : 5		B P
H	Tapered key shaft 1 : 8		O
N	Dihedral claw		M
Q	Straight keyed shaft SAE J 744 16-1		R
R	Splined shaft SAE J 744 16-4 9T		R C
P	Splined shaft SAE J 744 19-4 11T		R C
F	Splined shaft DIN 5482 B 17 x 14		B P
S	Tapered key shaft 1 : 5 for flange A		A

Front cover

B	Square flange Centering Ø 80 mm	
R	SAE J 744 82-2 A 2-bolt flange Ø 82.55 mm	
P	2-bolt mounting Centering Ø 50 mm	
O	Square flange Centering Ø 36.47 mm	
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm	
M	2-bolt mounting Centering Ø 52 mm with seal ring	
A	Outboard bearing Ø 80 mm, Type 1	
N	2-bolt mounting Centering Ø 50 mm	

Line ports

20	Rectangular flange	
12	Thread (UN-2B) SAE seal ring BOSS	
30	Rectangular flange	
01	Pipe thread ISO 228/1	
03	Thread, metric ISO 6149 with seal ring	

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units Multiple pumps “SILENCE”

AZ	P	GGSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm^3/rev
S = 4.0...28 cm^3/rev
F = 4.0...28 cm^3/rev
N = 20.0...36 cm^3/rev
G = 22.5...63 cm^3/rev

Series, relates to pump section 1
1x = Standard bearing
2x = Reinforced bearing

Version, relates to pump section 1
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = Clockwise,
L = Counter-clockwise

Rear cover
relates to last pump section
B = Standard

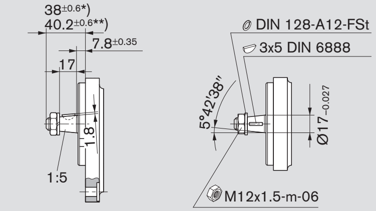
Seals
M = NBR
P = FKM
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts relates to pump part 1		Suitable front cover	Front cover relates to pump part 1		Line ports every pump parts	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**02**	Thread, metric DIN 3852 T1
Series F, S:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm		
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
N	Dihedral claw	**M**	**M**	Centering Ø 52 mm with seal ring		
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm		

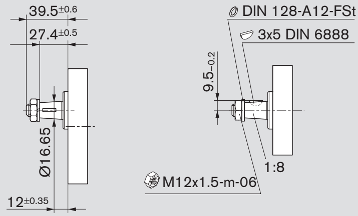
Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Drive shafts

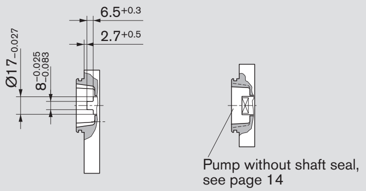
C



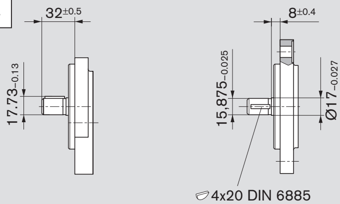
H



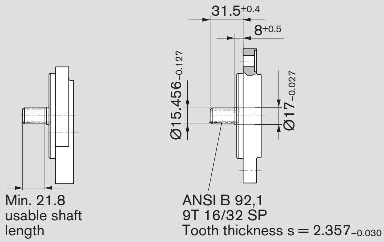
N



Q



R



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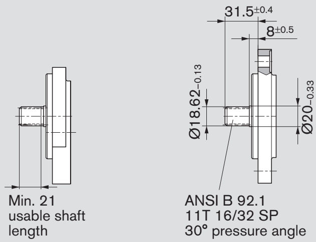
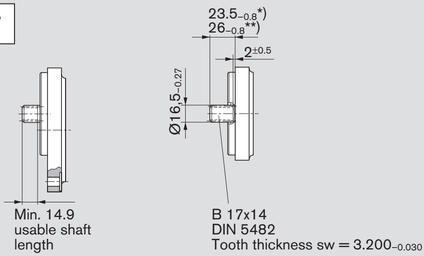


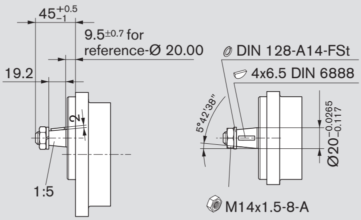
F



*) in combination with front cover B

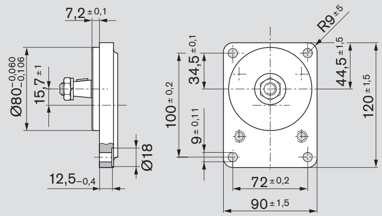
**) in combination with front cover P

S

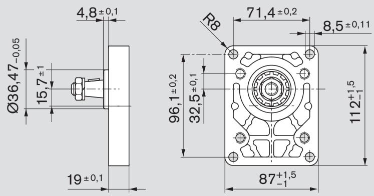


Front cover

B



O



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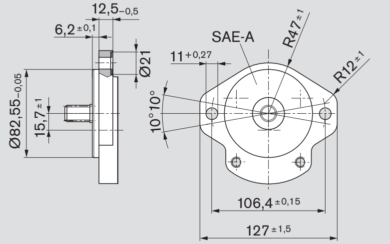

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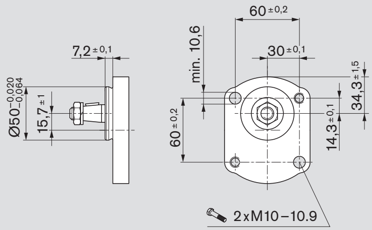
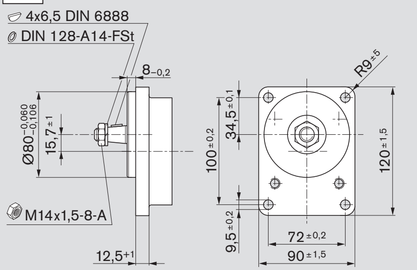


A



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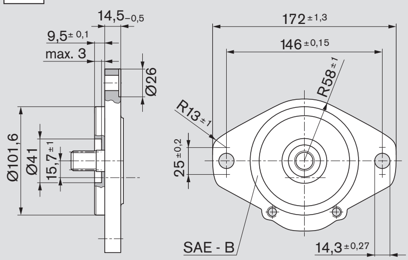

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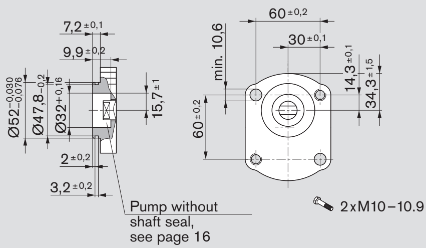
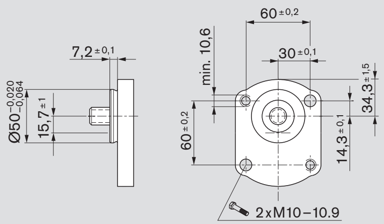
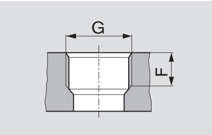


N



3

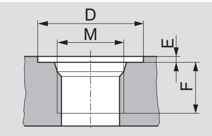
Line ports



01 **Pipe thread ISO 228/1**

At pressures $p_2 > 210$ bar limited service life

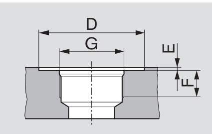
Ordering code	Size	Pressure side		Suction side	
		G	F	G	F
01	4...16 cm^3	G $^1/_2$	16	G$^3/_4$	16
	19...28 cm^3	G$^3/_4$		G1	19



03 **Thread, metric ISO 6149 with seal ring**

At pressures $p_2 > 210$ bar limited service life

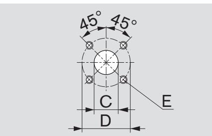
Ordering code	Size	Pressure side				Suction side			
		M	D	E	F	M	D	E	F
03	4...5.5 cm^3	M18 x 1.5	29	0.5	16	M18 x 1.5	29	0.5	16
	8...16 cm^3	M22 x 1.5	34		18	M27 x 1.5	40		19
	19...28 cm^3					M33 x 2	46		22



12 **Thread (UN-2B, UNF-2B) SAE Seal ring BOSS**

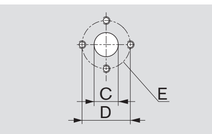
At pressures $p_2 > 210$ bar limited service life

Ordering code	Size	Pressure side				Suction side			
		G	D	E	F	G	D	E	F
12	4...5.5 cm^3	9/16–18 UNF-2B	25	0.5	13	9/16–18 UNF-2B	25	0.5	13
	8 cm^3	7/8–14 UNF-2B	35		16	7/8–14 UNF-2B	35		16
	11...28 cm^3					1 1/16–12 UN-2B	45		19



20 **Rectangular flange**

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
20	4...5.5 cm^3	15	35	M6, depth 13	15	40	M6, depth 13
	8...16 cm^3				20		
	19...28 cm^3				26	55	M8, depth 13

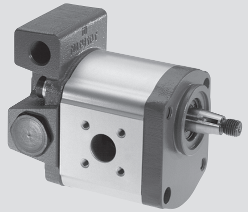


30 **Rectangular flange**

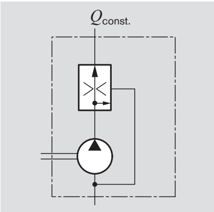
Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
30	4...8 cm^3	13.5	30.2	M6, depth 13	13.5	30.2	M6, depth 13
	11...28 cm^3				20.0	39.7	M8, depth 13

Gear pumps with integral valves

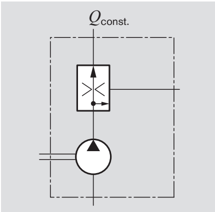
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



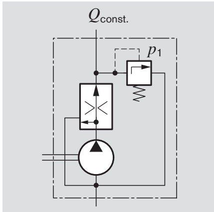
Upon request



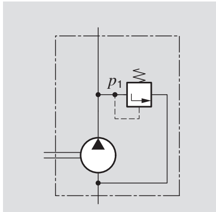
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min
p_1 = 100...180 bar



Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

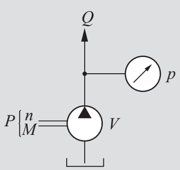
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

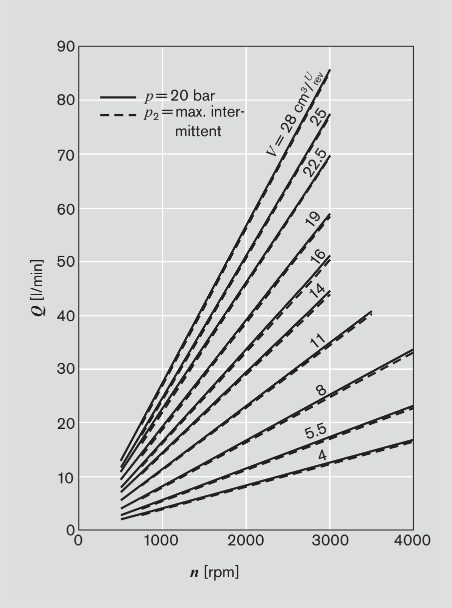
n —— $\eta_v \longrightarrow Q$
M —— $\eta_{hm} \longrightarrow p$
P —— $\eta_t \longrightarrow p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

Caution: η [%] e.g. 95 [%]

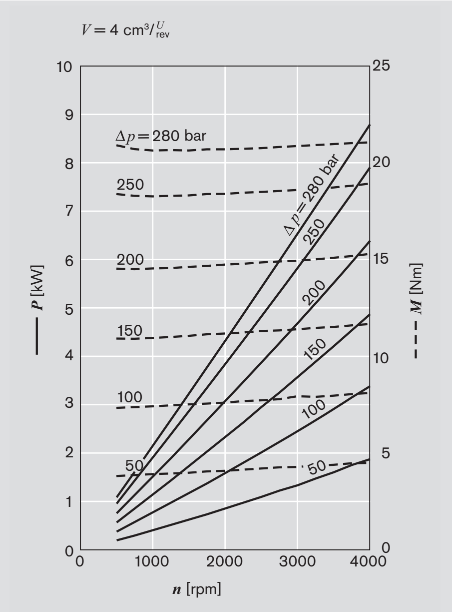
3

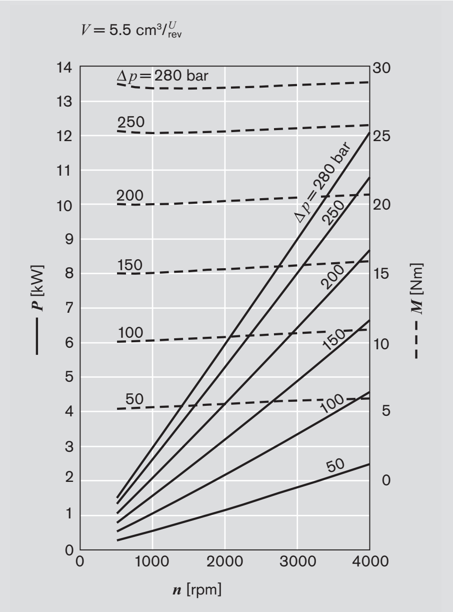
Performance charts



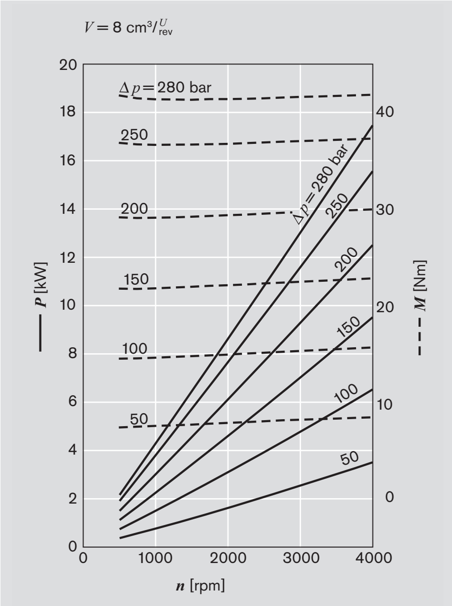
$\nu = 35$ mm²/s, $\vartheta = 50$ °C

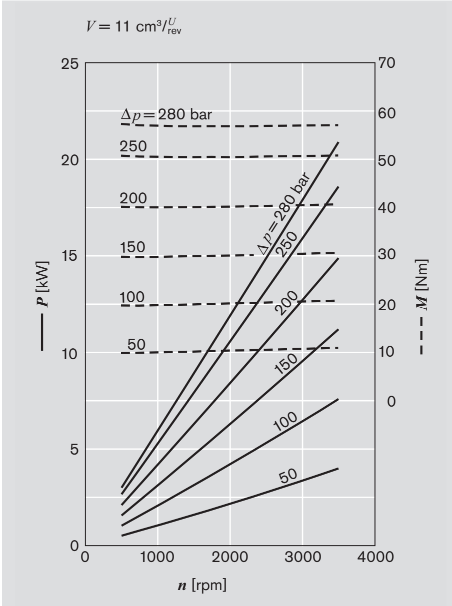
$Q = f(n,V)$ incl. η_v
$P = f(n, p)$ ——— incl. η_t
$M = f(n, p)$ – – – incl. η_{hm}

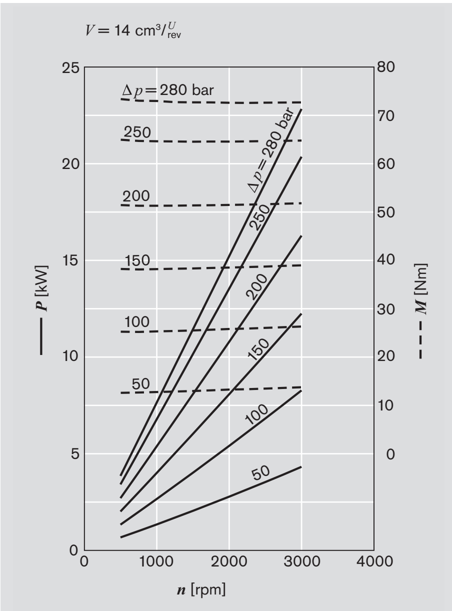


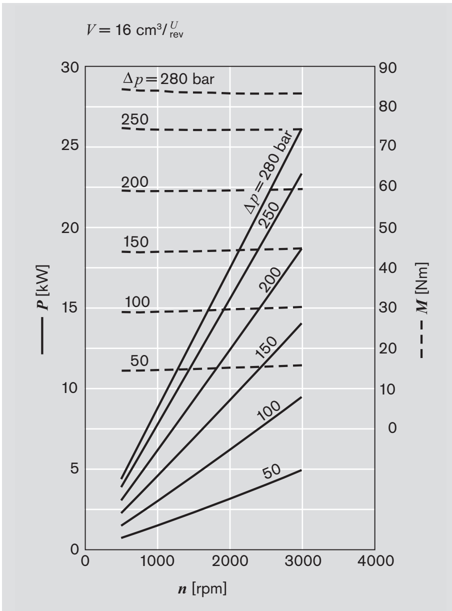


Performance charts (continued)

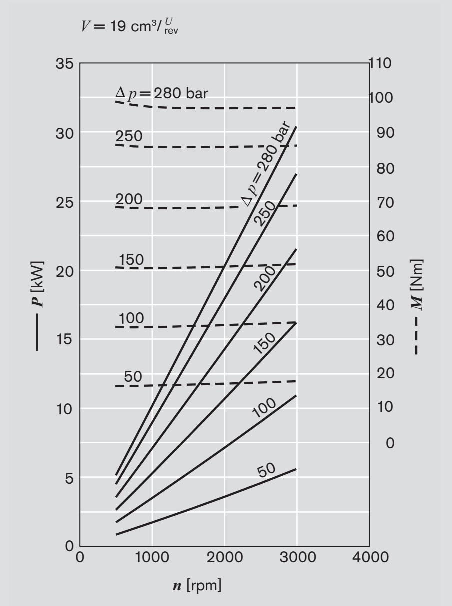


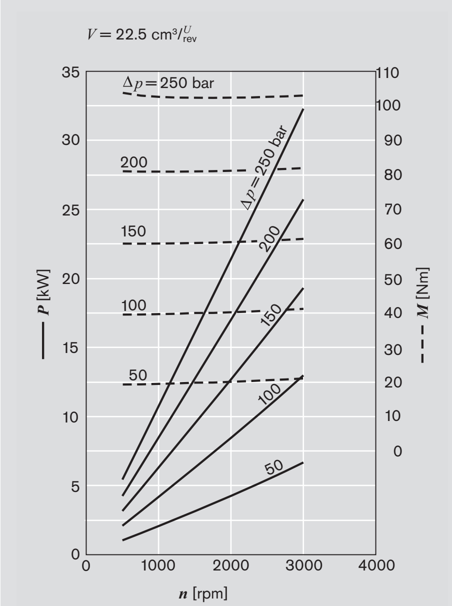


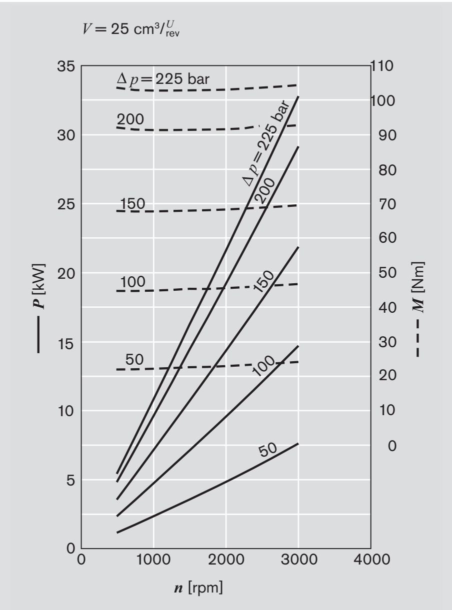


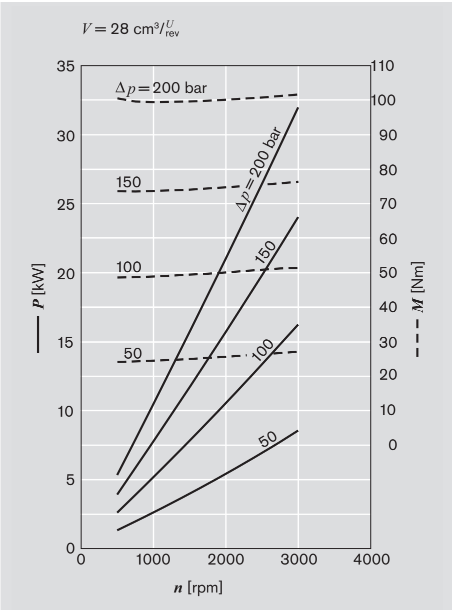


Performance charts (continued)





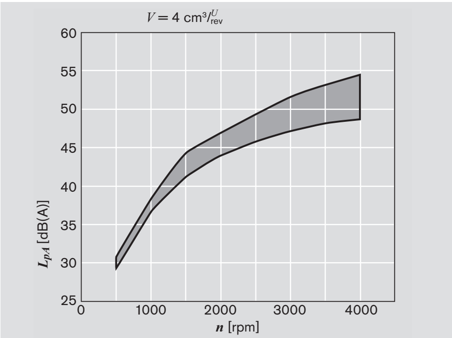


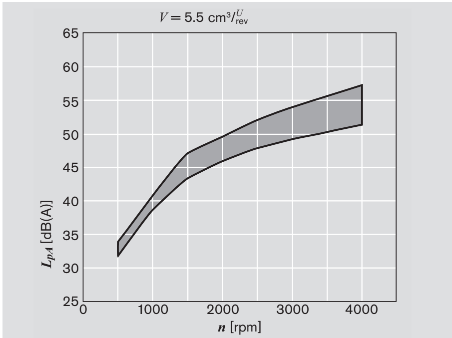


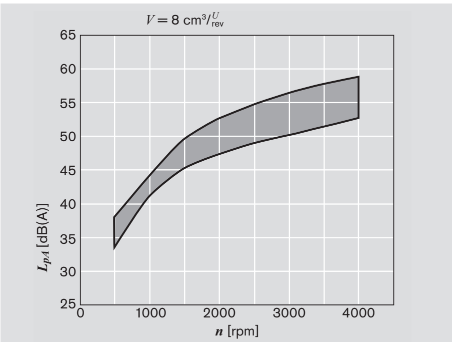
Noise charts

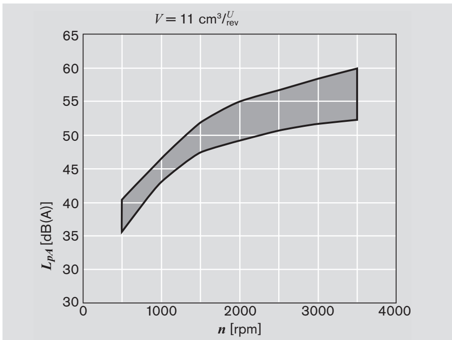
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 15 Specifications table).
Oil data: $\nu = 32\ mm^2/s$, $\vartheta = 50\,°C$.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

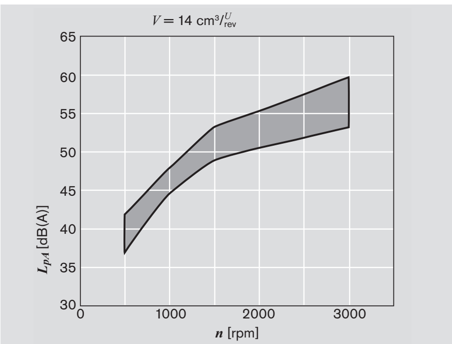
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

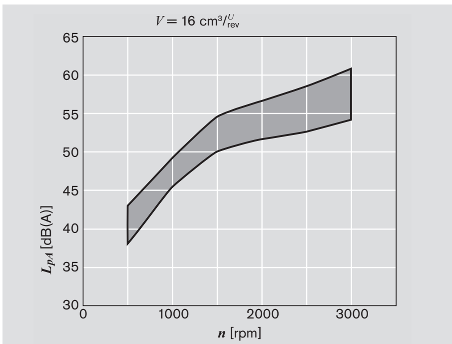












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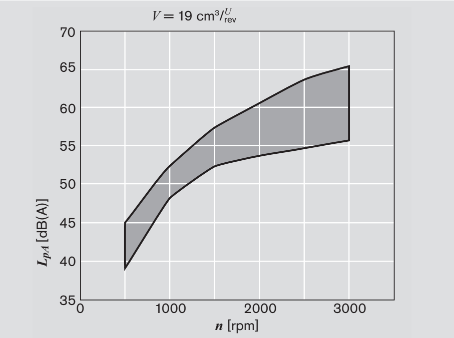
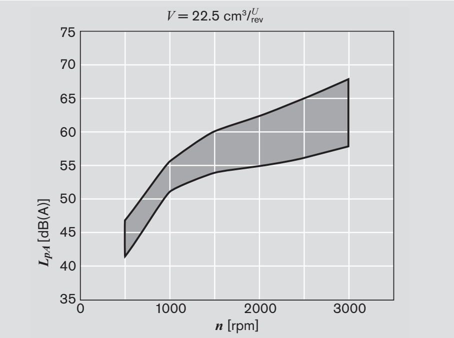
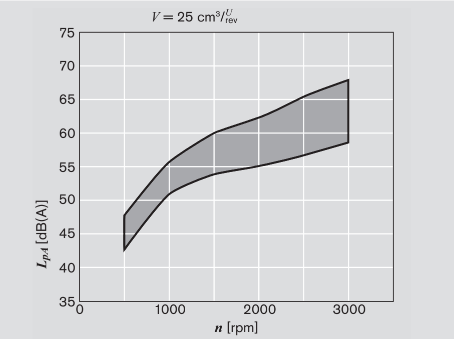
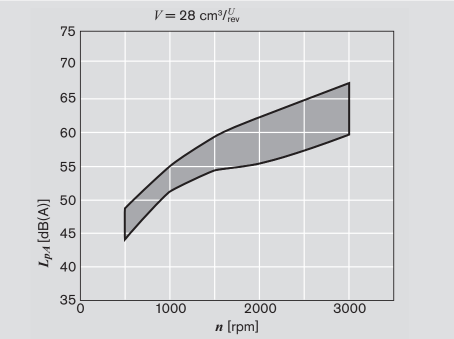
Noise charts (continued)









Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Screw, flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	−30 °C...+80 °C or max. 110 °C with FKM seal
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals*) max. +110 °C with FKM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

Safety requirements pertaining to the whole systems are to be observed.

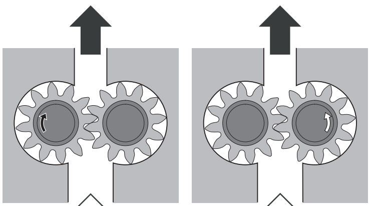
In the case of applications with high numbers of load cycles please consulting.

3

Definition of direction of rotation

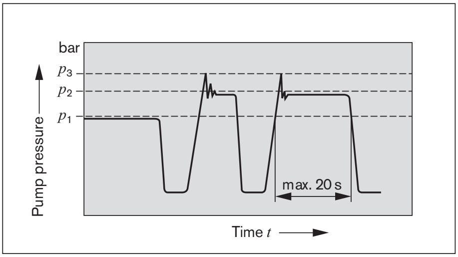
Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps.On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Clockwise rotation Counter-clockwise rotation

Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

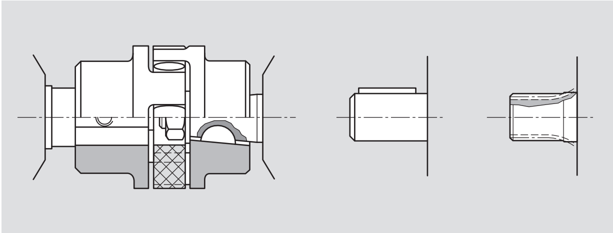
Series			AZPS-1x						AZPS-2x			
Displacement	V	cm³/rev	4	5.5	8	11	14	16	19	22.5	25	28
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)									
Max. continuous pressure	p_1	bar	250							220	195	170
Max. intermittent pressure	p_2	bar	280							250	225	200
Max. peak pressure	p_3	bar	300							290	265	240
Min. rotational speed at bar	< 100	rpm	600	500	500	500	500	500	500	500	500	500
12 mm²/s	100...180	rpm	1200	1200	1000	1000	800	800	800	800	800	800
	180... p_2	rpm	1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
25 mm²/s	p_2	rpm	700	700	700	600	500	500	500	500	500	500
Max. rotational speed at	p_2	rpm	4000			3500	3000	3000	3500	3500	3000	3000

Drive arrangement

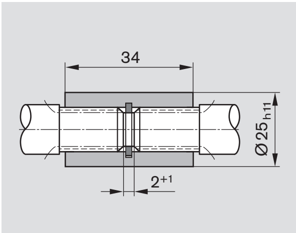
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



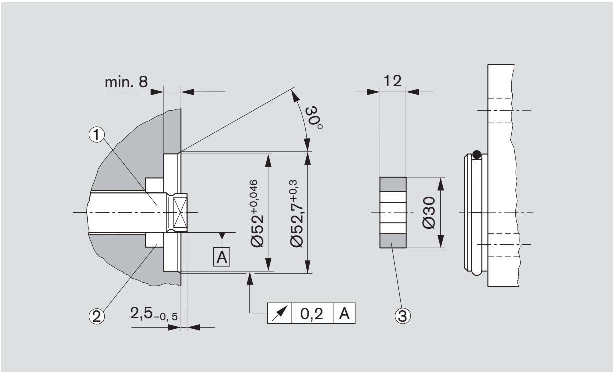
Splined shaft	M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
DIN	100	4...28	p_{max}
SAE 9t	110		
SAE 11t	180		

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 0.6 deep; HRC $60^{\pm 3}$
Surface for sealing ring
ground without rifling $R_{max.} \leq 4 \mu m$

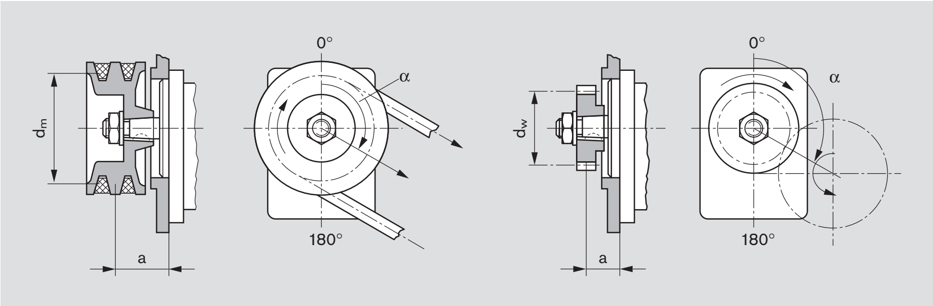
② **Radial shaft seal ring**
Rubber-covered seal (see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
65	4...14	280
	16	230
85	19	250
	22.5	210
	25	190
	28	170

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

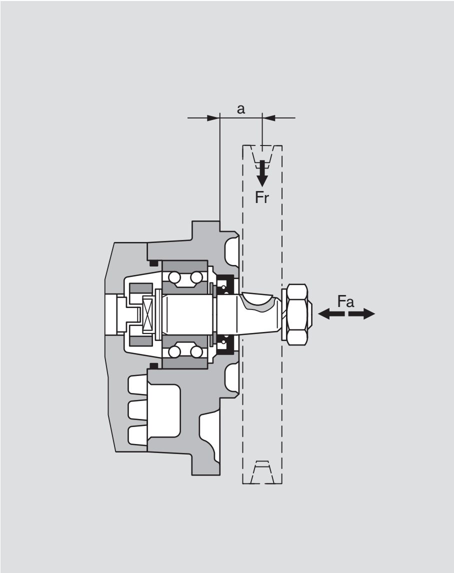
When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.

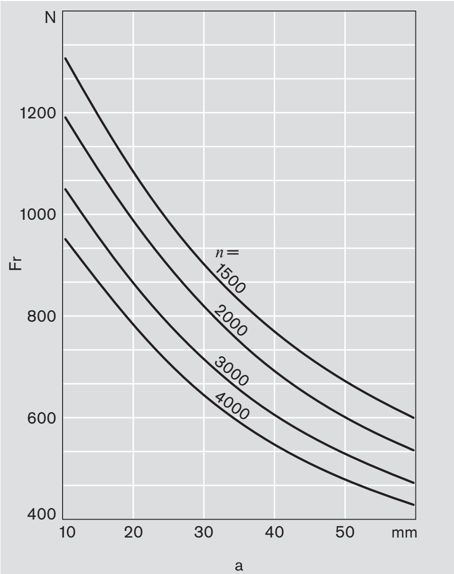


5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of L_H = 1,000 hours.

M_{max} [Nm]	V [cm^3/rev]	p_{max} [bar]
65	4...14	280
	16	230





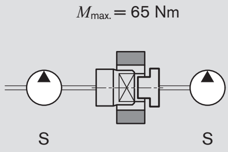
Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers.Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series N, the driver for the second pumping stage can carry a load of up to $S_{max.}$ = 95 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		Max. transferrable drive torque * [Nm]
C	1:5	155
N	Claw	65 or 85
D	SAE 13t	320
P	SAE 11t	180

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.



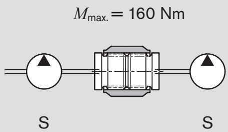
Combinations

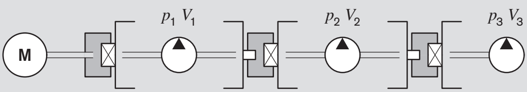
Series pump 1	$M_{max.}$ [Nm]	Series pump 2
S	65	S
S	65	F
S	12	B – 1x
F	65	S
S	25	B – 2x

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.



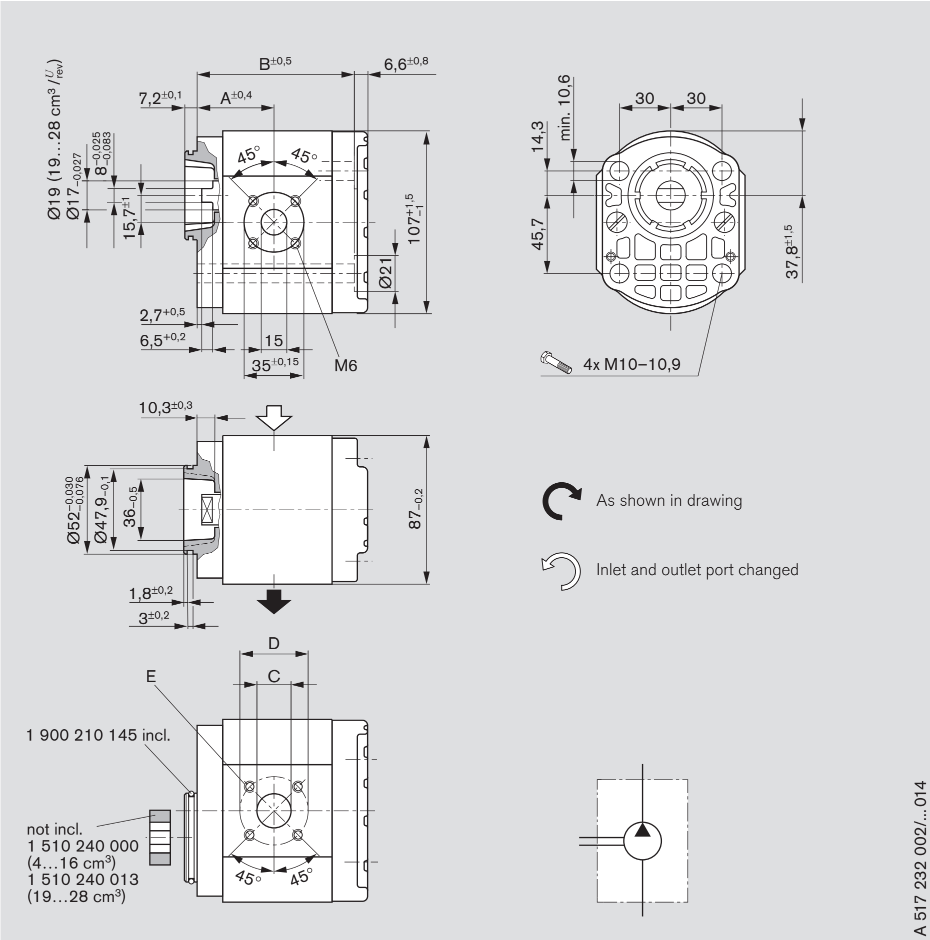


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range

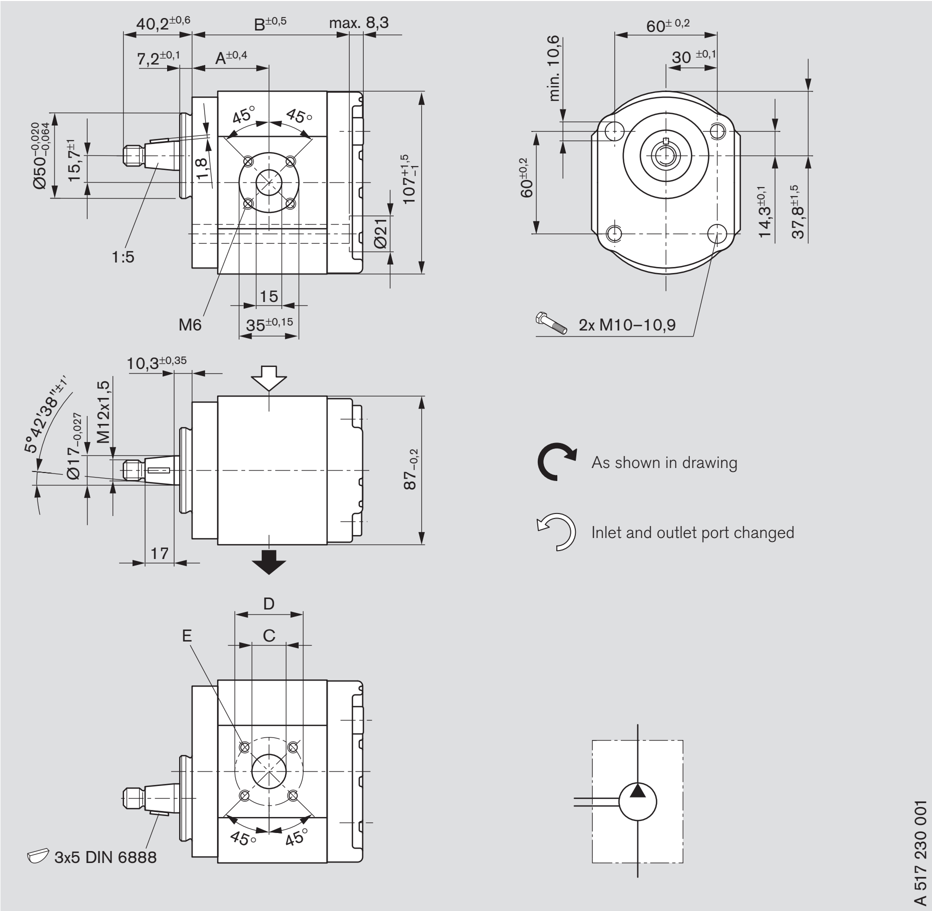


Ordering code:
AZPS – xx – □□□ □ N M 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 215 301**	**0 517 215 001**	280	4000	2.15	37.4	73.7	15	40	M6 13 depth
5.5	**0 517 315 301**	**0 517 315 001**	280	4000	2.2	38.6	76.2	15	40	
8	**0 517 415 301**	**0 517 415 001**	280	4000	2.3	40.7	80.3	20	40	
11	**0 517 515 302**	**0 517 515 001**	280	3500	2.4	44.5	85.3	20	40	
14	**0 517 515 303**	**0 517 515 002**	280	3000	2.55	45	90.3	20	40	
16	**0 517 615 301**	**0 517 615 001**	230	3000	2.6	45	93.7	20	40	
19	**0 517 615 302**	**0 517 615 002**	250	3500	3.0	55.8	110.7	26	55	M8 13 depth
22.5	**0 517 715 301**	**0 517 715 001**	210	3500	3.2	58.5	116.1	26	55	
25	**0 517 715 302**	**0 517 715 002**	190	3000	3.3	60.6	120.3	26	55	
28	**0 517 715 303**	**0 517 715 003**	170	3000	3.4	63	125.1	26	55	

Dimensions

Standard range

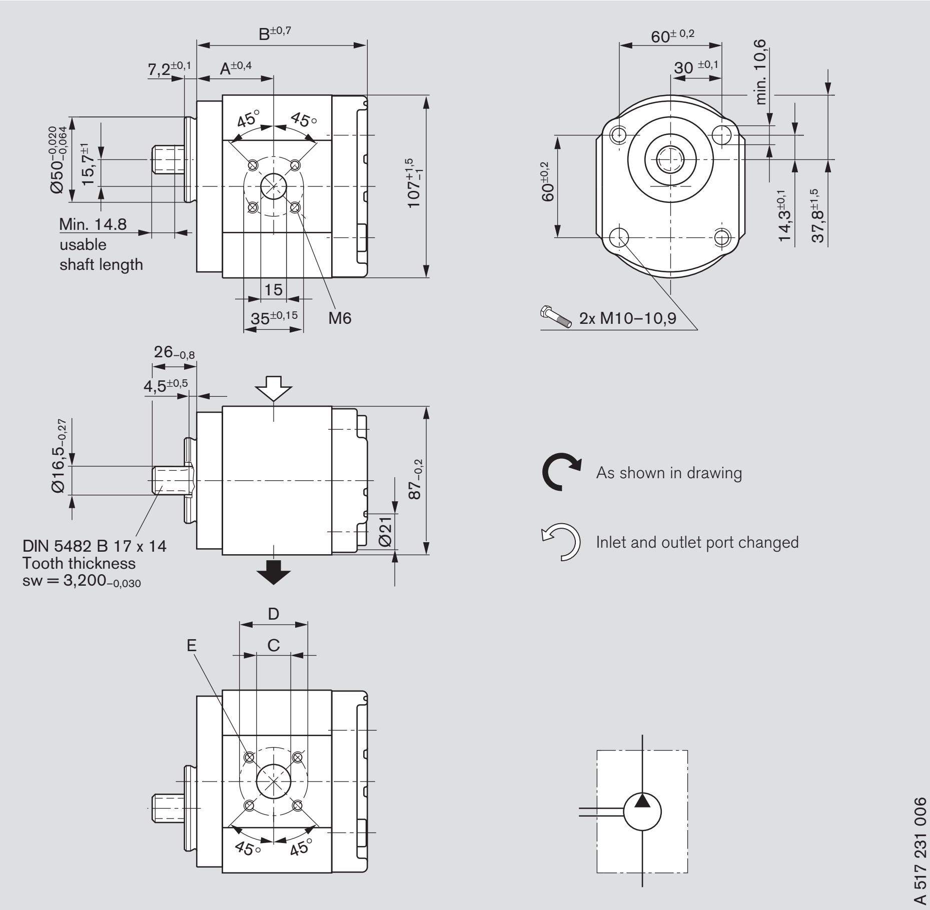


Ordering code:
AZPS – xx – □ □ □ □ C P 20 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11	**0 517 515 304**		280	3500	3.1	44.5	85.3	20	40	
14	**0 517 515 306**		280	3000	3.3	45	90.3	20	40	
16	**0 517 615 303**		280	3000	3.4	45	93.7	20	40	
19			280	3500						
22.5			250	3500						
25			225	3000						
28			200	3000						

Dimensions

Standard range

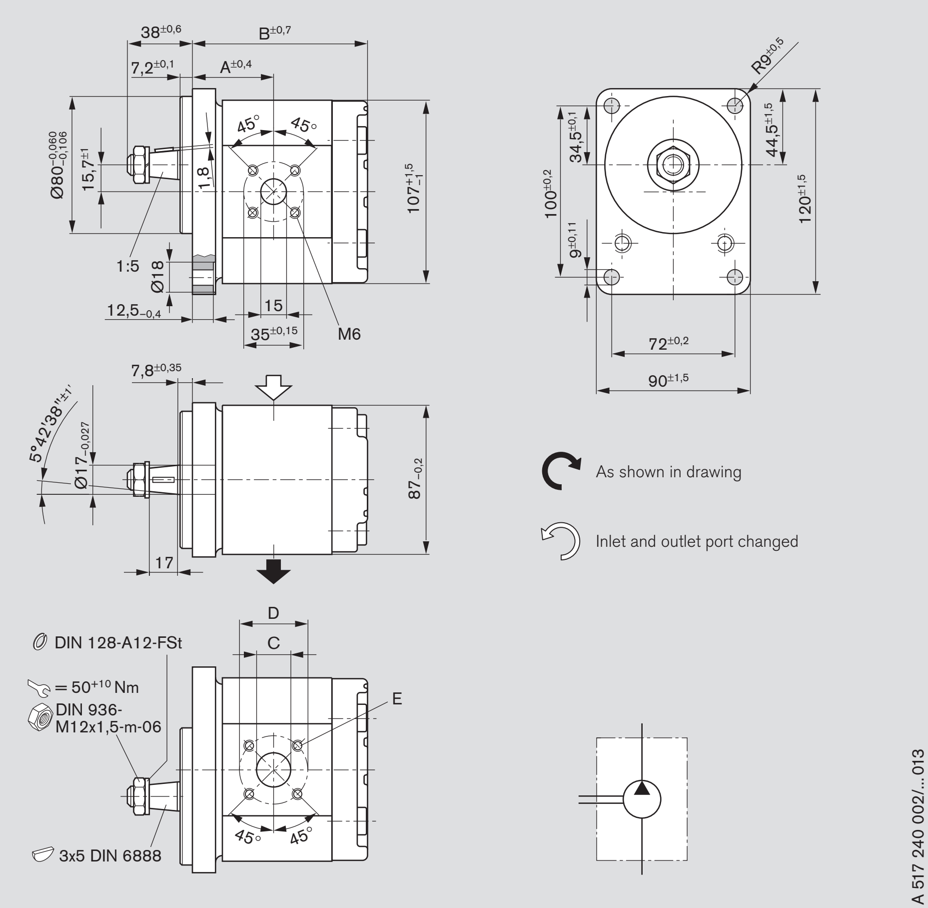


Ordering code:
AZPS – xx – □□□ □ F N 20 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11			280	3500						
14			280	3000						
16		**0 517 615 003**	280	3000	3.3	45	100.5	20	40	
19			280	3500						
22.5			250	3500						
25			225	3000						
28			200	3000						

Dimensions

Standard range

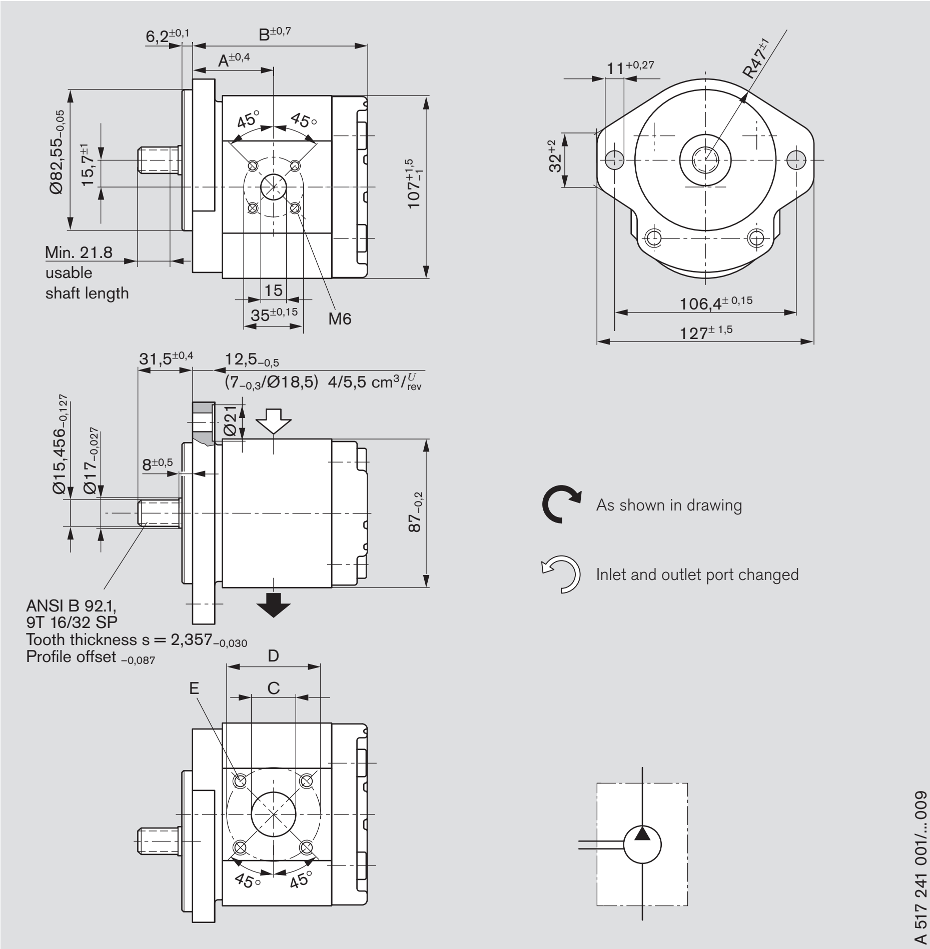


Ordering code:
AZPS – xx – □□□ □ C B 20 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 225 301**	**0 517 225 001**	280	4000	3.4	39.9	83	15	40	M6 13 depth
5.5	**0 517 325 301**	**0 517 325 001**	280	4000	3.5	41.1	85.5	15	40	
8	**0 517 425 301**	**0 517 425 001**	280	4000	3.6	43.2	89.6	20	40	
11	**0 517 525 301**	**0 517 525 001**	280	3500	3.8	47	94.6	20	40	
14	**0 517 525 302**	**0 517 525 002**	280	3000	3.9	47.5	99.6	20	40	
16	**0 517 625 301**	**0 517 625 001**	280	3000	–	47.5	103	20	40	
19	**0 517 625 302**	**0 517 625 002**	280	3500	4.5	58.3	120	26	55	M8 13 depth
22.5	**0 517 725 301**	**0 517 725 001**	250	3500	4.6	61	125.4	26	55	
25	**0 517 725 302**	**0 517 725 002**	225	3000	4.8	63.1	129.6	26	55	
28	**0 517 725 303**	**0 517 725 003**	200	3000	4.9	65.5	134.4	26	55	

Dimensions

Standard range



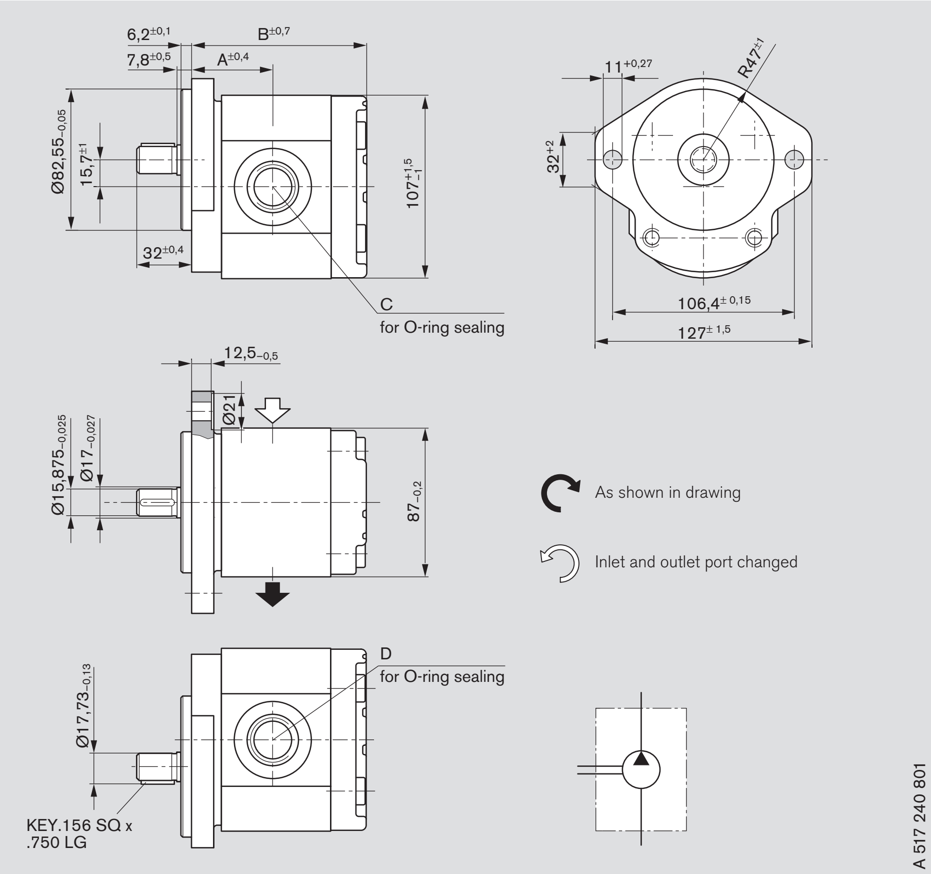
3

Ordering code:
AZPS – xx – ☐ ☐ ☐ ☐ R R 20 M B
AZPS – 1x – 0 1 6 L R R 20 P B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 225 302**	**0 517 225 002**	280	4000	3.4	39.9	83	15	40	M6 13 depth
5.5	**0 517 325 302**	**0 517 325 002**	280	4000	3.5	41.1	85.5	15	40	
8	**0 517 425 302**	**0 517 425 002**	280	4000	3.6	43.2	89.6	20	40	
11	**0 517 525 303**	**0 517 525 003**	280	3500	3.7	47	94.6	20	40	
14	**0 517 525 304**	**0 517 525 004**	280	3000	3.9	47.5	99.6	20	40	
16	**0 517 625 303**	**0 517 625 003**	280	3000	3.9	47.5	103	20	40	
19	**0 517 625 304**	**0 517 625 004**	280	3500	4.4	58.3	120	26	55	M8 13 depth
22.5	**0 517 725 304**	**0 517 725 004**	250	3500	4.6	61	125.4	26	55	
25	**0 517 725 305**	**0 517 725 005**	225	3000	4.7	63.1	129.6	26	55	
28	**0 517 725 306**	**0 517 725 006**	200	3000	4.8	65.5	134.4	26	55	

Dimensions

Standard range

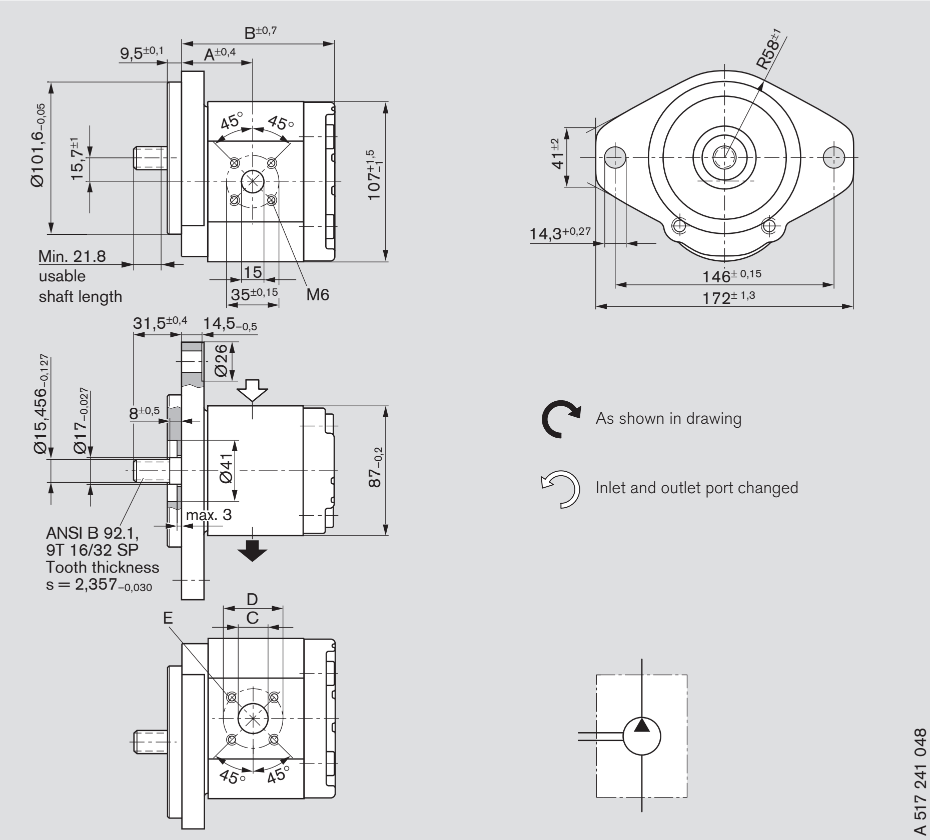


Ordering code:
AZPS – xx – ☐☐☐ ☐ Q R 12 M B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D
4			260	4000					
5.5			260	4000					
8		**0 517 425 003**	260	4000	3.6	43.2	89.6	7/8″-14 UNF-2B 16 depth	
11			260	3500					
14			230	3000					
16			200	3000					
19			210	3500					
22.5			180	3500					
25			160	3000					
28			140	3000					

Dimensions

Standard range

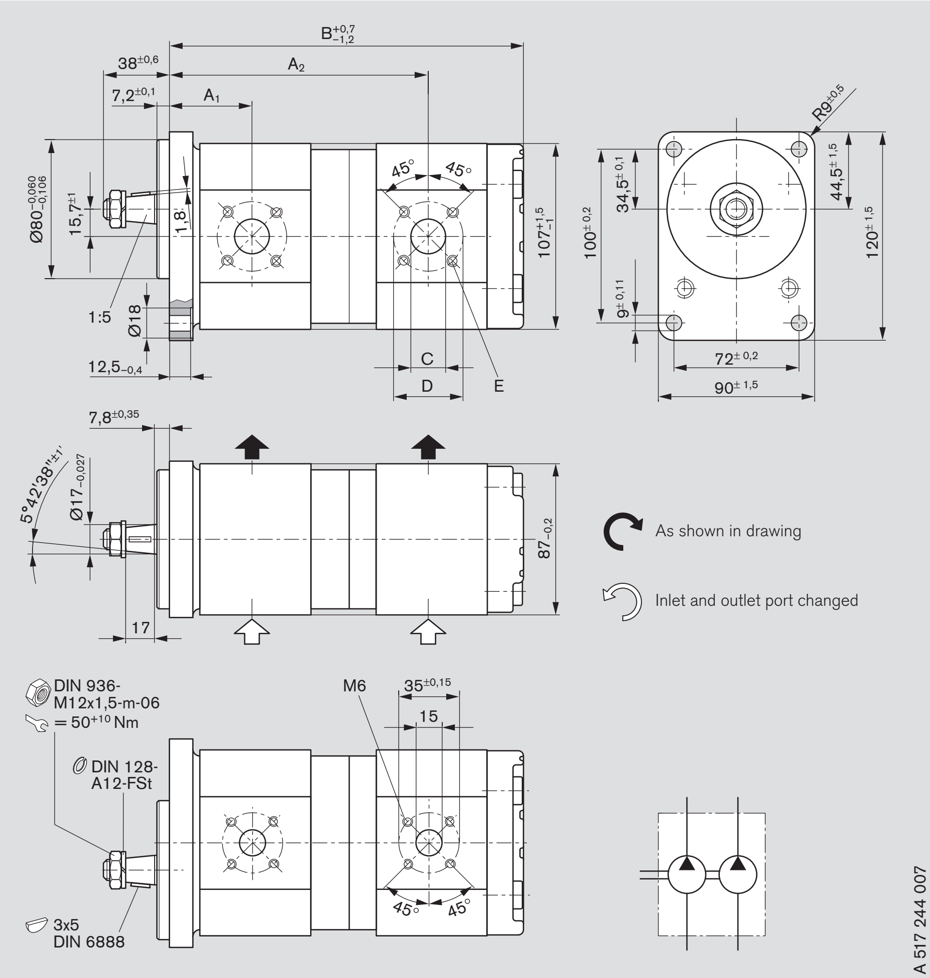


Ordering code:
AZPS – xx – □□□ □ R C 20 K B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11	**0 517 525 306**		280	3500	4.3	47	95.2	20	40	
14			280	3000						
16			280	3000						
19			280	3500						M8 13 depth
22.5			250	3500						
25		**0 517 725 008**	225	3000	5.2	63.1	130.2	26	55	
28			200	3000						

Dimensions

Standard range



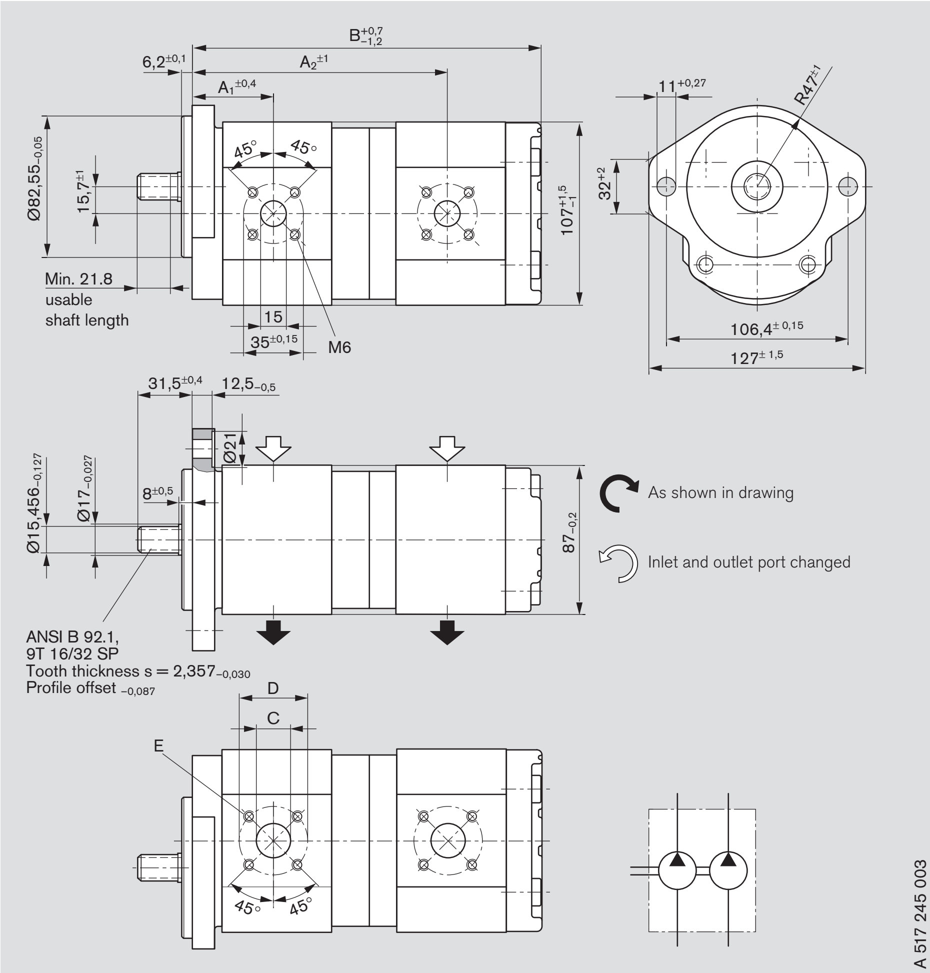
Ordering code:
AZPSS – xx – ☐☐☐ / ☐☐☐ ☐ C B 20 20 M B

Displacement [cm³/rev] P1	P2	Ordering-No. L	R	Max. operating pressure [bar] P1	P2	Max. rotation speed [rpm]	kg	Dimension [mm] A1	A2	B	C*)	D	E
16	5.5	**0 517 665 304**		280	280	3000	5.8	47.5	142.8	187.0	20	40	M6 13 depth
16	8			280	280	3000							
16	11	**0 517 665 305**		280	280	3000	6.1	47.5	148.7	196.3	20	40	
14	11		**0 517 565 011**	280	260	3000	5.9	47.5	145.3	192.5	20	40	

*) at 4 and 5.5 cm³ Ø15

Dimensions

Standard range



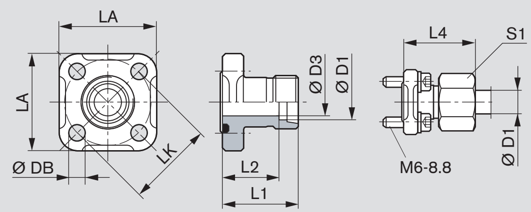
Ordering code:
AZPSS – xx – □□□/□□□ □ R R 20 20 M B

Displacement [cm³/rev]		Ordering-No.		Max. operating pressure [bar]		Max. rotation speed [rpm]	kg	Dimension [mm]					
P1	P2	L	R	P1	P2			A1	A2	B	C*)	D	E
16	5.5		**0 517 665 007**	280	280	3000	5.8	47.5	142.8	186.9	20	40	M6 13 depth

*) at 4 and 5.5 cm³ Ø15

Fittings

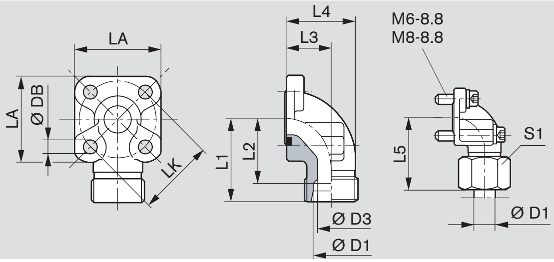
Gear pump flange, straight, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws 4x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M6x22	20x2.5	0.10	**1 515 702 066**	250
40	15L	12	35	28.0	43.0	42	27	6.4	M6x22	24x2.5	0.12	**1 515 702 067**	100
40	18L	15	35	27.5	44.0	42	32	6.4	M6x22	24x2.5	0.13	**1 515 702 068**	100
40	22L	19	35	27.5	44.5	42	36	6.4	M6x22	24x2.5	0.12	**1 515 702 069**	100
40	28L	24	42	27.5	34.5	42	41	6.4	M6x22	24x2.5	0.15	**1 515 702 008**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

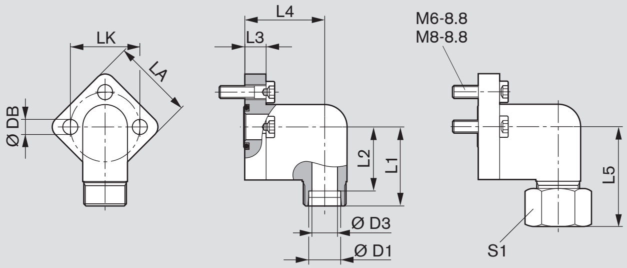
Gear pump flange, 90° angle, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	Screws 2x	Seal ring NBR *)	Mass [kg]	Part number	p (bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M6x22	M6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M6x22	M6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M6x22	M6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M6x22	M6x45	20x2.5	0.24	**1 515 702 017**	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M6x22	M6x22	24x2.5	0.15	**1 515 702 073**	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 074**	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M6x22	M6x45	24x2.5	0.20	**1 515 702 011**	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 075**	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M6x20	M6x50	24x2.5	0.24	**1 515 702 010**	100
40	35L	31	41	30.5	34.0	55.0	52.0	42	50	6.4	M6x22	M6x60	24x2.5	0.33	**1 515 702 018**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Gear pump flange, 3-hole, 90° angle, for rectangular flange 30 see page 8



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 3x	Seal ring NBR *)	Mass [kg]	Part number	*p* [bar]
30	12L	10	37	30.0	10	37.5	46	38	22	6.4	M 6x22	16x2.5	0.13	**1 515 702 146**	250
30	15L	12	37	30.0	10	37.5	47	38	27	6.4	M 6x22	16x2.5	0.14	**1 515 702 147**	250
30	18L	15	37	30.0	10	37.5	47	38	32	6.4	M 6x22	16x2.5	0.17	**1 515 702 148**	160
40	22L	19	43	35.5	14	41.0	53	48	36	8.4	M 8x30	24x2.5	0.29	**1 515 702 149**	160
40	28L	24	43	35.5	14	41.0	53	48	41	8.4	M 8x30	24x2.5	0.40	**1 515 702 150**	160

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

3

Note
You can find the permissible tightening torques in our publication:
“General Operating Instructions for External Gear Units”
RE 07 012-B1.

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0 517 215 001	19
0 517 215 301	19
0 517 225 001	22
0 517 225 002	23
0 517 225 301	22
0 517 225 302	23
0 517 315 001	19
0 517 315 301	19
0 517 325 001	22
0 517 325 002	23
0 517 325 301	22
0 517 325 302	23
0 517 415 001	19
0 517 415 301	19
0 517 425 001	22
0 517 425 002	23
0 517 425 003	24
0 517 425 301	22
0 517 425 302	23
0 517 515 001	19
0 517 515 002	19
0 517 515 302	19
0 517 515 303	19
0 517 515 304	20

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0 517 515 306	20
0 517 525 001	22
0 517 525 002	22
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0 517 525 301	22
0 517 525 302	22
0 517 525 303	23
0 517 525 304	23
0 517 525 306	25
0 517 565 011	26
0 517 615 001	19
0 517 615 002	19
0 517 615 003	21
0 517 615 301	19
0 517 615 303	19
0 517 615 303	20
0 517 625 001	22
0 517 625 002	22
0 517 625 003	23
0 517 625 004	23
0 517 625 301	22
0 517 625 302	22
0 517 625 303	23

Ordering-No.	Page
0 517 625 304	23
0 517 665 007	27
0 517 665 304	26
0 517 665 305	26
0 517 715 001	19
0 517 715 002	19
0 517 715 003	19
0 517 715 301	19
0 517 715 302	19
0 517 715 303	19
0 517 725 001	22
0 517 725 002	22
0 517 725 003	22
0 517 725 004	23
0 517 725 005	23
0 517 725 006	23
0 517 725 008	25
0 517 725 301	22
0 517 725 302	22
0 517 725 303	22
0 517 725 304	23
0 517 725 305	23
0 517 725 306	23

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 19 – 27, are contained in delivery.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Service parts

Page	Ordering code	Seal kit Pos. 800 1 517 010...	Shaft seal ring Pos. 3 1 510 283...	Dimension	Seal ring Pos. 31 1 900 210...	Material	Dimen-sion	Driver Pos. 30 1 510 240...
19	AZPS – 1x – □□□ □N M 20 **M** B	208	–		145	NBR	45x2.5	000
19	AZPS – 2x – □□□ □N M 20 **K** B	212	–		145	NBR	45x2.5	013
20	AZPS – 1x – □□□ □C P 20 **K** B	208	027 FKM	17x30x7/8	–	–		–
21	AZPS – 1x – □□□ □F N 20 **K** B	208	027 FKM	17x30x7/8	–	–		–
22	AZPS – 1x – □□□ □C B 20 **M** B	208	008 NBR	17x30x7/8	–	–		–
22	AZPS – 2x – □□□ □C B 20 **M** B	212	008 NBR	17x30x7/8	–	–		–
23	AZPS – 1x – □□□ □R R 20 **M** B	208	008 NBR	17x30x7/8	–	–		–
23	AZPS – 1x – 0 1 6 L R R 20 **P** B	206	027 FKM	17x30x7/8	–	–		–
23	AZPS – 2x – □□□ □R R 20 **M** B	212	008 NBR	17x30x7/8	–	–		–
24	AZPS – 1x – □□□ □Q R 12 **M** B	208	008 NBR	17x30x7/8	–	–		–
25	AZPS – 1x – □□□ □R C 20 **K** B	208	027 FKM	17x30x7/8	–	–		–
25	AZPS – 2x – □□□ □R C 20 **K** B	212	027 FKM	17x30x7/8	–	–		–
26	AZPSS – 1x – □□□ □□□ □C B 20 20 **M** B	208	008 NBR	17x30x7/8	145	NBR	45x2.5	–
27	AZPSS – 1x – □□□ □□□ □R R 20 20 **M** B	208	008 NBR	17x30x7/8	145	NBR	45x2.5	–

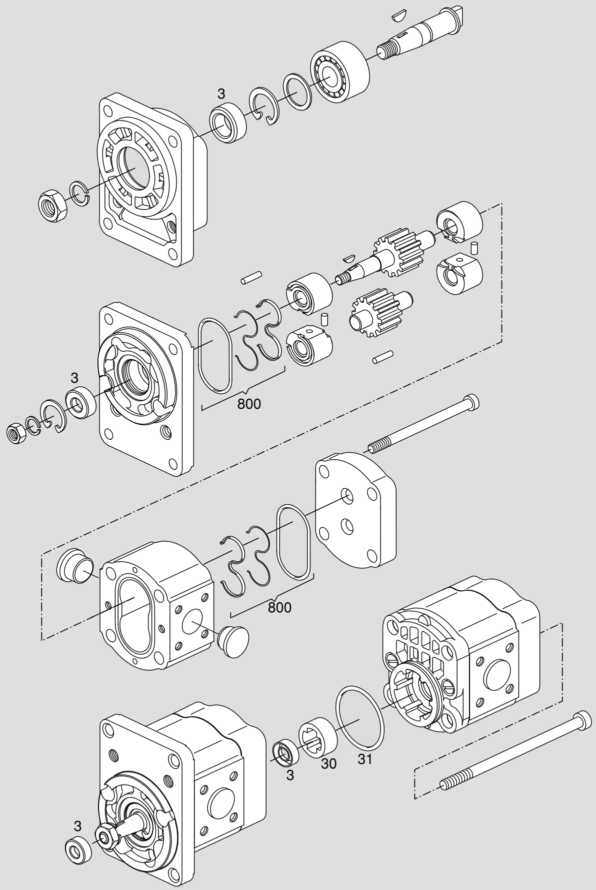
NBR = Perbunan® FKM = Viton®

3

Outboard bearing

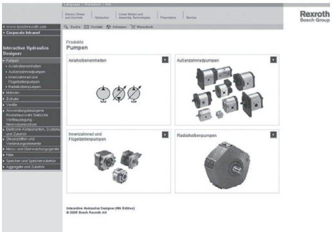
Single pump

Multiple pump

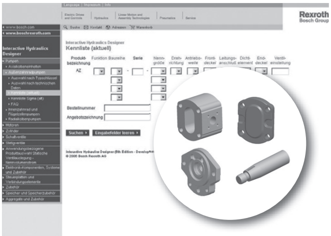


The AZ configurator at www.boschrexroth.com/azconfigurator

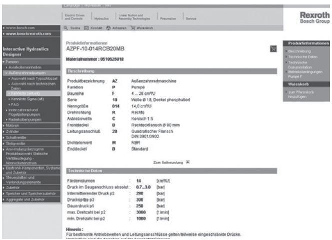
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

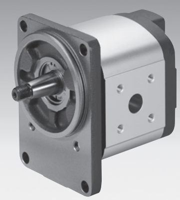
Bosch Rexroth AG
External Gear Units
Robert-Bosch-Straße 2
D-71701 Schwieberdingen
Phone +49 (0) 711-811 10 63
Fax +49 (0) 711-811 17 98
brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Rexroth
Bosch Group

External Gear Pumps
Series T

RE 10 092/02.12
Replaces
RE 10 092/02.07

AZPT-...



Fixed pumps
$V = 20...36$ cm^3/rev

SILENCE

Overview of contents

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Features

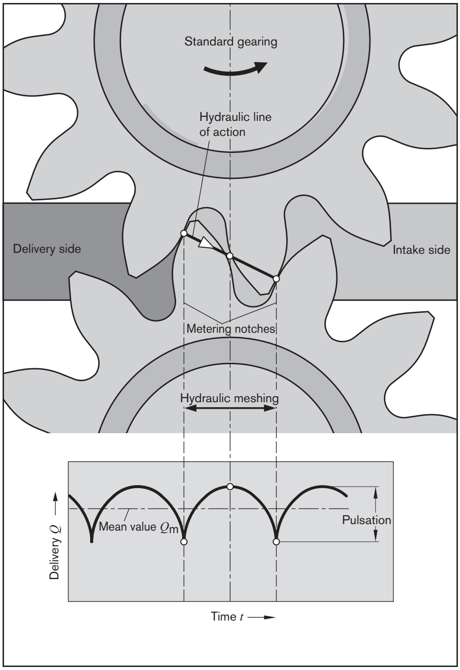
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports:
  connection flange or screw thread
- Optimized pressure pulsation with reduced noise emissions and vibration excitation in the system
- Consistent high quality
- Considerably longer service life due to reinforced shaft and case

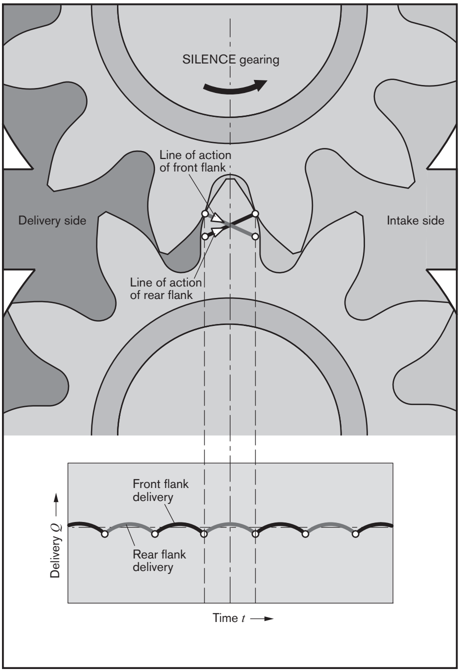
General

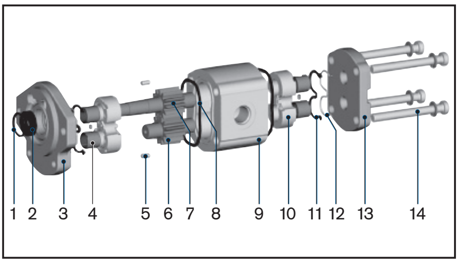
The key task of external gear units is to convert mechanical energy (torque and rotational speed) into hydraulic energy (flow and pressure). In external gear motors this is the other way round. These machines are required to be highly efficient in order to avoid unnecessary heat. This efficiency is achieved by means of precision production engineering and pressure-sensitive gap sealing.

Moreover, in the low-noise SILENCE pumps, the dual-flank principle helps to reduce flow pulsation by up to 75 %.

The displacement method







1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

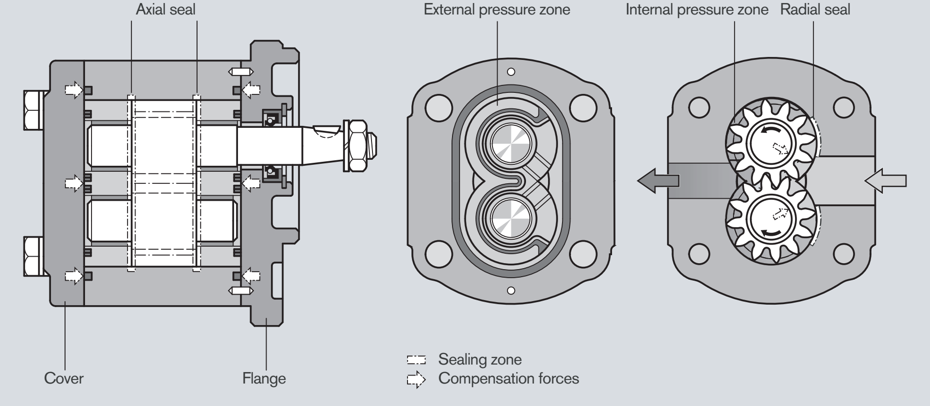
The geometry of the displacement gearing, matched in form by the rotation of the drive shaft, results in the parabolic flow characteristic shown here on the left. In a standard pump, this characteristic is repeated each time a gear tooth meshes. With their dual-flank system, the flow pulsation of SILENCE pumps is reduced by 75 % – with correspondingly lower excitation of downstream system components – at double the fundamental frequency. During this process, the gear pair exhibits an extremely reduced rear flank backlash, so that hydraulic sealing is provided not just by the front flank of the driven gear, but also by the rear flanks. In this way, the front and rear flanks alternately contribute to flow displacement. And by adapting the shape of the metering notches, the expansion of the hydraulic line of action is half that of the standard pump.

Construction

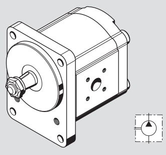
The external gear pump consists essentially of a pair of gears supported in bearing bushings or bearing, dependent on the series, and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

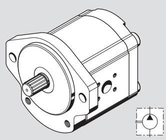
The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

Gear pump axial compensation



Overview of “Series T” standard types

Version	Page
	16

Version	Page
	17

Ordering code

External gear units Single pumps "SILENCE"

AZ	P	T	–	x	x	–	020	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
2 = Case width 110 mm

Version
2 = Chromatized, pinned

Size T
020 = 20.0 cm³/rev
022 = 22.5 cm³/rev
025 = 25.0 cm³/rev
028 = 28.0 cm³/rev
032 = 32.0 cm³/rev
036 = 36.0 cm³/rev

Direction of rotation
R = Clockwise
L = Counter-clockwise

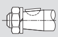
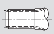
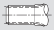
Special design

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

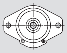
Rear cover
B = Standard
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
K = NBR, SSR in FKM

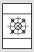
Drive shafts

		Suitable front cover
C	Tapered key shaft 1 : 5 	**B**
N	Dihedral claw 	**M**
D	Splined shaft SAE J 744 22-4 13T 	**C**
P	Splined shaft SAE J 744 19-4 11T 	**C**

Front cover

B	Square flange Centering Ø 100 mm 
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm 
M	2-bolt mounting Centering Ø 52 mm with seal ring 

Line ports

07	Square flange SAE Thread, metric 
20	Rectangular flange 

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units Multiple pumps "SILENCE"

AZ	P	TTSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm^3/rev
S = 4.0...28 cm^3/rev
F = 4.0...28 cm^3/rev
T = 20.0...36 cm^3/rev
N = 20.0...36 cm^3/rev
U = 22.5...63 cm^3/rev
G = 22.5...63 cm^3/rev

Series, relates to pump section 1
2 = Case width 110 mm

Version, relates to pump section 1
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = Clockwise
L = Counter-clockwise

Rear cover
relates to last pump section
B = Standard

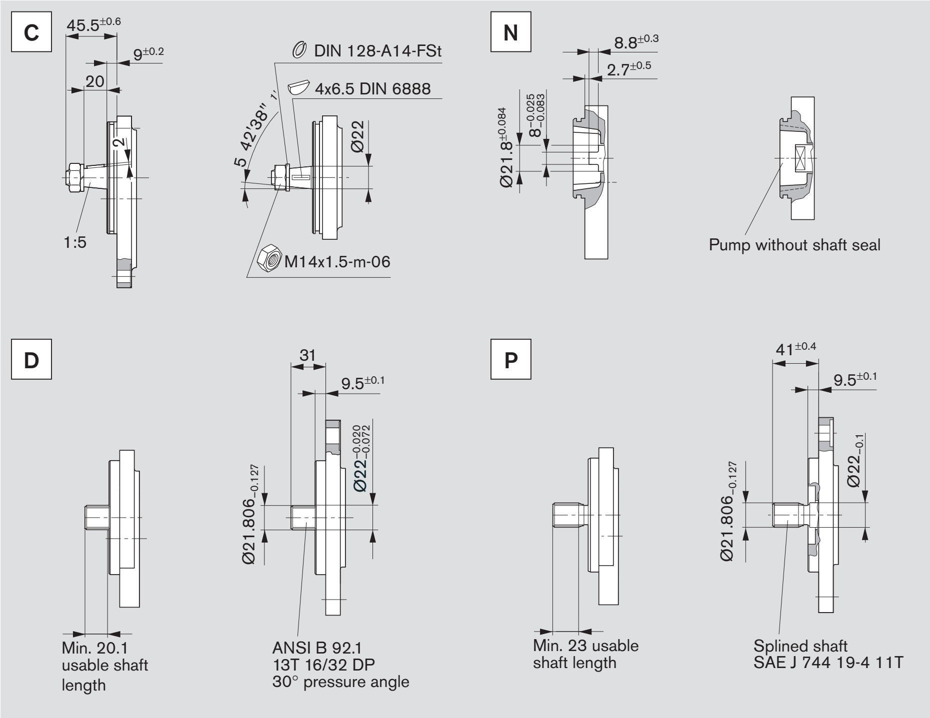
Seals
M = NBR
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts relates to pump part 1		Suitable front cover	Front cover relates to pump part 1		Line ports every pump parts	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**02**	Thread, metric DIN 3852 T1
Series F, S:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm		
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
N	Dihedral claw	**M**	**M**	Centering Ø 52 mm with seal ring		
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm		

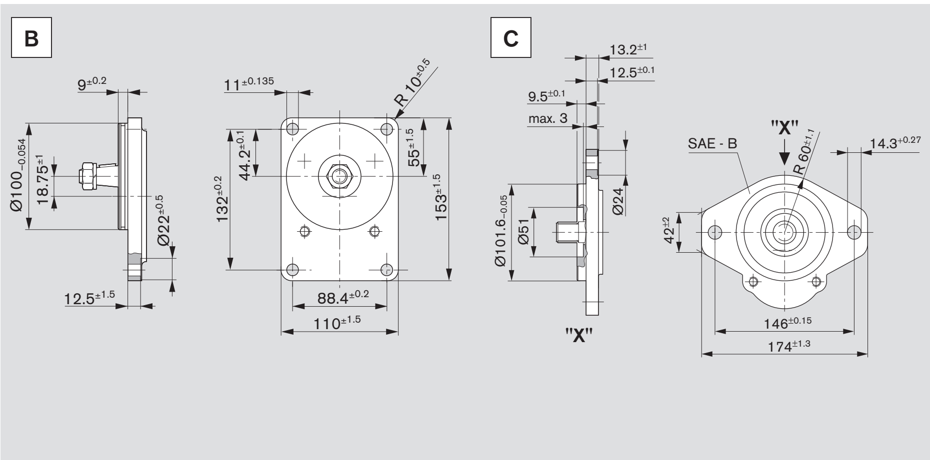
Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

3

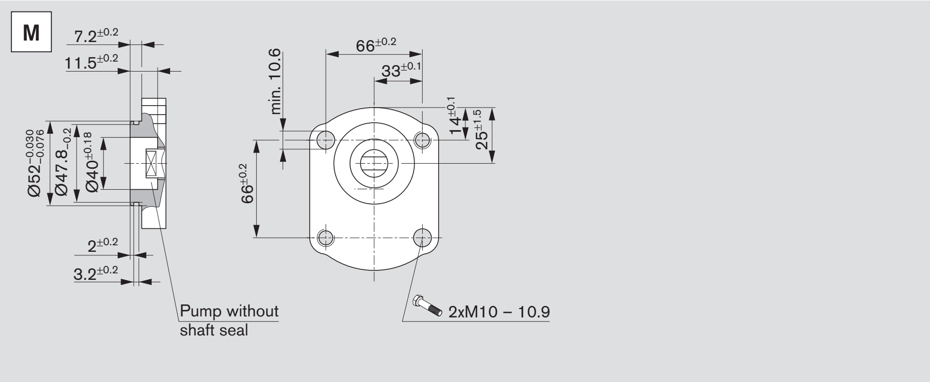
Drive shafts



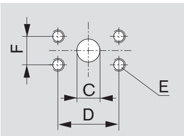
Front cover



Front cover (continued)

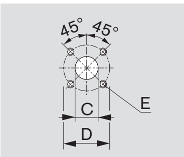


Line ports



07 **Square flange SAE, thread, metric**

Ordering code	Size	Pressure side C	D	E	F	Suction side C	D	E	F
07	20 cm^3	18	47.6	M10	22.2	25	47.6	M10	22.2
	22.5...36 cm^3			depth 14			52.4	depth 14	26.2

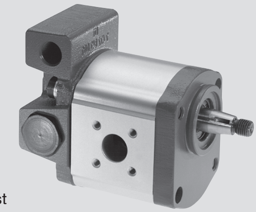


20 **Rectangular flange**

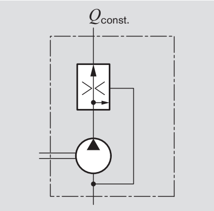
Ordering code	Size	Pressure side C	D	E	Suction side C	D	E
20	20...36 cm^3	18	55	M8 depth 13	26	55	M8 depth 13

Gear pumps with integral valves

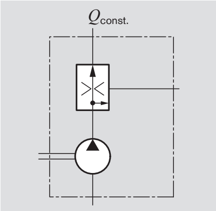
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



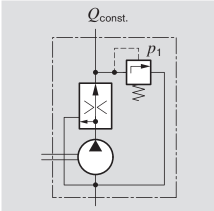
Upon request



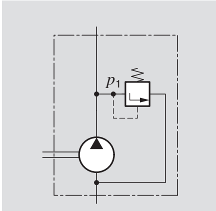
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.} = 2...30$ l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min
$p_1 = 100...180$ bar



Pressure-relief valve.
Discharge returned to suction line
$p_1 = 5...250$ bar

Ordering code

S	xxx17

E	xxx12

V	15011

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

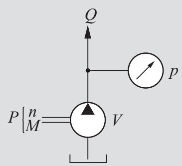
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

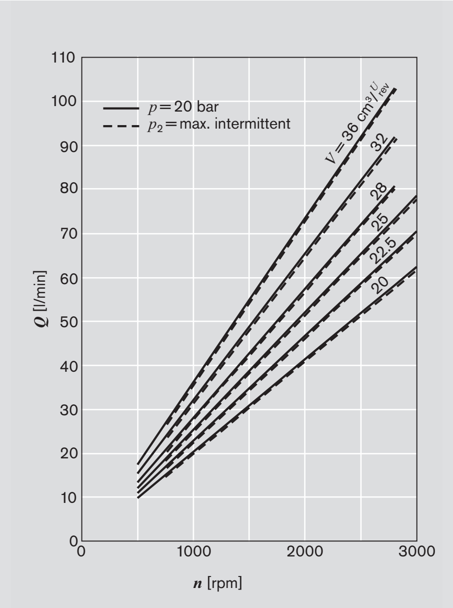
n —— η_v ⟶ Q
M —— η_{hm} ⟶ p
P —— η_t ⟶ $p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

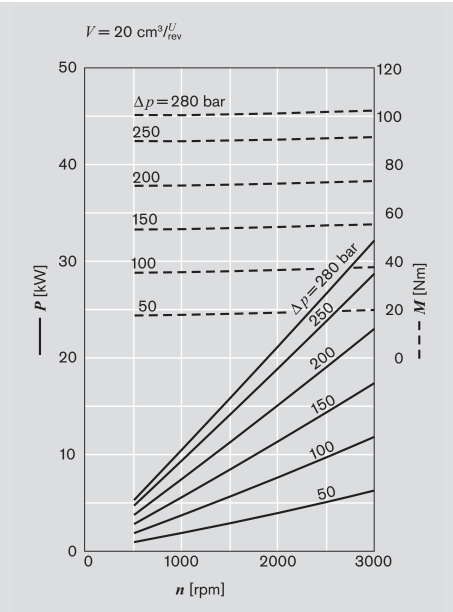
Caution: η [%] e.g. 95 [%]

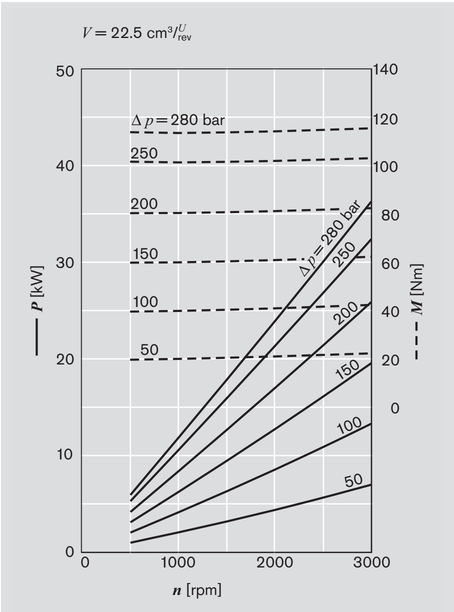
Performance charts

$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$

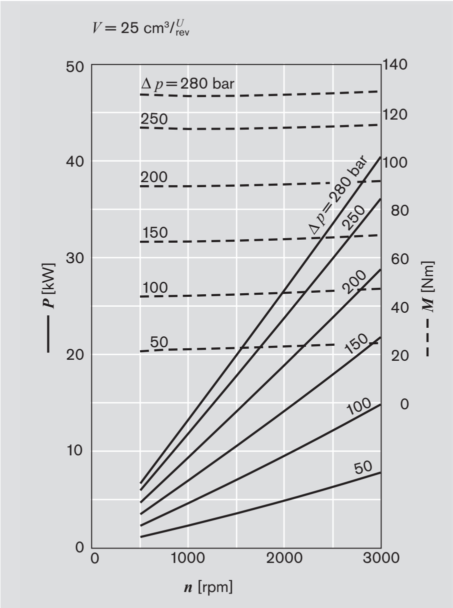


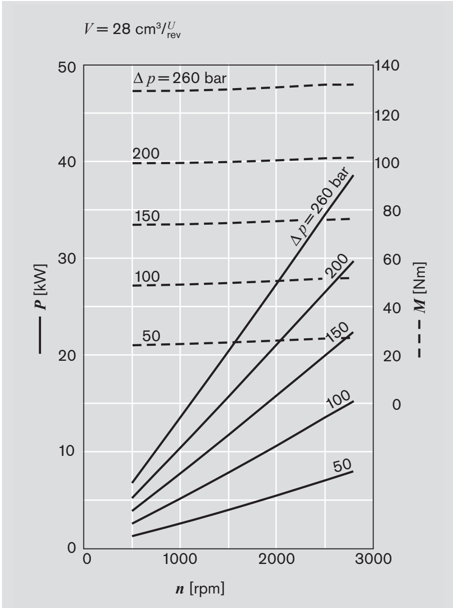
$Q = f(n, V)$ incl. η_v
$P = f(n, p)$ ——— incl. η_t
$M = f(n, p)$ – – – incl. η_{hm}

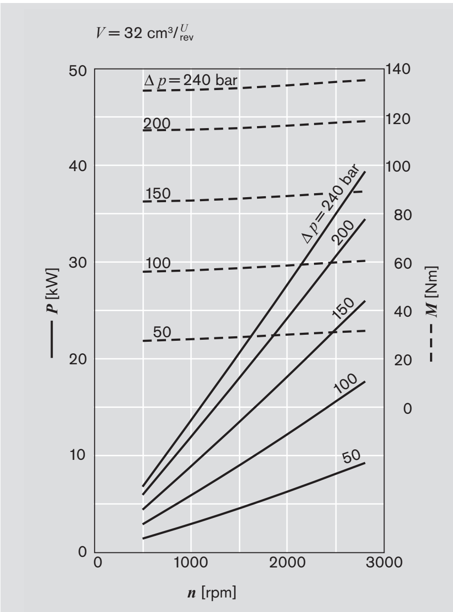


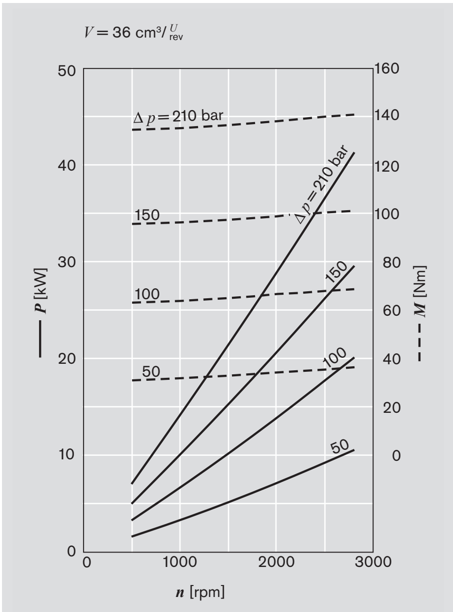


Performance charts (continued)





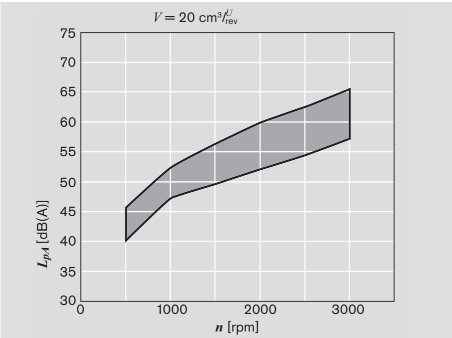


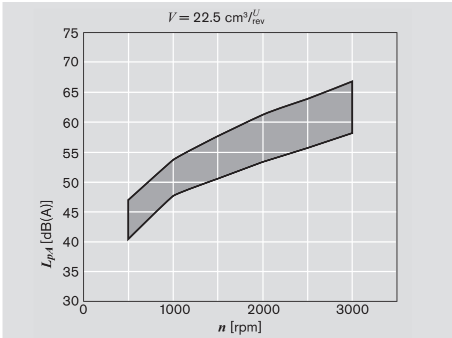


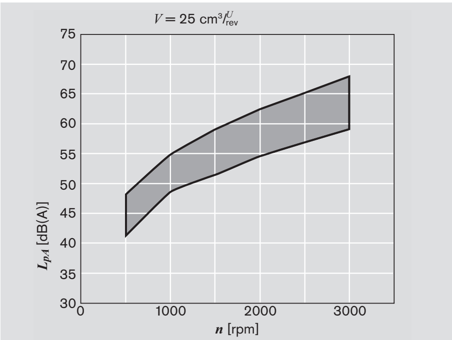
Noise charts

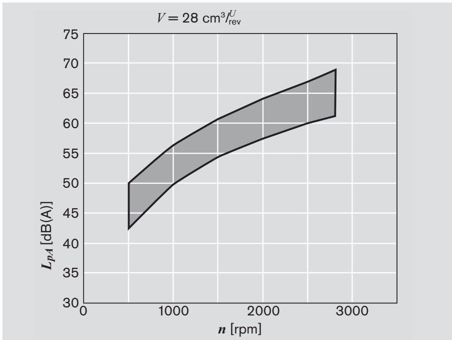
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 12 Specifications table).
Oil data: $\nu = 32\ mm^2/s$, $\vartheta = 50\,°C$.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

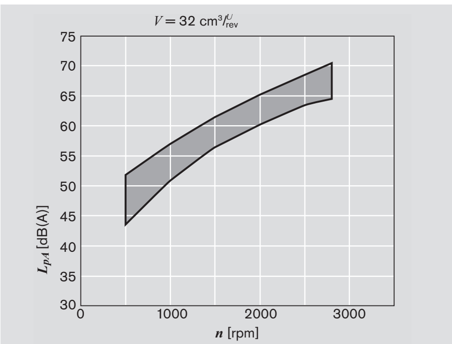
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

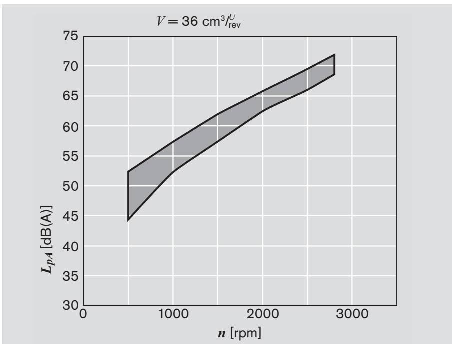












Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C or max. +110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm^2/s permitted range 20...100 mm^2/s recommended range ...2000 mm^2/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals *) max. +110 °C with FKM seals **)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) On hydraulic systems or devices with critical counter-reaction, such as steering and counterbalance valves, the type of filtration selected must be adapted to
the sensitivity of these devices/ systems.

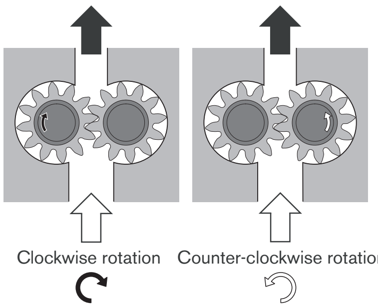
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

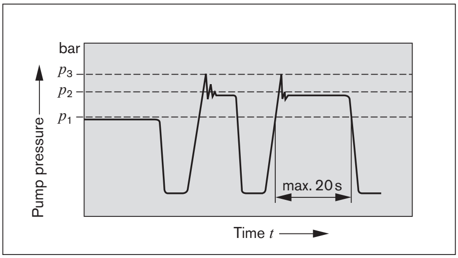
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps.On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures

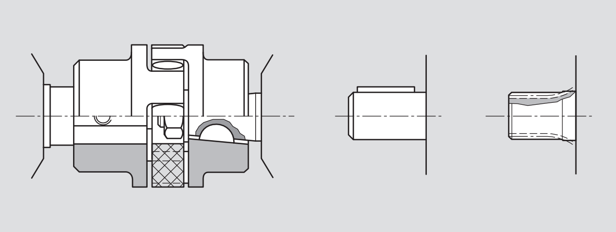


p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPT-2x

Displacement	V	cm^3/rev	20	22,5	25	28	32	36
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps p_e (p_2) = max. 0.5 p_e (p_1)					
Max. continuous pressure	p_1		250	250	250	230	210	180
Max. intermittent pressure	p_2		280	280	280	260	240	210
Max. peak pressure	p_3		300	300	300	280	260	230
Min. rotational speed at bar 12 mm^2/s	<100	rpm	500	500	500	500	500	500
	100...180		600	600	600	600	600	600
	180... p_2		800	800	800	800	800	800
25 mm^2/s	p_2		500	500	500	500	500	500
Max. rotational speed at	p_2		3000	3000	3000	2800	2800	2800

Drive arrangement

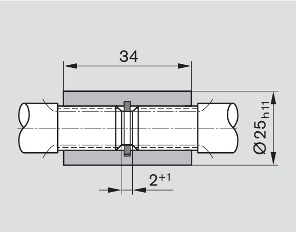


1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.

2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



Splined shaft	Ordering code	M_{max} [Nm]
SAE-B 13 teeth	D	320
SAE-C 11 teeth	P	180

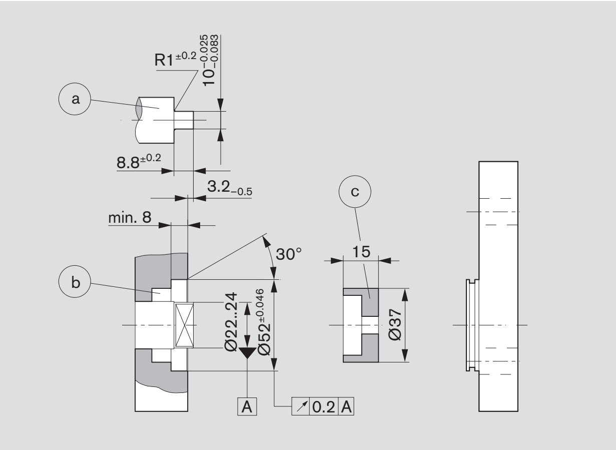
3

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ⓒ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

ⓐ **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm2}$
Surface for sealing ring
ground without rifling $R_t \leq 4\mu m$

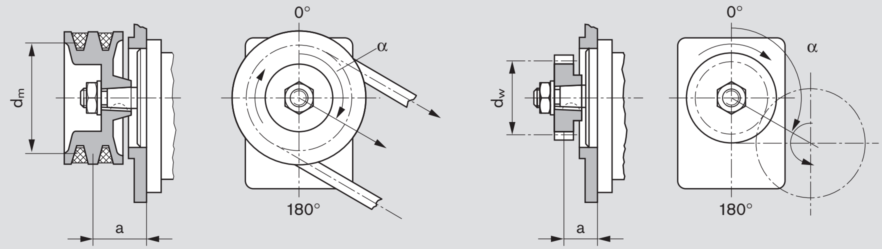
ⓑ **Radial shaft seal ring**
Rubber-covered seal (see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
95	20	270
	22.5	240
	25	220
	28	190
	32	170
	36	150

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.



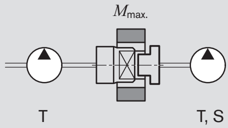
Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series T, the driver for the second pumping stage can carry a load of up to $M_{max.} = 95$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		Max. transferrable drive torque * [Nm]
C	1:5	200
N	Claw	95
D	SAE 13t	320
P	SAE 11t	180

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.



Combinations

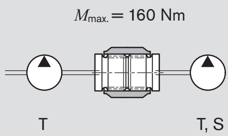
Series pump 1	$M_{max.}$ [Nm]	Series pump 2
T	95	T
T	65	S

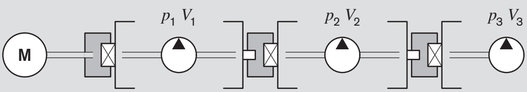
For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

3

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.



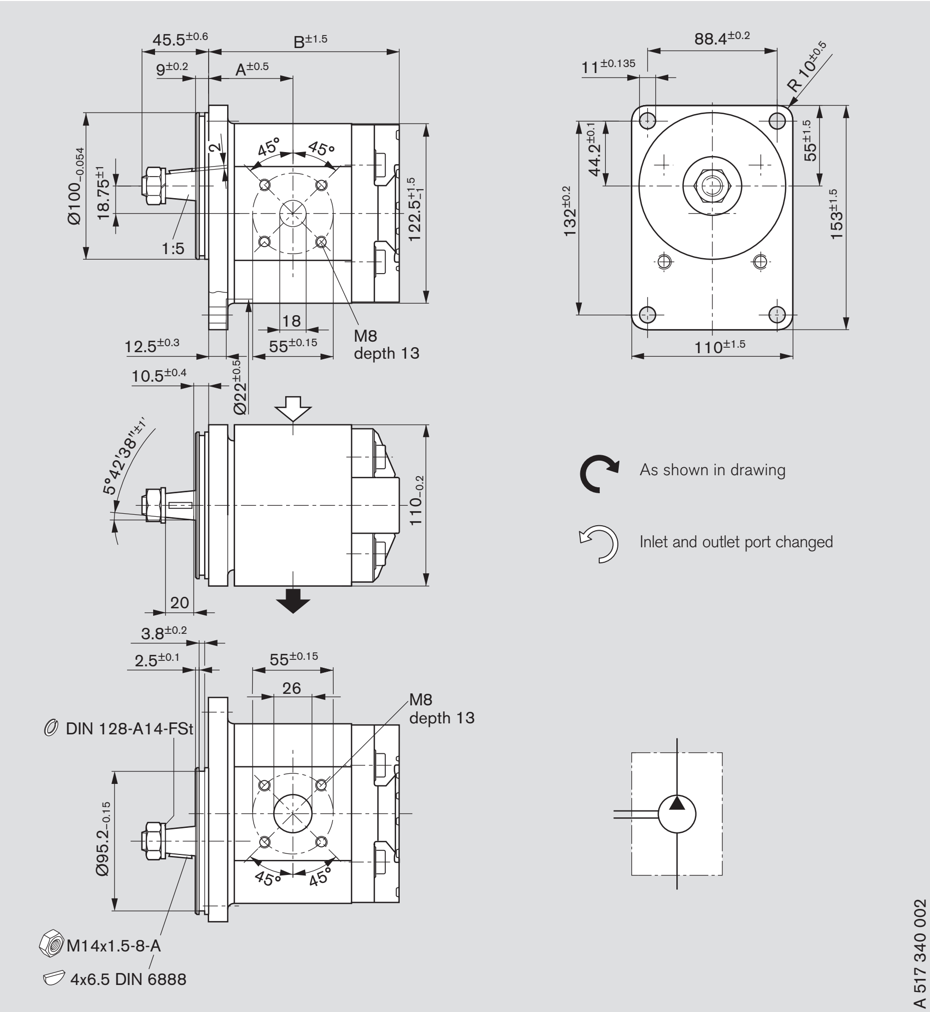


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm^3/rev]

Dimensions

Standard range

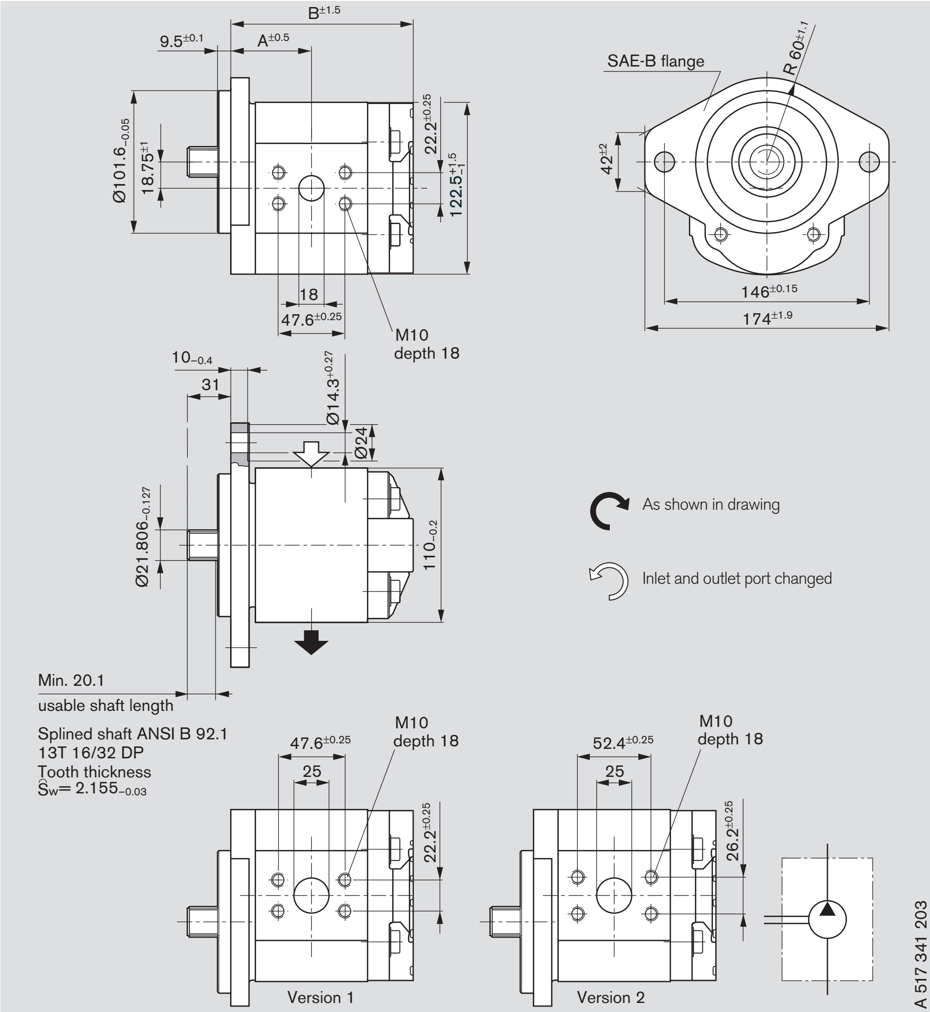


Ordering code:
AZPT – 22 – □□□ □C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	Dimension [mm] B	
20	**0 517 625 309**	**0 517 625 008**	280	3000		52.0	119.1	M8 13 depth
22.5	**0 510 725 302**	**0 517 725 016**	280	3000		53.5	122.1	
25	**0 517 725 313**	**0 517 725 017**	280	3000		55.0	125.1	
28	**0 517 725 314**	**0 517 725 018**	260	3000		56.5	128.1	
32	**0 517 725 315**	**0 517 725 019**	240	2800		59.0	132.6	
36	**0 517 725 316**	**0 517 725 020**	210	2600		61.0	137.1	

Dimensions

Standard range



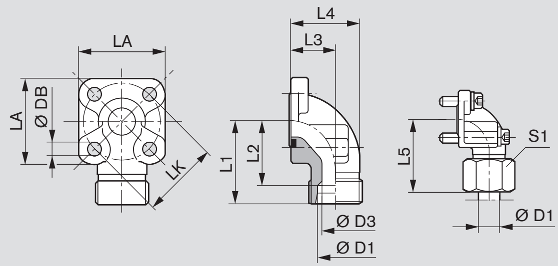
Ordering code:
AZPT – 22 – □□□ □ D C 07 K B

Displace-ment [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D		Version
20	**0 517 625 310**	**0 517 625 009**	280	3000		52.0	119.1	25	47.6	M10 18 depth	1
22.5	**0 517 725 317**	**0 517 725 021**	280	3000		53.0	122.1	25	52.4		2
25	**0 517 725 318**	**0 517 725 022**	280	3000		55.0	125.1	25	52.4		
28	**0 517 725 319**	**0 517 725 023**	260	3000		56.5	128.1	25	52.4		
32	**0 517 725 320**	**0 517 725 024**	240	2800		59.0	132.6	25	52.4		
36	**0 517 725 321**	**0 517 725 025**	210	2600		61.0	137.1	25	52.4		

Fittings

Fittings can be used for rectangular flange **20** **see page 7**

Gear pump flange, 90° angle

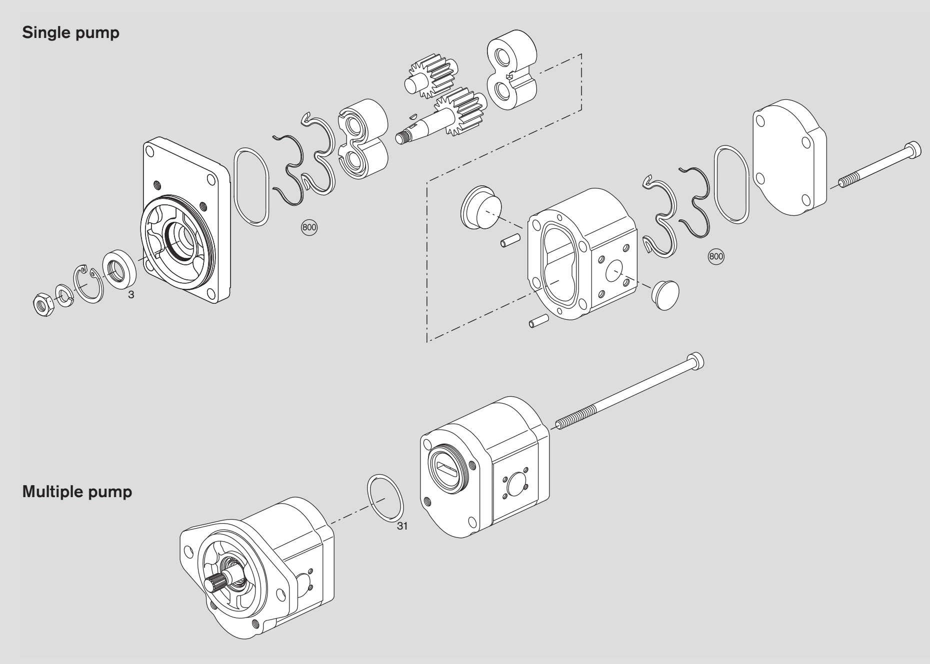


LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws		Seal ring	Mass kg	Part number	*p* (bar)
											2 pcs.	2 pcs.				
55	20S	17	45	34.5	24.0	40.0	56.0	58	36	8.4	M8x25	M8x50	33x2.5	0.44	**1 515 702 004**	250
55	30S	26	49	35.5	32.0	50.0	62.0	58	50	8.4	M8x25	M8x50	33x2.5	0.50	**1 515 702 006**	250
55	35L	31	49	38.5	32.0	51.5	62.0	58	50	8.4	M8x25	M8x60	32x2.5	0.47	**1 515 702 005**	100
55	42L	38	49	38.0	40.0	64.5	61.0	58	60	8.4	M8x25	M8x70	32x2.5	0.60	**1 515 702 019**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Note
You can find the permissible tightening torques in our publication:
"General Operating Instructions for External Gear Units"
RE 07 012-B1.

Service parts



Page	Ordering code	Seal kit “T” Pos. 800 NBR	Shaft seal ring Pos. 3	Dimension	Seal ring Pos. 31	Material	Dimension
16	AZPT – 22 – □□□ □ C B 20 M B	1517010226	1510283023	40x22x7	–	NBR	
17	AZPT – 22 – □□□ □ D C 20 K B	1517010226	1510283028	40x22x7	–	FKM (SSR)	

NBR = Perbunan® FKM = Viton®

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, "Project planning notes and design of hydraulic systems". Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

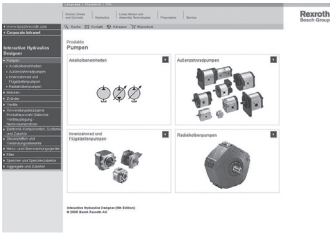
Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: "General product information for hydraulic products" RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 16 – 17, are contained in delivery.

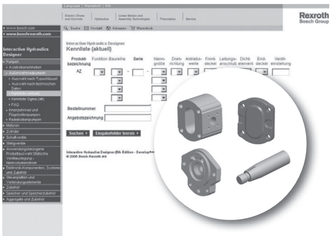
You can find further information in our publication: "General Operating Instructions for External Gear Units" RE 07 012-B1.

The AZ configurator at www.boschrexroth.com/azconfigurator

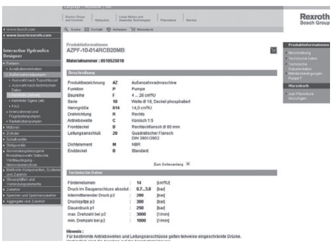
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Ordering-No.

Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page
0 517 625 008	16	0 517 725 020	16	0 517 725 314	16
0 517 625 009	17	0 517 725 021	17	0 517 725 315	16
0 517 625 309	16	0 517 725 022	17	0 517 725 316	16
0 517 625 310	17	0 517 725 023	17	0 517 725 317	17
0 517 725 016	16	0 517 725 024	17	0 517 725 318	17
0 517 725 017	16	0 517 725 025	17	0 517 725 319	17
0 517 725 018	16	0 517 725 302	16	0 517 725 320	17
0 517 725 019	16	0 517 725 313	16	0 517 725 321	17

Bosch Rexroth AG
External Gear Units
Robert-Bosch-Straße 2
D-71701 Schwieberdingen
Telefon +49 (0) 711-811 10 63
Telefax +49 (0) 711-811 17 98
brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Rexroth
Bosch Group

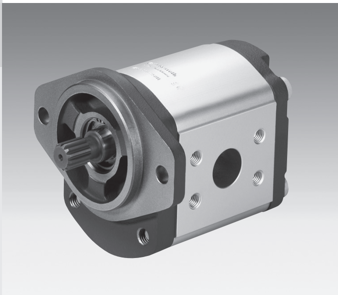
External gear pump
Series U

RE 10 098/02.12
Replaces
RE 10 098/08.07

AZPU-...

Fixed pumps
V = 22.5...63 cm^3/rev

SILENCE



Overview of contents

Contents	**Page**
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Drive shaft	6
Front cover	6
Line ports	7
Pumps with integral valves	8
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Performance charts	9
Noise charts	12
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Drive arrangements	15
Multiple pumps through drives	17
Dimensions	18
Fittings	22
Notes on commissioning and maintenance	23
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Features

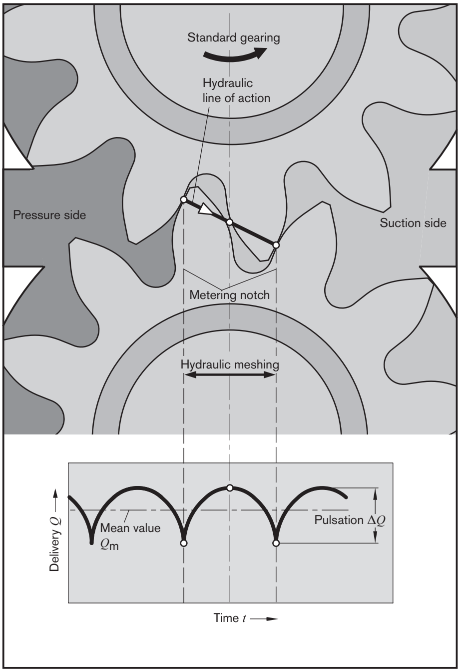
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports: connection flanges
- Optimized pressure pulsation, which reduces noise emissions and vibration input in system
- Long service life thru reinforced design of shafts and case
- Consistent high quality thru mass production
- Numerous configuration variants available

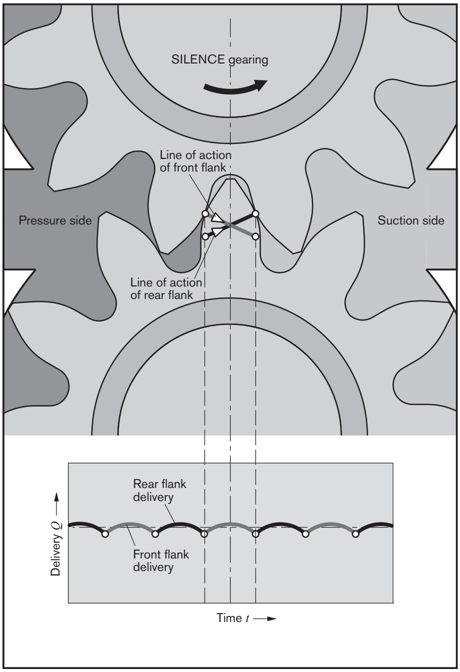
General

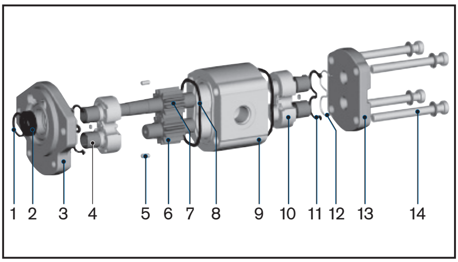
The key task of external gear units is to convert mechanical energy (torque and rotational speed) into hydraulic energy (flow and pressure). In external gear motors this is the other way round. These machines are required to be highly efficient in order to avoid unnecessary heat. This efficiency is achieved by means of precision production engineering and pressure-sensitive gap sealing.

Moreover, in the low-noise SILENCE pumps, the dual-flank principle helps to reduce flow pulsation by up to 75 %.

The displacement method







1	Retaining ring	8	Case seal
2	Shaft seal ring	9	Pump case
3	Front cover	10	Bearing
4	Slide bearing	11	Axial zone seal
5	Centering pin	12	Support
6	Gear	13	End cover
7	Gear (frictional)	14	Fixing screws

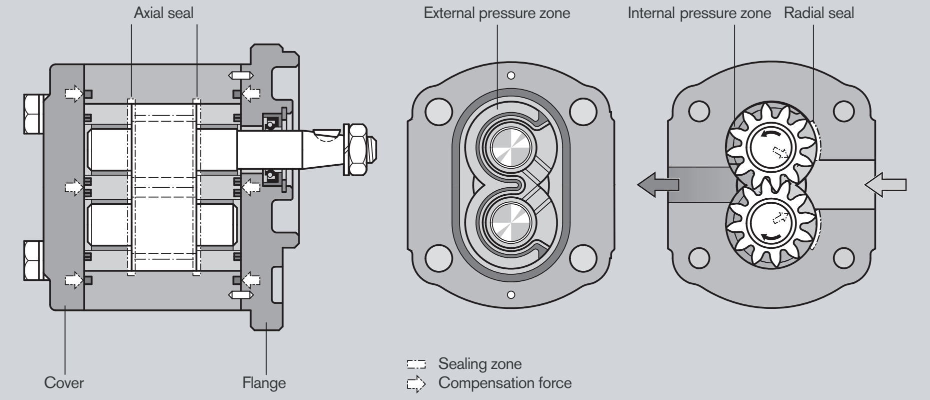
The geometry of the displacement gearing, matched in form by the rotation of the drive shaft, results in the parabolic flow characteristic shown here on the left. In a standard pump, this characteristic is repeated each time a gear tooth meshes. With their dual-flank system, the flow pulsation of SILENCE pumps is reduced by 75 % – with correspondingly lower excitation of downstream system components – at double the fundamental frequency. During this process, the gear pair exhibits an extremely reduced rear flank backlash, so that hydraulic sealing is provided not just by the front flank of the driven gear, but also by the rear flanks. In this way, the front and rear flanks alternately contribute to flow displacement. And by adapting the shape of the metering notches, the expansion of the hydraulic line of action is half that of the standard pump.

Construction

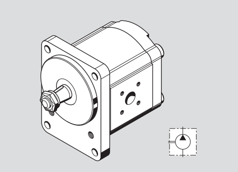
The external gear pump consists essentially of a pair of gears supported in bearing bushings or bearing, dependent on the series, and the case with a front and rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special slide bearings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

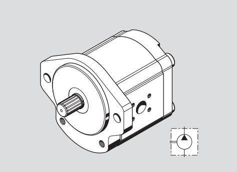
The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

Axial and radial compensation for gear pump



Overview of “Series U” standard types

Version	Page
	18

Version	Page
	19 20 21

Ordering code

External gear units Single pumps "SILENCE"

AZ	P	U	–	2	2	–	063	R	C	B	20	M	D	18009	S xxxx

Function
- **P** = Pump

Series
- **2** = 2nd generation

Version
- **2** = corrosion-resistant, pinned

Size G
- **022** = 22.5 cm³/rev
- **025** = 25.0 cm³/rev
- **028** = 28.0 cm³/rev
- **032** = 32.0 cm³/rev
- **036** = 36.0 cm³/rev
- **040** = 40.0 cm³/rev
- **045** = 45.0 cm³/rev
- **050** = 50.0 cm³/rev
- **056** = 56.0 cm³/rev
- **063** = 63.0 cm³/rev

Direction of rotation
- **R** = Clockwise
- **L** = Counterclockwise

*) Some of the special designs shown on pages 18–21 are not covered in the illustration of the ordering code.

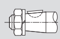
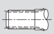
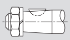
Special design *)

Valve adjustment
- **200 xx** = PRV 200 bar
- **xxx 11** = FCV 11 l/min
- **18009** = PRV + FCV 180 bar, 9 l/min

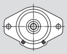
Rear cover
- **B** = Standard
- **D** = PRV residual flow internal
- **E** = FCV residual flow external
- **S** = FCV residual flow internal
- **V** = PRV + FCV

Seals
- **M** = NBR
- **K** = NBR, SSR in FKM

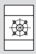
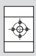
Drive shafts

			Suitable front cover
C	Tapered key shaft 1 : 5		**B**
D	Splined shaft SAE J 744 22-4 13T		**C**
H	Tapered key shaft 1 : 8		**O**

Front cover

B	Rectangular flange Centering Ø 105 mm	
C	SAE J 744 101-2 B 2-hole flange Ø 101.6 mm	
O	Rectangular flange Centering Ø 50.78 mm	

Line ports

20	Rectangular flange	
07	Square flange SAE thread, metric	
30	Rectangular flange	

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units Multiple pumps "SILENCE"

AZ	P	UUSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm^3/rev
S = 4.0...28 cm^3/rev
F = 4.0...28 cm^3/rev
T = 20.0...36 cm^3/rev
N = 20.0...36 cm^3/rev
U = 22.5...63 cm^3/rev
G = 22.5...63 cm^3/rev

Series, relates to pump section 1
2 = 2nd generation

Version, relates to pump section 1
2 = corrosion-resistant, pinned

Size
as per individual Series

Direction of rotation
R = Clockwise
L = Counterclockwise

Rear cover
relates to last pump part
B = Standard

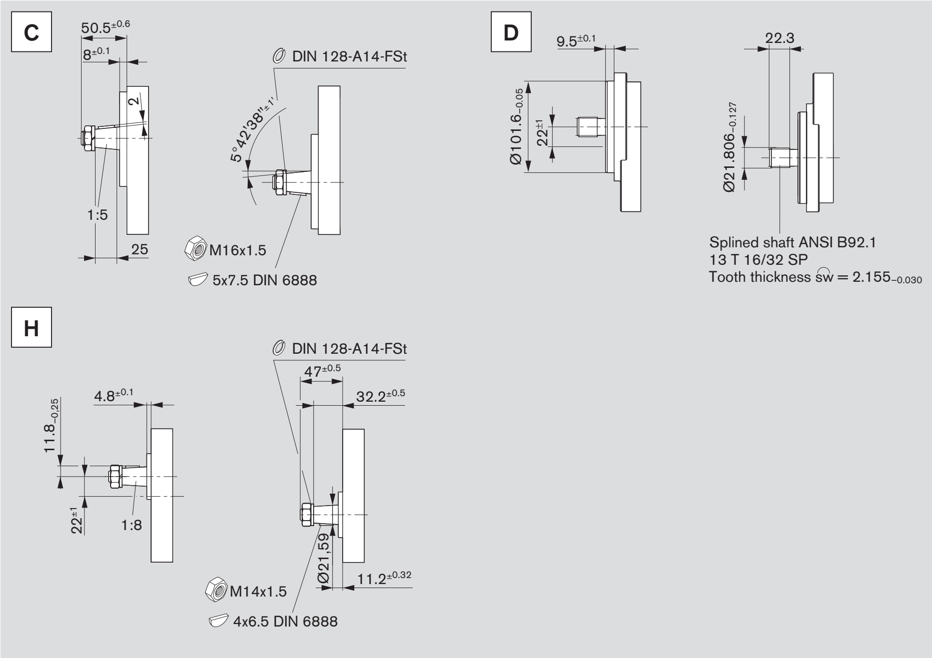
Seals
M = NBR
P = FKM
K = NBR, WDR in FKM
WDR relates to pump part 1

Drive shafts relates to pump part 1	Suitable front cover	Front cover relates to pump part 1	Line ports every pump parts
Series B:			
H Tapered key shaft 1 : 5	**O**	**O** Square flange Centering Ø 25.38 mm	**01** Pipe thread ISO 228/1
			20 Rectangular flange
Series F, S:			
C Tapered key shaft 1 : 5	**B**	**B** Square flange Centering Ø 80 mm	**20** Rectangular flange
H Tapered key shaft 1 : 8	**O**	**O** Square flange Centering Ø 36.47 mm	**30** Rectangular flange
R Splined shaft SAE J 744 16-4 9T	**R**	**R** SAE J 744 82-2 A 2-bolt flange Ø 82.55 mm	
Series N, T:			
C Tapered key shaft 1 : 5	**B**	**B** Square flange Centering Ø 100 mm	**07** Square flange SAE Thread, metric
D Splined shaft SAE J 744 22-4 13T	**C**	**C** SAE J 744 101-2 B 2-bolt flange Centering Ø 101.6 mm	**20** Rectangular flange
Series G, U:			
C Tapered key shaft 1 : 5	**B**	**B** Square flange Centering Ø 105 mm	**07** Square flange SAE Thread, metric
D Splined shaft SAE J 744 22-4 13T	**C**	**C** SAE J 744 101-2 B B 2-bolt flange Centering Ø 101.6 mm	**20** Rectangular flange
H Tapered key shaft 1 : 8	**O**	**O** Square flange Centering Ø 50.78 mm	**30** Rectangular flange

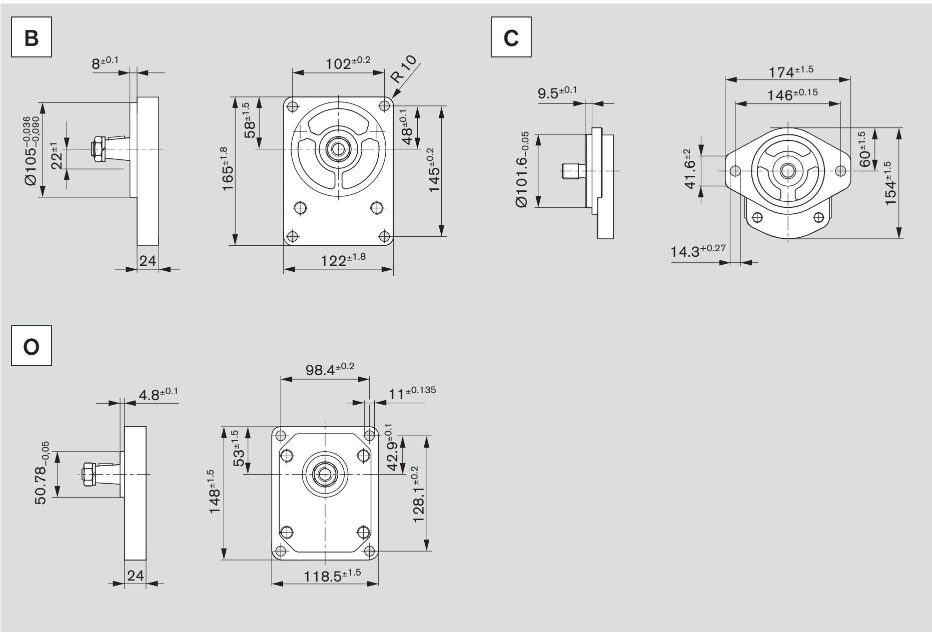
Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

3

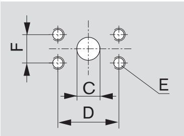
Drive shafts



Front cover

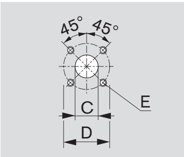


Line ports



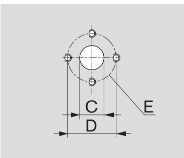
07 Square flange SAE, thread, metric

Ordering code	Size	Pressure side				Suction side			
		C	D	E	F	C	D	E	F
07	22.5...28 cm^3	18	47.6	M10 depth 18	22.2	25	52.4	M10 depth 14	26.2
	32.0...50 cm^3	25	52.4		26.2	32	58.7		30.2
	56.0...63 cm^3	32	58.7		30.2	38	69.8		35.8



20 Rectangular flange

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
20	22.5...63 cm^3	18	55	M8 depth 13	26	55	M8 depth 13



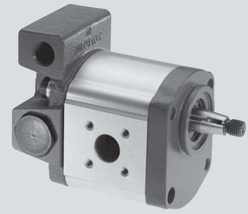
30 Rectangular flange

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
30		18	39.7	M8 depth 13	26	50.8	M10 depth 13

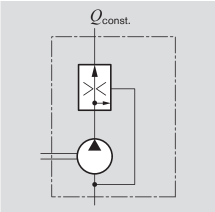
3

Gear pumps with integral valves

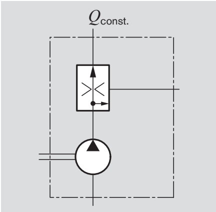
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the cover of the gear pump. Such solutions are used, for example for supplying hydraulic oil to power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



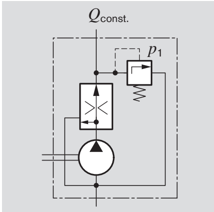
Upon request



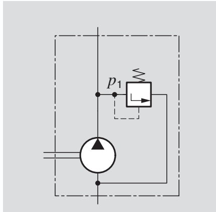
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.} = 2...30$ l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.} = 2...30$ l/min
$p_1 = 100...180$ bar



Pressure-relief valve.
Discharge returned to suction line
$p_1 = 5...250$ bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

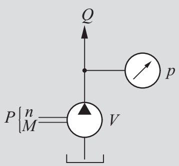
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

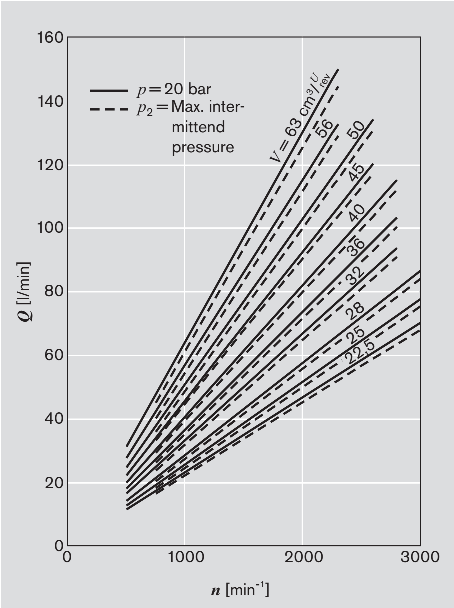
n —— $\eta_v \longrightarrow Q$
M —— $\eta_{hm} \longrightarrow p$
P —— $\eta_t \longrightarrow p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

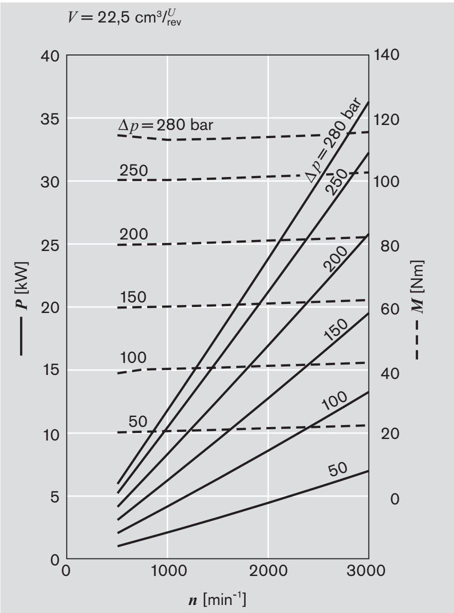
Caution: η [%] e.g. 95 [%]

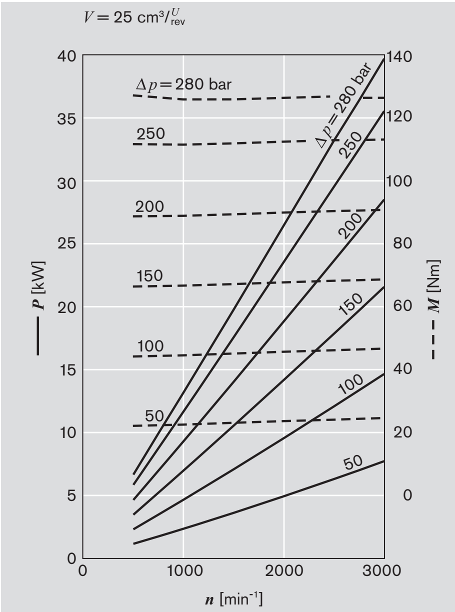
Performance charts

$\nu = 35\ \text{mm}^2/\text{s}$, $\vartheta = 50\,°\text{C}$



$Q = f(n, V)$ incl. η_v
$P = f(n, p)$ ——— incl. η_t
$M = f(n, p)$ – – – incl. η_{hm}





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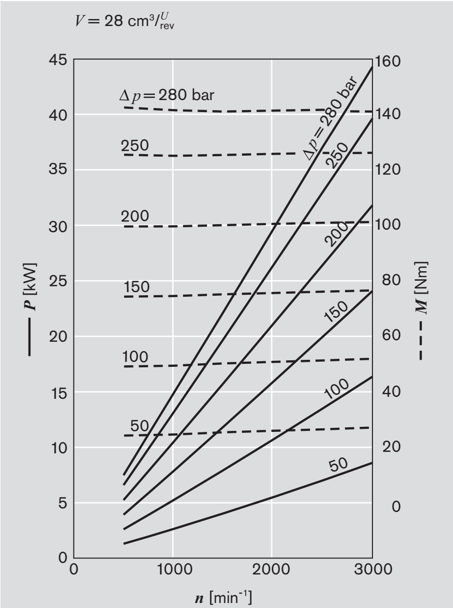
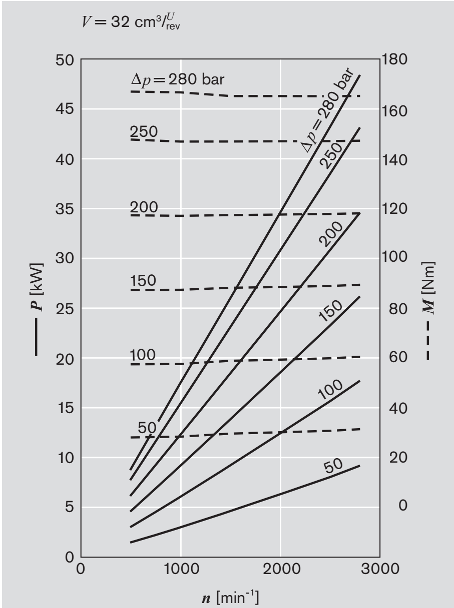
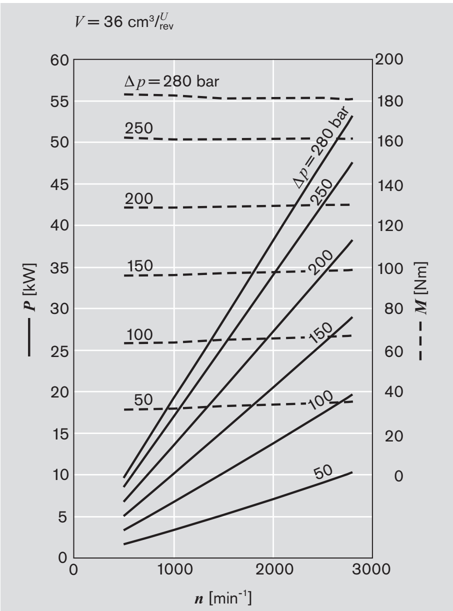
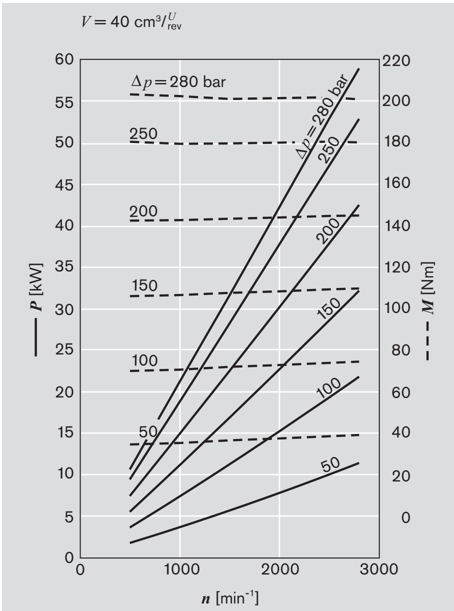
Performance charts (continued)

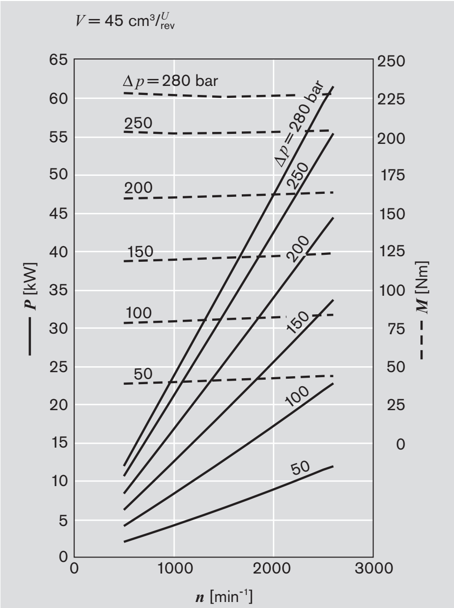


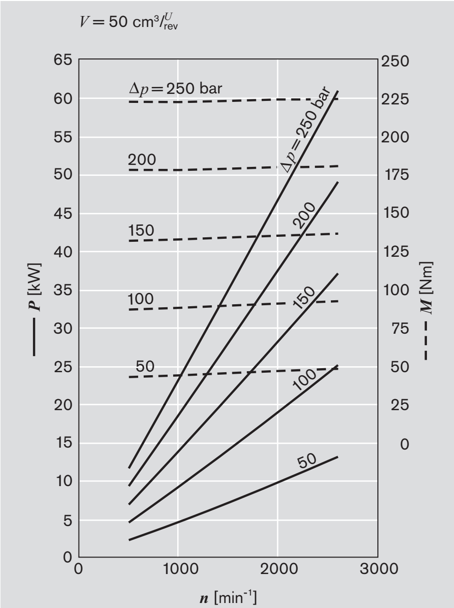


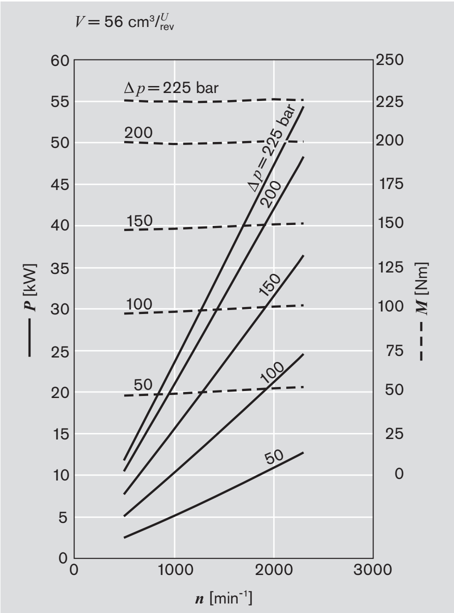


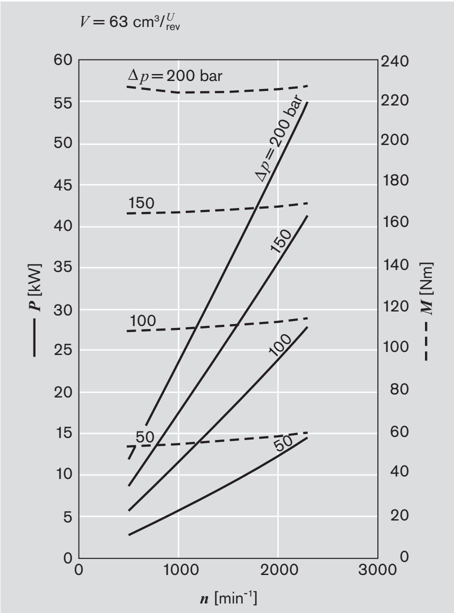


Performance charts (continued)









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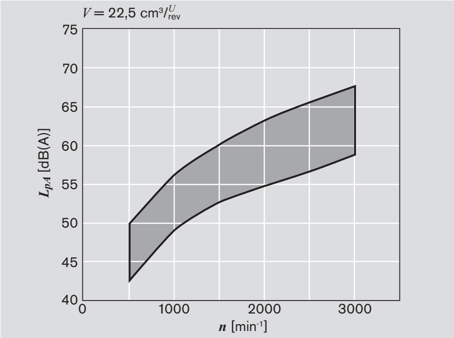
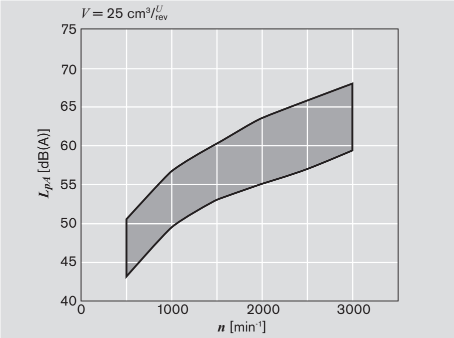
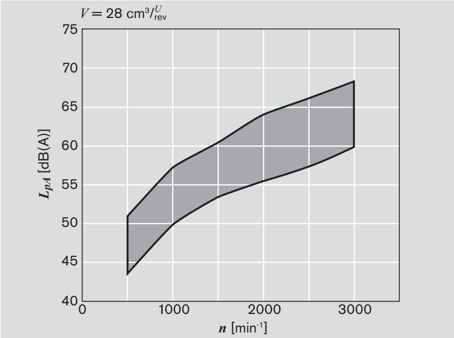
Noise charts

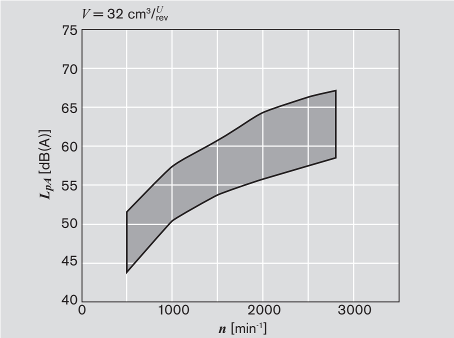
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 14 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45 635, Part 26.
Spacing between measuring sensor – pump: 1 m.

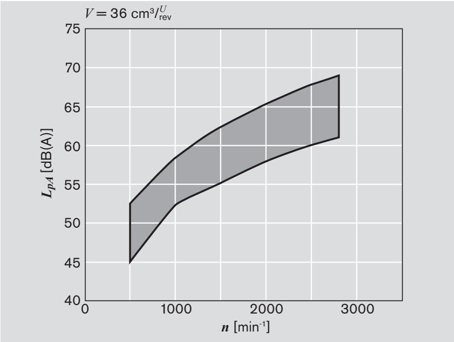
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

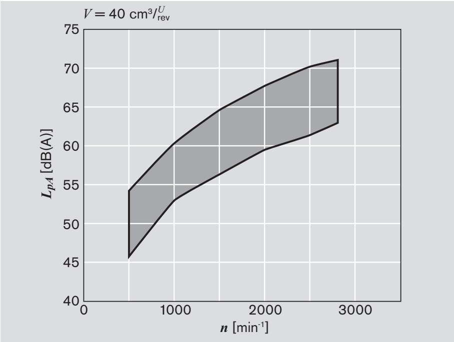




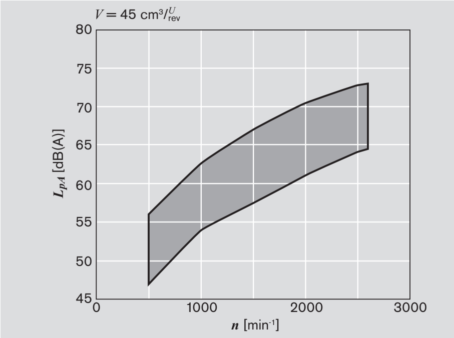


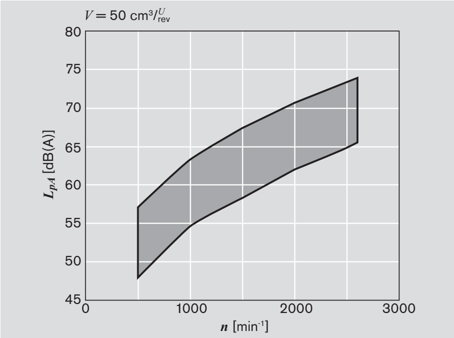


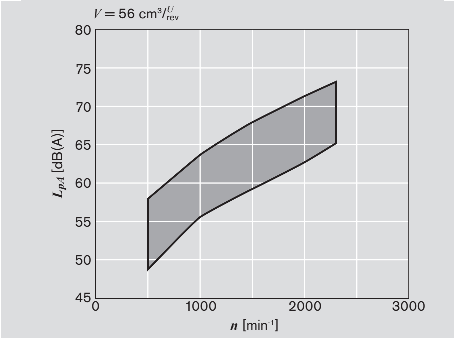


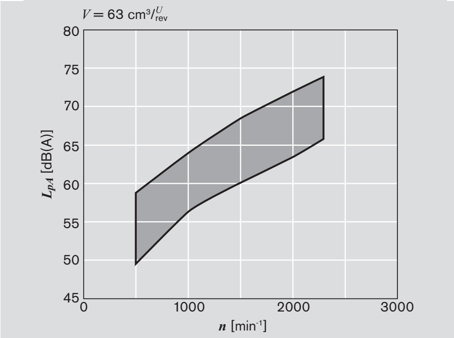


Noise charts (continued)









Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C or max. +110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals *) max. +110 °C with FKM seals **)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) On hydraulic systems or devices with critical counter-reaction, such as steering and counterbalance valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

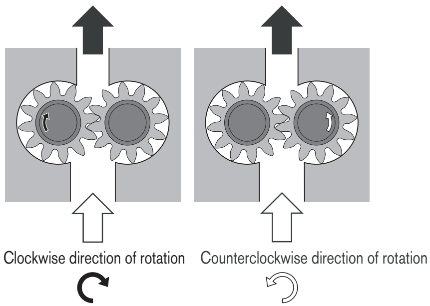
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

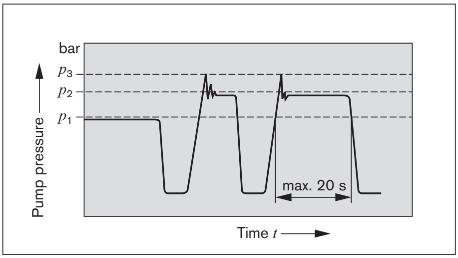
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps. On counterclockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittend pressure
p_3 max. peak pressure

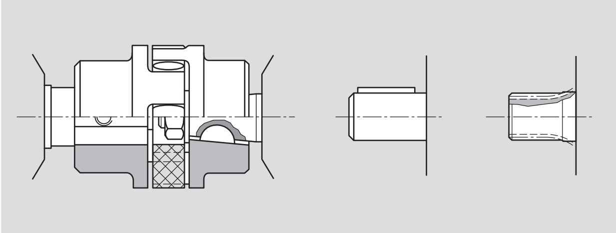
Size AZPU

Displacement	V	cm³/rev	22.5	25	28	32	36	40	45	50	56	63
Suction pressure	p_e		0,7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)									
max. continuous pressure	p_1	bar	250							220	195	170
max. intermittent pressure	p_2		280							250	225	200
max. peak pressure	p_3		300							280	250	230
min. rpm at bar, 12 mm²/s	< 100	rpm	500	500	500	500	500	500	500	500	500	500
	100...180		1,200	1,200	1,000	1,000	1,000	800	800	800	800	800
	180... p_2		1,400	1,400	1,400	1,400	1,200	1,200	1,000	1,000	1,000	1,000
25 mm²/s	p_2		600	600	500	500	500	500	500	500	500	500
max. rotational speed at	p_2		3,000	3,000	3,000	2,800	2,800	2,800	2,600	2,600	2,300	2,300

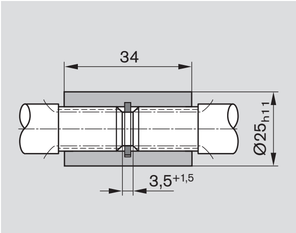
Drive arrangement

1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be $3.5^{+1.5}$. Oil-bath or oil-mist lubrications is necessary.



Splined shaft	Ordering code	M_{max} [Nm]
SAE-B 13 teeth	D	300

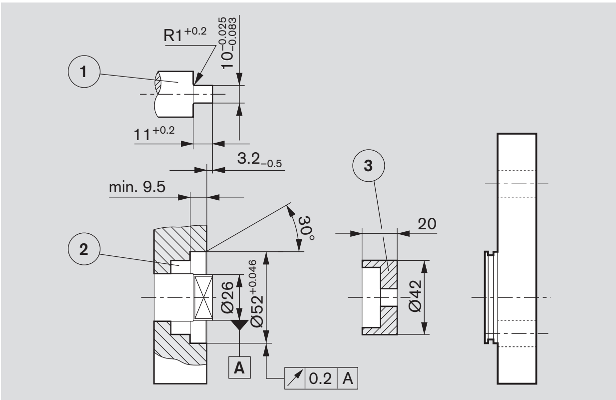
3

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm 2}$
Surface for sealing ring
ground without rifling $R_t \leq 4\mu m$

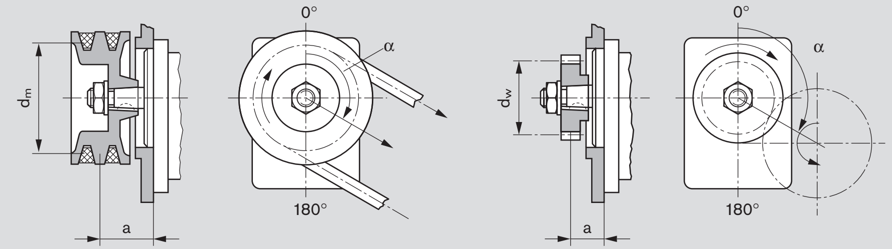
② **Radial shaft seal**
with rubber covered seal
(see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
130	28	260
	36	200
	40	180
	45	160
	50	150
	56	130
	63	110
	70	100
	80	90
	100	70

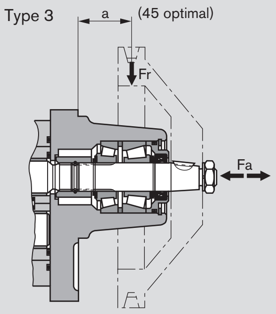
4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

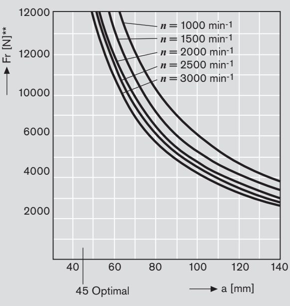
When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.



5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of L_H = 1000 h.





Multiple gear pumps

Gear pumps are suitable for multiple setups, whereby the drive shaft for the 1st pump is extended to a second and even a 3rd pump. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

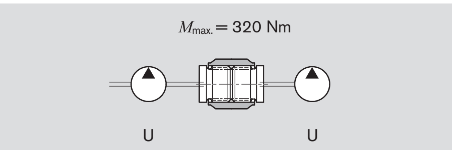
Pressure restrictions during standard through drive
In the case of series U, the driver for the second pumping stage can carry a load of up to $M_{max.}$ = 130 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

$M_{max.}$ [Nm]	V [cm³/rev]	p_{max} [bar]
65 Series F, S	16	230
	19	190
	22.5	160
	25	140
	28	130
130 Series G, U	22.5	280
	25	280
	28	260
	32	230
	36	200
	40	180
	45	160
	50	150
	56	130
	63	110

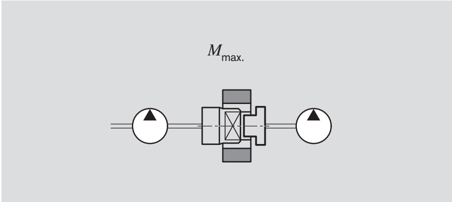
If the 1st stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

Reinforced through drive



Standard through drive



Combinations

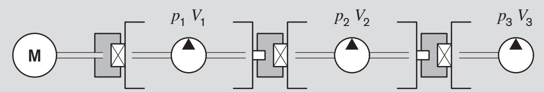
Series Pump 1	$M_{max.}$ [Nm]	Series Pump 2
U	130	G, U
U	65	F, S

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

Max. transferrable drive torque

Function	Code	Designation	Max. transferrable drive torque * [Nm]
Splined shafts	D	SAE J744 22-4 (13T 16/32 DL)	300
	E	SAE-C 15 teeth	450
Tapered key shaft	C	1:5	290
	H	1:8	240

* These figures are valid providing the conditions defined on pages 15 and 16 are observed. Bosch Rexroth is to be consulted if the stated values are exceeded.

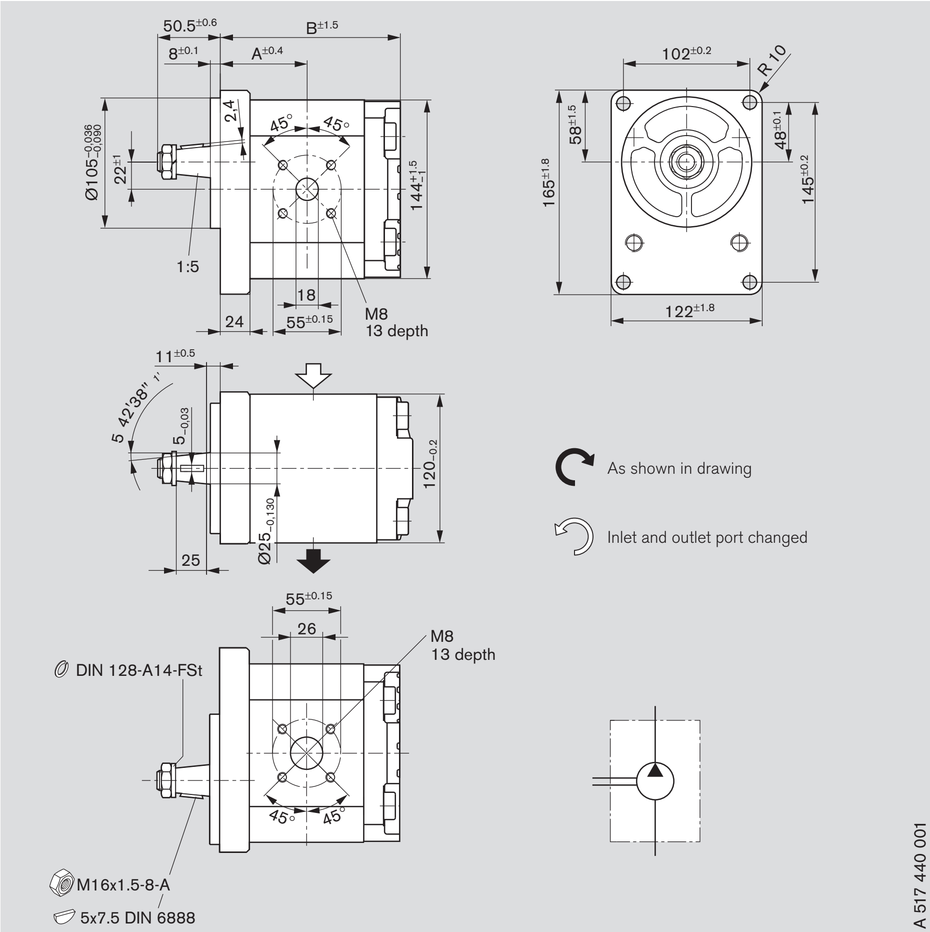


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range

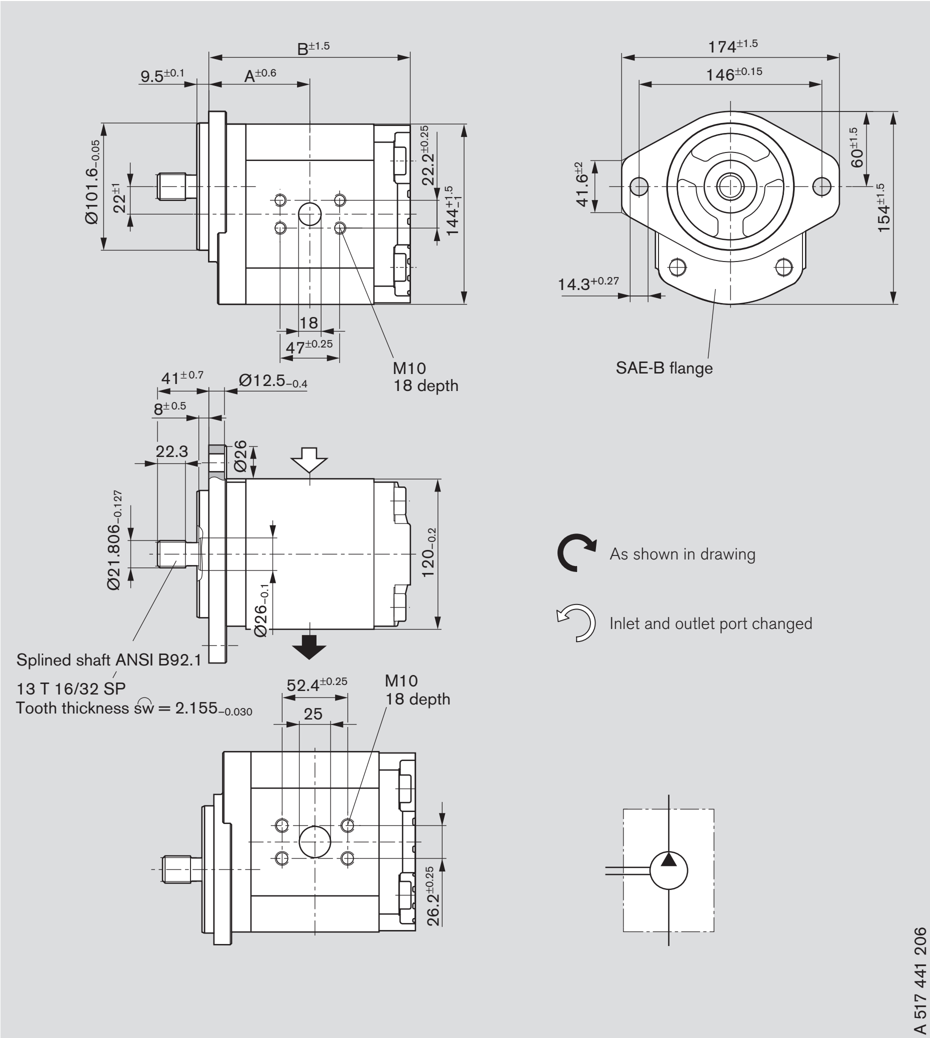


Ordering code:
AZPU – 22 – ☐☐☐ ☐ C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B
22.5	**0 517 725 322**	**0 517 725 026**	280	3,000	10.3	60.9	124.6
25	**0 517 725 323**	**0 517 725 027**	280	3,000	10.4	61.9	126.6
28	**0 517 725 324**	**0 517 725 028**	280	3,000	10.5	63.2	129.1
32	**0 517 725 325**	**0 517 725 029**	280	2,800	10.7	64.8	132.4
36	**0 517 725 326**	**0 517 725 030**	280	2,800	10.9	66.4	135.7
40	**0 517 725 327**	**0 517 725 031**	280	2,800	11.0	68.1	139.0
45	**0 517 725 328**	**0 517 725 032**	280	2,600	11.2	70.1	143.1
50	**0 517 825 301**	**0 517 825 001**	250	2,600	11.4	72.2	147.2
56	**0 517 825 302**	**0 517 825 002**	225	2,300	11.7	74.7	152.2
63	**0 517 825 303**	**0 517 825 003**	200	2,300	12.0	77.6	158.0

Dimensions

Standard range



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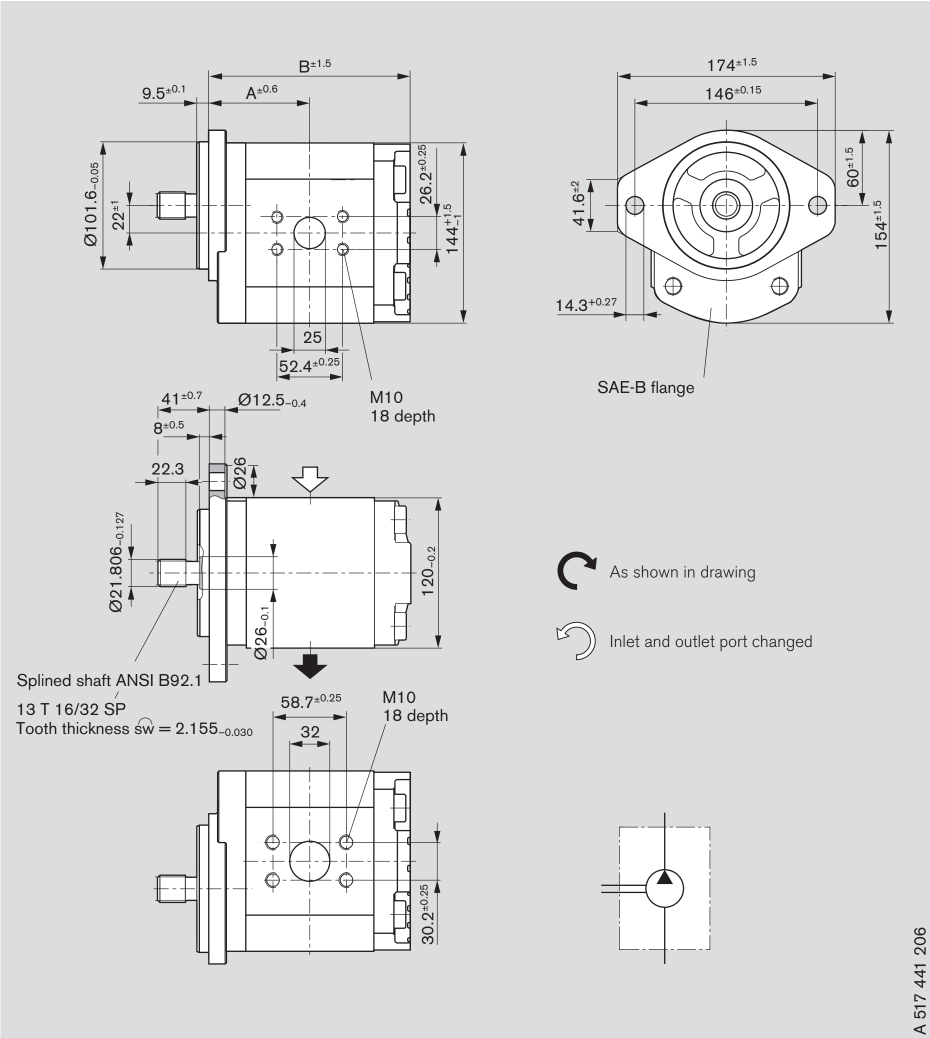
Ordering code:
AZPU – 22 – □ □ □ □ D C 07 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	Dimension [mm] B
22.5	**0 517 725 329**	**0 517 725 033**	280	3,000	9.6	66.4	130.1
25	**0 517 725 330**	**0 517 725 034**	280	3,000	9.7	67.4	132.1
28	**0 517 725 331**	**0 517 725 035**	280	3,000	9.8	68.7	134.6

Dimensions

Standard range

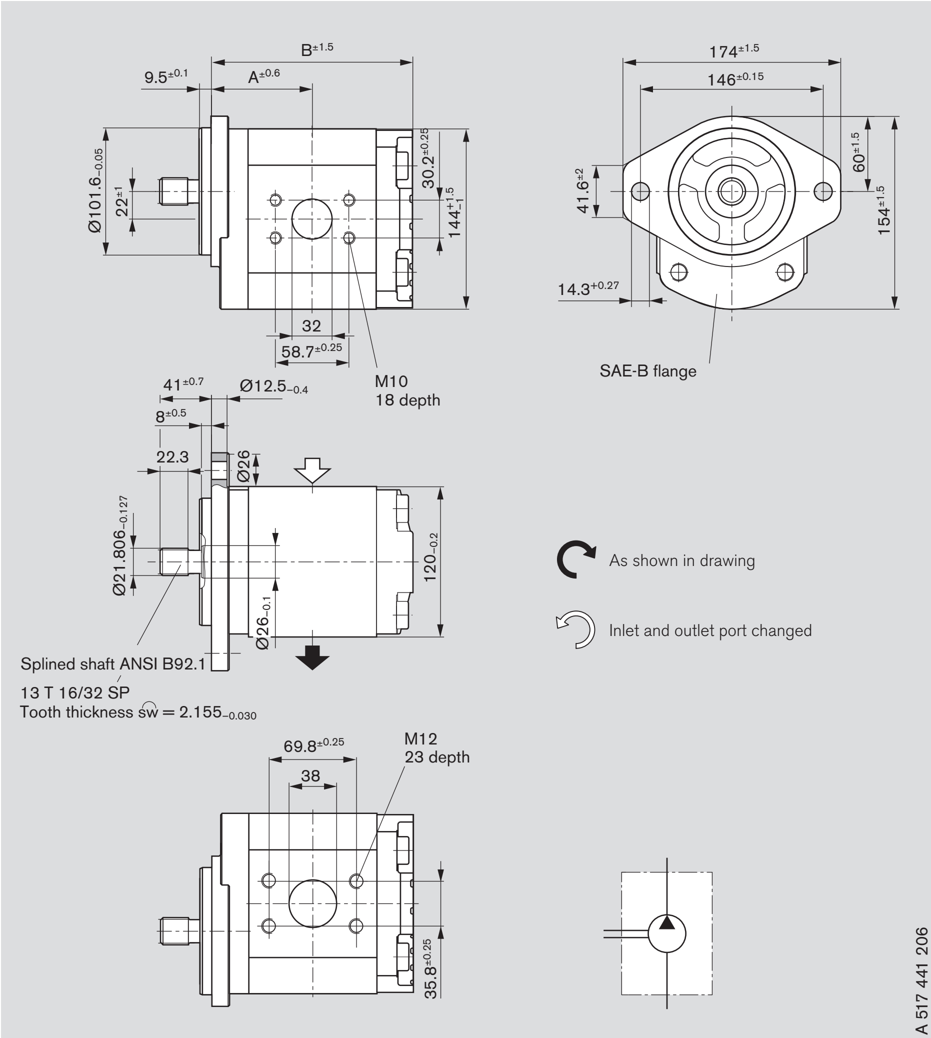


Ordering code:
AZPU – 22 – □□□ □ D C 07 K B

Displacement [cm³/rev]	Ordering-No. L	R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B
32	**0 517 725 332**	**0 517 725 036**	280	2,800	10.0	70.3	137.9
36	**0 517 725 333**	**0 517 725 037**	280	2,800	10.1	71.9	141.2
40	**0 517 725 334**	**0 517 725 038**	280	2,800	10.3	73.6	144.5
45	**0 517 725 335**	**0 517 725 039**	280	2,600	10.5	75.6	148.6
50	**0 517 825 304**	**0 517 825 004**	250	2,600	10.7	77.7	152.7

Dimensions

Standard range



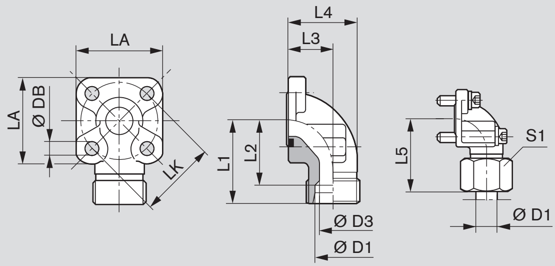
Ordering code:
AZPU – 22 – □ □ □ □ D C 07 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	Dimension [mm] B
56	**0 517 825 305**	**0 517 825 005**	225	2,300	11.0	80.2	157.7
63	**0 517 825 306**	**0 517 825 006**	200	2,300	11.3	83.1	163.5

Fittings

Fittings can be used for rectangular flange 20 see page 7

Gear pump flange, 90° angle



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2 pcs.	2 pcs.	Seal ring	Mass kg	Part number	p (bar)
55	20S	17	45	34.5	24.0	40.0	56.0	58	36	8.4	M8x25	M8x50	33x2.5	0.44	**1 515 702 004**	250
55	30S	26	49	35.5	32.0	50.0	62.0	58	50	8.4	M8x25	M8x50	33x2.5	0.50	**1 515 702 006**	250
55	35L	31	49	38.5	32.0	51.5	62.0	58	50	8.4	M8x25	M8x60	32x2.5	0.47	**1 515 702 005**	100
55	42 L	38	49	38.0	40.0	64.5	61.0	58	60	8.4	M8x25	M8x70	32x2.5	0.60	**1 515 702 019**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Note
The permissible tightening torques can be found in our publication:
"General operating instructions for external gear units"
RE 07 012-B1.

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General

- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 15 – 18).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

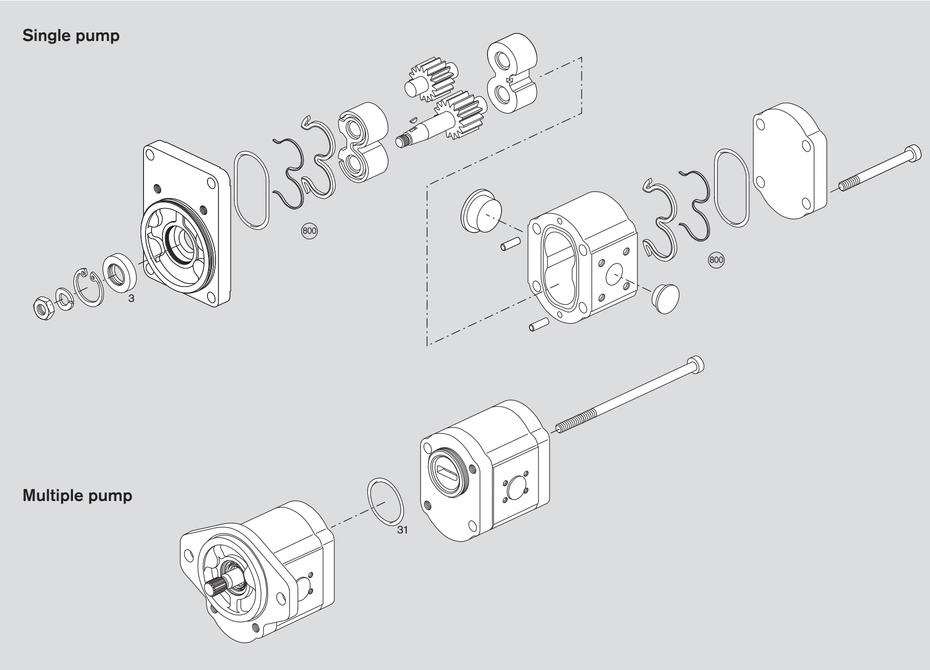
Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 12.

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 18 – 21, are contained in delivery.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Service parts



Page	Ordering code	Seal kit "U" Item 800 NBR	Shaft seal ring Item 3	Dimension	Material
18	AZPU – 22 – □□□ □ C B 20 M B	1 517 010 231	1 510 283 072	42 x 26 x 7	NBR
19, 20, 21	AZPU – 22 – □□□ □ D C 07 K B	1 517 010 231	1 510 283 069	42 x 26 x 7	FKM

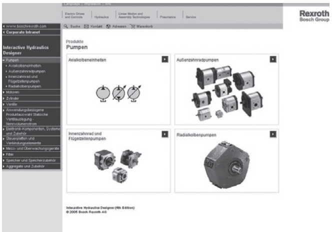
NBR = Perbunan® FKM = Viton®

For multiple pumps

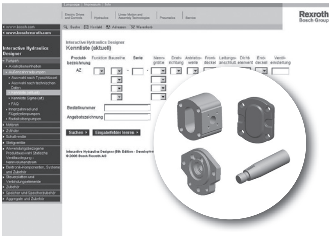
Seal ring Item 31 NBR	1 900 210 145

The AZ configurator at www.boschrexroth.com/azconfigurator

The AZ configurator assists you to configure your individual external gear unit easily and user-friendly You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical require-ments. This means that you can search for exter-nal gear units that have already been configured, or you specify the configu-ration variant of the exter-nal gear unit based upon the operating parameters you require.

If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed instal-lation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Ordering-No.

Ordering-No.	Page	Ordering-No.	Page	Ordering-No.	Page
0 517 725 004	20	0 517 725 039	20	0 517 725 334	20
0 517 725 026	18	0 517 725 304	20	0 517 725 335	20
0 517 725 027	18	0 517 725 322	18	0 517 825 001	18
0 517 725 028	18	0 517 725 323	18	0 517 825 002	18
0 517 725 029	18	0 517 725 324	18	0 517 825 003	18
0 517 725 030	18	0 517 725 325	18	0 517 825 005	21
0 517 725 031	18	0 517 725 326	18	0 517 825 006	21
0 517 725 032	18	0 517 725 327	18	0 517 825 301	18
0 517 725 033	19	0 517 725 328	18	0 517 825 302	18
0 517 725 034	19	0 517 725 329	19	0 517 825 303	18
0 517 725 035	19	0 517 725 330	19	0 517 825 305	21
0 517 725 036	20	0 517 725 331	19	0 517 825 306	21
0 517 725 037	20	0 517 725 332	20		
0 517 725 038	20	0 517 725 333	20		

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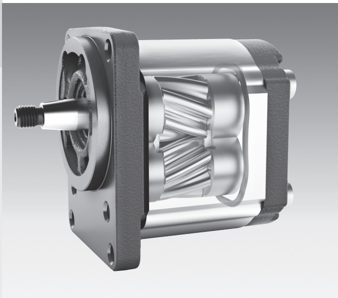
brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Rexroth
Bosch Group

External Gear Pumps Series J

RE 10 094/05.12

AZPJ-...



Fixed pumps
$V = 12...16$ cm^3/rev

SILENCE PLUS

Overview of contents

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Ordering code multiple pumps	5
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Design calculations for pumps	9
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Features

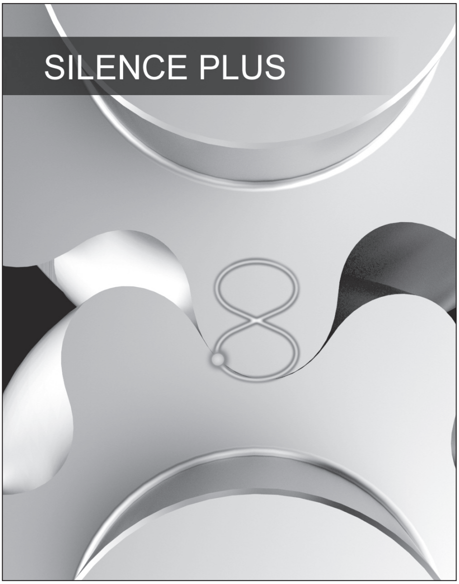
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports: connection flange
- very low inherent noise
- pleasant pitch due to low frequency
- Optimized pressure pulsation with reduced noise emissions and vibration excitation in the system
- Consistent high quality
- Considerably longer service life due to reinforced shaft and case

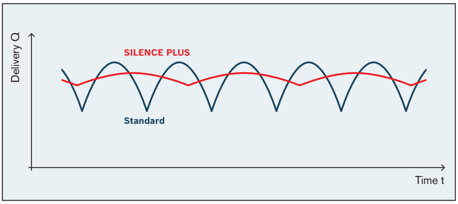
General

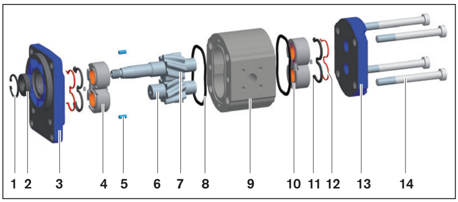
The key task of external gear units is to convert mechanical energy (torque and rotational speed) into hydraulic energy (flow and pressure). In external gear motors this is the other way round. These units are required to be highly efficient in order to avoid unnecessary heat. This efficiency is achieved by means of precision production engineering and pressure sensitive gap sealing.

With the extremely low-noise SILENCE PLUS pumps the inherent noise is reduced by 15 dB (A) in average and, in addition, the flow pulsation about 75 %, versus standard external gear pumps.

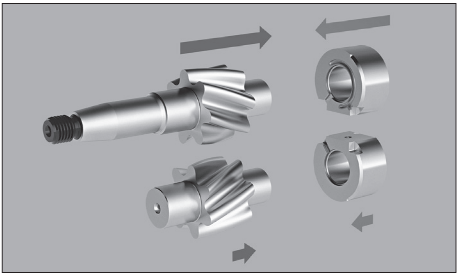
The displacement method







1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws



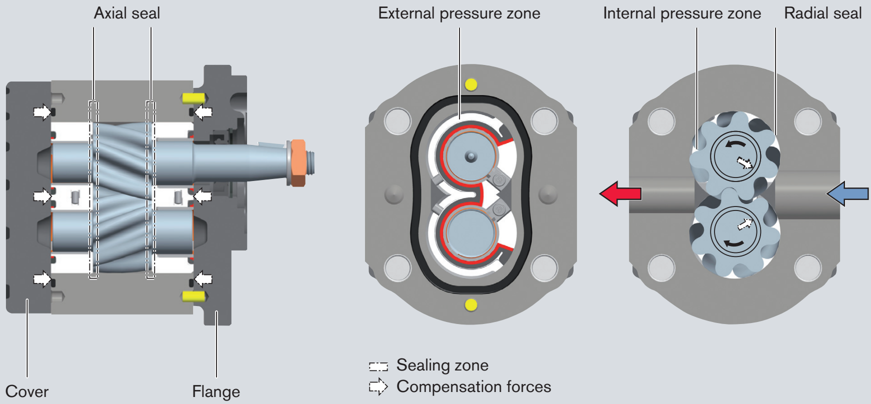
Continuous tooth contact reduces operating noise:
A non-involute rounded tooth profile, combined with helical cut teeth, forms the heart of the SILENCE PLUS. Thanks to permanent tooth contact the fluid is transported almost continuously and noiselessly. The possibility of noise from trapped oil between the tooth flanks is prevented in the first place.
Hydrostatic bearing ensures long service life:
The high performance and long service life of the SILENCE PLUS is due to a Rexroth patented solution: Hydrostatic grooves provide wear-free compensation for the internal axial forces generated in the helical gear – even at pressures up to 280 bar!

Construction

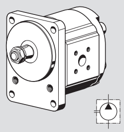
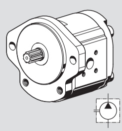
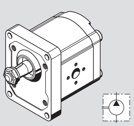
The external gear unit consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 7 teeth. This keeps both flow pulsation and noise emission to a minimum.

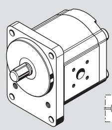
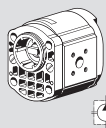
The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

Gear pump axial compensation SILENCE PLUS



Product overview of “SILENCE PLUS standard range”

Version	Page
	17
	18
	19

Version	Page
	20
	21

Ordering code

External gear units Single pumps "SILENCE PLUS"

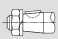
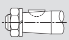
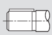
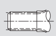
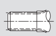
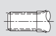
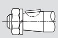
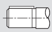
AZ	P	J	–	x	x	–		016	R	C	B	20	M	B	18009	S xxxx

Special design *)

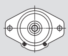
Function	
P = Pump	
Series	
2x = Reinforced bearing Ø 20	
Version	
1 = Phosphatized, pinned	
2 = Chromatized, pinned	
Size (J)	
012 = 12.0 cm³/rev	
014 = 14.0 cm³/rev	
016 = 16.0 cm³/rev	
Direction of rotation	
R = Clockwise	
L = Counter-clockwise	

Valve adjustment	
200 xx	= PRV 200 bar
xxx 11	= FCV 11 l/min
18009	= PRV + FCV 180 bar, 9 l/min
Rear cover	
B	= Standard
D	= PRV residual flow internal
T	= PRV residual flow external
E	= FCV residual flow external
S	= FCV residual flow internal
V	= PRV + FCV
Seals	
M	= NBR
P	= FKM
K	= NBR, SSR in FKM

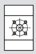
Drive shafts

Code	Drive shaft		Suitable front cover
C	Tapered key shaft 1 : 5		B, P
H	Tapered key shaft 1 : 8		O
N	Dihedral claw		M
Q	Straight keyed shaft SAE J 744 16-1		R
R	Splined shaft SAE J 744 16-4 9T		R, C
P	Splined shaft SAE J 744 19-4 11T		R, C
F	Splined shaft DIN 5482 B 17 x 14		B, P
S	Tapered key shaft 1 : 5 for flange A		A, G
A	Straight keyed shaft ISO Ø 18 mm		B

Front cover

Code	Front cover	
B	Square flange Centering Ø 80 mm	
R	SAE J 744 82-2 A 2-bolt flange Ø 82.55 mm	
P	2-bolt mounting Centering Ø 50 mm	
O	Square flange Centering Ø 36.47 mm	
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm	
M	2-bolt mounting Centering Ø 52 mm with seal ring	
A	Outboard bearing Ø 80 mm, Type 1	
N	2-bolt mounting Centering Ø 50 mm	
T	4-bolt mounting Centering Ø 52 mm with seal ring	
G	Outboard bearing Ø 80 mm, Type 2	

Line ports

Code	Line ports	
20	Rectangular flange	
30	Rectangular flange	

Not all variants can be selected by using ordering code! Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth! Special options are possible upon request.

Ordering code

External gear units Multiple pumps

AZ	P	GGSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

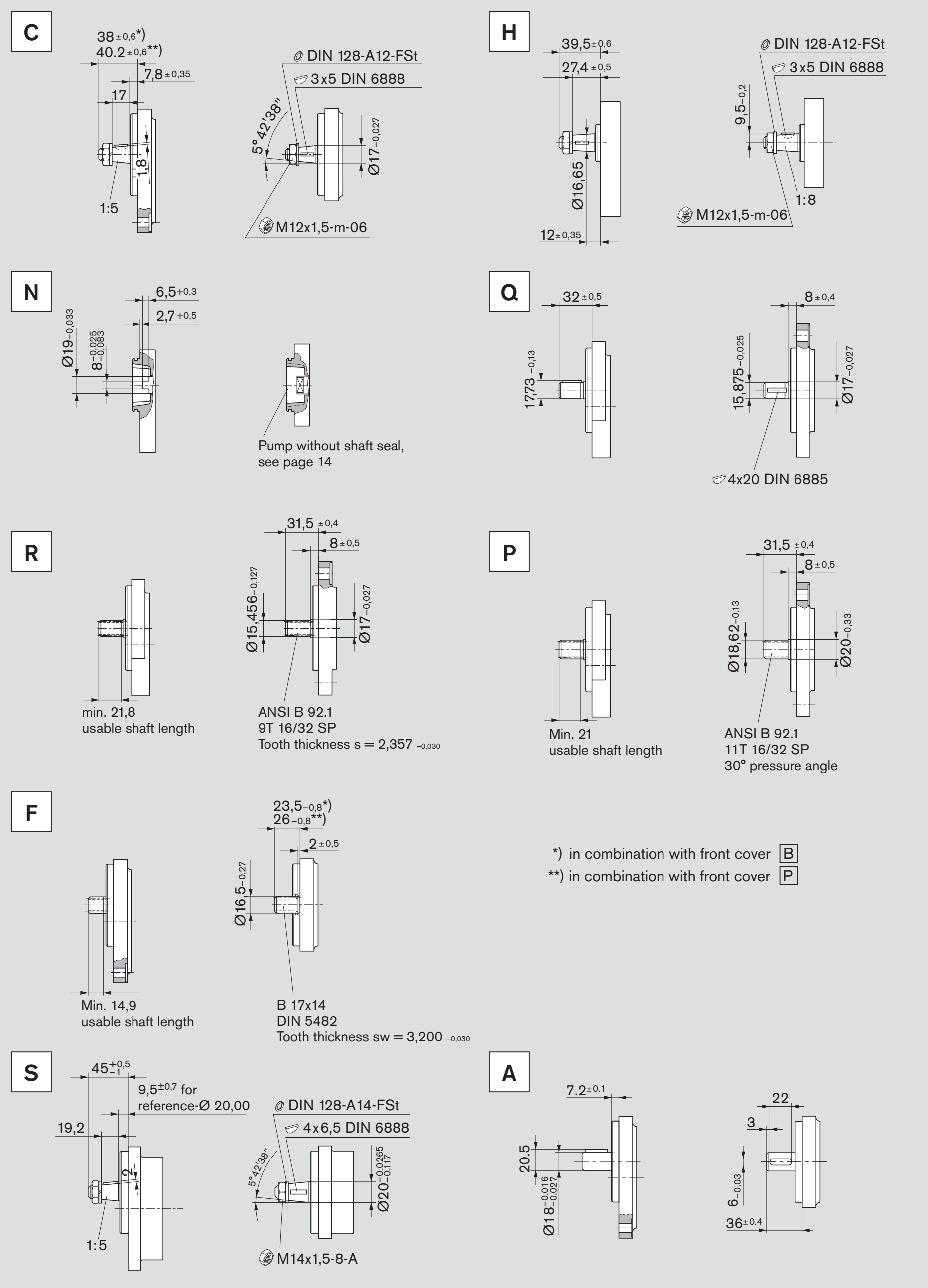
Function	
P = Pump	
Series	
B = 1.0...7.1 cm^3/rev *)	*) Standard
F = 4.0...28 cm^3/rev	
N = 20.0...36 cm^3/rev	
G = 22.5...100 cm^3/rev	
S = 4.0...28 cm^3/rev **)	**) SILENCE
T = 20.0...36 cm^3/rev	
U = 22.5...63 cm^3/rev	
J = 12.0...16 cm^3/rev ***)	***) SILENCE PLUS
Series, relates to pump section 1	
1x = Standard bearing	
2x = Reinforced bearing	
Version, relates to pump section 1	
1 = Phosphatized, pinned	
2 = Chromatized, pinned	
Size	
corresponding to each series	
Direction of rotation	
R = cw, **L** = ccw	

Rear cover relates to last pump section
B = Standard
Seals
M = NBR
P = FKM
K = NBR, SSR in FKM Shaft seal relate to pump section 1

Drive shafts relates to pump part 1		Suitable front cover	**Front cover** relates to pump part 1		**Line ports** every pump parts	
Series B:						
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 25.38 mm	**02**	Thread, metric DIN 3852 T1
Series F, S, J:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 80 mm	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 36.47 mm	**30**	Rectangular flange
R	Splined shaft SAE J 744 16-4 9T	**R**	**R**	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting		
Series N, T:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 100 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
N	Dihedral claw	**M**	**M**	Centering Ø 52 mm with seal ring		
Series G, U:						
C	Tapered key shaft 1 : 5	**B**	**B**	Square flange Centering Ø 105 mm	**07**	Square flange SAE Thread, metric
D	Splined shaft SAE J 744 22-4 13T	**C**	**C**	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting	**20**	Rectangular flange
H	Tapered key shaft 1 : 8	**O**	**O**	Square flange Centering Ø 50.78 mm		

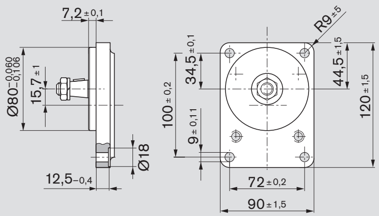
Not all variants can be selected by using ordering code! Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth! Special options are possible upon request.

Drive shafts

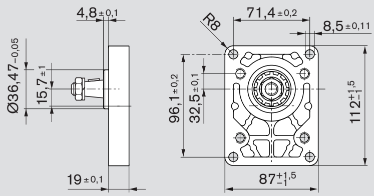


Front cover

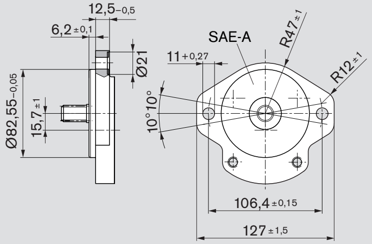
B



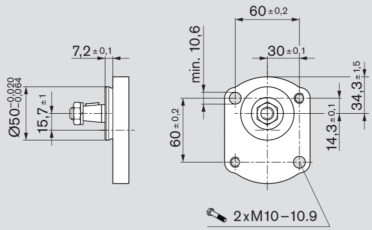
O



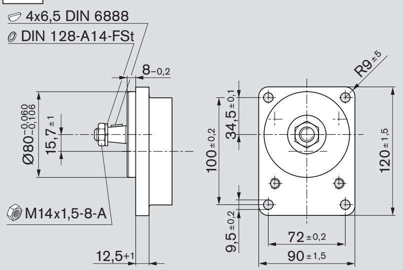
R



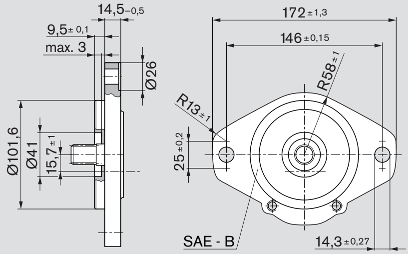
P



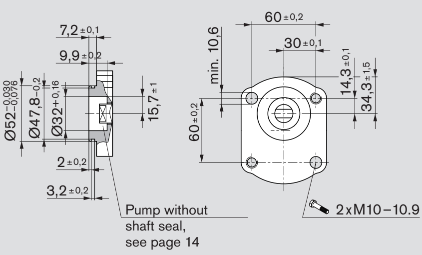
A



C



M



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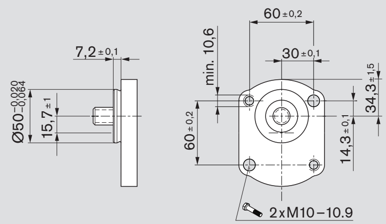

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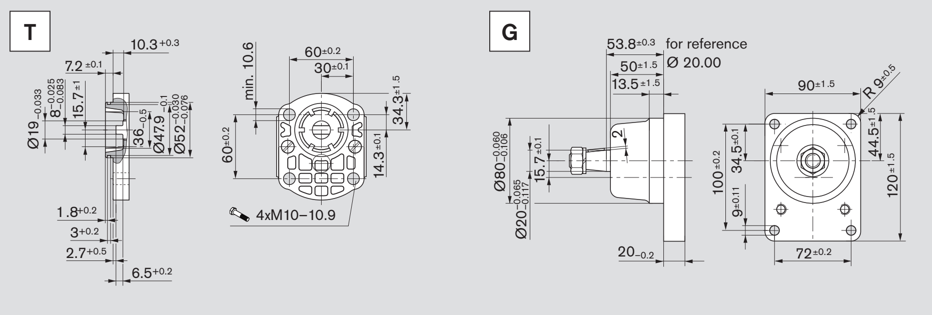
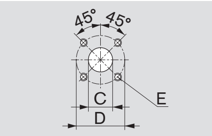
Front cover (continued)

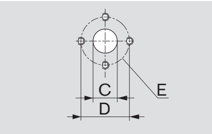


Line ports



20 Rectangular flange

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
20	12...16 cm³	15	35	M6, depth 13	20	40	M6, depth 13

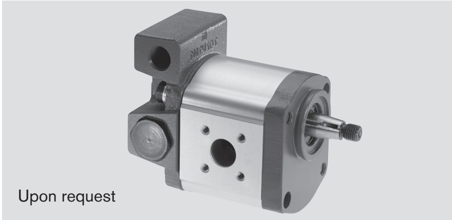


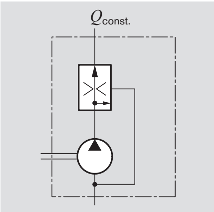
30 Rectangular flange

Ordering code	Size	Pressure side			Suction side		
		C	D	E	C	D	E
30	12...16 cm³	13.5	30.2	M6, depth 13	20.0	39.7	M8, depth 13

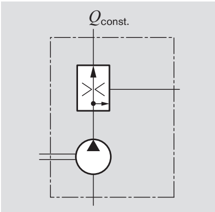
Gear pumps with integral valves

In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.

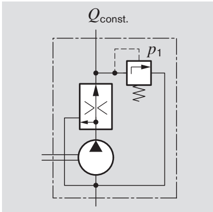

Upon request



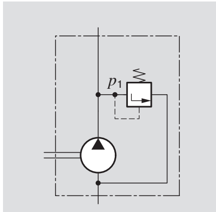
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min
p_1 = 100...180 bar



Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

3

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

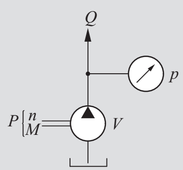
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

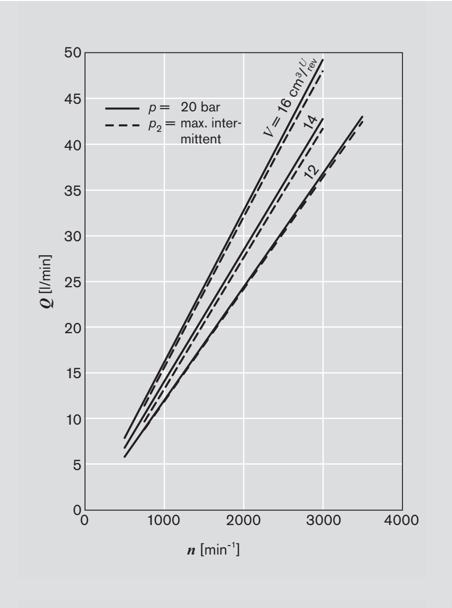
[%]
n —— η_v $\longrightarrow$ Q
M —— η_{hm} $\longrightarrow$ p
P —— η_t $\longrightarrow$ $p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

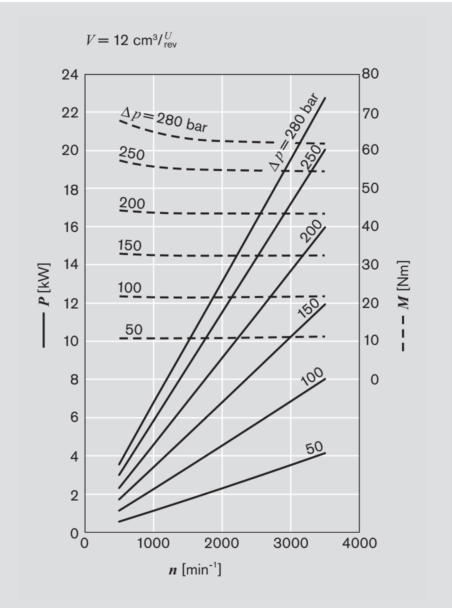
Caution: η [%] e.g. 95 [%]

Performance charts

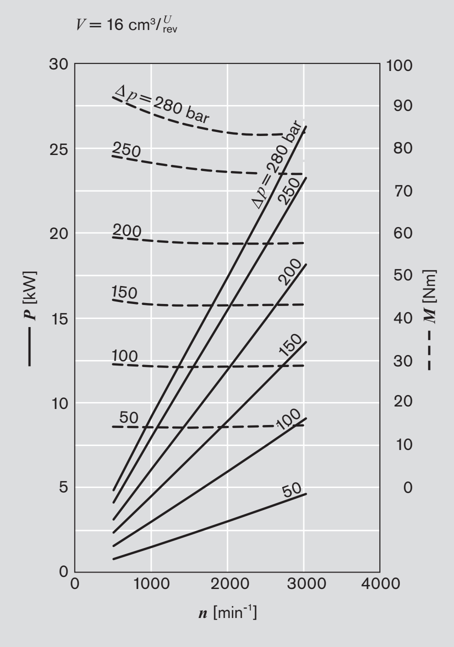
$\nu = 32\ mm^2/s$, $\vartheta = 50\ °C$



$Q = f(n, V)$ incl. η_v
$P = f(n, p)$ ——— incl. η_t
$M = f(n, p)$ – – – incl. η_{hm}



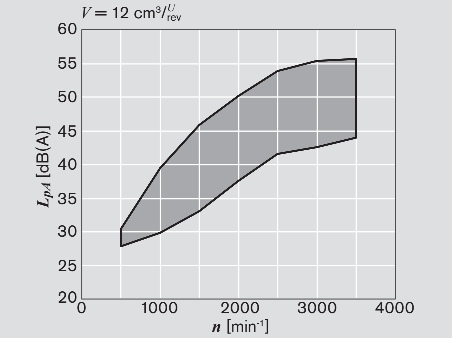
Performance charts (continued)

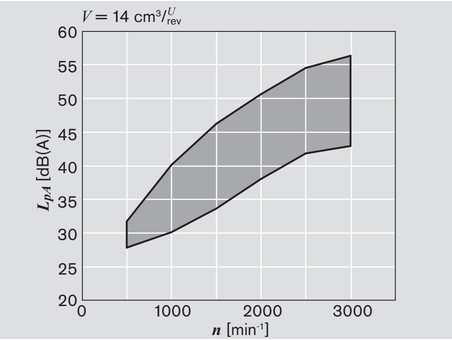


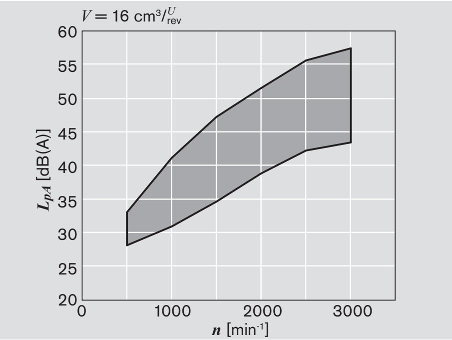
Noise charts

Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 15 Specifications table).
Oil data: $\nu = 32$ mm^2/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.
Apart from the low levels, the much lower frequency also contributes to the substantial noise benefits of the SILENCE PLUS compared to other pump designs.







Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	−30 °C...+80 °C with NBR seals −20 °C...+110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm²/s permitted range 20...100 mm²/s recommended range ...2000 mm²/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals*) max. +110 °C with FKM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

Safety requirements pertaining to the whole systems are to be observed.

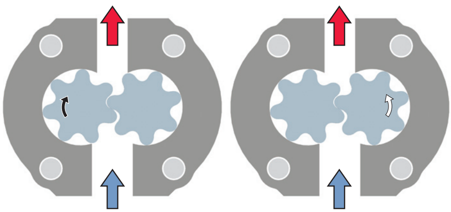
In the case of applications with high numbers of load cycles please consulting.

3

Definition of direction of rotation

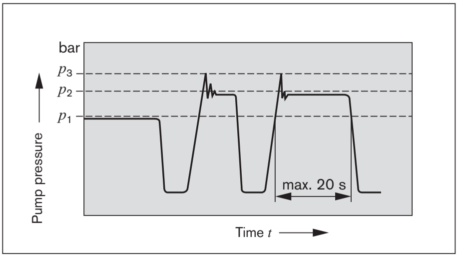
Always look on the drive shaft.

Caution: At counter-clockwise-rotation pumps the position of the drive shaft and the suction and pressure ports are different to clockwise-rotation pumps.



Clockwise rotation Counter-clockwise rotation

Definitions of pressures



p_1 max continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

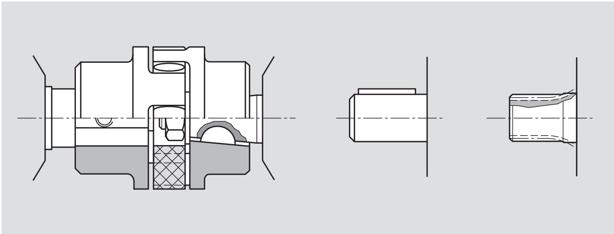
Series				AZPJ-2x		
Displacement		V	cm³/rev	12	14	16
Suction pressure		p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)		
Max. continuous pressure		p_1	bar	250		
Max. intermittent pressure		p_2	bar	280		
Max. peak pressure		p_3	bar	300		
Min. rotational speed at bar	12 mm²/s	< 100	min⁻¹	500	500	500
	12 mm²/s	100...180	min⁻¹	1000	800	800
	12 mm²/s	180... p_2	min⁻¹	1200	1000	1000
	25 mm²/s	p_2	min⁻¹	600	500	500
Max. rotational speed at		p_2	min⁻¹	3500	3000	3000

Drive arrangement

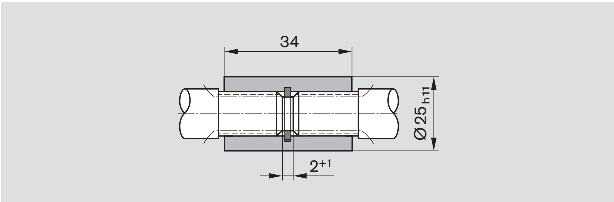
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Provide installation space for circlip. Oil-bath or oil-mist lubrications is necessary.



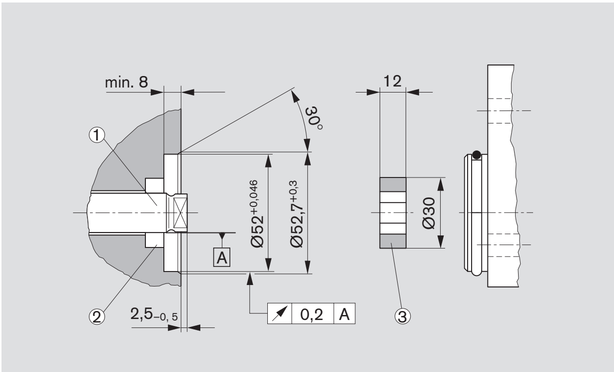
Drive shaft	Splined shaft	M_{max} [Nm]	V [cm^3/rev]	p_{max} [bar]
F	DIN	100	12...16	280
R	SAE 9z	110		
P	SAE 11z	180		

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① Drive shaft
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 0.6 deep; HRC $60^{\pm 3}$
Surface for sealing ring
ground without rifling $R_{max.} \leq 4 \mu m$
The maximal transmissible torque of 85 Nm is considered with a claw height of 19 mm. With lower claw heights e.g. 17 mm the transmissible torque decreases on 65 Nm.

② Radial shaft seal ring
Rubber-covered seal (see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.

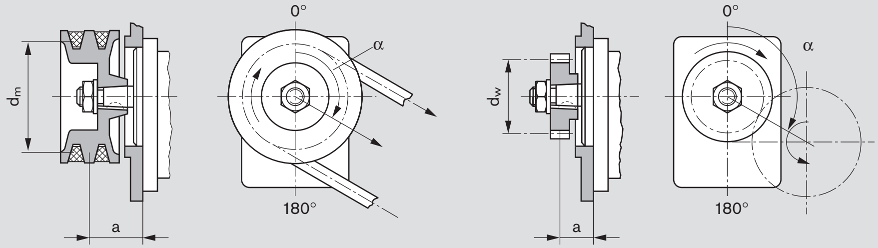


Drive with tang

M_{max} [Nm]	V [cm^3/rev]	p_{max} [bar]
65	12	280
	14	
85	16	

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).
For helical toothed gear drives, details of the helix angle β are also required.

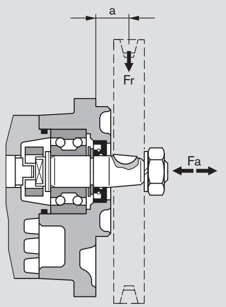


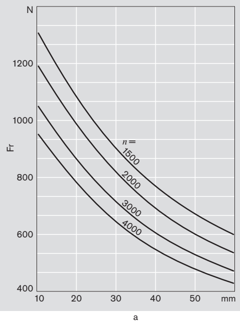
5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of L_H = 1,000 hours.

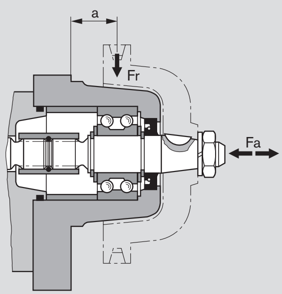
Kind of the bearing	M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
Type 1	65	12...14	280
		16	230
Type 2	85	12...16	280

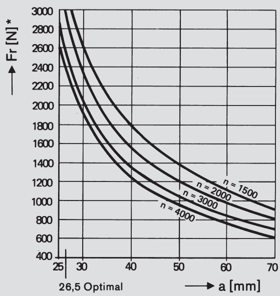
Type 1
(front cover A)





Type 2
(front cover G)





Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers.Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series J, the driver for the second pumping stage can carry a load of up to $S_{max.} = 65$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		Max. transferrable drive torque * [Nm]
C	1:5	155
H	Tapered key shaft 1:8	160
F	DIN 5482	100
N	Claw	65 (12 cc, 14 cc) 85 (16 cc)
R	SAE 9T	110
P	SAE 11T	180
Q	Straight keyed shaft SAE	55
A	Straight keyed shaft ISO Ø 18	75

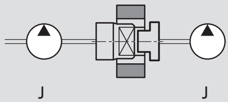
* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

Standard through drive

$M_{max.} = 65$ Nm



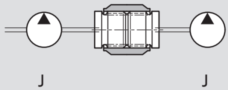
Combinations (drive with tang)

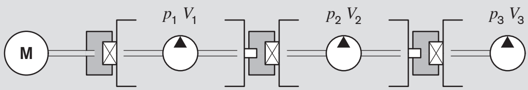
Series pump 1	$M_{max.}$ [Nm]	Series pump 2
J	65	J
J	65	F
F	65	J
J	25	B – 2x

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

Reinforced through drive

$M_{max.} = 160$ Nm



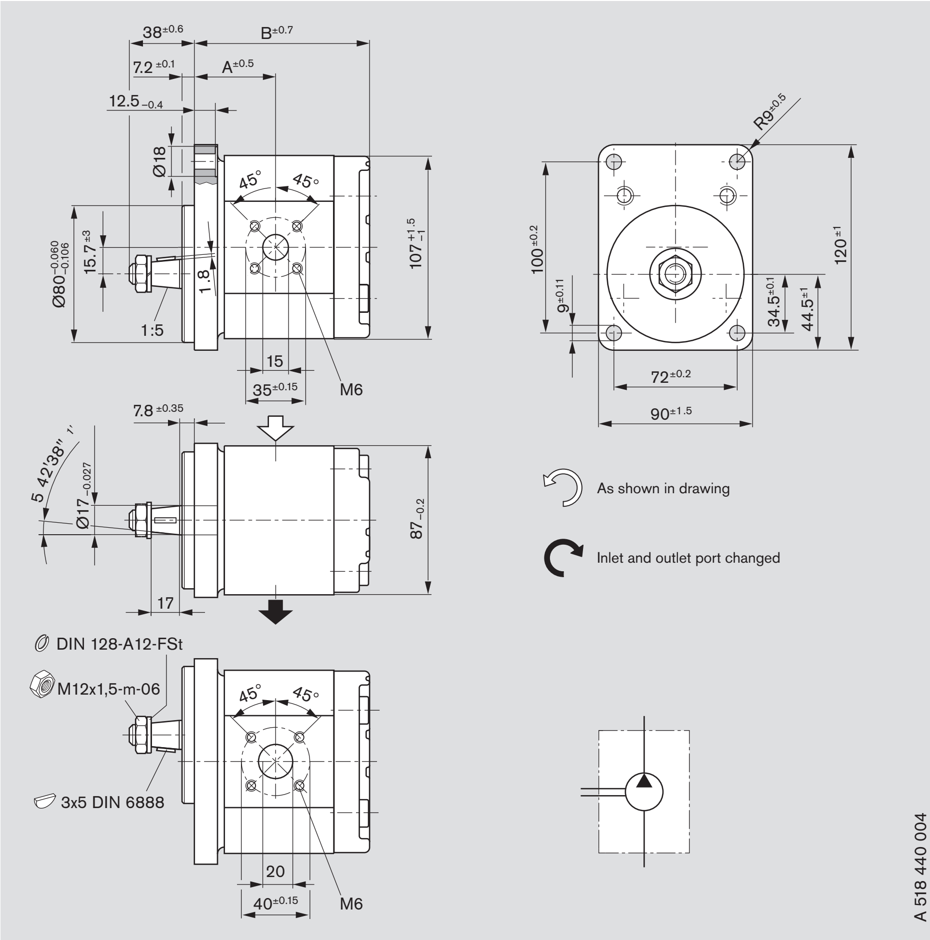


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0{,}0177 + \Delta p_2 \cdot V_2 \cdot 0{,}0177 + \Delta p_3 \cdot V_3 \cdot 0{,}0177$$

Δp [bar] V [cm^3/rev]

Dimensions

Standard range



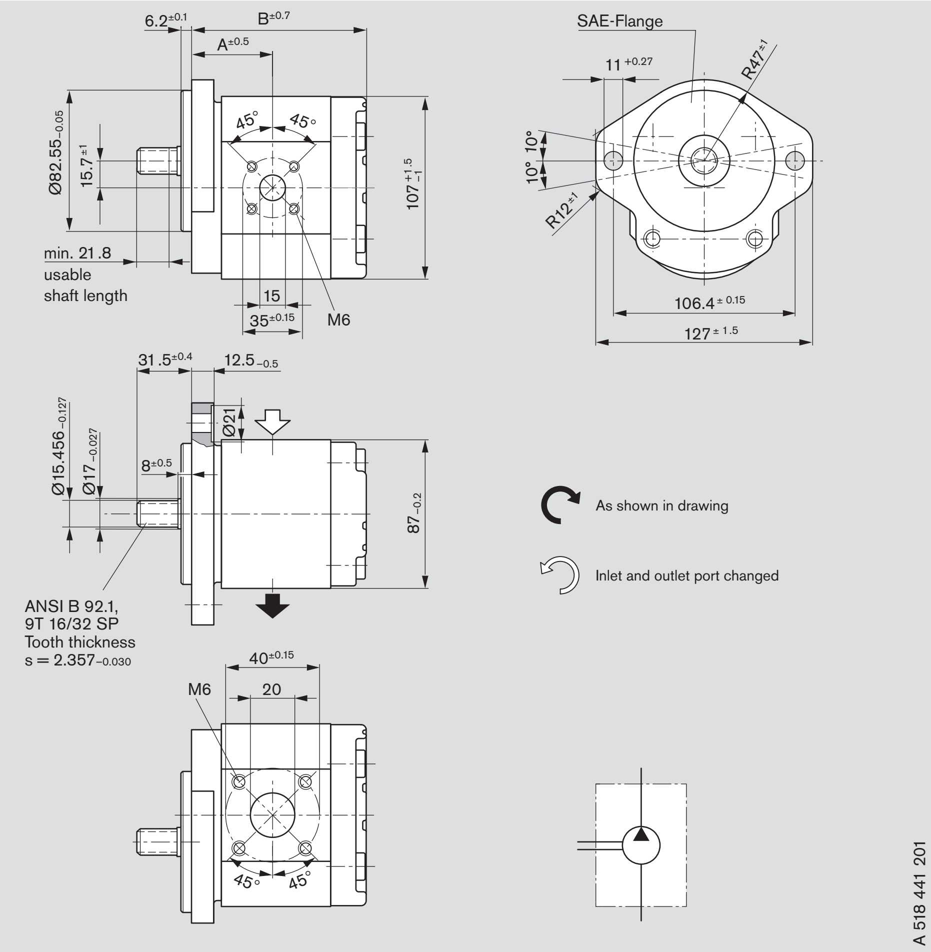
3

Ordering code:
AZPJ – 22 – ☐☐☐ ☐C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Mass kg	Dimension [mm]	Dimension [mm]
12	**0 518 525 302**	**0 518 525 001**	280	3500	3.9	46.5	96.3
14	**0 518 525 303**	**0 518 525 002**	280	3000	4.0	47.5	99.5
16	**0 518 625 301**	**0 518 625 001**	280	3000	4.1	47.5	102.9

Dimensions

Standard range

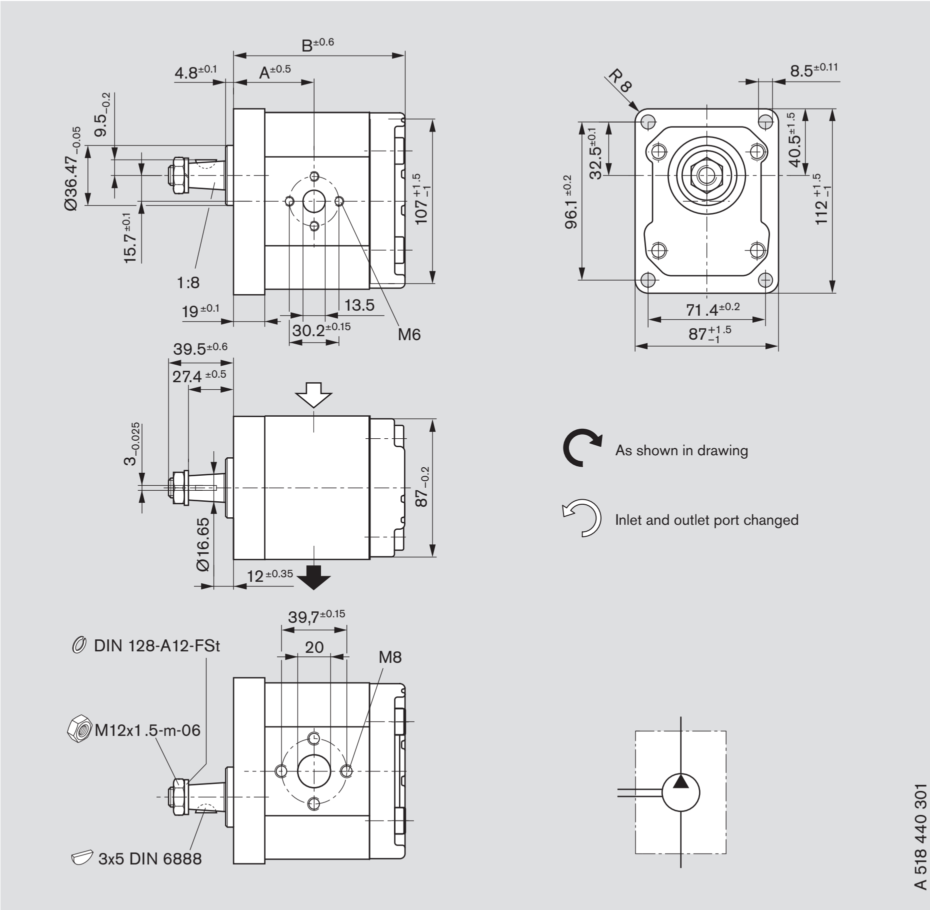


Ordering code:
AZPJ – 22 – ☐☐☐ ☐ R R 20 M B

Displacement [cm³/rev]	Ordering-No. L	R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Mass kg	Dimension [mm]	[mm]
12	**0 518 525 306**	**0 518 525 005**	280	3500	3.8	46.5	96.3
14	**0 518 525 307**	**0 518 525 006**	280	3000	3.9	47.5	99.5
16	**0 518 625 303**	**0 518 625 003**	280	3000	4.0	47.5	102.9

Dimensions

Standard range

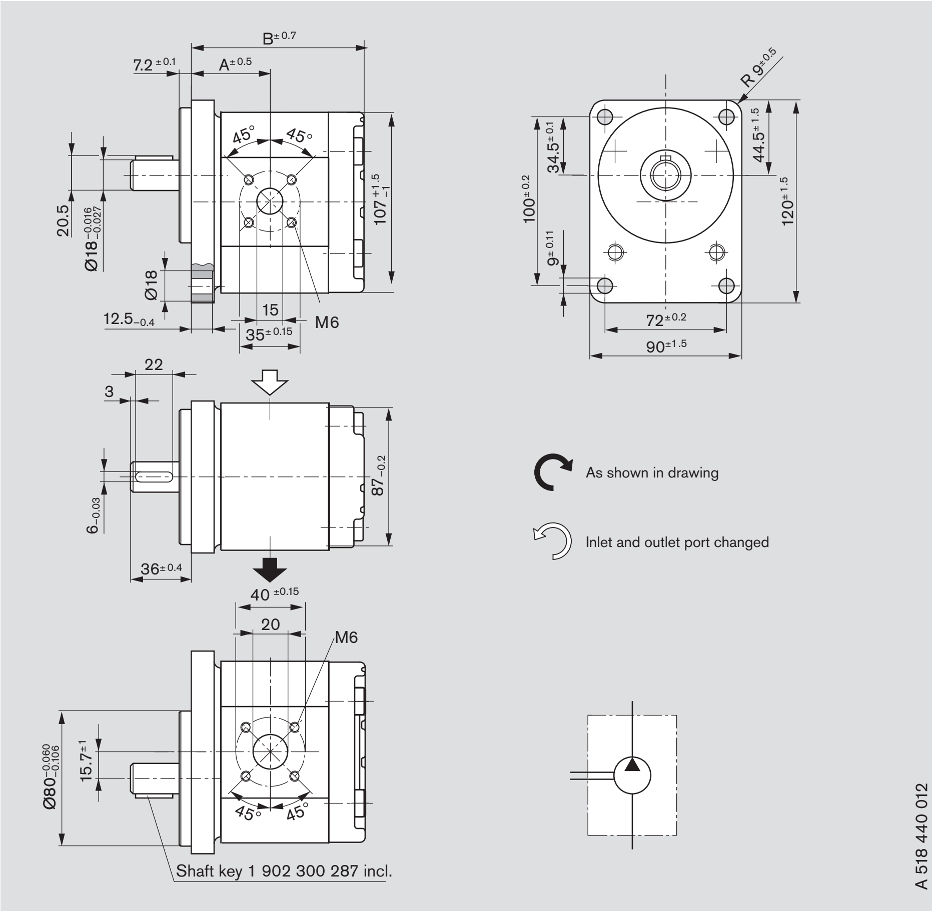


Ordering code:
AZPJ – 22 – □□□ □H O 30 M B

Displacement	Ordering-No.		Max. operating pressure	Max. rotation speed	Mass	Dimension	
[cm³/rev]	L	R	[bar]	[min⁻¹]	kg	[mm]	[mm]
12	**0 518 525 308**	**0 518 525 007**	280	3500	3.7	48.0	97.8
14	**0 518 525 309**	**0 518 525 008**	280	3000	2.8	49.0	101.0
16	**0 518 625 304**	**0 518 625 004**	280	3000	3.9	49.0	104.4

Dimensions

Standard range

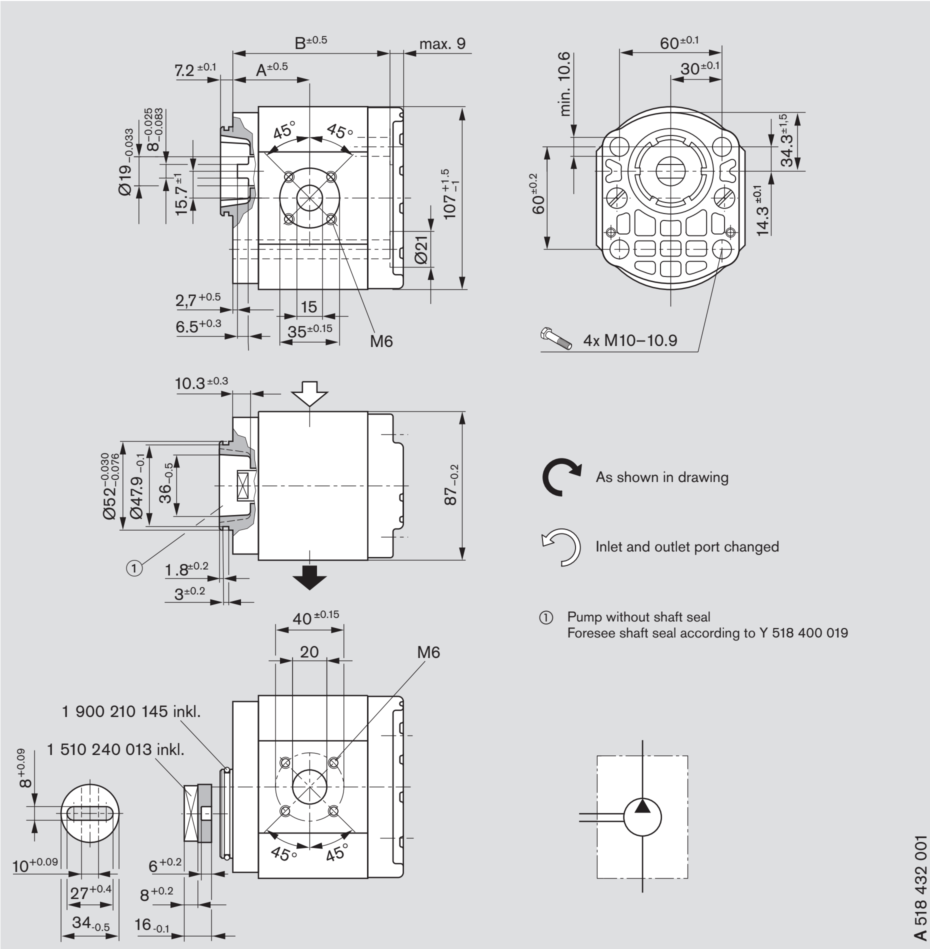


Ordering code:
AZPJ – 22 – □ □ □ □ A B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Mass kg	Dimension [mm]	Dimension [mm]
12	**0 518 525 304**	**0 518 525 003**	280	3500	3.9	46.5	96.3
14	**0 518 525 305**	**0 518 525 004**	280	3000	4.0	47.5	99.5
16	**0 518 625 302**	**0 518 625 002**	270	3000	4.1	47.5	102.9

Dimensions

Standard range



3

Ordering code:
AZPJ – 22 – ☐☐☐ ☐ N T 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Mass kg	Dimension [mm]	Dimension [mm]
12 *)	**0 518 515 301**	**0 518 515 001**	280	3500	2.5	44.0	87.1
14 *)	**0 518 515 302**	**0 518 515 002**	280	3000	2.6	45.0	90.3
16 **)	**0 518 615 301**	**0 518 615 001**	280	3000	2.7	45.0	93.7

*) Drive shaft Ø 17 mm, driver 1 510 240 011 included in the scope of supply
**) Drive shaft Ø 19 mm, driver 1 510 240 013 included in the scope of supply

Notes for commissioning

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
As a warranty cannot be issued for dirt-specific wear, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible dimension in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see pages 13–16).

Project planning notes
Comprehensive notes and suggestions are available in Hydraulics Trainer, Volume 3 RE 00 281, “Project planning notes and design of hydraulic systems”. Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, scattering is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics displayed on pages 10 to 11 .

Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

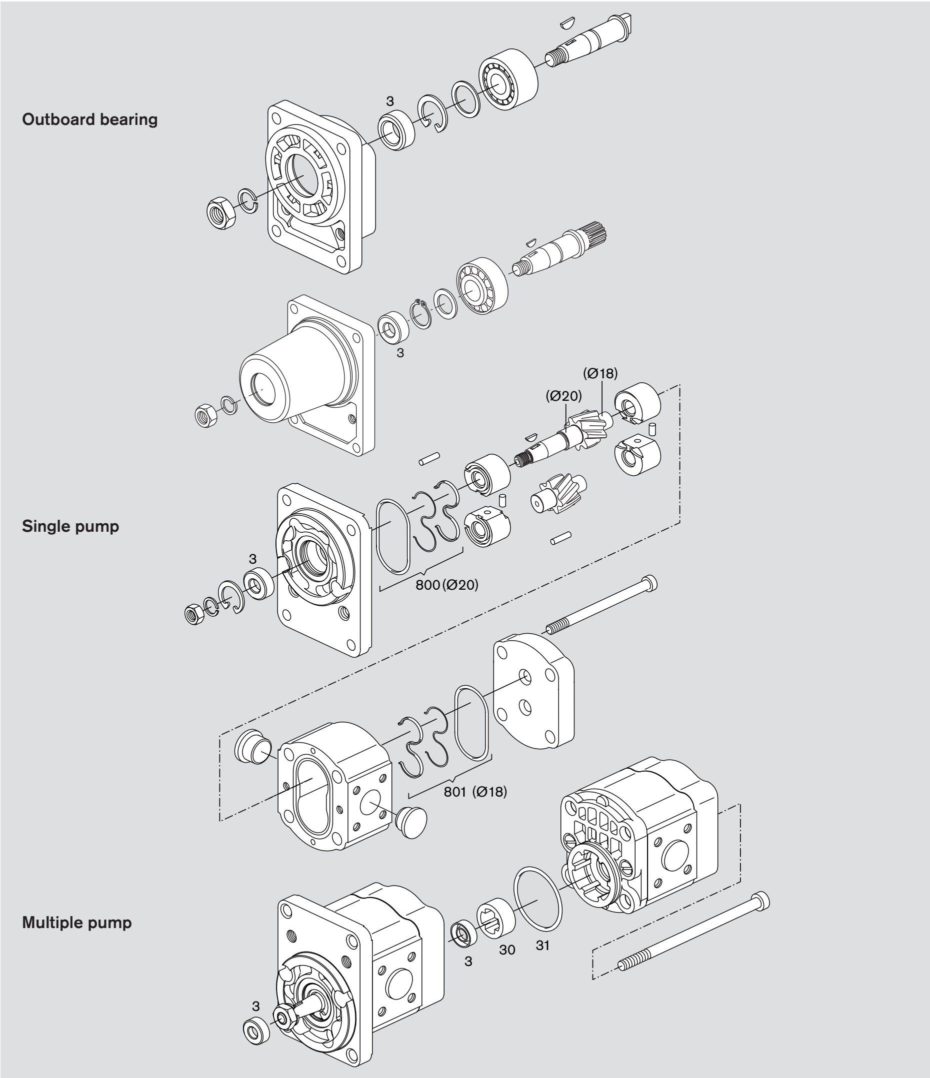
Contained in delivery
Deliveries contains the component as per drawing on pages 17–21 .

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Service parts

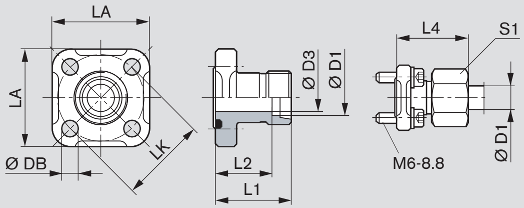
Page	Ordering code	Seal kit Pos. 800 1 517 010 ...	Seal kit Pos. 801 1 517 010 ...	Shaft seal ring Pos. 3 1 510 283 ...	Dimension	Seal ring Pos. 31 1 900 210 ...	Material	Dimen- sion	Driver Pos. 30 1 510 240 ...
17	AZPJ – 22 – □□□ □ C B 20 **M** B	212	247	035 NBR	17x30x7/8	–	–		–
18	AZPJ – 22 – □□□ □ R R 20 **M** B	212	247	035 NBR	17x30x7/8	–	–		–
19	AZPJ – 22 – □□□ □ H O 30 **M** B	212	247	035 NBR	17x30x7/8	–	–		–
20	AZPJ – 22 – □□□ □ A B 20 **M** B	212	247	035 NBR	17x30x7/8	–	–		–
21	AZPJ – 22 – □□□ □ N T 20 **M** B	212	247	–		145	NBR	45x2.5	013

NBR = Perbunan® FKM = Viton®



Fittings

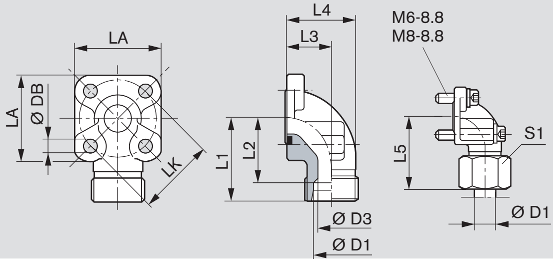
Gear pump flange, straight, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws 4x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M 6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M 6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M 6x22	20x2.5	0.10	**1 515 702 066**	250
40	15L	12	35	28.0	43.0	42	27	6.4	M 6x22	24x2.5	0.12	**1 515 702 067**	100
40	18L	15	35	27.5	44.0	42	32	6.4	M 6x22	24x2.5	0.13	**1 515 702 068**	100
40	22L	19	35	27.5	44.5	42	36	6.4	M 6x22	24x2.5	0.12	**1 515 702 069**	100
40	28L	24	42	27.5	34.5	42	41	6.4	M 6x22	24x2.5	0.15	**1 515 702 008**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

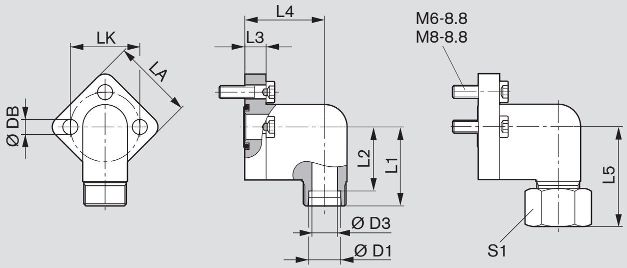
Gear pump flange, 90° angle, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	Screws 2x	Seal ring NBR *)	Mass [kg]	Part number	p (bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M 6x22	M 6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M 6x22	M 6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M 6x22	M 6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M 6x22	M 6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M 6x22	M 6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M 6x22	M 6x45	20x2.5	0.24	**1 515 702 017**	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M 6x22	M 6x22	24x2.5	0.15	**1 515 702 073**	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M 6x22	M 6x22	24x2.5	0.17	**1 515 702 074**	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M 6x22	M 6x45	24x2.5	0.20	**1 515 702 011**	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M 6x22	M 6x22	24x2.5	0.17	**1 515 702 075**	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M 6x20	M 6x50	24x2.5	0.24	**1 515 702 010**	100
40	35L	31	41	30.5	34.0	55.0	52.0	42	50	6.4	M 6x22	M 6x60	24x2.5	0.33	**1 515 702 018**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Gear pump flange, 3-hole, 90° angle, for rectangular flange 30 see page 8



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 3x	Seal ring NBR *)	Mass [kg]	Part number	*p* [bar]
30	12L	10	37	30.0	10	37.5	46	38	22	6.4	M 6x22	16x2.5	0.13	**1 515 702 146**	250
30	15L	12	37	30.0	10	37.5	47	38	27	6.4	M 6x22	16x2.5	0.14	**1 515 702 147**	250
30	18L	15	37	30.0	10	37.5	47	38	32	6.4	M 6x22	16x2.5	0.17	**1 515 702 148**	160
40	22L	19	43	35.5	14	41.0	53	48	36	8.4	M 8x30	24x2.5	0.29	**1 515 702 149**	160
40	28L	24	43	35.5	14	41.0	53	48	41	8.4	M 8x30	24x2.5	0.40	**1 515 702 150**	160

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

3

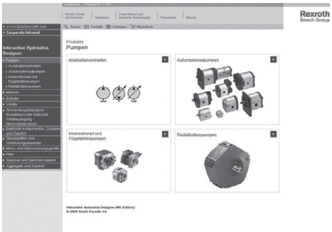
Note
You can find the permissible tightening torques in our publication:
“General Operating Instructions for External Gear Units”
RE 07 012-B1.

Ordering-No.

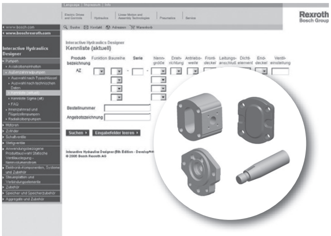
Ordering-No.	Page	Ordering-No.	Page
0 518 515 001	21	0 518 625 003	18
0 518 515 002	21	0 518 625 004	19
0 518 515 301	21	0 518 625 301	17
0 518 515 302	21	0 518 625 302	20
0 518 525 001	17	0 518 625 303	18
0 518 525 002	17	0 518 625 304	19
0 518 525 003	20		
0 518 525 004	20		
0 518 525 005	18		
0 518 525 006	18		
0 518 525 007	19		
0 518 525 008	19		
0 518 525 302	17		
0 518 525 303	17		
0 518 525 304	20		
0 518 525 305	20		
0 518 525 306	18		
0 518 525 307	18		
0 518 525 308	19		
0 518 525 309	19		
0 518 615 001	21		
0 518 615 301	21		
0 518 625 001	17		
0 518 625 002	20		

The AZ configurator at www.boschrexroth.com/azconfigurator

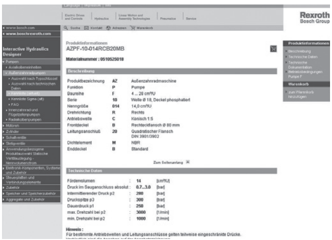
The AZ configurator assists you to configure your individual external gear unit easily and user-friendly. You only need to specify your requirements: From the displacement, direction of rotation, drive shaft, connection flange right up to the required rear cover. You immediately receive a project drawing (PDF format) if a configuration already exists. You receive the price of the configured external gear unit upon request.



The AZ configurator assists you to configure your individual external gear unit easily and user-friendly – all data needed for project planning are acquired thru menu guidance.



Selection is made either on an ordering code or your technical requirements. This means that you can search for external gear units that have already been configured, or you specify the configuration variant of the external gear unit based upon the operating parameters you require.



If the external gear unit you selected has been released you will receive the part number, ordering code and a detailed installation drawing. If your special configuration is not available please send your specification to Rexroth. One of our employees will then contact you.

Notes

Notes

Bosch Rexroth AG
External Gear Units
Robert-Bosch-Straße 2
D-71701 Schwieberdingen
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Fax +49 (0) 711-811 17 98
brm-az.info@boschrexroth.de
www.boschrexroth.com/brm

Internal gear pumps

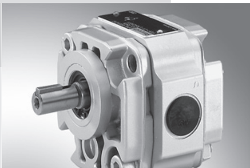
Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Fixed displacement	PGF	1,7 ... 40	2X/3X	250	10213	1319
Fixed displacement	PGH	5 ... 16	2X	350	10223	1339
Fixed displacement	PGH	20 ... 250	3X	350	10227	1355

Internal Gear Pump, Fixed Displacement PGF

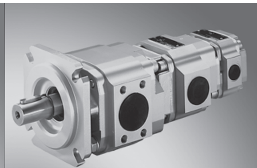
RE 10213/05.12 1/20
Replaces: 04.05

Type PGF

Frame sizes 1, 2 and 3
Component series: 2X (BG1 and 2)
3X (BG3)
Maximum operating pressure 250 bar
Maximum displacement 1.7 to 40 cm^3



H7158
Type PGF1… for direct mounting



H7163
Type PGF3… 3-fold combination

Contents

Ordering code	2
Functions, section, symbol	3
Technical data	4
Mean characteristic curve values for frame size 1	6
Mean characteristic curve values for frame size 2	7
Mean characteristic curve values for frame size 3	8
Unit dimensions, frame size 1	9
Unit dimensions, frame size 2	11
Unit dimensions, frame size 3	14
Suction and pressure ports	16
Multiple pumps	17
Installation instructions	18
Commissioning notes	19
Engineering notes	20

Features

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low viscosity due to sealing gap compensation
- Long service life due to slide bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- All frame sizes and sizes can be combined with each other
- Can be combined with PGH internal gear pumps, PV7 vane pumps and axial piston pumps
- Valve technology can be integrated in the cover on request
- Use:
  For drives in the medium-output and medium-pressure range in industrial applications, such as machine tools.
  At high operating pressure for endurant drives in mobile applications, such as lifting devices, fans and spreaders.

Ordering code

PG	F	– /							*

Series

Medium-pressure pump = **F**

Frame size - component series

BG1 – component series 2X = **1–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
BG2 – component series 2X = **2–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
BG3 – component series 3X = **3–3X**
(component series 30 to 39: unchanged installation and connection dimensions)

Size	NG	Displacement/revolution	
BG1	1.7	1.7 cm³	**= 1.7**
	2.2	2.2 cm³	**= 2.2**
	2.8	2.8 cm³	**= 2.8**
	3.2	3.2 cm³	**= 3.2**
	4.1	4.1 cm³	**= 4.1**
	5.0	5.0 cm³	**= 5.0**
BG2	6.3	6.5 cm³	**= 006**
	8.0	8.2 cm³	**= 008**
	11.0	11.0 cm³	**= 011**
	13.0	13.3 cm³	**= 013**
	16.0	16.0 cm³	**= 016**
	19.0	18.9 cm³	**= 019**
	22.0	22.0 cm³	**= 022**
BG3	20.0	20.6 cm³	**= 020**
	25.0	25.4 cm³	**= 025**
	32.0	32.5 cm³	**= 032**
	40.0	40.5 cm³	**= 040**

Direction of rotation (viewed to shaft end)

R = Clockwise
L = Counter-clockwise

Shaft versions

A = Cylindrical
E = Cylindrical with output drive
J = Involute splines with output drive
N = Two flats for claw coupling
L = Two flats for claw coupling with output drive
O = Conical with output drive 1 : 5

Suction and pressure port

01 = Pipe thread according to ISO 228/1 (BSP)
07 = SAE flange port
20 = Square flange port according to DIN 3901 or DIN 3902, metric fastening thread

Seal material

V = FKM seals

Mounting-flange centering

K4 = Special flange according to ISO 7653-1985 (for truck PTO)
E4 = 4-hole mounting flange according to ISO 3019/2 and VDMA 24560 Part 1
U2 = SAE-2-hole-mounting flange
M = 2-hole mounting, centering Ø 32 mm (BG1), centering Ø 52 mm (BG2 and 3)
P = 2-hole mounting, centering Ø 50 mm
P1 = 2-hole mounting, centering Ø 45.24 mm
P2 = 2-hole mounting, centering Ø 63 mm

Options

N = Anticavitation valve
K = Cover for mounting the next-smaller size

Further details in clear text

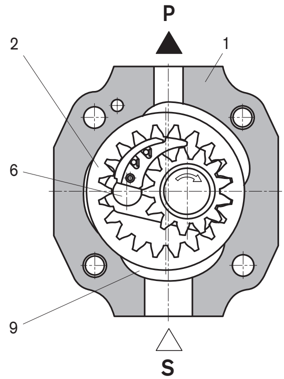
Ordering example: **PGF2–2X/011RE01VE4**

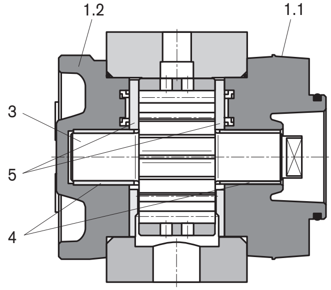
Material number: **R900932271**

Not all of the variants according to the type code are possible! Please select the desired pump on the basis of the selection tables (preferred types, pages 9 to 17) or consult Bosch Rexroth!

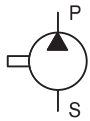
Special options are available on request, e.g., integrated pressure-relief valves.

Functions, section, symbol





Symbol



Design

PGF hydraulic pumps are leak gap-compensated internal gear pumps with a fixed displacement.

They consist basically of: housing (1), bearing cover (1.1), cover (1.2), ring gear (2), pinion shaft (3), slide bearings (4), axial discs (5) and stop pin (6) as well as the segment assembly (7) which is composed of a segment (7.1), segment carrier (7.2) and the sealing rolls (7.3).

Suction and displacement process

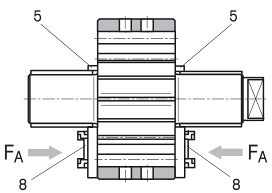
The hydrodynamically supported pinion shaft (3) drives the internally toothed ring gear (2) in the direction of rotation shown.

During rotation, the volume is increased in the suction area over an angle of approx. 180 °. A negative pressure is generated and fluid flows into the chambers.

The sickle-shaped segment assembly (7) separates the suction chamber from the pressure chamber. Within the pressure chamber, the teeth of the pinion shaft (3) mesh with the tooth spaces of the ring gear (2). The fluid is then displaced through the pressure channel (P).

Axial compensation

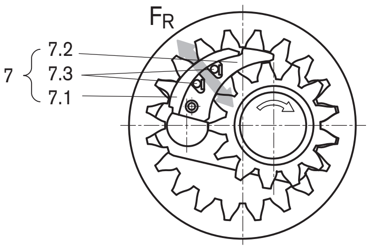
The axial compensation force F_A acts in the area of the pressure chamber and is generated by the pressure zone (8) in the axial discs (5).



The axial, longitudinal gaps between rotating and fixed parts are therefore extremely small and ensure optimum axial sealing of the pressure chamber.

Radial compensation

The radial compensation force F_R acts on the segment (7.1) and segment carrier (7.2).



The area ratios and the position of the sealing rolls (7.3) between the segment and segment carrier are designed to provide virtually gap-free sealing between the ring gear (2), the segment assembly (7) and the pinion shaft (3).

Spring elements under the sealing rolls (7.3) ensure adequate contact pressure, even at very low pressures.

Hydrodynamic and hydrostatic bearing

The forces acting on the pinion shaft (3) are absorbed by hydrodynamically lubricated radial slide bearings (4) while those acting on the ring gear (2) are absorbed by the hydrostatic bearing (9).

Splines

Involute splining was selected for the gear. Their long length of contact results in a low flow and pressure pulsation; these low pulsation rates greatly contribute to the low-noise operation.

Technical data (for applications outside these values, please consult us!)!)

General	
Design	Internal gear pump, gap-compensated
Type	PGF
Type of mounting	2-hole mounting, SAE 2-hole mounting flange according to ISO 3019/1, 4-hole mounting flange according to VDMA 24560 Part 1 and ISO 3019/2
Pipe connections	Square flange port; SAE flange port; pipe thread according to ISO 228/1
Installation position	Arbitrary
Shaft loading	Radial and axial forces (e.g., belt pulley) **only** after consultation
Direction of rotation (viewed to shaft end)	Clockwise or counter-clockwise – **not** reversing!

Frame size	BG		PGF1					
Size	NG		1.7	2.2	2.8	3.2	4.1	5.0
Weight	m	kg	0.8	0.9	1.0	1.0	1.1	1.3
Speed range[1)]	n_{min}	rpm	600					
Displacement	V	cm^3	1.7	2.2	2.8	3.2	4.1	5.0
Flow[2)]	q_V	l/min	2.4	3.2	4.1	4.6	6.0	7.2
Moment of inertia (at drive axle)	J	kgm^2	0.000012	0.000013	0.000015	0.000017	0.000021	0.000026
Operating pressure, absolute Inlet	p	bar	0.6 to 3					
Outlet, continuous	p_{max}	bar	180	210	210	210	210	180
Outlet, intermittent[3)]	p_{max}	bar	210	250	250	250	250	210
Minimum required drive power at $\Delta p \approx 1$ bar		kW	0.75	0.75	0.75	0.75	0.75	0.75

Frame size	BG		PGF2						
Size	NG		6.3	8	11	13	16	19	22
Weight	m	kg	2.1	2.2	2.4	2.6	2.7	2.9	3.1
Speed range[1)]	n_{min}	rpm	600						600
	n_{max}	rpm	3600						3000
Displacement	V	cm^3	6.5	8.2	11	13.3	16	18.9	22
Flow[2)]	q_V	l/min	9.4	11.9	16	19.3	23.3	27.4	31.9
Moment of inertia (at drive axle)	J	kgm^2	0.000074	0.000090	0.00012	0.00014	0.00016	0.00019	0.00022
Operating pressure, absolute Inlet	p	bar	0.6 to 3						
Outlet, continuous	p_{max}	bar	210	210	210	210	210	210	180
Outlet, intermittent[3)]	p_{max}	bar	250	250	250	250	250	250	210
Minimum required drive power at $\Delta p \approx 1$ bar		kW	0.75	0.75	0.75	0.75	0.75	1.1	1.1

For footnotes, see page 5

Technical data (for applications outside these values, please consult us!)!)

Frame size	BG		PGF3			
Size	NG		20	25	32	40
Weight[4)]	m	kg	0.8	1.0	1.0	1.1
Speed range[1)]	n_{min}	rpm	500			
	n_{max}	rpm	3600	3200	3000	2500
Displacement	V	cm^3	20.6	25.4	32.5	40.5
Flow[2)]	q_V	l/min	29.9	36.8	47.1	58.7
Moment of inertia (at drive axle)	J	kgm^2	0.00029	0.00035	0.00043	0.00053
Operating pressure, absolute Inlet	p	bar	0.6 to 3			
Outlet, continuous	p_{max}	bar	210	210	210	180
Outlet, intermittent[3)]	p_{max}	bar	250	250	250	210
Minimum required drive power at $\Delta p \approx 1$ bar		kW	1.1	1.5	1.5	1.5

Hydraulic

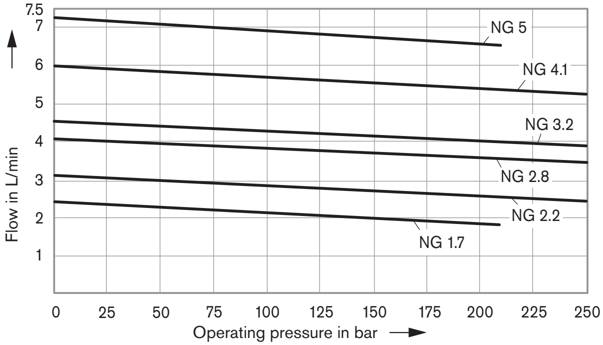
Hydraulic fluid[5)]		HL mineral oil according to 51524 Part 1 / HLP - mineral oil according to DIN 51524 Part 2 HEES fluids according to DIN ISO 15380 HEPR fluids according to DIN ISO 15380 **Please note our specification according to data sheet RE90220!**
Hydraulic fluid temperature range	°C	– 20 to + 100; for other temperatures, please consult us!
Ambient temperature range	°C	- 20 to + 60
Viscosity range	mm^2/s	10 to 300; permissible starting viscosity 2000
Maximum permissible degree of contamination of the hydraulic fluid Cleanliness level according to ISO 4406 (c)		Class 20/18/15[6)]
Permissible radial loading of the pinion shaft		On request

1) For other speeds, please consult us (e.g., impulse control)
2) Measured at $n = 1450$ rpm and $p = 10$ bar
3) Max 6 s, up to 15% of actuated time, max. $2 \cdot 10^6$ load cycles
4) For pumps with 2-hole mounting as flanged version
   – Frame size 2 approx. 0.9 kg heavier
   – Frame size 3 approx. 1.0 kg heavier
5) Other fluids on request
6) Cleanliness levels specified for the components must be maintained in the hydraulic systems. Effective filtration prevents malfunctions and simultaneously extends the service life of the components.

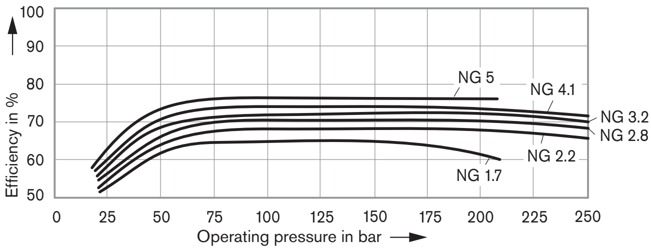
4

Mean characteristic curve values for frame size 1 (measured at n = 1450 rpm; ν = 46 mm²/s and ϑ = 40 °C)

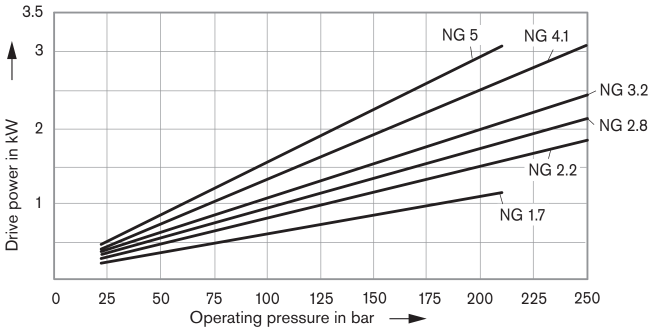
Flow



Efficiency



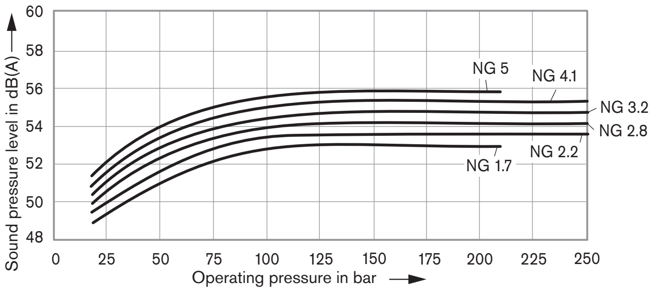
Drive power



Sound pressure level

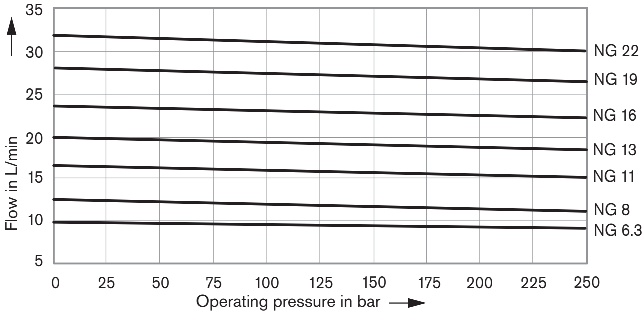
Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

Distance between microphone – pumps = 1 m

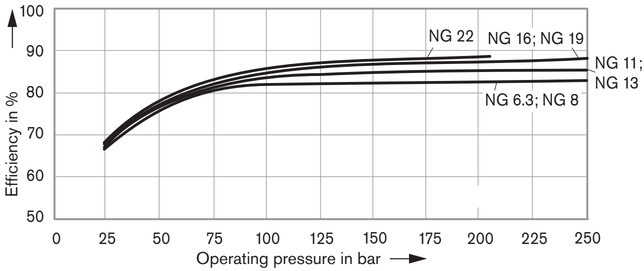


Mean characteristic curve values for frame size 2 (measured at $n = 1450$ rpm; $\nu = 46$ mm²/s and $\vartheta = 40$ °C)

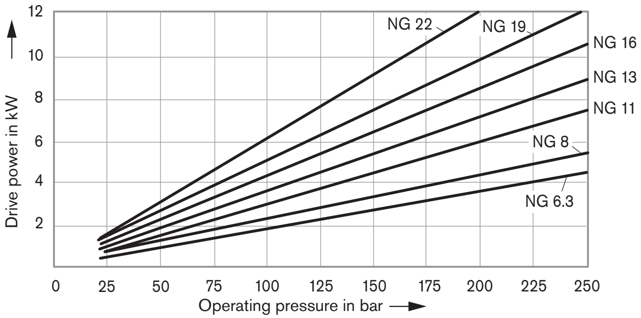
Flow



Efficiency



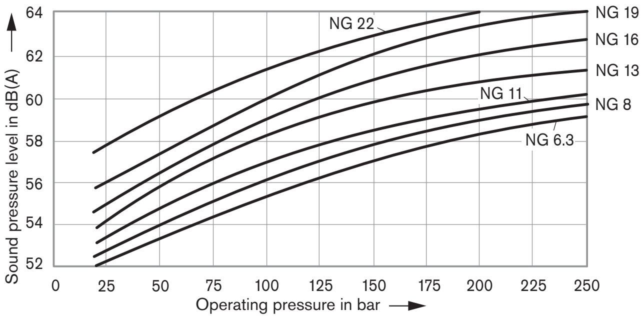
Drive power



Sound pressure level

Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

Distance between microphone – pumps = 1 m



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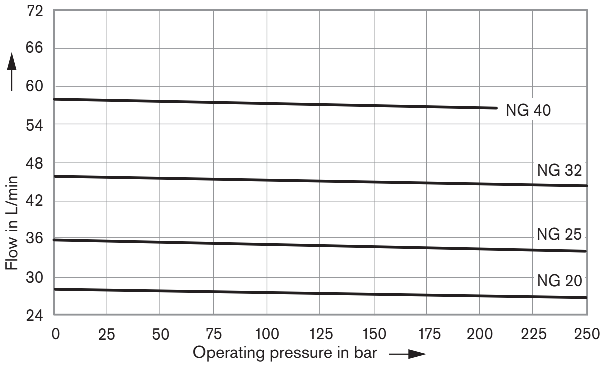
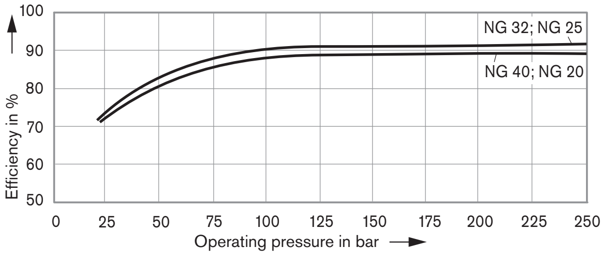
Mean characteristic curve values for frame size 3 (measured at n = 1450 rpm; ν = 46 mm2/s and ϑ = 40 °C)

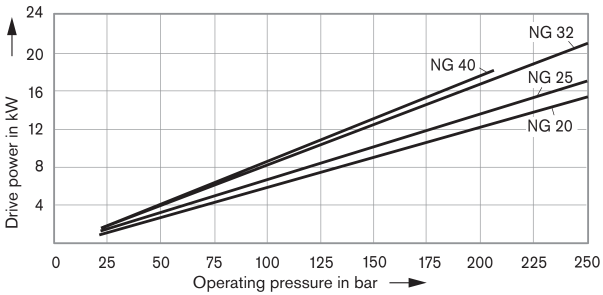
Flow



Efficiency



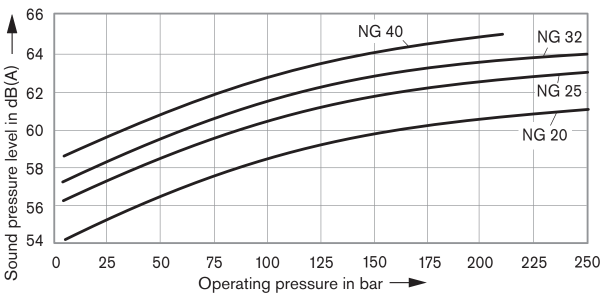
Drive power



Sound pressure level

Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

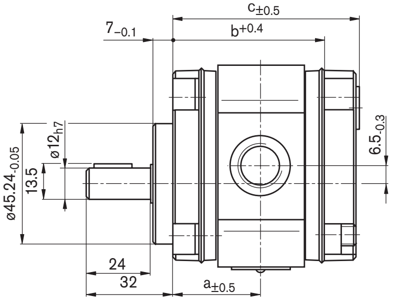
Distance between microphone – pumps = 1 m

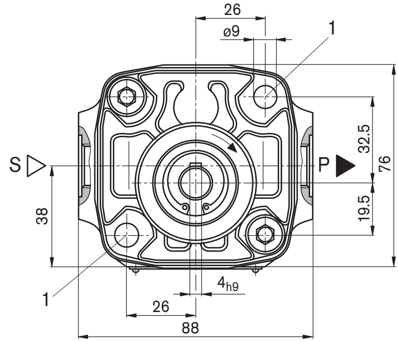


Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

PGF1-2X/ ... RA01VP1 (cylindrical drive shaft, without through drive)

Type NG	Material no. "R" clockwise	Dimensions a	b	c	S	P
PGF1-2X/ **1.7** RA01VP1	R900932132	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.2** RA01VP1	R900932133	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.8** RA01VP1	R900932134	30.7	51.4	64.8	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3.2** RA01VP1	R900932135	31.5	53.0	66.4	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4.1** RA01VP1	R900932136	33.4	56.7	70.1	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5.0** RA01VP1	R900932137	35.2	60.4	74.4	G 1/2; 14	G 3/8; 12.5

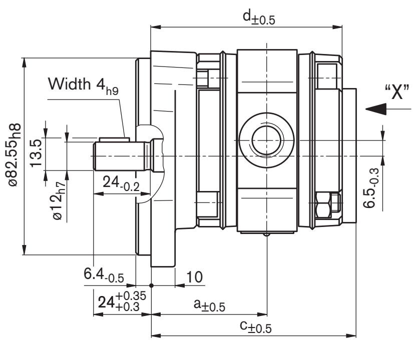


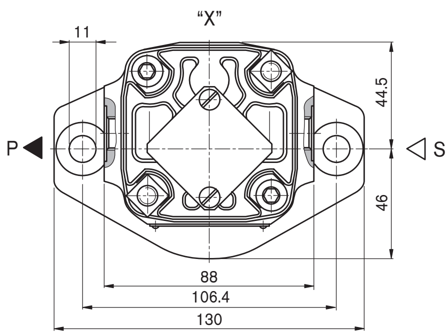


1 Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A = 25\ (+5)$ Nm
b = Clamping length

PGF1-2X/ ... RE01VU2 (cylindrical drive shaft, with through drive)

Type NG	Material no. "R" clockwise	Dimensions a	c	d	S	P
PGF1-2X/ **1.7** RE01VU2	R900086159	48.6	85.7	79.7	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.2** RE01VU2	R900086160	48.6	85.7	79.7	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.8** RE01VU2	R900086161	49.7	88.0	82.0	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3.2** RE01VU2	R900086162	50.5	89.6	83.6	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4.1** RE01VU2	R900086163	52.4	93.2	87.2	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5.0** RE01VU2	R900086164	54.2	97.0	91.0	G 1/2; 14	G 3/8; 12.5

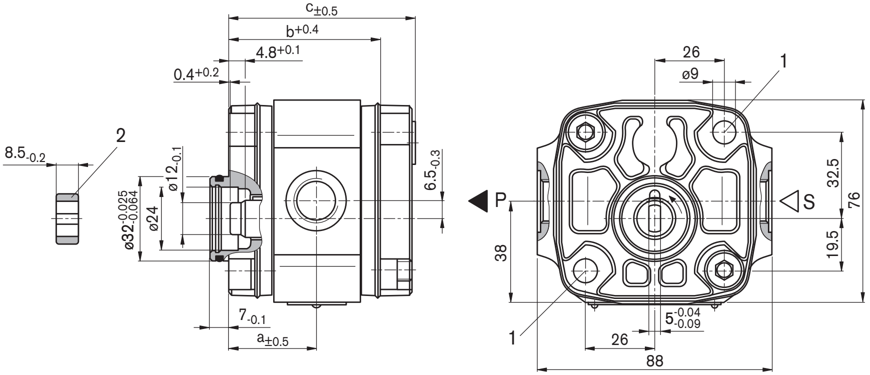




Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

PGF1-2X/ ... LN01VM (drive shaft for claw coupling, without through drive); rear pump

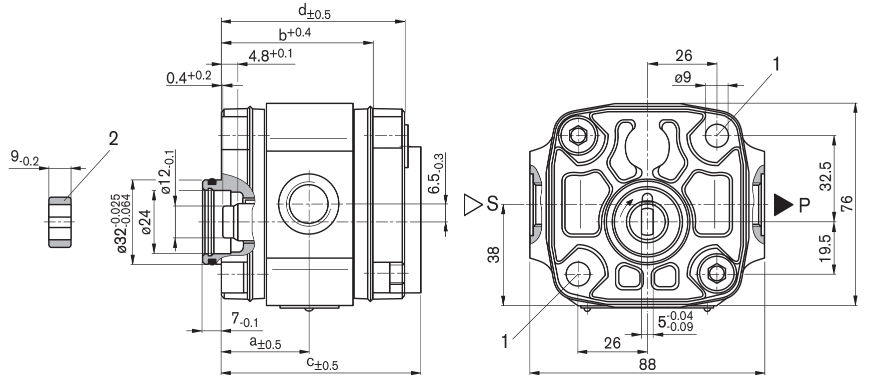
Type NG	Material no. "L" counter-clockwise	Dimensions a	b	c	S	P
PGF1-2X/ **1.7** LN01VM	R900086147	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.2** LN01VM	R900086148	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.8** LN01VM	R900086149	30.7	51.4	64.8	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3.2** LN01VM	R900086150	31.5	53.0	66.4	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4.1** LN01VM	R900932131	33.4	56.7	70.1	G 3/8; 14	G 3/8; 12.5



1 Through hole for M8 DIN 912 socket-head screw, tightening torque M_A = 25 (+5) Nm
2 Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

PGF1-2X/ ... R/L L01VM (drive shaft for claw coupling, with through drive); middle or rear pump

Type NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	c	d	S	P
PGF1-2X/ **1.7.** L01VM	R900086165	R900932093	29.6	49.1	67.2	61.1	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.2.** L01VM	R900086166	R900932094	29.6	49.1	67.2	61.1	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2.8.** L01VM	R900932138	R900051293	30.7	51.4	69.4	63.4	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3.2.** L01VM	R900086168	R900051294	31.5	53.0	71.0	65.0	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4.1.** L01VM	R900086169	R900088913	33.4	56.7	74.7	68.7	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5.0.** L01VM	R900086170	R900051295	35.2	60.4	78.4	72.4	G 1/2; 14	G 3/8; 12.5

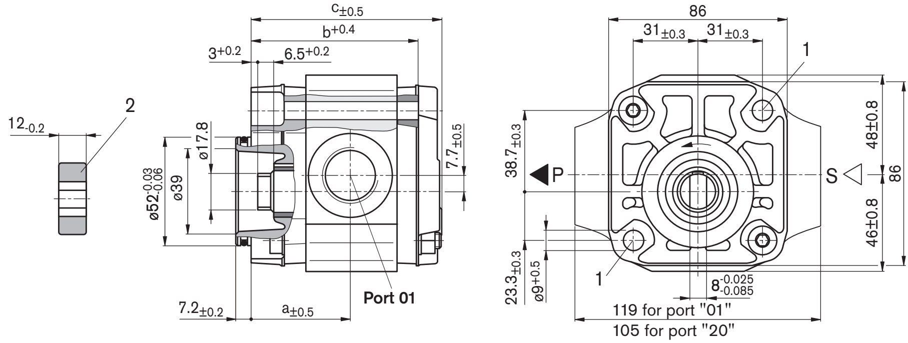


1 Through hole for M8 DIN 912 socket-head screw, tightening torque M_A = 25 (+5) Nm
2 Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/ ... LN…VM (drive shaft for claw coupling, without through drive); rear pump

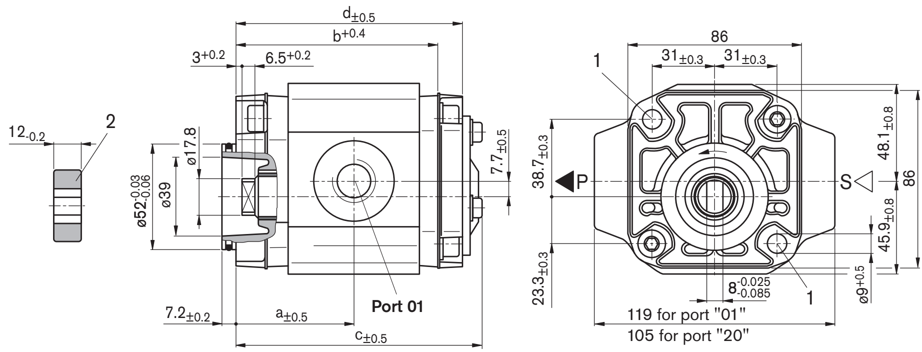
Type NG	Material no. "L" counter-clockwise	Dimensions a	b	c	S	P
PGF2-2X/ **006** LN01VM	R900563948	46	76	87	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** LN01VM	R900062364	47.5	79.5	90.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** LN01VM	R900077364	50.5	85	96	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** LN20VM	R900034010	53	90	101	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **016** LN20VM	R900033354	55.5	95	106	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **019** LN20VM	R900932120	58.5	101	112	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **022** LN20VM	R900081192	61.5	107	118	ø20, PC ø40 1)	ø12, PC ø35 1)



1 Through hole for M8 DIN 912 socket-head screw, tightening torque M_A = 25 (+5) Nm
2 Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

PGF2-2X/ ... R/L L…VM (drive shaft for claw coupling, with through drive); middle or rear pump

Type NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	c	d	S	P
PGF2-2X/ **006.** L01VM	R900567307	R900066012	46	76	99	89	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008.** L01VM	R900563291	R900070239	47.5	79.5	102.5	92.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011.** L01VM	R900561146	R900079232	50.5	85	106	98	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013.** L20VM	R900049570	R900058674	53	90	113	103	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **016.** L20VM	R900064718	R900983463	55.5	95	118	108	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **019.** L20VM	R900932243	R900983464	58.5	101	124	114	ø20, PC ø40 1)	ø12, PC ø35 1)
PGF2-2X/ **022.** L20VM	R900932186	R900983933	61.5	107	130	120	ø20, PC ø40 1)	ø12, PC ø35 1)



1 Through hole for M8 DIN 912 socket-head screw, tightening torque M_A = 25 (+5) Nm
2 Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

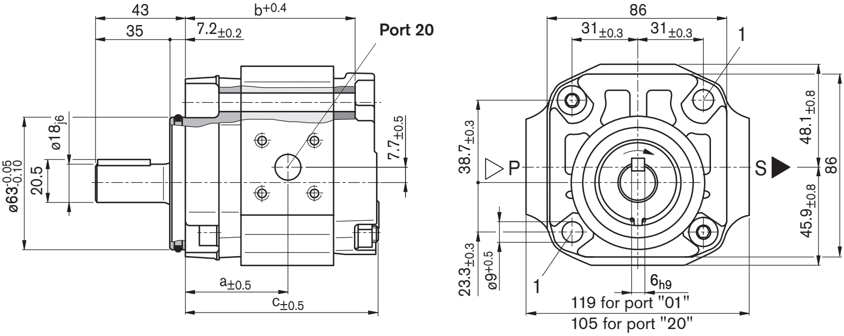
1) PC = pitch circle

4

Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/ ... RA …VP2 (cylindrical drive shaft, without through drive)

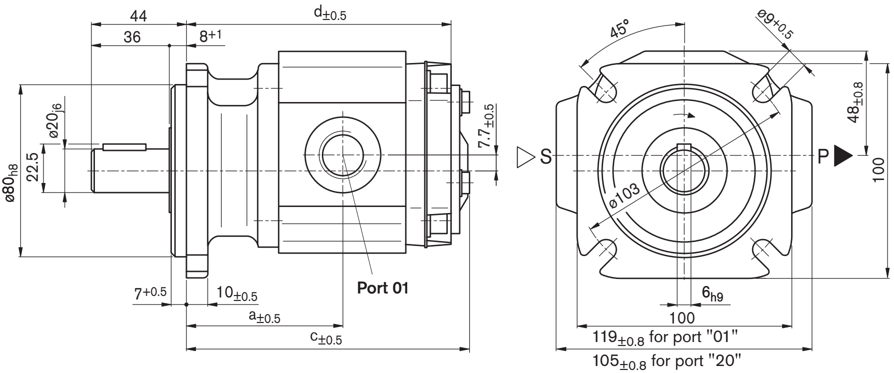
Type NG	Material no. "R" clockwise	Dimensions a	b	c	S	P
PGF2-2X/ **006** RA01VP2	R900932272	46	76	87	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** RA01VP2	R900564037	47.8	79.5	90.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** RA01VP2	R900568523	50.5	85	96	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** RA20VP2	R900032712	53	90	101	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/ **016** RA20VP2	R900932275	55.5	95	106	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/ **019** RA20VP2	R900571401	58.5	101	112	ø20, PC ø40[1)]	ø12, PC ø35[1)]



1 Through hole for M8 DIN 912 socket-head screw, tightening torque M_A = 25 (+5) Nm
b = Clamping length

PGF2-2X/ ... RE …VE4 (cylindrical drive shaft, with through drive)

Type NG	Material no. "R" clockwise	Dimensions a	c	d	S	P
PGF2-2X/ **006** RE01VE4	R900932265	63	114	104	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** RE01VE4	R900932266	64.3	117.5	107.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** RE01VE4	R900932271	67.5	123	113	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** RE20VE4	R900943181	70	128	118	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/ **016** RE20VE4	R900932193	72.5	133	123	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/ **019** RE20VE4	R900943182	75.5	139	129	ø26, PC ø55[1)]	ø12, PC ø35[1)]
PGF2-2X/ **022** RE20VE4	R900932126	78.5	144	134	ø26, PC ø55[1)]	ø12, PC ø35[1)]

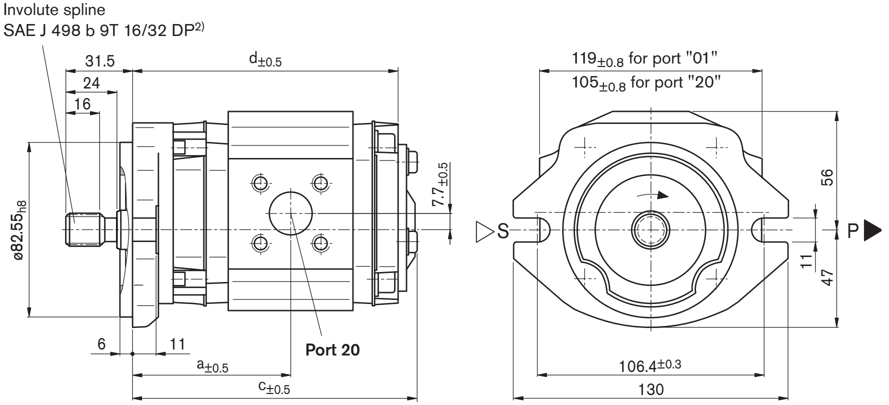


1) PC = pitch circle

Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/ ... R/L J.VU2 (splined drive shaft, with through drive)

Type	NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	c	d	S	P
PGF2-2X/	**006** RJ01VU2	R900931660	R900247697	65	116	106	G 3/4; 16	G 1/2; 14
PGF2-2X/	**008** RJ01VU2	R900953363	R900247698	67	119.5	109.5	G 3/4; 16	G 1/2; 14
PGF2-2X/	**011** RJ01VU2	R900247699	R900079232	69.5	125	115	G 3/4; 16	G 1/2; 14
PGF2-2X/	**013** RJ20VU2	R900932264	R900969259	72	130	120	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/	**016** RJ20VU2	R900932085	R900936173	74.5	135	125	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/	**019** RJ20VU2	R900022882	R900984300	77.5	141	131	ø20, PC ø40[1)]	ø12, PC ø35[1)]
PGF2-2X/	**022** RJ20VU2	R900054053	R900935718	80.5	147	137	ø20, PC ø40[1)]	ø12, PC ø35[1)]



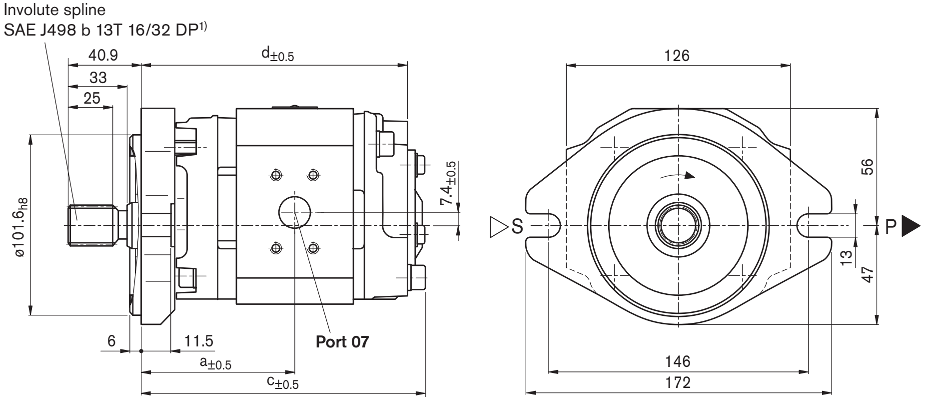
1) PC = pitch circle
2) ANSI B92.1a-1976, 30° pressure angle, flat root, flank centering, tolerance 5

4

Unit dimensions and selection tables for frame size 3 (nominal dimensions in mm)

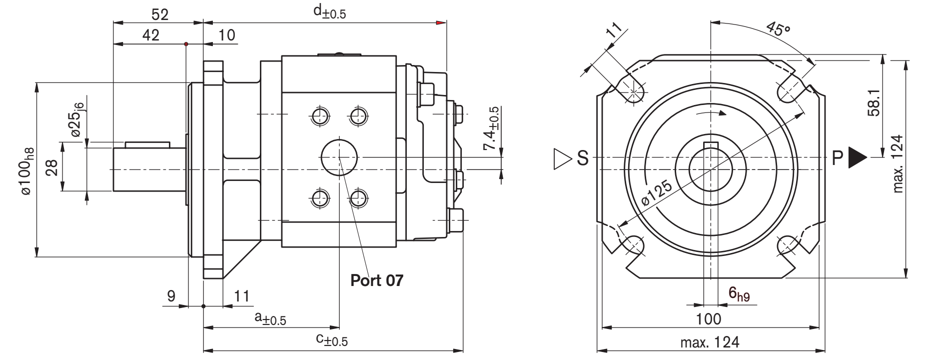
PGF3-3X/ … R/L J07VU2 (splined drive shaft, with through drive)

Type NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	c	d	S	P
PGF3-3X/ **020.** J07VU2	R900983792	R900948466	79.5	144.5	134.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025.** J07VU2	R900950057	R900568523	82.5	150.5	140.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032.** J07VU2	R900029561	R900984213	87	159.5	149.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040.** J07VU2	R900969266	R900932275	92	169.5	159.5	SAE 1 1/4"	SAE 3/4"



PGF3-3X/ … RE07VE4 (cylindrical drive shaft, with through drive)

Type NG	Material no. "R" clockwise	Dimensions a	c	d	S	P
PGF3-3X/ **020** RE07VE4	R900063299	71	136	126	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** RE07VE4	R900932088	74	142	132	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** RE07VE4	R900932112	78.5	151	141	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** RE07VE4	R900932111	83.5	161	151	SAE 1 1/4"	SAE 3/4"

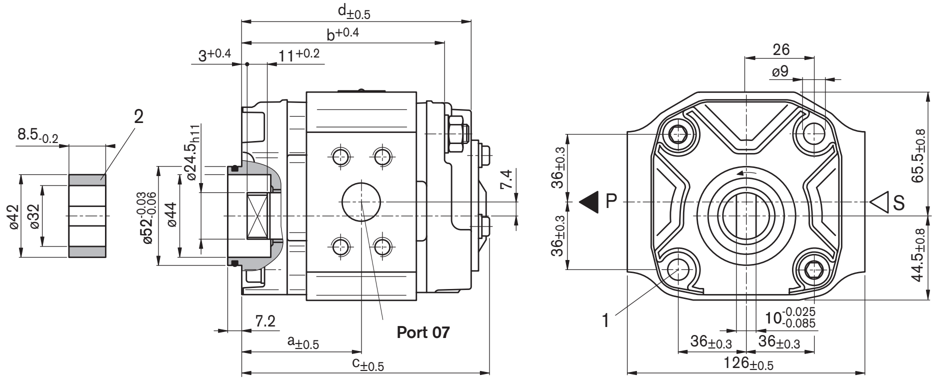


1) ANSI B92.1a-1976, 30° pressure angle, flat root, flank centering, tolerance 5

Unit dimensions and selection tables for frame size 3 (nominal dimensions in mm)

PGF3-3X/ ... $^{R}_{L}$ L07VM (drive shaft for claw coupling, with through drive), middle or rear pump

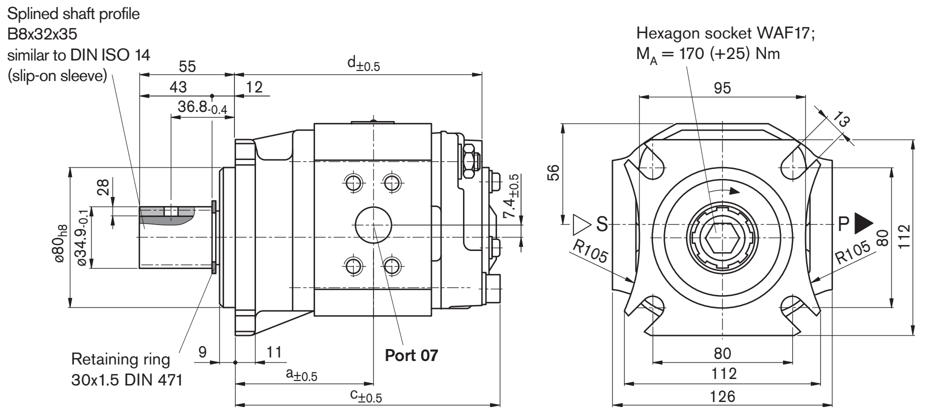
Type NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions					
			a	b	c	d	S	P
PGF3-3X/ **020.** L07VM	R900073539	R900758721	60.5	101.5	125.5	115.5	SAE 1 1/4“	SAE 3/4“
PGF3-3X/ **025.** L07VM	R900932121	R900960119	63.5	107.5	131.5	121.5	SAE 1 1/4“	SAE 3/4“
PGF3-3X/ **032.** L07VM	R900074369	R900034370	68	116.5	140.5	130.5	SAE 1 1/4“	SAE 3/4“
PGF3-3X/ **040.** L07VM	R900083281	R900058224	73	126.5	150.5	140.5	SAE 1 1/4“	SAE 3/4“



1 Through hole for M10 DIN 912 socket-head screw; tightening torque $M_A = 49$ (+5) Nm
2 Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

PGF3-3X/ ... $^{R}_{L}$ O07VK4 (conical drive shaft, with through drive)

Type NG	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions				
			a	c	d	S	P
PGF3-3X/ **020.** O07VK4	R900969302	R900619706	71	136.5	126	SAE 1 1/4“	SAE 3/4“
PGF3-3X/ **025.** O07VK4	R900943169	R900619710	74	142.5	132	SAE 1 1/4“	SAE 3/4“
PGF3-3X/ **032.** O07VK4	R900943168	R900943167	78.5	151.5	141	SAE 1 1/4“	SAE 3/4“



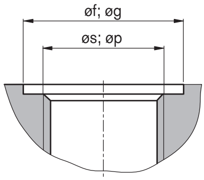
Suction and pressure ports (nominal dimensions in mm)

PGF1, port type 01
Pipe thread according to ISO 228/1

	Suction port dimensions		Pressure port dimensions	
NG	**s**	**f**	**p**	**g**
1.7	G 1/4; 14	23	G 1/4; 12.5	23
2.2	G 1/4; 14	23	G 1/4; 12.5	23
2.8	G 3/8; 14	26	G 1/4; 12.5	23
3.2	G 3/8; 14	26	G 1/4; 12.5	23
4.1	G 3/8; 14	26	G 3/8; 12.5	26
5.0	G 1/2; 14	27	G 3/8; 12.5	26

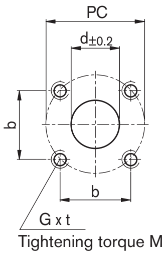
PGF2, port type 01
Pipe thread according to ISO 228/1

	Suction port dimensions		Pressure port dimensions	
NG	**s**	**f**	**p**	**g**
006	G 3/4; 16	35	G 1/2; 14	35
008	G 3/4; 16	35	G 1/2; 14	35
011	G 3/4; 16	35	G 1/2; 14	35
013	G 3/4; 16	35	G 1/2; 14	35
016	G 1; 18	40	G 1/2; 14	35
019	G 1; 18	40	G 1/2; 14	35
022	G 1; 18	40	G 1/2; 14	35



PGF2, port type 20 square flange port

	Suction port dimensions					Pressure port dimensions					
NG	**d**	**b**	**PC**	**Thread**	**t**	**M in Nm**	**d**	**b**	**PC**	**Thread**	**t**	**M in Nm**
006	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
008	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
011	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
013	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
016	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
019	26	38.9	55	M8	12	25	12	24.8	35	M6	12	10
022	26	38.9	55	M8	12	25	12	24.8	35	M6	12	10

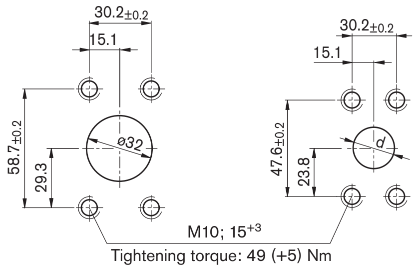


PGF3, port type 20 square flange port

	Suction port dimensions						Pressure port dimensions					
NG	**d**	**b**	**PC**	**Thread**	**t**	**M in Nm**	**d**	**b**	**PC**	**Thread**	**t**	**M in Nm**
020	26	38.9	55	M8	12	25	12	24.8	35	M6	10	10
025	26	38.9	55	M8	12	25	12	24.8	35	M6	10	10
032	26	38.9	55	M8	12	25	20	38.9	55	M8	12	25
040	26	38.9	55	M8	12	25	26	38.9	55	M8	12	25

PGF3, port type 07 SAE flange port

Suction port SAE 1 1/4" S **Pressure port SAE 3/4" S**



NG	d
020	16
025	16
032	20
040	20

Multiple pumps – ordering code

P3	GF2/022	+	GF2/011	+	GF1/2.8	R	E	20	+	20	+	01	E4

Internal gear pumps (e.g.)
Double = **P2**
Triple = **P3**

Series of first pump

Size of first pump

Series of second pump

Size of second pump

Series of third pump

Size of third pump

Mounting flange of first pump

Line port of third pump

Line port of second pump

Line port of first pump

Shaft variant of first pump

Direction of rotation

Multiple pumps – engineering notes

– The same general technical data apply as for single pumps (see pages 4 and 5).

– Combined pumps must all have the same direction of rotation.

– The pump that is subjected to the greatest loads should be the first pump.

– The engineer must verify the maximum through-drive torque for every application. This also applies for existing (coded) multiple pumps.

Maximum **drive torques** in Nm

Shaft	N	L	A	E	J
PGF1	14	14	30	30	–
PGF2	70	70	70	140	140
PGF3	140	140	–	230	230

– Common suction is **not** possible.

– For reasons of strength and stability, we recommend the use of ISO 4-hole mounting flanges to VDMA "E4" for combinations of three or more pumps

Selection

– The front pump must have shaft version E, J or L.

– The middle pump must have shaft version L.

– The rear pump must have shaft version N.

– If a pump of the next smaller frame size is to be mounted, the designation of the first pump must end with "K" (e.g., PGF3 + PGF2 ⇒ front pump: PGF3-3X/032RJ07VU2**K**)

– The drive torque of a pump stage is calculated as follows:

$$T = \frac{\Delta p \cdot V \cdot 0.0159}{\eta_{\text{hydr.-mech.}}}$$

T : Drive torque in Nm

Δp : Operating pressure in bar

V : Displacement in cm^3

η : Hydraulic mechanical efficiency

Maximum **output torques** in Nm

Shaft	L	E	J
PGF1	14	14	–
PGF2	70	70	70
PGF3	140	140	140

– Before operating pump combinations with different media, please consult Rexroth Hydraulics.

– PGF combinations are assembled without combination parts.

– The pumps are not sealed from each other.

Dimensions

– The dimensions of the ports are the same as for single pumps (see page 18).

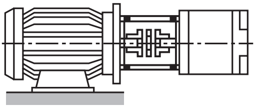
– The total length of the pump combination is calculated by adding up dimensions "d" of the single pumps (see pages 9 to 17).

– With the combination of PGF2 and PGF1, the installation length of the PGF2 (dimension d) increases by 4.5 mm. With the combination of PGF3 and PGF2, the installation length of the PGF3 (dimension d) increases by 2 mm. With the combination of PGF3 and PGF1, the installation length of the PGF3 (dimension d) increases by 12.5 mm.

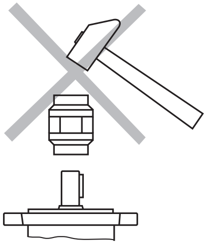
Installation instructions

Drive

Electric motor + pump support + coupling + pump

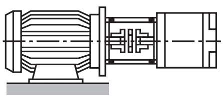


- No radial or axial forces permissible on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating shaft offsets!
- When installing the coupling, avoid axial forces, i.e., **when installing, do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

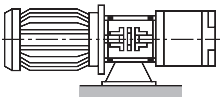


Installation positions

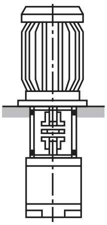
B3



B5



V1



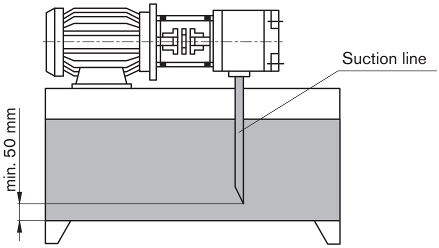
Fluid tank

- Adjust the usable capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; provide a cooler if necessary

Lines and ports

- Remove protective plug from the pump
- We recommend the use of seamless, precision steel pipes according to DIN 2391 and detachable pipe connections
- Select the clear width of pipes according to the ports (suction speed 0.6 to 1.2 m/s)
- For inlet pressure, see pages 4 and 5
- Thoroughly clean pipelines and fittings prior to installing

Recommendation for piping



- **Under no circumstances** returning fluid may be reaspired directly, i.e., select the largest possible distance between suction line and return line
- The return drain must always be below the oil level
- Ensure suction-tight installation of the pipelines

Filters

- If possible, use return-line filter or pressure filters.
  (Only use suction filters in combination with underpressure switch/contamination indicator)

Hydraulic fluid

- Please observe our specification according to data sheet RE90220
- We recommend the use of name-brand hydraulic fluids
- Different oil types must not be mixed together as this may result in decomposition and deterioration of the lubricity
- The hydraulic fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning residues from the fluid tank.

Commissioning notes

Preparations

- Check whether the system is thoroughly and properly installed.
- Fill the hydraulic fluid only in through filters with the required minimum retention rate.
- Fill the pump completely with hydraulic fluid via the suction or pressure tube.
- Check the direction of rotation of the motor for compliance with the direction of rotation according to the pump type.

Air bleeding

- Open the air bleeding port on the system by hand or change over to circulation at zero pressure in accordance with the instruction manual of the system. During air bleeding, the pressureless transportation of entrapped air must be ensured.
- To air bleed the pump, briefly switch the motor on and then switch it immediately off again (inching mode). Repeat this process until it is ensured that the pump has been completely air bled.
- Close the open air bleeding ports by hand..

Commissioning

- Once it is ensured that the pump has been completely air bled, switch on the motor. Let the pump run at zero pressure until the system is completely air bled. For air bleeding the system, observe the instruction manual for the system.
- Commission the system according to the instruction manual and let the pump run under load.
- After some time in operation, check the hydraulic fluid in the reservoir for bubbles or the formation of foam on the surface.

Operation

- During operation, take note of changes in the noise emissions. A slight increase in the noise level is normal due to warming up of the operating medium. A significant increase in the noise level or brief, stochastic changes in the noise characteristics may indicate the aspiration of air. If the suction pipes are too short or the fill level of the operating medium is too low, air can also be aspired via a vortex.
- Changes in operating speeds, temperatures, increase in the noise level or power consumption indicate wear or damage to the system or pump.

Recommissioning

- Inspect the pump and system for leakage. Loss of oil indicates leakage below the hydraulic fluid level. An increased hydraulic fluid level in the reservoir indicates leakage above the hydraulic fluid level.
- If the pump is arranged above the hydraulic fluid level, the pump can drain due to leakages, for example due to a worn-out shaft seal ring. In this case, air bleeding is again required during recommissioning. Have the damage repaired.
- Air bleeding must again be performed following repair and maintenance work.
- Switch on the motor when the system is in flawless condition.

General

- Pumps delivered by us are tested for function and performance. No changes of any nature may be made to the pump; the warranty is otherwise rendered void!
- Repairs may only be carried out by the manufacturer or his authorized dealers and subsidiaries. Repairs carried out by the customer are not covered by any warranty.

⚠ **Important notes**

- Installation, maintenance and repair of the pump may only be carried out by authorized, trained and instructed personnel!
- The pump may only be operated at the permissible data (see pages 4 and 5)!
- The pump may only be operated when in perfect condition!
- During all work on the pump, depressurize the system!
- Unauthorized conversions or changes that affect safety and function are not permissible!
- Mount safety devices (e.g., coupling protection) and do not remove any existing safety devices and equipment!
- Always ensure the proper fit of all mounting bolts! (Observe specified tightening torque!)
- The generally valid safety and accident prevention regulations must be observed!

Engineering notes

When using internal gear pumps, provide an additional manual, switchable or automatic air bleeding option. The air bleeding point for manual air bleeding must be provided in the pressure line upstream of the first valve or check valve to ensure air bleeding can be performed at zero pressure.

Technical data

All technical data given are dependent on manufacturing tolerances and are valid with certain boundary conditions.

Note that certain deviations are therefore possible and that technical data may vary when boundary conditions (e.g., viscosity) change.

Characteristic curves

When dimensioning the drive motor, observe the maximum possible application data on the basis of the characteristic curves shown on pages 6 to 8.

Sound pressure level

The values for sound pressure level shown on pages 6 to 8 were measured on the basis of DIN 45635, sheet 26. This means that only the noise emitted by the pump is shown. Ambient influences (installation site, piping etc.) were not taken into account.

These values always refer to only one pump.

With internal gear pumps, the excitation of valves, pipelines, machine parts, etc. is very low due to the low flow pulsation (approx. 2 to 3 %).

Nevertheless, under unfavorable conditions, the sound pressure level at the installation site of the power unit can be 5 to 10 dB(A) higher than the values of the pump itself.

Pump combinations

Internal gear pumps of the PGF series can be combined to form multiple pumps. In this case, please observe the permissible through-drive torques (see engineering aid for multiple pumps). The hydraulic fluid of the respective pump stages is not separated by shaft seals.

Caution!
The operation of multiple pumps with different hydraulic fluids is only possible after consultation.

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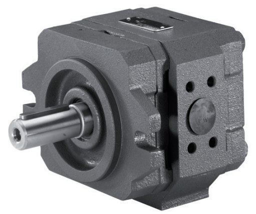
The Drive & Control Company

Rexroth
Bosch Group

Internal gear pump PGH
Fixed displacement
Series 2X

RE 10223
Edition: 04.2013
Replaces: 03.2005



- Frame sizes 2 and 3
- Size 5 to 16
- Maximum pressure 350 bar
- Displacement 5.2 to 16.0 cm^3

Features

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low rotational speed and viscosity due to sealing gap compensation
- Suitable for a wide viscosity and speed range
- All frame sizes and sizes can be optionally combined with each other
- Can be combined with internal gear pumps, radial piston pumps and external gear pumps

Contents

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Technical data	4
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Dimensions frame size 2	6
Dimensions frame size 3	7
Multiple pump units	9
SAE connection flanges	12
Pump safety block	12
Engineering notes	13
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Ordering code

01	02	03		04		05	06	07	08	09	10	11
PG	**H**		–	**2X**	**/**				**07**		**U2**	

Type

01	Internal gear pump, fixed displacement, gap compensated		**PG**

Series

02	High pressure pump, maximum pressure 350 bar		**H**

Frame sizes BG

03	BG2		**2**
	BG3		**3**

Unit series

04	Unit series 20 to 29 (20 to 29: unchanged installation and connection dimensions)		**2X**

Sizes

		NG	
05	BG2	5	**005**
		6	**006**
		8	**008**
	BG3	11	**011**
		13	**013**
		16	**016**

Directions of rotation

06	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shafts

07	Parallel keyed shaft, DIN 6885		**E**
	Splined shaft to SAE J744 with involute spline to ANSI B92.1a	16-4 (A) 9T 16/32DP	**R**
		19-4 11T 16/32DP	**S**

Line ports

08	Suction and pressure port to SAE, pressure port standard pressure series		**07**

Seals

09	FKM (fluor-caoutchouc)		**V**
	FKM (fluor-caoutchouc), shaft seal in NBR (nitrile-caoutchouc)[1)]		**W**

Mounting flange

10	SAE 2-hole		**U2**

11	Further parameters in clear text		

Ordering example

PGH3-2X/016RE07VU2

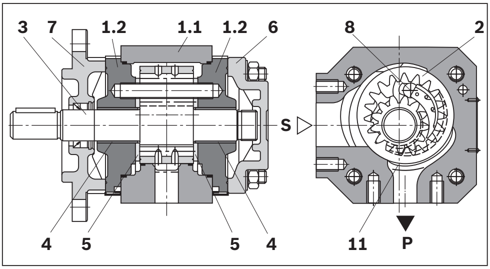
Material number

R900951305

Not all of the variants according to the ordering code are possible! Please select the desired pump with the help of the selection table (page 6 to 8) or after consultation with Bosch Rexroth.

1) For HFC-fluids

Functional description



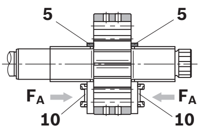
Assembly

PGF hydraulic pumps are leak gap-compensated internal gear pumps with a fixed displacement.
They consist basically of housing (**1.1**), bearing cover (**1.2**), ring gear (**2**), pinion shaft (**3**), slide bearings (**4**), axial discs (**5**), end cover (**6**), mounting flange (**7**) and stop pin (**8**), as well as the segment assembly (**9**), which is composed of a segment (**9.1**), segment carrier (**9.2**) and the sealing rolls (**9.3**).

Suction and displacement process

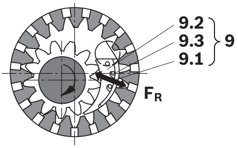
The hydro dynamically supported pinion shaft (**3**) drives the internally toothed ring gear (**2**) in the direction of rotation shown.
During rotation, the volume is increased in the suction area over an angle of approx. 90 °. A negative pressure is generated and fluid flows into the chambers.
The sickle-shaped segment assembly (**9**) separates the suction chamber from the pressure chamber. Within the pressure chamber, the teeth of the pinion shaft (**3**) mesh with the tooth spaces of the ring gear (**2**). The fluid is then displaced through the pressure channel (**P**).

Axial compensation



The axial compensation force F_A acts in the area of the pressure chamber and is generated by the pressure zone (**10**) in the axial discs (**5**).
The axial, longitudinal gaps between rotating and fixed parts are therefore extremely small and ensure optimum axial sealing of the pressure chamber.

Radial compensation



The radial compensation force F_R acts on the segment (**9.1**) and segment carrier (**9.2**).
Depending on the operating pressure the two segment assemblies (**9.1**) and (**9.2**) are pressed against the pinion shaft-head diameter (**3**) and the ring gear(**2**) .
The area ratios and the position of the sealing rolls (**9.3**) between the segment and segment carrier are designed to provide virtually gap-free sealing between the ring gear (**2**), the segment assembly (**9**) and the pinion shaft (**3**).
Spring elements under the sealing rolls (**9.3**) ensure adequate contact pressure, even at very low pressures.

4

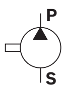
Hydrodynamic and hydrostatic bearing

The forces acting on the pinion shaft (**3**) are absorbed by hydro dynamically lubricated radial slide bearings (**4**) while those acting on the ring gear (**2**) are absorbed by the hydrostatic bearing (**11**).

Splines

Involute splining was selected for the splines. Their long length of contact results in a low flow and pressure pulsation; these low pulsation rates greatly contribute to the low-noise operation.

▼ **Symbol**



Technical data

Frame size		BG	2	2	2	3	3	3
Size		NG	5	6	8	11	13	16
Displacement, geometric	V_g	cm^3	5.24	6.5	8.2	11.0	13.3	16.0
Drive speed	n_{min}	rpm	600	600	600	600	600	600
	n_{max}	rpm	3000	3000	3000	3000	3000	3000
Operating pressure, absolute								
Inlet	p	bar	0.8 to 2 (short-term at start 0.6 bar)					
Outlet continuous								
Standard fluid	p_n	bar	315	315	315	315	315	315
Special fluid 1)	p_n	bar	210	210	210	210	210	210
intermittend 2)								
Standard fluid	p_{max}	bar	350	350	350	350	350	350
Special fluid 1)	p_{max}	bar	230	230	230	230	230	230
Flow (at n = 1450 rpm, p = 10 bar, ν = 46 mm^2/s)	q_V	l/min	7.5	9.3	11.8	15.8	19.1	23.0
weight	m	kg	4.3	4.4	4.6	4.8	5	5.3
Shaft loading			Radial and axial forces (e.g., belt pulley) only after consultation					
Type of mounting			Flange mounting					

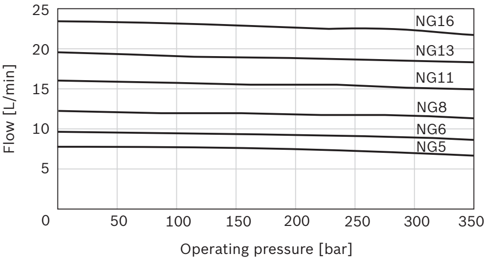
Hydraulic fluid			
Standard fluid		HLP mineral oil according to DIN 51524 Part 2	
Special fluid		▶ Environmentally acceptable fluids HEES according to DIN ISO 15380 ▶ Fire resistant anhydrous fluids HFD-U according to VDMA 24317 ▶ Hydrous polymer-solutionsn HFC according to DIN EN ISO 12922 3) ▶ Observe our application instructions and application requirements in the data sheets 90220 (HLP), 90221 (HEES) and 90222 (HFD-U). ▶ Other fluids on request!	
Temperature range	°C	Standard fluid	–10 to +80, for other temperatures please consult us!
		Special fluid	–10 to +50, for other temperatures please consult us!
Ambient temperature range	°C		–20 to +60
Viscosity range	mm/s^2		10 to 300; permissible starting viscosity 2000
Maximum permissible degree of contamination of the hydraulic fluid. Cleanliness level according to ISO 4406 (c)			Class 20/18/15 4)

Note
Please contact us it the unit is to be used outside the specified values!

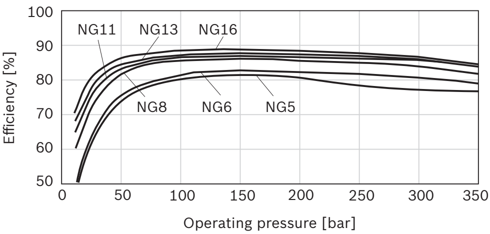
1) For special fluids observe restrictions of the technical data!
2) Maximum 10 s, at most 50 % of the duty cycle
3) Execution of seals W
4) Cleanliness levels specified for the components must be maintained in the hydraulic systems. Effective filtration prevents malfunctions and simultaneously extends the service life of the components.
For the selection of the filters see data sheets 50070, 50076, 50081, 50086, 50087 and 50088.

Characteristic median values for frame size 2 and 3

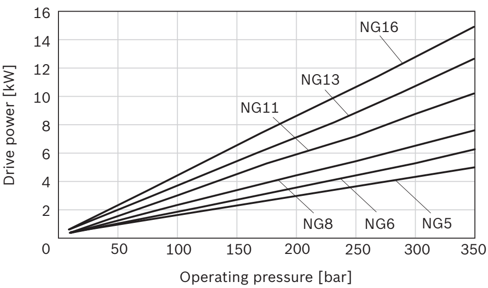
▼ **Flow**



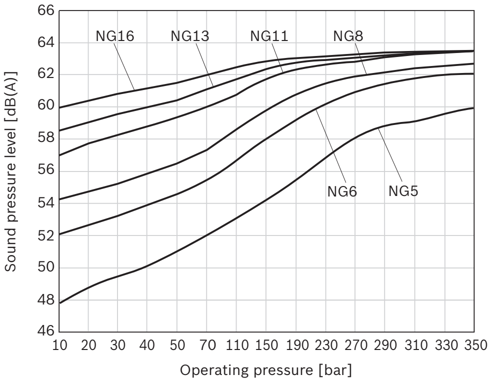
▼ **Efficiency**



▼ **Drive power**



▼ **Sound pressure level**



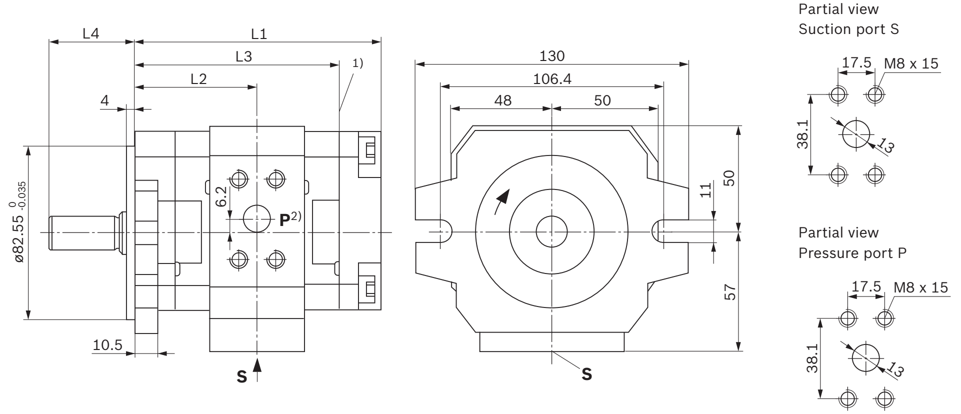
Note

- ▶ Characteristics measured at n = 1450 rpm;
  ν = 41 mm²/s; θ = 50 °C
- ▶ Sound pressure level measured in acoustic room according to DIN 45635, page 26;
  distance sound sensor – pump = 1 m

4

Dimensions frame size 2

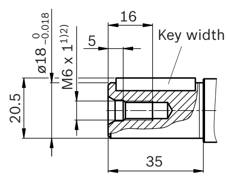
With parallel keyed shaft or splined shaft SAE J744 and SAE-mounting flange 82–2



Type					Material numbers	L1	L2	L3	L4	Suction port S[4)]	Pressure port P[4)]
PGH2-2X/	**005**	R[3)]	**E**	07VU2	R900968999	110	54.2	89.5	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L			R900703725						
		R[3)]	**R**	07VU2	R900972378				31.5		
		L			R900703727						
	006	R[3)]	**E**	07VU2	R900951301	112.5	55.5	92	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L			R900961547						
		R[3)]	**R**	07VU2	R900961549				31.5		
		L			R900961550						
	008	R[3)]	**E**	07VU2	R900951302	116	57.3	95.5	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L			R900961548						
		R[3)]	**R**	07VU2	R900961551				31.5		
		L			R900961552						

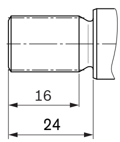
▼ **Parallel keyed shaft DIN 6885**

E



▼ **Splined shaft SAE J744**

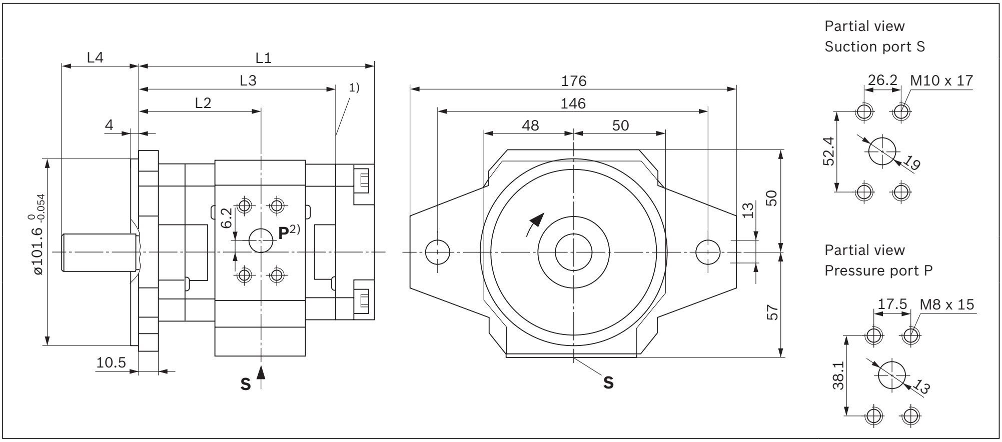
R - 16-4 (A) in 9T 16/32DP[5)6)]



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clock-wise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range
5) In multiple pump units suitable as middle and rear pump
6) Involute spline to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

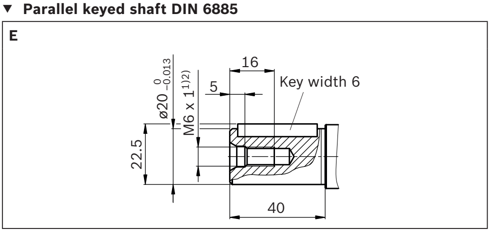
Dimensions frame size 3

With parallel keyed shaft and SAE-mounting flange 101–2



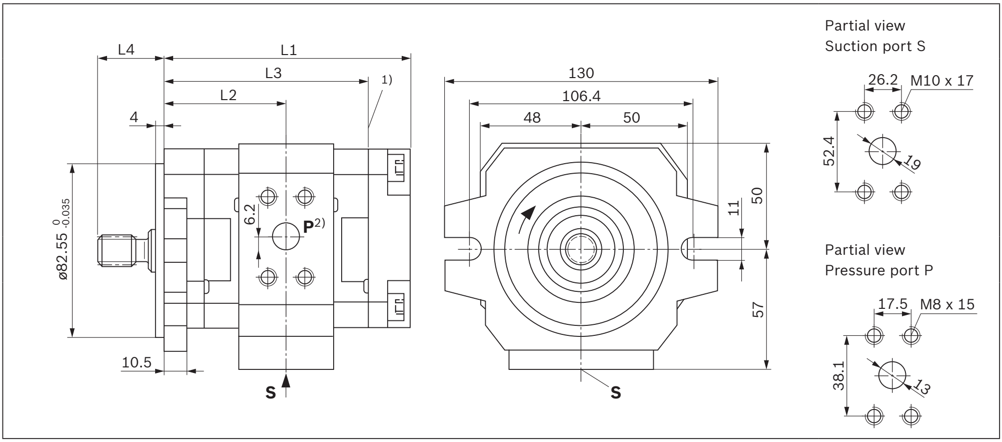
Type				Material numbers	L1	L2	L3	L4	Suction port S[4)]	Pressure port P[4)]
PGH3-2X/**011**	R[3)]	**E**	07VU2	R900951303	128	66.5	107.5	41	1 in; 3000 psi	1/2 in; 5000 psi
	L			R900961553						
013	R[3)]	**E**	07VU2	R900951304	133	69	112.5	41	1 in; 3000 psi	1/2 in; 5000 psi
	L			R900961554						
016	R[3)]	**E**	07VU2	R900951305	138	71.5	117.5	41	1 in; 3000 psi	1/2 in; 5000 psi
	L			R900961555						

▼ Parallel keyed shaft DIN 6885



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clockwise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range

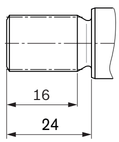
With splined shaft SAE J744 and SAE-mounting flange 82–2



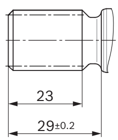
Type				Material numbers	L1	L2	L3	L4	Suction port S[4)]	Pressure port P[4)]
PGH3-2X/	**011**	R[3)]	**R** 07VU2	R900961556	121.5	60	101	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961559						
		R	**S** 07VU2	R901267181				37		
	013	R[3)]	**R** 07VU2	R900961557	126.5	62.5	106	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961560						
		R	**S** 07VU2	R901281697				37		
	016	R[3)]	**R** 07VU2	R900961558	131.5	65	111	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961561						
		R	**S** 07VU2	R901281698				37		

▼ **Splined shaft SAE J744**

R - 16-4 (A) in 9T 16/32DP[5)6)]



S - 19-4 in 11T 16/32DP[6)]



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clockwise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range
5) In multiple pump units suitable as middle and rear pump
6) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Multiple pump units

All internal gear pumps type PGH are combinable, every pump has a through drive connection. The combination options and the material numbers for the necessary combination parts can be taken from the following table.

Rear pump	Front pump	
	PGH2-2X	**PGH3-2X**
PGH2-2X/...R...U2	R900886137	R900886137
PGH3-2X/...R...U2	R900886137	R900886137
PGP2-2X/...J...U2	R900886137	R900886137
PGF2-2X/...J...U2	R900886137	R900886137
AZPF...RR...B	R900886137	R900886137
PR4-1X...WA	R901015657	R901015657

Ordering code

01	02		03		04		05		06		07	08	09	10		11	12		13	14	15
		/		+		/		+		/					+			+			

Type

01	2-fold		**P2**
	3-fold		**P3**
02	Series of the first pump[1]		
03	Size of the first pump[1]		
04	Series of the second pump[1]		
05	Size of the second pump[1]		
06	Series of the third pump[1]		
07	Size of the third pump[1]		

Direction of rotation

08	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shaft of the first pump

09	Parallel keyed shaft, DIN 6885		**E**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**R**
		19-4 11T 16/32DP	**S**

Line port of the first pump

10	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Drive shaft of the second pump[2]

11	Parallel keyed shaft, DIN 6885		**A**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**J**
			R

Line port of the second pump

12	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Drive shaft of the third pump[2]

13	Parallel keyed shaft, DIN 6885		**A**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**J**
			R

Line port of the third pump

14	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Mounting flange of the first pump

15	SAE 2-hole[2]	**U2**

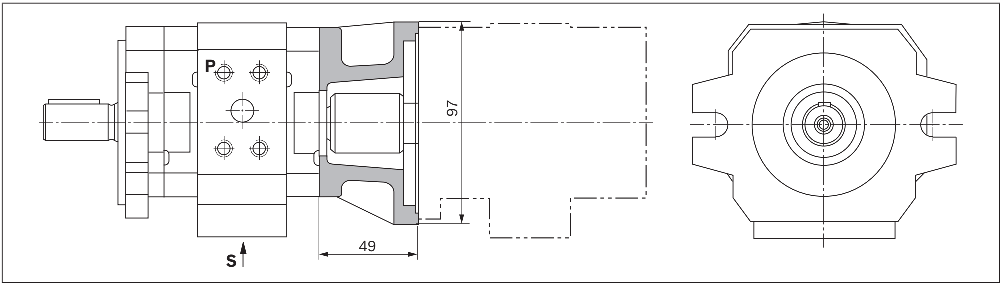
1) Detailed information see ordering code page 2
2) See table page 9

Dimensions

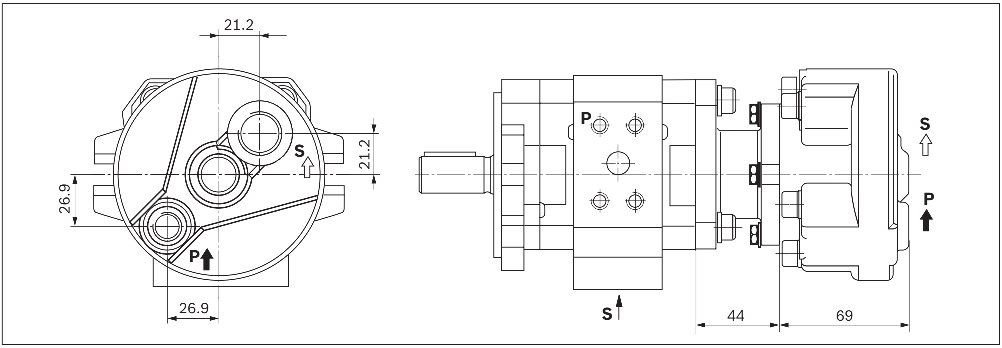
The dimensional drawings show the first pump and the combination part.[1)]

PGH2/PGH3

PGH2 with combination part for PGH2, PGH3, PGF2, PGP2, AZPF

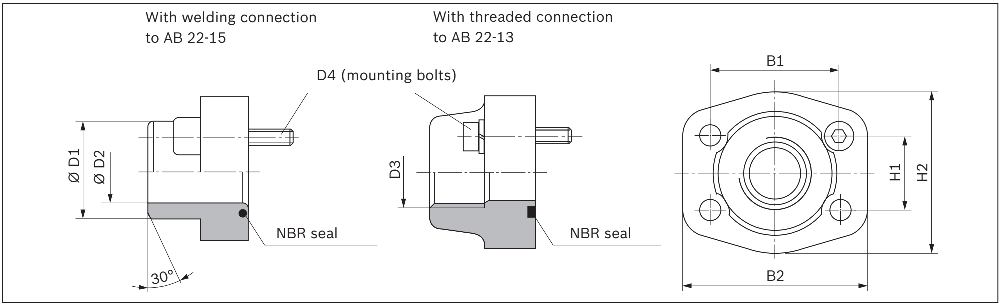


PGH2/PGH3 + R4-Mini



1) Dimensions of the single pumps see page6 to 8 or the relevant data sheets of the rear pump.

SAE connection flanges



PGH		Flange	Material number[1] for flange with		Dimensioning							
Suction flange	**Pressure flange**	**NG, pressure**	**Welding port**	**Threaded connection[2]**	**B1**	**B2**	**H1**	**H2**	**D1**	**D2**	**D3**	**D4**
PGH2/005/ 006/008	PGH2/005/ 006/008 PGH3/011/ 013/016	1/2 in 5000 psi	R900026298	R900024200	38.1	54	17.5	46	20	14	G1/2	M8 x 30
PGH3/011/013/016,	–	1 in 3000 psi	R900012937	R900014154	52.4	70	26.2	59	35	27	G1	M10 x 35

Pump safety block

For limitation of the operating pressure or (and) for solenoid-actuated relief of operating pressure we recommend our pump-pressure-safety-block to data sheets 25880 and 25891.

1) The material numbers comprise the flange, the O-ring (NBR) and the mounting bolts.
2) Pipe thread "G" according to DIN EN ISO 228/1

Engineering notes

Extensive notes and suggestions can be found in the Hydraulic Trainer, volume 3 "Project planning recommendations and design of hydraulic systems".
When using internal gear pumps, provide an additional manual, switchable or automatic air bleeding option. The air bleeding point for manual air bleeding must be provided in the pressure line upstream of the first valve or check valve to ensure air bleeding can be performed depressurized.

Technical data

All mentioned technical data are dependent on manufacturing tolerances and are applicable for certain boundary conditions.
Note that certain deviations are therefore possible and that technical data may vary when boundary conditions (e. g., viscosity) change.

Characteristic curves

When dimensioning the diesel engine, observe the maximum possible application data on the basis of the characteristics shown on the pages 5 and 5.

Sound pressure level

The shown values for the sound pressure level on page 5 were measured in dependence on DIN 45635, sheet 26. This means that only the noise emitted by the pump is shown. Ambient influences (installation site, piping etc.) were not taken into account.
These values always refer to only one pump.
With internal gear pumps, the excitation of valves, pipelines, machine parts, etc. is very low due to the low flow pulsation (approx. 2 to 3 %).
Nevertheless, under unfavorable conditions, the sound pressure level at the installation site of the power unit can be 5 to 10 dB(A) higher than the values of the pump itself.

Multiple pump units

- The same general technical data apply as for the single pumps (see page 4).
- Combined pumps must all have the same direction of rotation.
- The pump with the largest input drive torque should be taken as the first pump.
- The engineer must verify the maximum through-drive torque for each application. This also applies for existing (coded) multiple pumps.
- The sum of all input torques in a multiple pump unit may not exceed the permissible input torque of the first pump.
- Common suction is not possible.
- Before operating pump combinations with different hydraulic fluids, please contact Bosch Rexroth.
- The middle and the rear pump must feature the drive shaft execution "R" (stronger spline).
- The drive torque of a pump stage is calculated as follows:

$$T = \frac{\Delta p \cdot V \cdot 0.0159}{\eta_{\text{hydr-mech}}}$$

Key	
T	Torque T [Nm]
Δp	Operating pressure [bar]
V	Displacement [cm^3]
η	Hydraulic mechanical efficiency

▼ **Maximum permissible torques [Nm]**

Type	Drive torque			Output torque
	Parallel shaft E	Splined shaft R	Splined shaft S	
PGH2	100	80	155	75
PGH3	110	80	155	75

4

Installation instructions

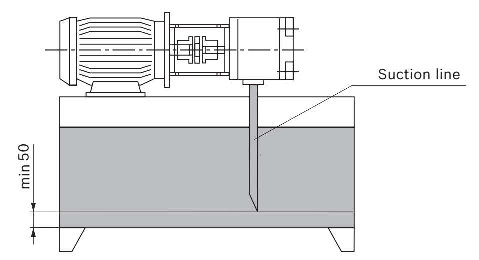
Fluid tank

- Adjust the usable capacity of the tank to the operating conditions.
- The permissible fluid temperature must not be exceeded; provide a cooler if necessary.

Lines and ports

- Remove protective plug from the pump.
- Select the clear width of pipes according to the ports (suction speed 1 to 1.5 m/s).
- Inlet pressure see page4
- Thoroughly clean pipelines and fittings prior to installing.

Proposal for piping layout



- Under no circumstances may returning fluid be drawn directly into the suction port again, i.e., select the largest possible distance between suction line and return line.
- The suction line and return tank line must always be clearly below the oil level.
- Ensure suction-tight installation of the pipelines.

Filter

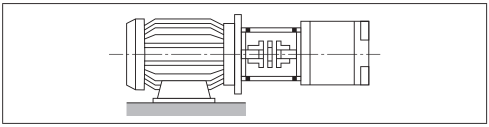
If possible, use return-line filter or pressure filters.
(Only use suction filters in combination with a low pressure switch/ contamination indicator).

Hydraulic fluid

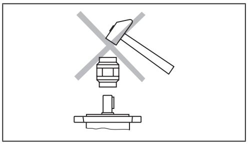
- Please observe our specification according to data sheet 90220.
- We recommend brand name hydraulic fluids
- Different oil types must not be mixed together as this may result in decomposition and deterioration of the lubricity
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning residues from the fluid reservoir.

Drive

Electric motor + pump support + coupling + pump

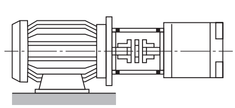


- No radial or axial forces permissible on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, i.e. **when installing, do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

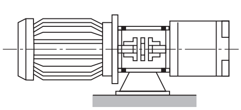


Installation positions

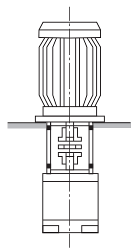
B3



B5



V1



Commissioning instructions

Preparation
- Check whether the system is thoroughly and properly installed.
- Fill the hydraulic fluid only in through filters with the required minimum retention rate.
- Fill pump completely with fluid through suction and pressure line.
- Check the direction of rotation of the motor for compliance with the direction of rotation according to the pump type.

Air bleed
- Open the air bleeding port on the system by hand or change over to depressurized circulation in accordance with the instruction manual of the system. During air bleeding, the discharge of entrapped air must be ensured.
- To air bleed the pump, briefly switch the motor on and then switch it immediately off again (inching mode). Repeat this process until it is ensured that the pump has been completely air bled.
- Close the open air bleeding ports by hand.

Commissioning
- Once it is ensured that the pump has been completely air bled, switch on the motor. Let the pump run depressurized until the system is completely air bled. For air bleeding the system, observe the instruction manual for the system.
- Commission the system according to the instruction manual and let the pump run under load.
- After some time in operation, check the hydraulic fluid in the reservoir for bladders or the formation of foam on the surface.

Operation
- During operation, take note of changes in the noise emissions. A slight increase in the noise level is normal due to heating the operating medium. A significant increase in the noise level or brief, stochastic changes in the noise characteristics may indicate the aspiration of air. If suction lines are too short or fluid level not high enough air can also be primed in a swirl action.
- Changes in operating speeds, temperatures, increase in the noise level or power consumption indicate wear or damage to the system or pump.

Recommissioning
- Inspect the pump and system for leakage. Loss of oil indicates leakage below the hydraulic fluid level. An increased hydraulic fluid level in the reservoir indicates leakage above the hydraulic fluid level.
- If the pump is arranged above the hydraulic fluid level, the pump can drain due to leakages, for example due to a worn-out shaft seal ring. In this case, air bleeding is again required during recommissioning. Have the damage repaired.
- Air bleeding must again be performed following repair and maintenance work.
- Switch on the motor when the system is in flawless condition.

General
- Pumps delivered by us are tested for function and power. The warranty applies only to the delivered configuration.
- Repairs may only be performed by the manufacturer or his authorized dealers and subsidiaries. The entitlement to warranty cover will be rendered void if the product is incorrectly repaired, installed, commissioned or operated, or if it is used or handled improperly.
- Through opening, conversion or extension of the internal gear pump, the entitlement under warranty will be rendered void.

Notes
- Installation, maintenance and repair of the pump may only be carried out by authorized, trained and instructed personnel!
- The pump may only be operated at the permissible data (see pages 4).
- The pump may only be operated when in perfect condition!
- During all work on the pump, depressurize the system!
- Unauthorized conversions or changes that affect safety and function are not permissible!
- Mount safety devices (e.g., coupling protection) and do not remove any existing safety devices and equipment!
- Always ensure the proper fit of all mounting bolts! (Observe the specified tightening torques)
- The generally valid safety and accident prevention regulations must be observed!

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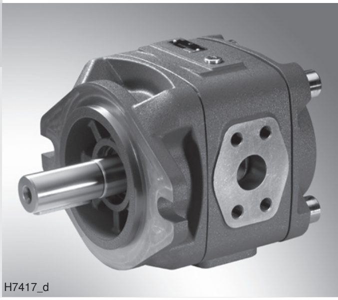
Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10227/12.10
Replaces: 04.07

Type PGH

Frame size 4 and 5
Component series: 3X
Maximum operating pressure 350 bar
Maximum displacement volume 250 cm^3



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Ordering code single pumps	2
Function, section, symbol	3
Technical data	4 and 5
Characteristic curves	On request
Unit dimensions single pumps	6 to 11
Ports	12
Pump combinations	13
Unit dimensions pump combinations	14 to 18
Project planning information	19 to 22
Commissioning notes	23

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Fixed displacement
- Low operating noise
- Little flow pulsation
- High efficiency also at low speed and viscosity due to sealing gap compensation
- Suitable for broad viscosity and speed ranges
- All frame sizes and sizes can be combined with each other in any form
- Can be combined with internal gear pumps, vane pumps and axial piston pumps
- Suitable for operation with HFC fluid (seal design "W")
- Use:
  For fatigue-resistant drives with high power and high pressures with very large load cycle numbers, e.g. plastics processing machines, automated presses, foundry machines and other applications with accumulator charging operation.

Ordering code: Single pumps

PG	H		–3X/						*

Series
High pressure pump **= H**

Frame size
BG4 **= 4**
BG5 **= 5**

Component series: Component series 30 to 39 **= 3X**
(30 to 39: Unchanged installation and connection dimensions)

Size	Size	Displacement/ revolution	
BG4	20	20.10 cm^3	**= 020**
	25	25.30 cm^3	**= 025**
	32	32.70 cm^3	**= 032**
	40	40.10 cm^3	**= 040**
	50	50.70 cm^3	**= 050**
BG5	63	64.70 cm^3	**= 063**
	80	81.40 cm^3	**= 080**
	100	100.20 cm^3	**= 100**
	125	125.30 cm^3	**= 125**
	160	162.80 cm^3	**= 160**
	200	200.40 cm^3	**= 200**
	250	250.50 cm^3	**= 250**

Further details in the plain text

Type of connection
U2 = SAE 2-hole mounting flange
E4 = [1] ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560

Seal material
V = FKM seals
W = [2] Shaft seal ring made of NBR (remaining seals made of FKM)

Line connection [3]
07 = SAE flange standard pressure series
11 = SAE flange high-pressure series

Shaft design
E = Cylindrical
R = SAE involute gear

Direction of rotation (looking at the shaft end)
R = Clockwise
L = Counterclockwise (on request)

[1] Only in connection with cylindrical shaft (according to VDMA), only with clockwise rotation

[2] In case of operation with HFC fluid

[3] For each size, one type of connection **07** or **11** has been determined:
07: PGH5-3X/200/250…
11: PGH4-3X/020/025/032/040/050…
PGH5-3X/063/080/100/125/160...

The suction ports have all been designed in standard pressure series (dimensions see page 12).

Not all variants are possible according to the type key! Please select the desired pump using the selection tables (pages 6 to 11) or after consultation with Bosch Rexroth.

Standard types PGH4-3X	
Type	Material no.
PGH4-3X/020RE11VU2	R901147100
PGH4-3X/025RE11VU2	R901147101
PGH4-3X/032RE11VU2	R901147102
PGH4-3X/040RE11VU2	R901147103
PGH4-3X/050RE11VU2	R901147104

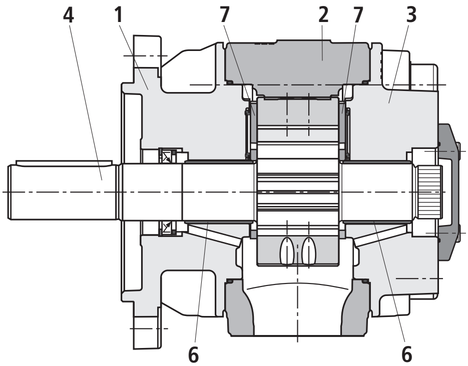
Standard types PGH5-3X	
Type	Material no.
PGH5-3X/063RE11VU2	R901147115
PGH5-3X/080RE11VU2	R901147116
PGH5-3X/100RE11VU2	R901147117
PGH5-3X/125RE11VU2	R901147118
PGH5-3X/160RE11VU2	R901147119
PGH5-3X/200RE07VU2	R901147120
PGH5-3X/250RE07VU2	R901147121

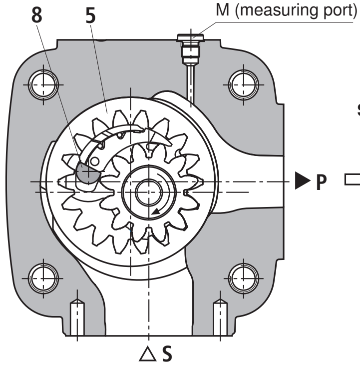
Function, section, symbol

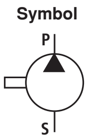
Structure

Hydraulic pumps of type PGH.-3X are gap-compensated internal gear pumps with fixed displacement.

They mainly consist of: Mounting flange (1), housing (2), cover with through-drive (3), pinion shaft (4), internal gear (5), sliding bearings (6), axial washers (7) and stop pin (8) as well as the radial compensation consisting of segment (9), segment support (10) and the seal rolls (11).







Suction and displacement procedure

The hydro-dynamically mounted pinion shaft (4) drives the toothed internal gear (5) in the direction of rotation shown.

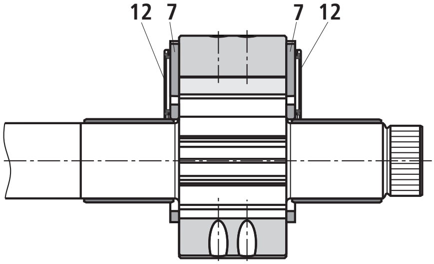
The tooth clearances opening in the suction area prime the fluid. The fluid is transported into the tooth clearances of pinion and internal gear, from the suction area (S) into the pressure area (P).

There, the fluid is displaced from the closing tooth clearances and delivered into the pressure port (P).

Suction and discharge area are separated by the radial compensation elements (9 to 11) and the tooth engagement between internal gear and pinion shaft.

Axial compensation

The displacement chamber in the pressure area is axially sealed by axial washers (7).

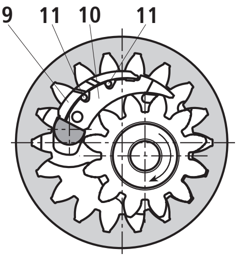


The sides of the axial washers facing away from the displacement area are backed by a pressure field (12). These fields balance the axial washers vis-à-vis the displacement area, which results in a perfect sealing with low mechanical losses.

Radial compensation

The radial compensation elements consist of segment (9), segment support (10) and seal rolls (11).

Segment (9) and segment support (10) are arranged in the pressure field so that the resulting compressive force is basically accepted by the stop pin.



A small compressive force component presses segment and segment support onto the tooth tips of pinion shaft and internal gear and in this way provides for the separation of the pressure area from the suction area with automatic clearance adjustment.

This is the prerequisite for constantly high volumetric efficiency during the entire operating time.

The clearance adjustment of segment and segment support is made possible by the seal rolls located inbetween.

Hydro-dynamic and hydrostatic mounting

The pinion shaft (4) is accepted by hydro-dynamically lubricated radial sliding bearings (6).

The internal gear (5) is mounted hydrostatically in the housing.

Gearing

The gearing with involute edges has a large meshing length for little flow and pressure pulsation and thus guarantees low-noise running.

4

Technical Data (For applications outside these parameters, please consult us!)

general

Design	Internal gear pump, gap-compensated
Type of connection	SAE 2-hole flange according to ISO 3019-1 or 4-hole flange according to VDMA 24560 and ISO 3019-2
Line connection	Flange port
Shaft load	Radial and axial forces (e.g. belt pulley) **only** after coordination
Direction of rotation (looking at the shaft end)	Clockwise or counterclockwise (on request) – **not** bidirectional!

hydraulic

Hydraulic fluid			HLP – mineral oil according to DIN 51524 part 2 HFC – water polymer solutions according to DIN EN ISO 12922 [1) 2)]: Seal design W HEES – fluids according to DIN ISO 15380 [1)] HFD-U – fluids according to VDMA 24317 [1)], DIN EN ISO 12922 [1)] **Please observe our specifications according to data sheet RE 90220** **Other fluids on request!**
Hydraulic fluid temperature range	HLP fluid	°C	–10 to +80; for other temperatures please consult us!
	Special fluid	°C	–10 to +50; for other temperatures please consult us!
Ambient temperature range		°C	–20 to +60
Viscosity range		mm^2/s	10 to 300 (to n = 1800 min^{-1}) 10 to 100 (to n = 3000 min^{-1}) 2000 admissible start viscosity (400 to 1800 min^{-1})
Max. admissible level of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3)]

1) **Attention!**
To these media, the limitations for special fluids apply

2) Hydraulic fluid HFC: Input speed n_{max} = 2000 min^{-1}

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Efficient filtration prevents failures and simultaneously increases the service life of the components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical Data (For applications outside these parameters, please consult us!)

Frame size	Frame size		PGH4				
Size	Size		20	25	32	40	50
Weight	m	kg	14	14.5	15	16	17
Speed range [1]	n_{min}	min^{-1}	200	200	200	200	200
	n_{max}	min^{-1}	3000	3000	3000	3000	3000
Displacement	V	cm^3	20.1	25.3	32.7	40.1	50.7
Flow [2]	q_V	l/min	28.9	36.3	46.9	57.6	72.8
Moment of inertia (around drive axis)	J	kgm^2	0.00037	0.00045	0.00055	0.00066	0.00081
Power consumption	P_{ad}	kW					
Min. drive power necessary (with $p \approx 1$ bar)			1.1	1.1	1.1	1.1	1.5
Max. admissible drive power			35	44	56	61	76
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)				
Nominal pressure – Output, continuous	p_N	bar					
	HLP fluid		315				250
	Special fluid [3]		220				175
intermittent [4]	p_{max}	bar					
	HLP fluid		350				315
	Special fluid [3]		245				210

Frame size	Frame size		PGH5						
Size	Size		63	80	100	125	160	200	250
Weight	m	kg	42	43.5	45.5	48	52	55.5	60.5
Speed range [1]	n_{min}	min^{-1}	200	200	200	200	200	200	200
	n_{max}	min^{-1}	3000	3000	3000	3000	3000	3000	3000
Displacement	V	cm^3	64.7	81.4	100.2	125.3	162.8	200.4	250.5
Flow [2]	q_V	l/min	92.8	116.9	143.8	179.8	233.7	287.7	359.6
Moment of inertia (around drive axis)	J	kgm^2	0.00237	0.00289	0.00329	0.00407	0.00506	0.00623	0.00760
Power consumption	P_{ad}	kW							
Min. drive power necessary (with $p \approx 1$ bar)			1.8	2.2	3	4	5.5	7.5	7.5
Max. admissible drive power			96	103	129	161	134	140	134
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)						
Nominal pressure – Output, continuous	p_N	bar							
	HLP fluid		315				210	170	135
	Special fluid [3]		220				145	115	90
intermittent [4]	p_{max}	bar							
	HLP fluid		350				260	210	170
	Special fluid [3]		245				180	145	115

1) Hydraulic fluid HFC: Input speed $n_{max} = 2000\ min^{-1}$

2) Measured with $n = 1450\ min^{-1}$, $p = 10$ bar and = 30 mm^2/s

3) **Attention!**
To these media, the limitations for special fluids apply

4) Max 10 s, max. 50 % of the duty cycle

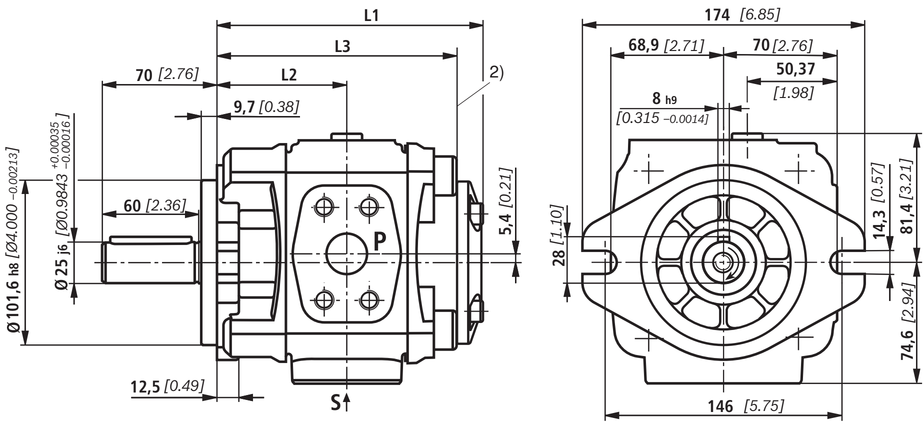
4

Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/...R/L E...VU2

Drive shaft cylindrical,
SAE 2-hole mounting flange

Type Size	Material no. "R" clockwise	"L" counter-clockwise	**L1**	**L2**	**L3**	**S** 1)	**P** 1)
PGH4-3X/020..E11VU2	R901147100	On request	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025..E11VU2	R901147101	On request	150 *[5.91]*	73 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032..E11VU2	R901147102	On request	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040..E11VU2	R901147103	On request	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050..E11VU2	R901147104	On request	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H



1) S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

2) For multiple pumps, the combination part starts from here

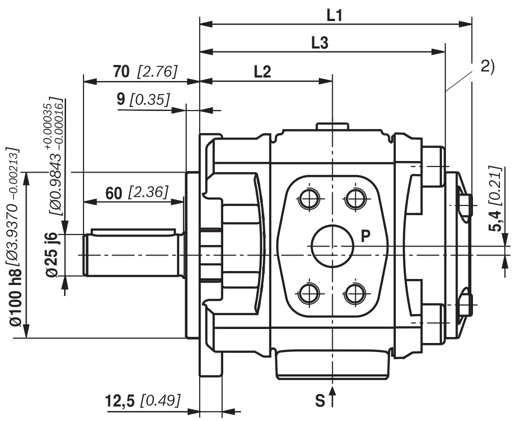
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

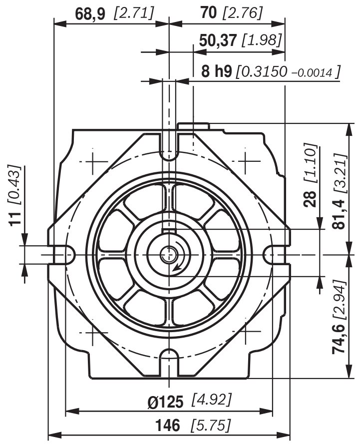
Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/... RE...VE4

Drive shaft cylindrical,
4-hole mounting flange according to ISO 3019-2
and VDMA 24560

Type Size	Material no. "R" clockwise	L1	L2	L3	S [1)]	P [1)]
PGH4-3X/020RE11VE4	R901147105	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025RE11VE4	R901147106	150 *[5.91]*	73.0 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032RE11VE4	R901147107	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040RE11VE4	R901147108	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050RE11VE4	R901147109	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H





[1)] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2)] For multiple pumps, the combination part starts from here

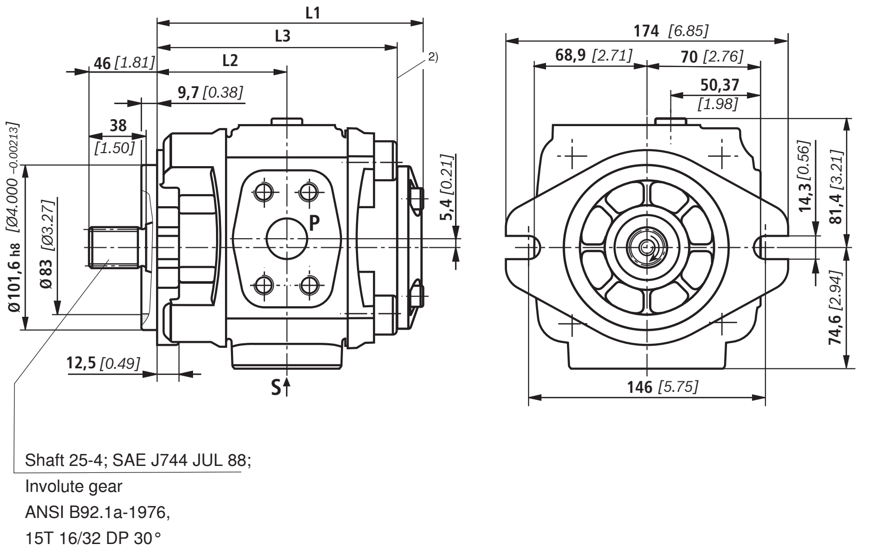
Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/...$^{R}_{L}$R...VU2

Drive shaft splined, SAE 2-hole mounting flange

(central and back pump in pump combinations)

Type Size	Material no. "R" clockwise	"L" counter-clockwise	L1	L2	L3	S [1)]	P [1)]
PGH4-3X/020..R11VU2	R901147110	On request	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025..R11VU2	R901147111	On request	150 *[5.91]*	73 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032..R11VU2	R901147112	On request	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040..R11VU2	R901147113	On request	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050..R11VU2	R901147114	On request	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H



1) S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

2) For pump combinations, the combination part starts from here

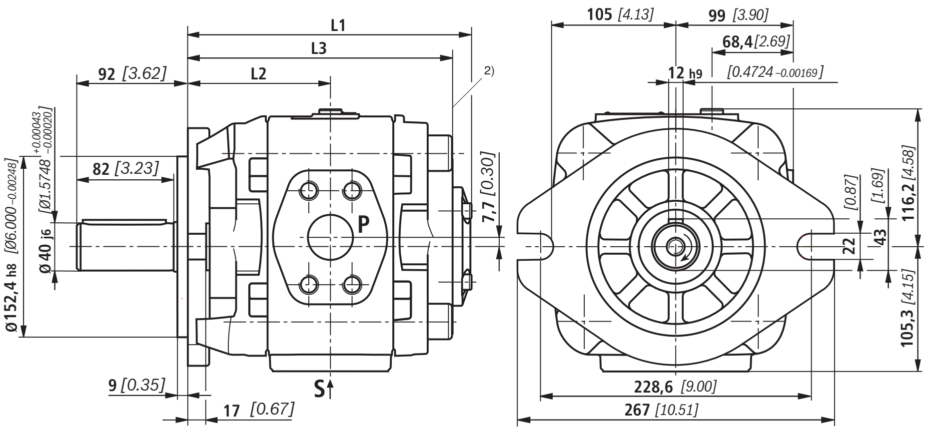
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

PGH5-3X/... R/L E...VU2

Drive shaft cylindrical, SAE 2-hole mounting flange

Type Size	Material no. "R" clockwise	Material no. "L" counter-clockwise	L1	L2	L3	S [1)]	P [1)]
PGH5-3X/063..E11VU2	R901147115	On request	210 *[8.27]*	105.5 *[4.15]*	194 *[7.64]*	2" S	1 1/4" H
PGH5-3X/080..E11VU2	R901147116	On request	218 *[8.58]*	109.5 *[4.31]*	202 *[7.95]*	2" S	1 1/4" H
PGH5-3X/100..E11VU2	R901147117	On request	227 *[8.94]*	114 *[4.49]*	211 *[8.31]*	2 1/2" S	1 1/2" H
PGH5-3X/125..E11VU2	R901147118	On request	239 *[9.41]*	120 *[4.72]*	223 *[8.78]*	2 1/2" S	1 1/2" H
PGH5-3X/160..E11VU2	R901147119	On request	257 *[10.12]*	129 *[5.08]*	241 *[9.49]*	3" S	2" H
PGH5-3X/200..E07VU2	R901147120	On request	275 *[10.83]*	138 *[5.43]*	259 *[10.20]*	3 1/2" S	2" S
PGH5-3X/250..E07VU2	R901147121	On request	299 *[11.77]*	150 *[5.91]*	283 *[11.14]*	3 1/2" S	2 1/2" S



1) S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

2) For pump combinations, the combination part starts from here

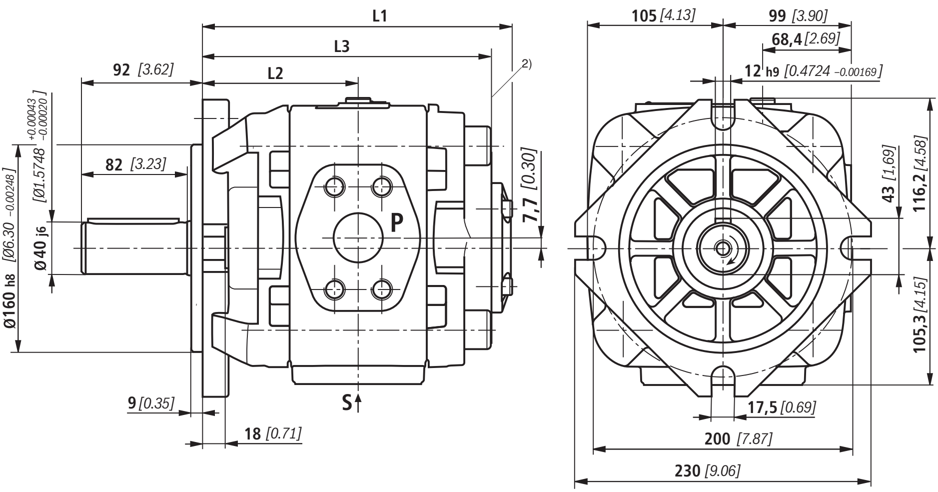
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

PGH5-3X/...RE...VE4

Drive shaft cylindrical,
4-hole mounting flange according to ISO 3019-2
and VDMA 24560

Type Size	Material no. "R" clockwise	L1	L2	L3	S 1)	P 1)
PGH5-3X/063RE11VE4	R901147122	210 *[8.27]*	105.5 *[4.15]*	194 *[7.64]*	2" S	1 1/4" H
PGH5-3X/080RE11VE4	R901147123	218 *[8.58]*	109.5 *[4.31]*	202 *[7.95]*	2" S	1 1/4" H
PGH5-3X/100RE11VE4	R901147124	227 *[8.94]*	114 *[4.49]*	211 *[8.31]*	2 1/2" S	1 1/2" H
PGH5-3X/125RE11VE4	R901147125	239 *[9.41]*	120 *[4.72]*	223 *[8.78]*	2 1/2" S	1 1/2" H
PGH5-3X/160RE11VE4	R901147126	257 *[10.12]*	129 *[5.08]*	241 *[9.49]*	3" S	2" H
PGH5-3X/200RE07VE4	R901147127	275 *[10.83]*	138 *[5.43]*	259 *[10.20]*	3 1/2" S	2" S
PGH5-3X/250RE07VE4	R901147128	299 *[11.77]*	150 *[5.91]*	283 *[11.14]*	3 1/2" S	2 1/2" S



1) S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

2) For pump combinations, the combination part starts from here

Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

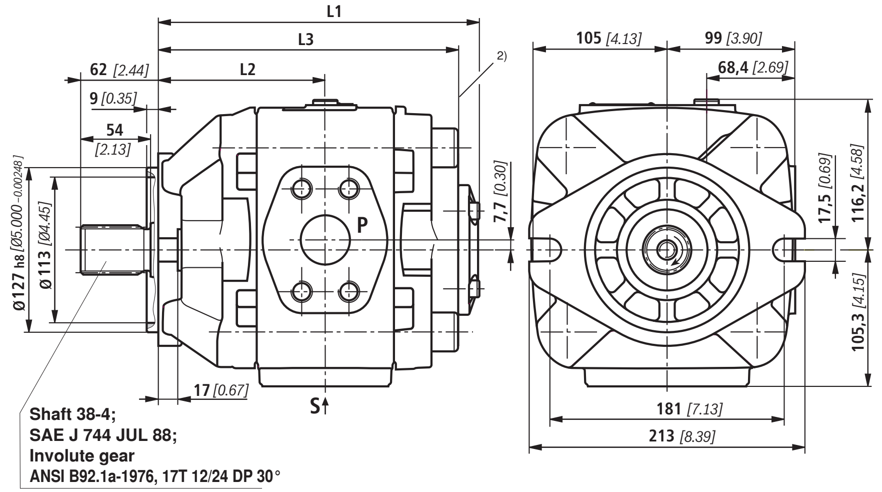
PGH5-3X/...R/L R...VU2

Drive shaft splined, SAE 2-hole mounting flange

(central and back pump for pump combinations)

Type Size	Material no.						
	"R" clockwise	"L" counter-clockwise	L1	L2	L3	S [1]	P [1]
PGH5-3X/063..R11VU2	R901147129	On request	219 *[8.62]*	114.5 *[4.51]*	203 *[7.99]*	2" S	1 1/4" H
PGH5-3X/080..R11VU2	R901147130	On request	227 *[8.94]*	118.5 *[4.67]*	211 *[8.31]*	2" S	1 1/4" H
PGH5-3X/100..R11VU2	R901147131	On request	236 *[9.29]*	123 *[4.84]*	220 *[8.66]*	2 1/2" S	1 1/2" H
PGH5-3X/125..R11VU2	R901147132	On request	248 *[9.76]*	129 *[5.08]*	232 *[9.13]*	2 1/2" S	1 1/2" H
PGH5-3X/160..R11VU2	R901147133	On request	266 *[10.47]*	138 *[5.43]*	250 *[9.84]*	3" S	2" H
PGH5-3X/200..R07VU2	R901147134	On request	284 *[11.18]*	147 *[5.79]*	268 *[10.55]*	3 1/2" S	2" S
PGH5-3X/250..R07VU2	R901147135	On request	308 *[12.13]*	159 *[6.26]*	292 *[11.50]*	3 1/2" S	2 1/2" S

4



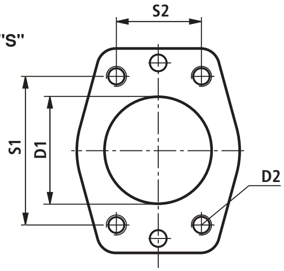
[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For pump combinations, the combination part starts from here

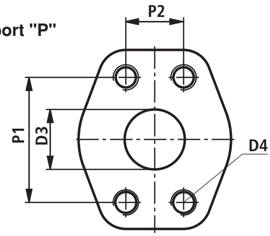
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Ports (dimensions in mm *[inch]*)

Suction port "S"

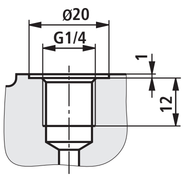


Pressure port "P"

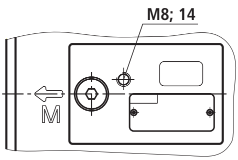


Frame size	Size	Porting pattern/ suction port S	D1	D2	S1	S2	Porting pattern/ pressure port P	D3	D4	P1	P2
4	**020**	1" 5000 PSI	Ø25 *[Ø0.984]*	M10; 18	52.4 *[2.063]*	26.2 *[1.032]*	3/4" 6000 PSI	Ø19 *[Ø0.748]*	M10; 18	50.8 *[2.000]*	23.8 *[0.937]*
	025	1 1/4" 4000 PSI	Ø32 *[Ø1.260]*	M10; 18	58.7 *[2.311]*	30.2 *[1.189]*	3/4" 6000 PSI	Ø19 *[Ø0.748]*	M10; 18	50.8 *[2.000]*	23.8 *[0.937]*
	032	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	040	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	050	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
5	**063**	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 21	66.6 *[2.622]*	31.8 *[1.252]*
	080	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 21	66.6 *[2.622]*	31.8 *[1.252]*
	100	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*
	125	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*
	160	3" 2000 PSI	Ø76 *[Ø2.992]*	M16; 30	106.4 *[4.189]*	61.9 *[2.437]*	2" 6000 PSI	Ø51 *[Ø2.008]*	M20; 35	96.8 *[3.811]*	44.5 *[1.752]*
	200	3 1/2" 500 PSI	Ø89 *[Ø3.504]*	M16; 30	120.7 *[4.752]*	69.9 *[2.752]*	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 23	77.8 *[3.063]*	42.9 *[1.689]*
	250	3 1/2" 500 PSI	Ø89 *[Ø3.504]*	M16; 30	120.7 *[4.752]*	69.9 *[2.752]*	2 1/2" 2500 PSI	Ø64 *[Ø2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*

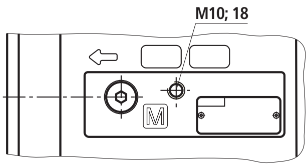
Measuring port PGH4-3X/... and PGH5-3X/...



Transport thread PGH4-3X/...



Transport thread PGH5-3X/...



Pump combinations

All internal gear pumps of type PGH-3X can be combined; each pump has an output shaft gearing. The combination options and the material numbers of the necessary combination parts are shown in the following figure.

Please observe the project planning information for pump combinations on page 21.

Back pump \ Front pump	Material no.	
	PGH4-3X	PGH5-3X
PGH2-2X/...R...U2 (RE10223)	R901155288	R901155283
PGH3-2X/...R...U2 (RE10223)	R901155288	R901155283
PGH4-3X/...R...U2	R901155289	R901155284
PGH5-3X/...R...U2	–	R901155285
PGF2-2X/...J...U2 (RE10213)	R901155288	R901155283
PGP2-2X/...J...U2 (RE10231)	R901155288	R901155283
PGF3-3X/...J...U2 (RE10213)	R901155287	R901155282
PGP3-3X/...J...U2 (RE10231)	R901155287	R901155282
PVV/Q1-1X/...J…B (RE10335)	R901155287	R901155282
PVV/Q2-1X/...J…B (RE10335)	R901155287	R901155282
PVV/Q4-1X/...J…C (RE10335)	–	R901155286
PVV/Q5-1X/...J…C (RE10335)	–	R901155286
AZPF-1X/...RR...B (RE10089)	R901155288	R901155283

4

Ordering code

		–3X/	+	–	/	+	–	/				

2-fold = **P2**
3-fold = **P3**

Series of the 1st pump 1)

Component series of the 1st pump 1)

Size of the 1st pump 1)

Series of the 2nd pump 1)

Component series of the 2nd pump 1)

Size of the 2nd pump 1)

Series of the 3rd pump 1)

Component series of the 3rd pump 1)

Size of the 3rd pump 1)

Direction of rotation (looking at the shaft end)
R = Clockwise
L = Counterclockwise (on request)

Shaft design of the 1st pump
E = Cylindrical
R = SAE involute gear

Seal material
V = FKM seals
W = Shaft seal NBR (remaining seals FKM)

Type of connection of the 1st pump
U2 = 2) SAE 2-hole mounting flange
E4 = 3) ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560

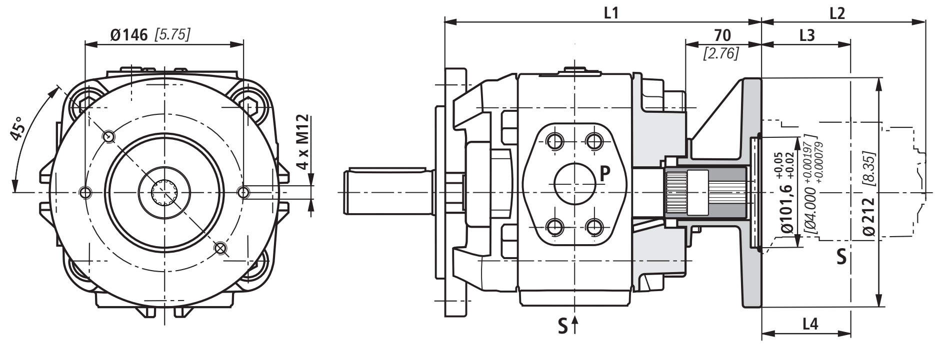
Order example:
P3GH5-3X/160+GH5-3X/100+GH4-3X/050REVE4

1) For detailed information refer to the ordering code page 2
2) In connection with cylindrical and splined shaft
3) Only in connection with cylindrical shaft (according to VDMA); only with clockwise rotation

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GF3-3X/VV1-1X/VV2-1X/K02
Material no.: **R901155282**



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PGF3/PGP2 Size	L2	L3
20	144.5 *[5.69]*	79.5 *[3.13]*
22	146.5 *[5.77]*	80.5 *[3.17]*
25	150.5 *[5.93]*	82.5 *[3.25]*
32	159.5 *[6.28]*	87 *[3.43]*
40	169.5 *[6.67]*	92 *[3.62]*

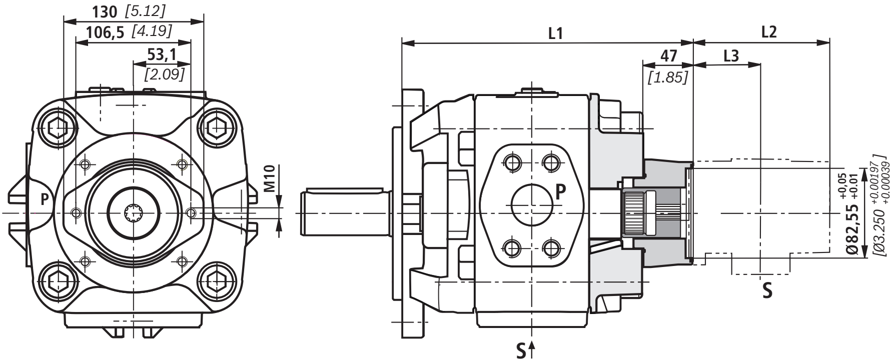
PVV..UMB Frame size	L2	L3 (P)	L4 (S)
1	156 *[6.14]*	133 *[5.24]*	63.5 *[2.50]*
2	163 *[6.42]*	38 *[1.50]*	120.5 *[4.75]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH2/3-2X/GF2-2X/AZPF-1X/K01

Material no.: **R901155283**



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	241 *[9.49]*	250 *[9.84]*
80	249 *[9.80]*	258 *[10.16]*
100	258 *[10.16]*	267 *[10.51]*
125	270 *[10.63]*	279 *[10.98]*
160	288 *[11.34]*	297 *[11.69]*
200	306 *[12.05]*	315 *[12.40]*
250	330 *[12.99]*	339 *[13.35]*

PGH2 Size	L2	L3
005	110 *[4.33]*	54 *[2.13]*
006	112.5 *[4.43]*	55.5 *[2.19]*
008	116 *[4.57]*	57 *[2.24]*

PGH3 Size	L2	L3
011	121.5 *[4.78]*	60 *[2.36]*
013	126.5 *[4.98]*	62.5 *[2.46]*
016	131.5 *[5.18]*	65 *[2.56]*

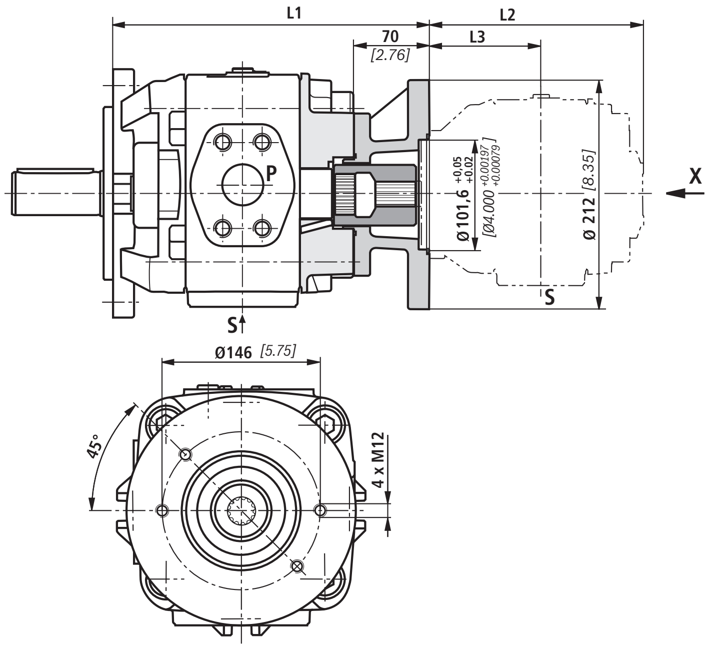
PGF2/PGP2 Size	L2	L3
006	116 *[4.567]*	65 *[2.559]*
008	119.5 *[4.705]*	67 *[2.638]*
011	125 *[4.921]*	69.5 *[2.736]*
013	130 *[5.118]*	72 *[2.835]*
016	135 *[5.315]*	74.5 *[2.933]*
019	141 *[5.551]*	77.5 *[3.051]*
022	147 *[5.787]*	80.5 *[3.169]*

AZPF Size	L2	L3
004	85 *[3.346]*	40 *[1.575]*
005	87.5 *[3.445]*	41 *[1.614]*
008	91.5 *[3.602]*	43 *[1.692]*
011	96.5 *[3.799]*	47 *[1.850]*
014	101.5 *[3.996]*	47.5 *[1.870]*
016	105 *[4.134]*	47.5 *[1.870]*
019	110 *[4.331]*	47.5 *[1.870]*
022	115.5 *[4.547]*	55 *[2.165]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH4-3X..R
Material no.: **R901155284**



View X

PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

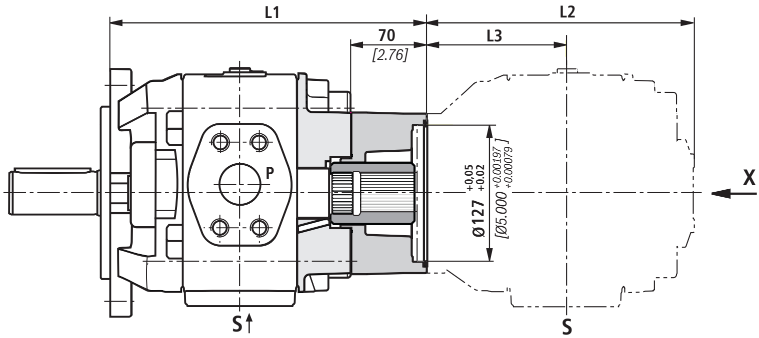
PGH4-3X…R..U2 Size	L2	L3
20	145 *[5.71]*	70.5 *[2.78]*
25	150 *[5.91]*	73 *[2.87]*
32	157 *[6.18]*	76.5 *[3.01]*
40	164 *[6.46]*	80 *[3.15]*
50	174 *[6.85]*	85 *[3.35]*

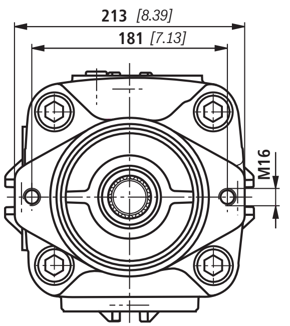
Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH5-3X..R

Material no.: **R901155285**





View X

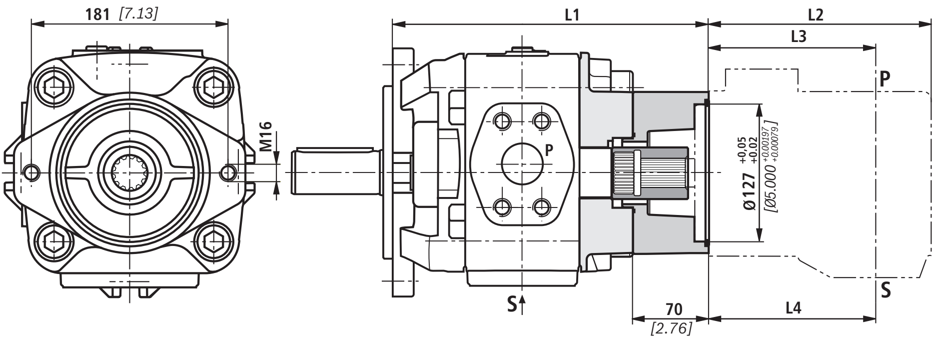
PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PGH5-3X…R..U2 Size	L2	L3
63	219 *[8.62]*	114.5 *[4.51]*
80	227 *[8.94]*	118.5 *[4.67]*
100	236 *[9.29]*	123 *[4.84]*
125	248 *[9.76]*	129 *[5.08]*
160	266 *[10.47]*	138 *[5.43]*
200	284 *[11.18]*	147 *[5.79]*
250	308 *[12.13]*	159 *[6.26]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part: PGH5-3X+VV4/5-1X..J
Material no. R901155286



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PVV..UMB Frame size	L2	L3 (P)	L4 (S)
4	186 *[7.32]*	38 *[1.50]*	126 *[4.96]*
5	216 *[8.50]*	43 *[1.69]*	153 *[6.02]*

Project planning information

1. General notes

This project planning information refers to the specific properties of the Rexroth PGH.-3X internal gear pump.

Comprehensive general information and suggestions are contained in the hydraulics trainer, edition 3 "Project planning information and design of hydraulic systems", RE 00281.

1.1 Intended use

Rexroth internal gear pumps are intended for the setup of hydraulic drive systems in the fields of machine and plant construction. During project planning, the basic principles of the EU Machinery Directive or comparable national regulations outside the EU have to be observed.

The pumps must not be used in explosive environments in accordance with directive 94/9/EC (ATEX).

1.2 Technical data

The system or machine manufacturer has to ensure compliance with the admissible technical data and operating conditions. The pump itself does not contain a device to prevent operation outside the admissible data.

All mentioned technical features are average values and are applicable for the specified boundary conditions. In case of modifications to the boundary conditions (e.g. viscosity), the technical data may change as well. Tolerances corresponding to the relevant state-of-the-art are possible.

Operating the pump outside of the admissible technical data (pages 4, 5) is possible to a certain extent, however, this requires the explicit written approval by Bosch Rexroth.

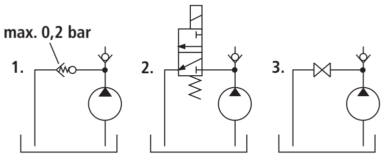
2. Hydraulic project planning

2.1 Bleeding option for commissioning

For Rexroth internal gear pumps PGH.-3X a manual, switchable or automatic bleeding option is to be provided for the initial commissioning or re-commissioning after maintenance and repair works. As bleeding point, the measurement port (M) available at the pump can be used. Otherwise, the bleeding point has to be put into the pressure line in front of the first valve or check valve. Bleeding may be effected with a maximum counter-pressure of 0.2 bar.

Examples of bleedings circuits:

1. Automatic bleeding via automatic bleeding valve
2. Switchable bleeding
3. Manually operated bleeding



2.2 Suction line

The line cross-sections have to be dimensioned for the designed flows in a manner that an ideal suction speed of 0.6 to 1.2 m/s is achieved on average. The suction speed must not exceed a maximum value of 2 m/s.

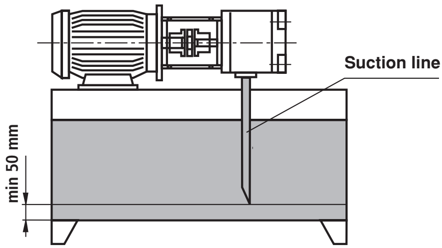
The suction cross-sections at the pump itself are dimensioned for the maximum flow and thus are a reference only. In case of continuous operation with speeds lower than the admissible maximum speed, the suction tube diameter is to be dimensioned smaller than the suction port of the pump in accordance with the actual suction speed.

All in all, the suction line has to be designed in a way that the admissible inlet operating pressure is complied with (0.8 to 2 bar absolute)! Bends and a combination of the suction tubes of several pumps must be avoided. If suction filters have to be used, it has to be ensured on the system side that the lowest admissible inlet operating pressure is not exceeded even when the filter is contaminated.

Please ensure air tightness of the transitions and dimensional stability of the suction hose as regards to the external air pressure.

The suction tube immersion depth should be selected as large as possible. Depending on the internal reservoir pressure, the viscosity of the operating medium, and the flow ratios within the reservoir, no vortex must be formed even during maximum flow. Otherwise there is the risk of sucking in air.

We recommend selecting suction tubes according to AB 23-03.



Project planning information

2.3 Pressure line

With pressure lines, sufficient bursting resistance of the tubes, hoses and connection elements has to be ensured. The cross-sections should be based on the maximum flow in order to avoid additional excessive load of the pump due to backpressure. In this connection, you must also consider the pipe losses across the entire pressure line length and other line resistances (e.g. bends, pressure filters).

2.4 Pressure limitation

The internal gear pump PGH is not equipped with devices for compliance with the maximum operating pressure. Setting and limiting the admissible operating pressure has to be ensured on the system side.

The pressure relief valves necessary for that purpose are to be designed considering the maximum flow and the existing pressure increase speed so that the admissible intermittent operating pressure is not exceeded.

2.5 Pressure holding function

In the variable-speed drive, the pump can temporarily also be operated below the specified minimum speed, in the pressure holding function. The holding time and the related necessary speed result from the operating viscosity and the pressure level. For the design, please contact Bosch Rexroth's Technical Sales.

In the deactivated condition (speed = 0), a leakage flow flows through the pump back into the reservoir, depending on the load pressure. If this is to be securely prevented, a check valve has to be used.

When using a check valve, please observe the information on bleeding in chapter 2.1.

3. Mechanical project planning

3.1 Installation and disassembly option

For installing and disassembling the pump on or from the drive, accessibility has to be provided for on the system side by means of suitable lifting gear. Please consider especially the own weight of frame size PGH 5 (see "Technical Data", page 5).

Screws of the property class 8.8 or 10.9 have to be provided for mounting purposes.

3.2 Mounting

On the machine side, the screws have to be accessible in a way that the required tightening torque can be applied. The tightening torque is based on the operating conditions and involved elements of the screw connection and has to be specified by the manufacturer in the power unit, machine or system project planning.

3.3 Reservoir

In the reservoir construction or the selection of suitable standard reservoirs, the following requirements are to be observed:

- Selection of the largest reservoir volume possible, depending on the continuous or average flow, in order to allow for the separation of air bubbles by means of enough dwell time of the medium in the reservoir. In this connection, the air separation capability of the fluid used is also important.
- Provision of settling zones for the fluid in the reservoir in order to allow for air separation.
- Provision of guiding plates in order to allowing for the deposit of contamination at the reservoir bottom outside the pump suction area.
- Large dimensioning of the reservoir surfaces depending on the heat output to be dissipated via the reservoir walls.

3.4 Required power unit functions

Hydraulic power units should at least be equipped with the following features:

- Reservoirs, the internal pressure of which corresponds to the ambient pressure in accordance with the design, have to be equipped with ventilation filters for pressure compensation purposes.
- The fluid should be filled by means of filling connections only excluding filling with unfiltered fluid.
- Pollution or humidity must be prevented from getting into the system. When using the pump in a highly polluted environment, the reservoir is to be pre-tensioned by means of air pressure for this. If cleansing of the external reservoir side is intended or to be expected during the period of use, reservoir fittings for tubes, lines, or hoses have to be selected, which ensure safe seal against external pressurization with water jet.

3.5 Place of installation and ambient conditions

With places of installation from a geodetic height of more than 1000 m, the pump is to be arranged in or below the reservoir or the reservoir is to be pre-tensioned by means of compressed air in order to comply with the admissible minimum inlet pressure. The suction line is to be selected short and with a large cross-section, bends should not be used.

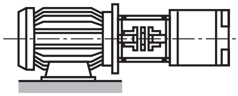
When installing the pump more than 10 m below the reservoir, the reduction of the inlet pressure to the maximum admissible value has to be ensured by means of additional measures.

When operating the pump in salt-containing or corrosive environments or when pressurization with strongly abrasive substances is possible, it has to be ensured on the system side that the shaft seal ring and the sealing area of the shaft do not make direct contact with the environment.

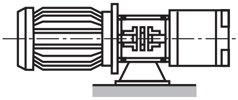
Project planning information

3.6 Installation positions

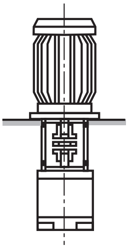
IM B3



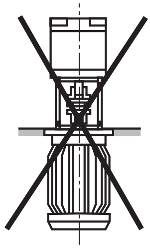
IM B5



IM V1



IM V2



⚠ **Attention!**
Installation position motor at bottom and pump at top (e.g. IM V2) is not admissible!

4. Pump combinations

- It has to be ensured with pump combinations that the operating data admissible for the relevant pump type is complied with in every stage.
- The combined pumps must all have the same direction of rotation.
- The pump with the largest torque, variable displacement pumps or pumps with intermittent load are to be provided as first stage in the pump combination.
- The maximum through-drive torque must be checked by the project planner for every application. This also applies to already existing (encoded) pump combinations.

- A pump stage drive torque is calculated as follows:

$$T = \frac{\Delta p \cdot V \cdot 0.0159}{\eta_{\text{hydr.-mech.}}}$$

T : Torque in Nm
Δp : Operating pressure in bar
V : Displacement in cm^3
η : Hydraulic-mechanical efficiency

Maximum admissible torques in Nm:

Type	Drive torque		Output torque
	Cylindrical shaft ..E	Splined shaft ..R	
PGH4	450	450	280
PGH5	1100	1400	700

- The total of the torques in a pump combination must not exceed the max. drive torque.
- Joint aspiration is not possible.
- For reasons of stability, we recommend the ISO 4-hole mounting flange according to VDMA "E4" for combinations of three and more pumps
- Before operating pump combinations with different mediums, please consult Bosch Rexroth.
- Central and back pumps must have the shaft design "R" (splined).

Project planning information

5. Maintenance schedule and operational safety

For safe operation and a long service life of the pump, a maintenance schedule has to be developed for the power unit, the machine, or the system. The maintenance schedule has to ensure that the intended or admissible operating conditions of the pump are complied with during the period of use.

In particular, compliance with the following operating parameters has to be ensured:

- The required oil cleanliness
- The operating temperature range
- The level of the operating medium

Furthermore, the pump and the system have to be checked for modifications of the following parameters on a regular basis:

- Vibrations
- Noise
- Temperature difference pump – fluid in the reservoir
- Foam formation in the reservoir
- Leak-proofness

Modifications of these parameters indicate wear of components (e.g. drive motor, coupling, pump, etc.). The cause has to be determined and remedied immediately.

In order to achieve high operational safety of the pump in the machine or system, we recommend checking the parameters mentioned above continuously and automatically and shutting the system down automatically in case of modifications exceeding the usual fluctuations in the intended operating range.

Plastic components of drive couplings should be replaced regularly, however, after 5 years at the latest. The corresponding information of the manufacturer is to be observed.

For preventive maintenance of the pump, we recommend having the seals replaced after a maximum operating period of 5 years by an authorized Bosch Rexroth service company.

6. Accessories

6.1 SAE connection flanges

We recommend selecting the SAE flanges for suction and pressure port according to AB 22-15 (with welded connection) or AB 22-13 (with threaded connection).

6.2 Pump safety block

For limiting the operating pressure and for the pump circulation at zero pressure, we recommend our pump safety blocks type DBA… according to RE 25890.

Automatic bleeding upon commissioning is, however, not possible via DBA blocks. In this connection, we recommend a separate manual or automatic bleeding, e.g. via the pump's measurement port (see page 19)!

6.3 Other accessories

To install the Rexroth PGH.-3X internal gear pump on electric motors, we recommend selecting the pump mounting brackets according to AB 41-20 and torsionally flexible couplings according to AB 33-22.

Commissioning notes

Preparation

– Check whether the system has been installed carefully and cleanly.
– Only fill in hydraulic fluid in through a filter with the required minimum retention rate.
– Via suction or pressure pipe, fill the pump completely with the hydraulic fluid.
– Check the direction of rotation for compliance with the direction of rotation according to the pump type.

Bleeding

– Open the bleed port at the system or switch to circulation at zero pressure, according to the system operating instructions. During bleeding, discharge of enclosed air at zero pressure must be guaranteed.
– For bleeding the pump, switch the pump on and immediately off again (jog mode). This process is to be repeated until complete bleeding of the pump is ensured.
– Close the manually opened bleed ports again.

Commissioning

– If complete bleeding of the pump has been ensured, switch on the motor. Let the pump run at zero pressure until the system is completely bled. For the bleeding of the system, the system operating instructions are to be observed.
– Commission the system according to the system operating instructions and load the pump.
– After some operating time, check the hydraulic fluid in the reservoir for bubble or foam formation at the surface.

Operation

– Pay attention to changes in the noise characteristic during operation. Due to heating of the operating medium, minor noise increases are normal. Considerable increase in the noise or random short-term changes in the noise may be an indication of the aspiration of air. If the suction tubes are too short or the operating medium filling levels are too low, air can also be sucked in via a vortex.
– Changes in operating speeds, temperatures, noise increase or power consumption are an indication of wear or damage at the system or the pump.

Re-commissioning

– Check the pump and the system for leakage. Leaks are an indication of leakage below the hydraulic fluid level. An increased hydraulic fluid level in the reservoir is an indication of leakage above the hydraulic fluid level.
– If the pump is arranged above the hydraulic fluid level, the pump may run empty due to leakage, e.g. a worn shaft seal. In this case, the system must be bled once again during re-commissioning. Provide for repair.
– After repair and maintenance works, you must bleed the system once again.
– If the system is intact, switch on the motor.

General

– The pumps supplied by us have been tested for function and performance. Modifications of any type at the pump are not permitted since this would result in the invalidation of warranty claims!
– Repairs may only be carried out by the manufacturer or their authorized dealers and agencies. Repairs carried out by the customer are not covered by a warranty.

⚠ Important notes

– The pump may only be installed, maintained and repaired by authorized, trained and instructed personnel!
– The pump may only be operated within the admissible data (see page 4 and 5)!
– The pump may only be operated if it is in an unobjectionable condition!
– When carrying out any work on the pump, depressurize the system!
– Unauthorized conversions or modifications, which affect safety and function are not permitted!
– Protective devices (e.g. coupling protection) are to be attached and/or existing protective devices must not be removed!
– Make sure that all mounting screws are always properly tightened! (Observe the prescribed tightening torque!)
– The generally valid safety and accident prevention regulations must imperatively be complied with!

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documentation@boschrexroth.de
www.boschrexroth.de

Gerotor pumps

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Fixed displacement	PGZ	20 ... 140	1X	15	10545	1381

Gerotor pump, fixed displacement volume

Type PGZ

Component series 1X
Maximum operating pressure 15 bar
Maximum displacement 140 cm³

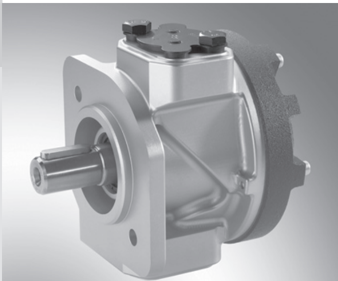

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Table of contents

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Ordering code	2
Function, section, symbol	3
Technical data	4 and 5
Unit dimensions, standard types	6 to 9
Ports	10
Project planning information	10 to 12

Features

- Low-pressure pump with fixed displacement
- Very low operating noise
- Suitable for wide viscosity and speed ranges
- Very good suction behavior
- Flexible combination possibilities with Rexroth axial piston, internal gear and vane pumps
- Use:
  For cooling, filtration or lubrication circuits at low pressures in industrial or mobile applications, e.g. plastics processing machines, machine tools, presses and wind turbines.

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

PG	Z	–	1X /		R		07	V		*

Series
Gerotor pump, low-pressure **= Z**

Frame size
BG4 **= 4**
BG5 **= 5**

Component series: Component series 10 to 19 **= 1X**
(10 to 19: Unchanged installation and connection dimensions)

Size

	Size	Displacement volume/ rotation	
BG4	20	21.0 cm^3	**= 20**
	32	33.4 cm^3	**= 32**
	40	42.1 cm^3	**= 40**
	50	52.0 cm^3	**= 50**
	63	64.4 cm^3	**= 63**
	80	84.2 cm^3	**= 80**
BG5	63	64.4 cm^3	**= 63**
	80	84.2 cm^3	**= 80**
	100	105.3 cm^3	**= 100**
	140	136.3 cm^3	**= 140**

Direction of rotation
Clockwise (viewed on the shaft end) **= R**

Further details in the plain text
e.g. special designs

Type of connection
E4 = ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560
U2 = SAE 2-hole mounting flange
B2 = ISO 2-hole mounting flange according to ISO 3019-2, secondary pump for through-drive KB2
B3 = ISO 2-hole mounting flange according to ISO 3019-2, secondary pump for through-drive KB3

Seal material
V = FKM seals

Line connection
07 = SAE flange standard pressure series

Shaft design
A = Cylindrical
T = SAE involute gear 11T
R = SAE involute gear 13T

Standard types PGZ-1X	
Type Size	**Material No.**
PGZ4-1X/**020**RA07VE4	**R901230020**
PGZ4-1X/**032**RA07VE4	**R901230024**
PGZ4-1X/**040**RA07VE4	**R901230028**
PGZ4-1X/**050**RA07VE4	**R901230032**
PGZ4-1X/**063**RA07VE4	**R901230036**
PGZ4-1X/**080**RA07VE4	**R901230040**
PGZ5-1X/**100**RA07VE4	**R901230052**
PGZ5-1X/**140**RA07VE4	**R901230056**

The possible flange shaft configurations can be found in the selection tables on the pages 6 to 9.

Function, section

Construction

Hydraulic pumps of the PGZ type are gerotor pumps with fixed displacement.

They mainly consist of: Flange housing (1), shaft (2), the displacer elements inner rotor (3) and outer rotor (4), as well as driving disk (5) and cover (6).

Suction and displacement procedure

Via the driving disk the shaft drives the inner rotor in the direction of rotation shown. The inner rotor meshes with the outer rotor and causes the same to rotate as well.

The tooth clearances opening in the suction area (S) prime the hydraulic fluid. The suction and pressure area are separated on the opposite side of the meshing area (Z) by a radial gap (R) created by the tooth profile of the outer and the inner rotor sliding against each other.

Within the pressure area (P) the hydraulic fluid is pumped into the pressure port as the chambers become.

Properties

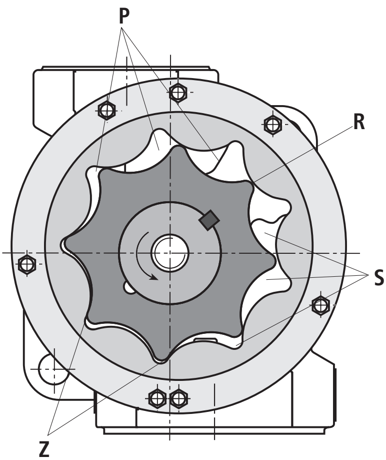
The gearing with cycloid contour is characterized by a large meshing length. Filling zone and displacement area cover a large rotation angle. This results in low flow pulsation and thus very low operating noise.
The shaft and the displacer are supported by a slide bearing and work in a wear-free manner when used as intended.

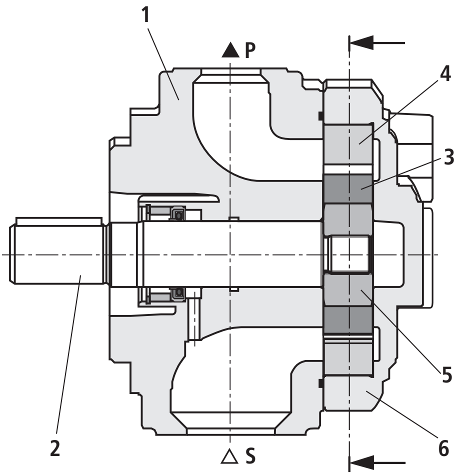
Gerotor pumps PGZ are self-priming.

Materials used

Flange housing (1): Aluminum

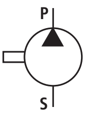
Shaft (2), inner rotor (3), outer rotor (4), and driving disk (5): Steel
Cover (6): Cast iron





5

Symbol



Technical data (For applications outside these parameters, please consult us!)

general

Type	Gerotor pump
Type of connection	ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560 SAE 2-hole mounting flange ISO 2-hole mounting flange according to ISO 3019-2, matching through-drive KB2 ISO 2-hole mounting flange according to ISO 3019-2, matching through-drive KB3
Line connection	Flange connection
Shaft load	Radial and axial forces cannot be transmitted
Direction of rotation (viewed on shaft end)	Clockwise

hydraulic

Hydraulic fluid			HLP - mineral oil according to DIN 51524 part 2 **Please observe our specification according to data sheet RE 90220** **Other fluids upon request!**
Hydraulic fluid temperature range		°C	–20 to +80, observe the admissible viscosity range!
Ambient temperature range		°C	–20 to +80
Viscosity range		mm^2/s	10 to 2000
Max admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)			Class 21/18/15 [1]

Frame size 4	**Frame size**		**PGZ4**					
Size	**Size**		**20**	**32**	**40**	**50**	**63**	**80**
Displacement	V	cm^3	21.0	33.4	42.1	52.0	64.4	84.2
Weight	m	kg	4.7	5.3	5.6	6.0	6.7	7.8
Flow [2]	q_V	l/min	28	46	58	71	88	116
Mass moment of inertia (around drive axis)	J	kgm^2	0.00086	0.00134	0.00167	0.00205	0.00253	0.00329
Speed range	n_{min}	rpm	200	200	200	200	200	200
	n_{max}	rpm	3000	3000	3000	3000	2300	1800
Operating pressure, absolute – Inlet	p	bar	0.7 to 2 (short-time during start 0.5 bar)					
Nominal pressure – Outlet, continuous	p_N	bar	15					
Min required driving power – at $\Delta p \approx 1$ bar, $n = 1,450\ min^{-1}$		kW	0.75	1.1	1.1	1.1	1.1	1.1
– at $\Delta p \approx 10$ bar, $n = 1,450\ min^{-1}$			1.5	2.2	2.2	2.2	3.0	3.0
Sound pressure level at 0 – 15 bar [3]		dB(A)	55	56	57	59	60	62

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems.
An efficient filtration prevents failures and simultaneously increases the lifetime of the components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

[2] Measured at n = 1.450 rpm, p = 10 bar, and $v = 30\ mm^2/s$

[3] Measured in sound-absorbent acoustic room at n = 1450 rpm and $\nu = 30\ mm^2/s$

Technical data (For applications outside these parameters, please consult us!)

Frame size 5	**Frame size**		**PGZ5**			
Size	**Size**		**63**	**80**	**100**	**140**
Displacement	V	cm^3	64.4	84.2	105.3	136.3
Weight	m	kg	6,6	7,7	8,9	10,7
Flow [1]	q_V	l/min	88	116	144	186
Mass moment of inertia (around drive axis)	J	kgm^2	0.00253	0.00329	0.00410	0.00529
Speed range	n_{min}	rpm	200	200	200	200
	n_{max}	rpm	3000	2300	1800	1500
Operating pressure, absolute – Inlet	p	bar	0.7 to 2 (short-time during start 0.5 bar)			
Nominal pressure – Outlet, continuous	p_N	bar	15			
Min required driving power – at $\Delta p \approx 1$ bar, $n = 1{,}450\ min^{-1}$		kW	1.1	1.1	1.5	1.5
– at $\Delta p \approx 10$ bar, $n = 1{,}450\ min^{-1}$			3.0	3.0	4.0	5.5
Sound pressure level at 0 – 15 bar [2]		dB(A)	60	62	63	66

[1] Measured at $n = 1{,}450$ rpm, $p = 10$ bar, and $v = 30\ mm^2/s$

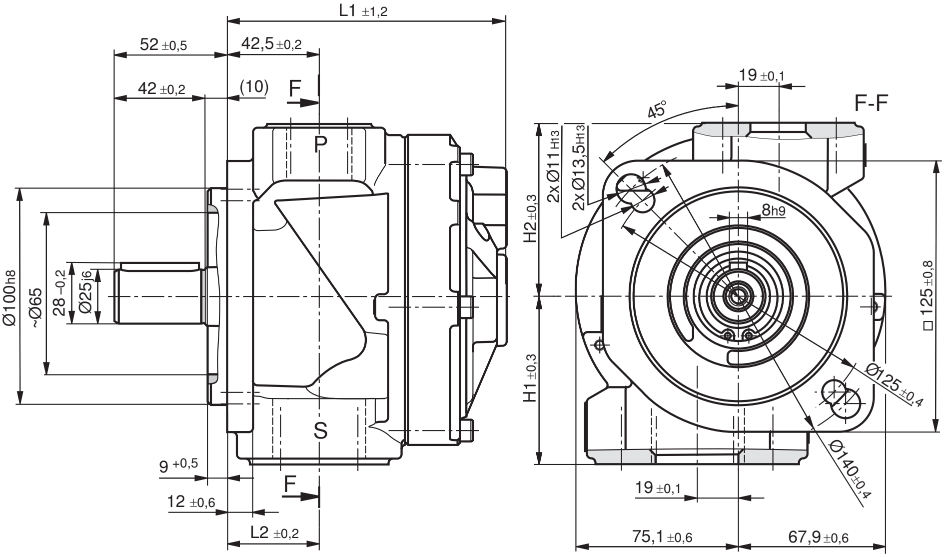
[2] Measured in sound-absorbent acoustic room at $n = 1450$ rpm and $\nu = 30\ mm^2/s$

5

Unit dimensions frame sizes 4 and 5, type...VE4 (dimensions in mm)

PGZ 4/5 -1X/ … RA07VE4

Drive shaft cylindrical,
4-hole mounting flange according to ISO 3019-2 and VDMA 24560



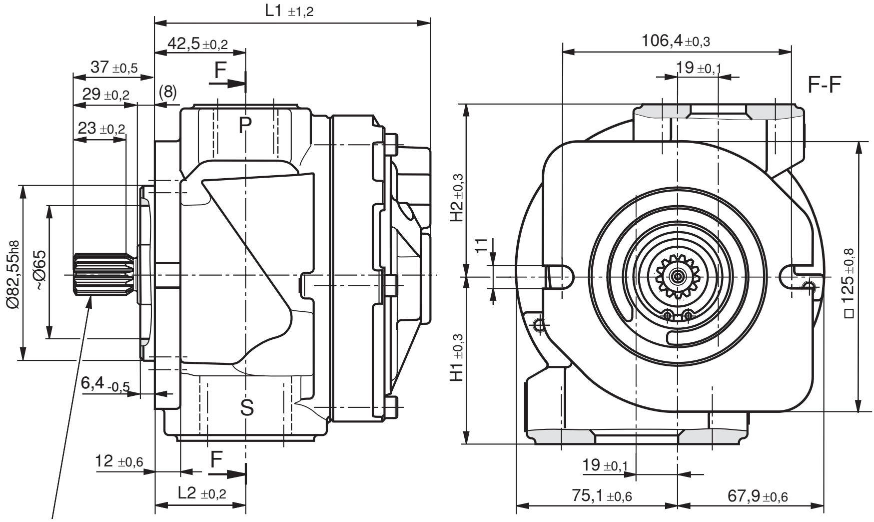
Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RA07VE4	**R901230020**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RA07VE4	**R901230024**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RA07VE4	**R901230028**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RA07VE4	**R901230032**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RA07VE4	**R901230036**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RA07VE4	**R901230040**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RA07VE4	**R901230044**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RA07VE4	**R901230048**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RA07VE4	**R901230052**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RA07VE4	**R901230056**	163	48,5	72,9	76,1	2“	1 1/4“

[1] Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VU2 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ ... RT07VU2

Drive shaft splined,
SAE 2-hole mounting flange



Involute gear ANSI B92.1-1996
11T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S [1)]	P [1)]
PGZ4-1X/**020**RT07VU2	**R901230021**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RT07VU2	**R901230025**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RT07VU2	**R901230029**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RT07VU2	**R901230033**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RT07VU2	**R901230037**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RT07VU2	**R901230041**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RT07VU2	**R901230045**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RT07VU2	**R901230049**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RT07VU2	**R901230053**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RT07VU2	**R901230057**	163	48,5	72,9	76,1	2“	1 1/4“

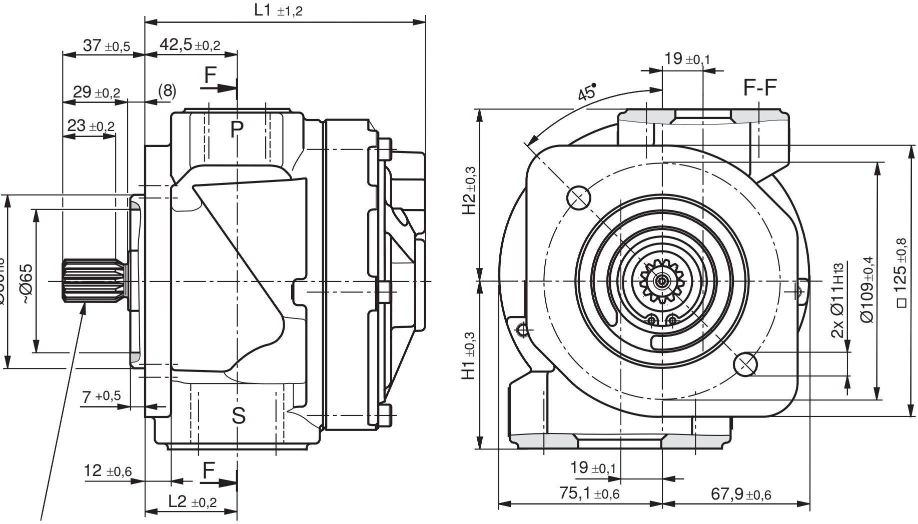
[1)] Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VB2 (dimensions in mm)

PGZ 4/5 -1X/ … RT07VB2

Drive shaft splined,
ISO 2-hole mounting flange according to ISO 3019-2

(Secondary pump for through-drive KB2)



Involute gear ANSI B92.1-1996
11T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S 1)	P 1)
PGZ4-1X/**020**RT07VB2	**R901230022**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RT07VB2	**R901230026**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RT07VB2	**R901230030**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RT07VB2	**R901230034**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RT07VB2	**R901230038**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RT07VB2	**R901230042**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RT07VB2	**R901230046**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RT07VB2	**R901230050**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RT07VB2	**R901230054**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RT07VB2	**R901230058**	163	48,5	72,9	76,1	2“	1 1/4“

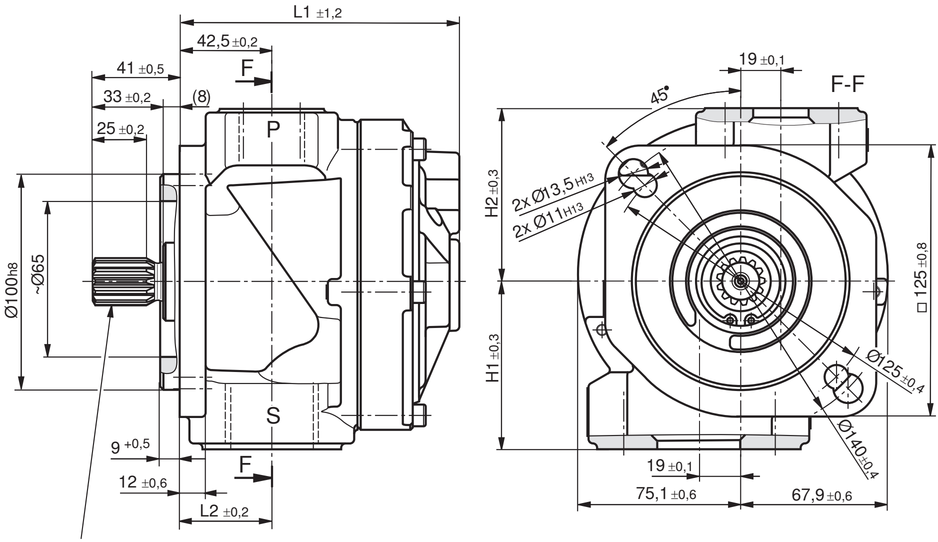
1) Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VB3 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ … RR07VB3

Drive shaft splined,
ISO 2-hole mounting flange according to ISO 3019-2

(Secondary pump for through-drive KB3)



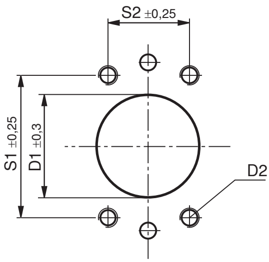
Involute gear ANSI B92.1-1996
13T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RR07VB3	**R901230023**	116,5	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**032**RR07VB3	**R901230027**	121,5	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**040**RR07VB3	**R901230031**	125	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**050**RR07VB3	**R901230035**	129	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**063**RR07VB3	**R901230039**	134	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**080**RR07VB3	**R901230043**	142	42,5	77,4	79,6	1 1/2"	1"
PGZ5-1X/**063**RR07VB3	**R901230047**	134	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**080**RR07VB3	**R901230051**	142	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**100**RR07VB3	**R901230055**	150,5	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**140**RR07VB3	**R901230059**	163	48,5	72,9	76,1	2"	1 1/4"

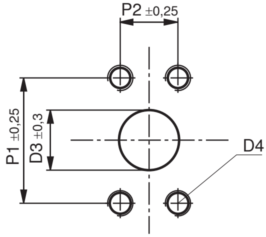
[1] Exact dimensions see table page 10

Ports (dimensions in mm)

Hole pattern of suction port "S"



Hole pattern of discharge port "P"



Frame size	Hole pattern / suction port S	D1	D2	S1	S2	Hole pattern / discharge port P	D3	D4	P1	P2
4	1 1/2"	Ø38,1	M12; 21	69,9	35,7	1"	Ø25,4	M10; 16	52,4	26,2
5	2"	Ø50,8	M12; 21	77,8	42,9	1 1/4"	Ø31,8	M10; 18	58,7	30,2

Project planning information

1. General notes

This project planning information relates to the specific properties of the Rexroth PGZ.-1X gerotor pump. Please find comprehensive general information and suggestions in The Hydraulic Trainer, Volume 3 "Planning and Design of Hydraulic Power Systems", RE 00281.

1.1 Intended use

Rexroth gerotor pumps are intended for the use in cooling, filtration, and lubrication circuits in the fields of machine and plant engineering. During project planning, the basic principles of the EU Machinery Directive or comparable national regulations outside of the EU have to be observed.

The pumps must not be used in potentially explosive atmospheres in accordance with Directive 94/9/EC (ATEX). The use as hydraulic motor is inadmissible!

1.2 Technical data

The plant or machine manufacturer has to ensure the compliance with the admissible technical data and operating conditions. The pump itself does not contain a device to prevent operation outside of the admissible data.

All mentioned technical features are average values and are applicable for the specified boundary conditions. In case of modifications to the boundary conditions (e.g. viscosity), the technical data may change as well. Tolerances are possible in accordance with state of the art.

Operating the pump outside of the admissible technical data (pages 4, 5) is possible to a certain extent, however, this requires an explicit written approval of Bosch Rexroth.

2. Hydraulic project planning

2.1 Installation location

When installing the pump more than 10 m below the tank, take additional measures to ensure that the inlet pressure is reduced to the maximum admissible value.

2.2 Suction line

The line cross-sections have to be dimensioned for the rated flows in a manner that an ideal suction speed of 0.6 to 1.2 m/s is achieved on average. The suction speed must not exceed a maximum value of 2 m/s.

The suction cross-sections at the very pump are dimensioned for the maximum flow and thus are a reference only. During continuous operation at speeds lower than the admissible maximum speed, the suction tube diameter is to be dimensioned smaller than the suction port of the pump in accordance with the actual suction speed.
All in all the suction line has to be designed in a way that the admissible inlet operating pressure is complied with (0.7 to 2 bar absolute)! Bends and a combination of the suction tubes of several pumps must be avoided.

If suction filters have to be used, it has to be ensured on the system side that the lowest admissible inlet operating pressure is not exceeded even when the filter is clogged.

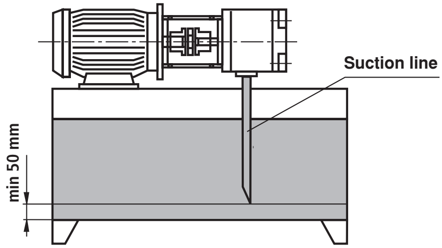
Please observe air tightness of the transitions and dimensional stability of the suction hose as regards to the external air pressure.

Project planning information

(continuation of 2.2 Suction line)

The value for the immersion depth of the suction tube should be selected as high as possible. Depending on the internal tank pressure, the viscosity of the hydraulic fluid, and the flow situation within the tank, no vortex must be formed even at maximum flow. Otherwise there is the risk of aspiring air.

We recommend selecting suction tubes according to AB 23-03.



2.3 Pressure limitation

The gerotor pump PGZ is not equipped with devices for not exceeding the maximum operating pressure. Setting and limiting the admissible operating pressure has to be ensured on the system side.

3. Mechanical project planning

3.1 Installation and disassembly option

For installing and disassembling the pump on or from the drive the accessibility has to be provided for on the system side.

Screws of the property class 8.8 or 10.9 have to be provided for mounting purposes.

3.2 Mounting

On the machine side, the screws have to be accessible in a way that the required tightening torque can be applied. The tightening torque is oriented on the operating conditions and elements involved in the screw connection and has to be specified by the manufacturer when engineering the power unit, the machine, or the plant.

3.3 Required power unit functions

Hydraulic power units should be equipped with the following features at least:

– Tanks, the internal pressure of which corresponds to the ambient pressure in accordance with the design, have to be equipped with breather filters for pressure compensation purposes.

– The hydraulic fluid should be filled in through filling connections with rule out filling with unfiltered hydraulic fluid.

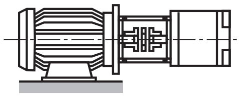
– The ingress of contaminants or moisture into the system must be avoided. When using the pump in a highly contaminated environment, the tank is to be pre-loaded by means of air pressure for this. If external cleansing of the tank is intended or to be expected during the period of use, tank fittings for tubes, lines, or hoses have to be selected ensuring a safe seal against external pressurization with water jet.

3.4 Ambient conditions

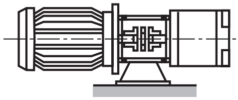
When operating the pump in salt-containing or corrosive environments or when when the pump can be exposed to strongly abrasive substances, it has to be ensured on the system side that the shaft seal and the sealing area of the shaft do not make direct contact with the environment and that the pump is equipped with a suitable corrosion protection.

3.5 Installation positions

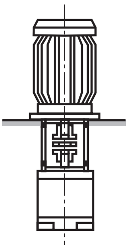
IM B3



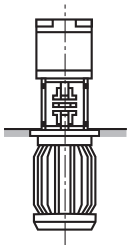
IM B5



IM V1



IM V2



Project planning information

4. Maintenance schedule and operational safety

For safe operation and a long lifetime of the pump a maintenance schedule has to be developed for the power unit, the machine, or the plant. The maintenance schedule has to ensure that the planned or admissible operating conditions of the pump are complied with during the period of use.

In particular, compliance with the following operating parameters has to be ensured:

- The required oil cleanliness
- The operating temperature range
- The level of the hydraulic fluid

Furthermore, the pump and the plant have to be checked for modifications of the following parameters on a regular basis:

- Vibrations
- Noise
- Temperature pump – hydraulic fluid in tank
- Foam formation in the tank
- Leak-proofness
- Operating pressure when using lubrication systems

Modifications of these parameters indicate wear of components (e.g. drive motor, coupling, pump, etc.). The reason has to be determined and remedied immediately.

In order to achieve high operational safety of the pump in the machine or plant we recommend checking the parameters mentioned above continuously and automatically and the automatic shut-down in case of changes exceeding the usual fluctuations in the designed operating range.

Plastic components of drive couplings should be replaced regularly, however, after 5 years at the latest. The corresponding information of the manufacturer is paramount.

For preventive maintenance of the pump we recommend having the seals replaced after an operating period of 5 years at the most by an authorized Bosch Rexroth service company.

5. Accessories

5.1 SAE connection flanges

We recommend selecting the SAE flanges for suction and pressure port according to AB 22-15 (with welded connection) or AB 22-13 (with threaded connection).

5.2 Other accessories

To install the Rexroth PGZ.-1X gerotor pump on electric motors we recommend selecting the pump mounting brackets according to AB 41-20 and torsionally flexible couplings according to AB 33-22.

☞ **Note!**

Please observe the following documentation in addition:

- **Data sheet RE 07008** General information on hydraulic products
- **Data sheet RE 07900** General information on installation, commissioning, and maintenance of hydraulic systems
- **Data sheet RE 90220** General information on hydraulic fluids on mineral oil basis

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Vane pumps

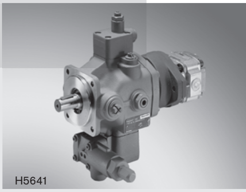
Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Adjustable, pilot operated	PV7...C/D/N/W	14 ... 150	1X	160	10515	1395
Adjustable, direct operated	PV7...A	10 ... 25	1X/2X	100	10522	1425
Displacement pump	PVV	18 ... 193	1X	210	10335	1441

Variable vane pumps, pilot operated

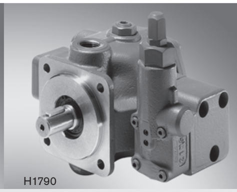
RE 10515/10.05
Replacements: 07.02

1/30

Type PV7



Type P2V7/...+ GF1/...



Type P2V7/16... C...

Sizes 14 to 150
Series1X
Maximum operating pressure 160 bar
Maximum flow 270 l/min

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Function, section	4 and 5
Technical data	6
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Dynamic characteristics of the pressure control	14
Controller programme (symbols, characteristic curves, unit dimensions)	15 to 19
Lock	20
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Combination options, ordering code of multiple pumps	21
Unit dimensions of pump combinations	22 to 27
SAE connection flanges	28
Engineering notes	28 and 29
Commissioning notes	29
Installation notes	30

Information on available spare parts:
www.boschrexroth.com/spc

Features

– Variable displacement
– Low operating noise
– Long service life due to hydrodynamically lubricated plain bearings
– Control of pressure and flow possible
– Low hysteresis
– Very short on and off-stroke times
– Mounting and connection dimensions to
  • VDMA 24560 part 1
  • ISO 3019/2
– Suitable for HETG and HEES media
– Standard single pumps of series PV7 can be flexibly combined to form multiple pumps
– PV7 pumps can additionally be combined with internal and external gear pumps, axial piston and radial piston pumps

Ordering code

Frame sizes and sizes		Pipe connection	Zero stroke pessure range
FS 10 - size 14 cm^3	**= 10-14**	**= 01**	**16 =** up to 160 bar
FS 10 - size 20 cm^3	**= 10-20**	**= 01**	**10 =** up to 100 bar
FS 16 - size 20 cm^3	**= 16-20**	**= 01**	**16 =** up to 160 bar
FS 16 - size 30 cm^3	**= 16-30**	**= 01**	**08 =** up to 80 bar
FS 25 - size 30 cm^3	**= 25-30**	**= 01**	**16 =** up to 160 bar
FS 25 - size 45 cm^3	**= 25-45**	**= 01**	**08 =** up to 80 bar
FS 40 - size 45 cm^3	**= 40-45**	**= 37**	**16 =** up to 160 bar
FS 40 - size 71 cm^3	**= 40-71**	**= 37**	**08 =** up to 80 bar
FS 63 - size 71 cm^3	**= 63-71**	**= 07**	**16 =** up to 160 bar
FS 63 - size 94 cm^3	**= 63-94**	**= 07**	**08 =** up to 80 bar
FS 100 - size 118 cm^3	**= 100-118**	**= 07**	**16 =** up to 160 bar
FS 100 - size 150 cm^3	**= 100-150**	**= 07**	**08 =** up to 80 bar

PV7 – 1X /		R	E		M		–	

Component series
Component series 10 to 19 **= 1X**
(10 to 19: unchanged installation and connection dimensions)

Direction of rotation
Clockwise **= R**

Shaft end
Cylindrical drive shaft with output **= E**

Line port
Standard version
FS 10, 16, 25:
Suction, pressure port: Pipe thread **= 01**
FS 40:
Suction port: SAE flange connection, pressure port: Pipe thread **= 37**
FS 63, 100
Suction, pressure port: SAE flange connection **= 07**

Directional valve [1)]
WG = Normally closed
WH = Normally open

Controller option
0 = Standard
3 = Lockable
5 = With K plate
6 = With Q plate
7 = Lockable with K plate
8 = Lockable with 0 plate

Type of controller
C = Pressure controller
D = Pressure controller for hydraulic pressure remote control
N = Flow controller
W = Pressure controller with electrical 2-stage pressure adjustment element

Seal material
M = NBR seals

Order examples: PV7-1X/16-20RE01MC5-16
PV7-1X/40-45RE37MD0-16

Pump with custom setting:

Please state the required setting in clear text on the order (e.g. q_{Vmax} = 20 l/min; $p_{zero\ stroke}$ = 70 bar). The pump will then be set to the desired values and the operating noise optimised accordingly.

Without indication in clear text, the flow and the zero stroke pressure will be set to the relevant maximum values and the operating noise optimised to these maximum values.

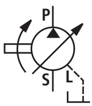
[1)] Only for C5, D5 and W controllers (optional)

Standard types (available at short notice)

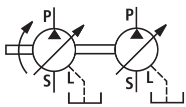
Type	Material no.
PV7-1X/10-14RE01MC0-16	R900580381
PV7-1X/10-20RE01MC0-10	R900534143
PV7-1X/16-20RE01MC0-16	R900580382
PV7-1X/16-30RE01MC0-08	R900533582
PV7-1X/25-30RE01MC0-16	R900580383
PV7-1X/25-45RE01MC0-08	R900534508
PV7-1X/40-45RE01MC0-16	R900580384
PV7-1X/40-71RE01MC0-08	R900535588
PV7-1X/63-71RE01MC0-16	R900506808
PV7-1X/63-94RE01MC0-08	R900560659
PV7-1X/100-118RE01MC0-16	R900506809
PV7-1X/100-150RE07MC0-08	R900561846

Type	Material no.
PV7-1X/10-14RE01MD0-16	R900504653
PV7-1X/10-20RE01MD0-10	R900906584
PV7-1X/16-20RE01MD0-16	R900509274
PV7-1X/16-30RE01MD0-08	R900560658
PV7-1X/25-30RE01MD0-16	R900509506
PV7-1X/25-45RE01MD0-08	R900568833
PV7-1X/40-45RE37MD0-16	R900593330
PV7-1X/40-71RE37MD0-08	R900539886
PV7-1X/63-71RE07MD0-16	R900519094
PV7-1X/63-94RE07MD0-08	R900574560
PV7-1X/100-118RE07MD0-16	R900532770
PV7-1X/100-150RE07MD0-08	R900915470

Symbols



Single pump



Double pump

6

Function, section

Design

Hydraulic pumps of type PV7 are vane pumps with variable displacement.

They basically consist of housing (1), rotor (2), vanes (3), stator ring (4), pressure controller (5) and adjustment screw (6).

The circular stator ring (4) is retained by the small reciprocating control piston (10) and the large reciprocating control piston (11). The third supporting point of the ring is height adjustment screw (7).

The driven rotor (2) rotates within stator ring (4). The vanes guided within the rotor are pressed against stator ring (4) by centrifugal force.

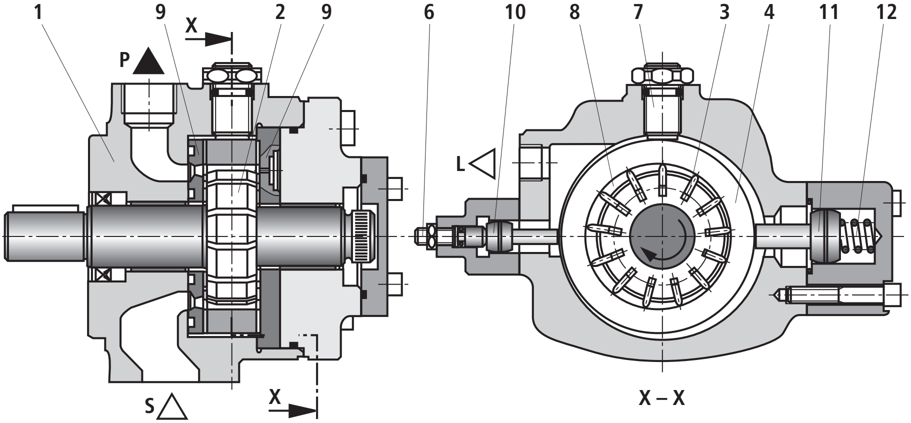
Adjustment

As pressure builds up in the system, the rear side of the small control piston (10) is always pressurised to system pressure via a channel.

In the displacement position, the rear side of the large control piston (11) is also pressurised to system pressure via a bore in control spool (14). Control piston (11) with the larger area holds stator ring (4) in its eccentric position.

The pump displaces fluid at a pressure below the zero stroke pressure set on pressure controller (5).

Control spool (14) is held by spring (13) in a certain position.



Suction and displacement process

The cells (8) required for transporting the fluid are formed by vanes (3), rotor (2), stator ring (4) and control plates (9).

To ensure the pump function during commissioning, stator ring (4) is held by spring (12) behind the large control piston (11) in its eccentric position (displacer position).

While rotor (2) is rotating, the volume of cells (8) increases and fill with fluid via suction channel (S). When the largest cell volume has been reached, cells (8) are disconnected from the suction side. As rotor (2) continues to rotate, they are connected to the pressure side, become smaller and displace fluid via pressure channel (P) into the system.

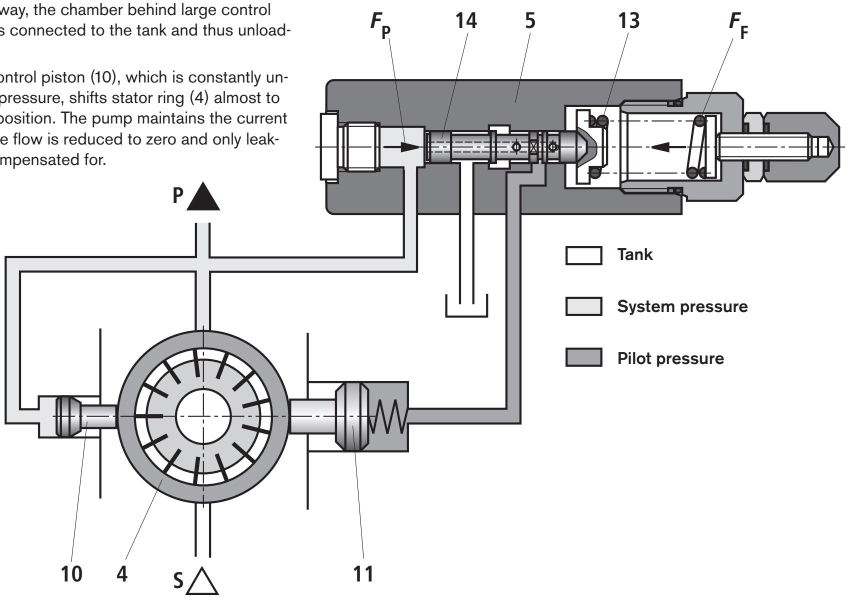
Function

Off-stroke control

When force F_P, which results from the product of pressure x area, exceeds counterforce F_S of the spring, control spool (14) is pressed against spring (13). In this way, the chamber behind large control piston (11) is connected to the tank and thus unloaded.

The small control piston (10), which is constantly under system pressure, shifts stator ring (4) almost to the central position. The pump maintains the current pressure, the flow is reduced to zero and only leakages are compensated for.

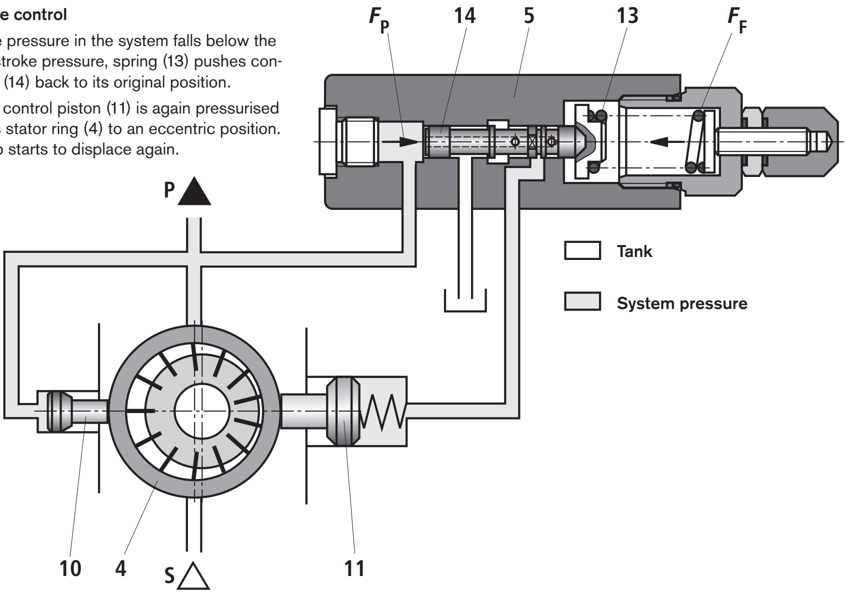
Power losses and heating of the fluid are kept at a low level. The q_V-p characteristic curve runs vertically and shifts in parallel as higher pressures are set.



On-stroke control

When the pressure in the system falls below the set zero stroke pressure, spring (13) pushes control spool (14) back to its original position.

The large control piston (11) is again pressurised and shifts stator ring (4) to an eccentric position. The pump starts to displace again.



Technical data (for applications outside these parameters, please consult us!)

Design			Pilot operated vane pump, variable											
Type			PV7											
Type of mounting			4-hole flange (to VMDA 24560 part 1 and ISO 3019/2)											
Pipe connections			Pipe thread or SAE flange connection (depending on frame size)											
Installation orientation			Optional, preferably horizontal (see pages 28 and 29)											
Shaft loading			Radial and axial forces **cannot** be transmitted											
Direction of rotation			Clockwise (viewed to shaft end)											
Drive speed	n	min^{-1}	900 to 1800											
Frame size		FS	10		16		25		40		63		100	
Size	V_g	cm^3	14	20	20	30	30	45	45	71	71	94	118	150
Input power [1]	P_{max}	kW	6.3	5.8	8.5	6.8	13.7	10.2	20.5	16.5	33	20.9	51.5	33
Permissible input torque	T_{max}	Nm	90		140		180		280		440		680	
Max. flow [2]	q_V	l/min	21	29	29	43.5	43.5	66	66	104	108	136	171	218
Leakage flow at zero stroke (at operating pressure output = p_{max})	q_{VL}	l/min	2.7	1.9	4	2.5	5.3	3.2	6.5	4	8	5.3	11	7.3
Operating pressure, absolute														
– Inlet	$p_{min-max}$	bar	0.8 to 2.5											
– Outlet [3]	p_{max}	bar	160	100	160	80	160	80	160	80	160	80	160	80
– Leakage outlet	p_{max}	bar	2											
Hydraulic fluid for operation at up to 160 bar (nominal pressure)			HLP mineral oil to DIN 51524 part 2											
Special hydraulic fluids [4]														
– Up to operating pressure p_{max} = 100 bar			HET and HEES hydraulic fluids to VDMA 24 568											
– Up to operating pressure p_{max} = 80 bar			HLP mineral oil to DIN 51524 part 2 (100 mm^2/s or higher) HL mineral oil to DIN 51524 part 1											
Hydraulic fluid temperature range	ϑ	°C	–10 to +70; observe permissible viscosity range!											
Viscosity range	ν	mm^2/s	16 to 160 at operating temperature max. 800 when starting up in displacement mode max. 200 when starting up in zero stroke mode											
Max. permissible degree of contamination of the hydraulic fluid - cleanliness class to ISO 4406 (c)			Class 20/18/15 [5]											
Weight (with pressure controller)	m	kg	12.5		17		21		30		37		56	
Change of flow (with one turn of the adjustment screw and at n = 1450 min^{-1})	q_V	l/min	10		14		18		25		34		46	

[1] Measured at $n = 1450\ min^{-1}$; $p = p_{max}$; $\nu = 41\ mm^2/s$

[2] Due to manufacturing tolerances, the specified flow values can be exceeded by approx. 6 % (measured at $n = 1450\ min^{-1}$; $p = 10$ bar; $\nu = 41\ mm^2/s$).

[3] The settable minimum pressure is approx. 20 bar; the factory setting is 30 bar as a standard.

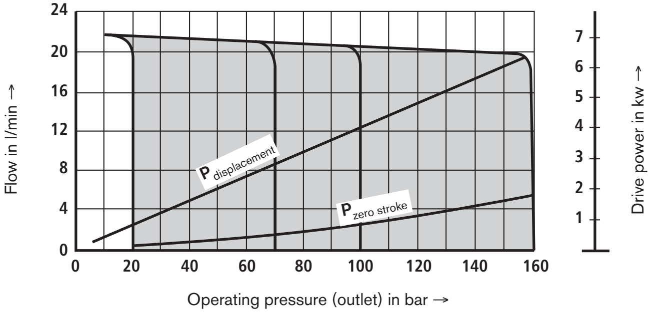
[4] Further special hydraulic fluids (e.g. for plant in the food processing industry or flame-retardant fluids) on enquiry

[5] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

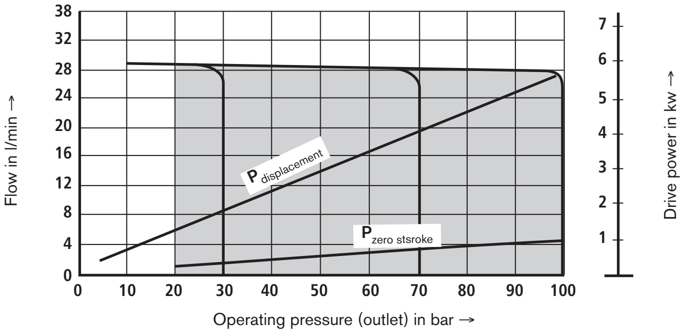
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50\ °\text{C}$)

PV7/10-14



PV7/10-20



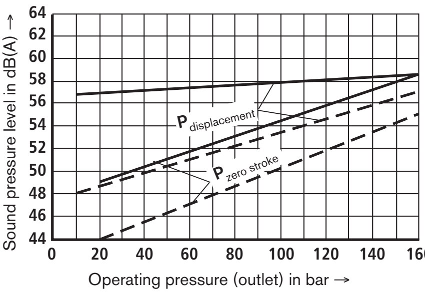
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

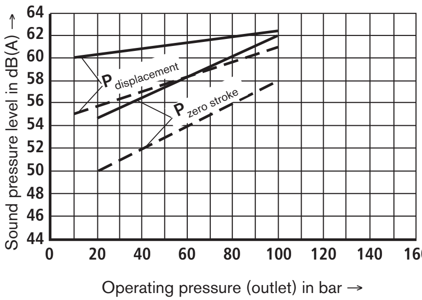
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe engineering notes on page 28 and 30 .

PV7/10-14



PV7/10-20



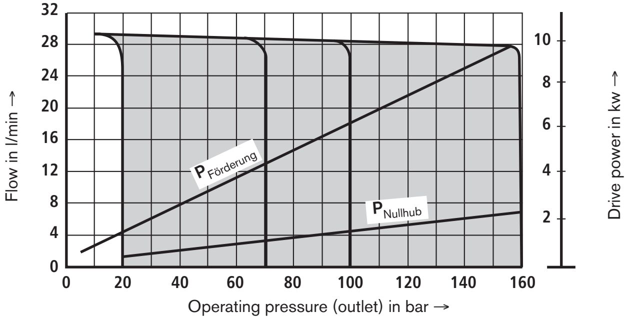
Drive speed: ——— $n = 1450\ \text{min}^{-1}$

– – – $n = 1000\ \text{min}^{-1}$

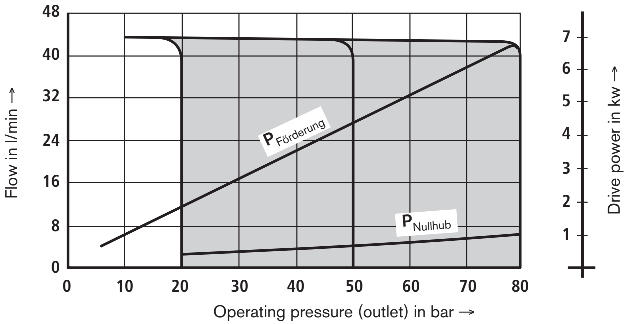
6

Characteristic curves (measured at $n = 1450$ min^{-1}, $\nu = 41$ mm^2/s and $\vartheta = 50$°C)

PV7/16-20



PV7/16-30



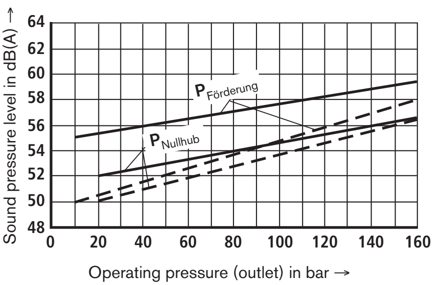
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

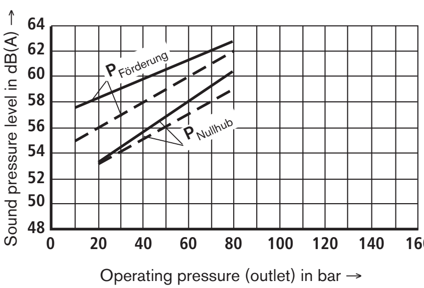
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe the engineering notes on pages 28 and 30.

PV7/16-20



PV7/16-30

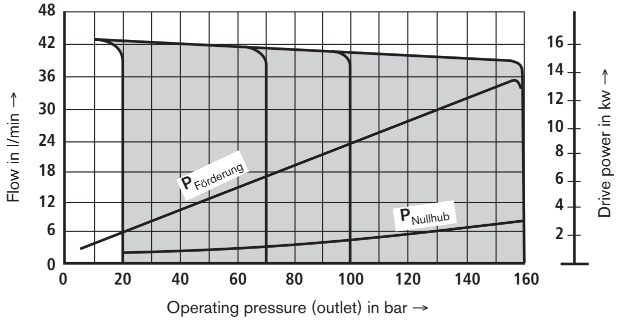


Drive speed: ——— $n = 1450$ min^{-1}

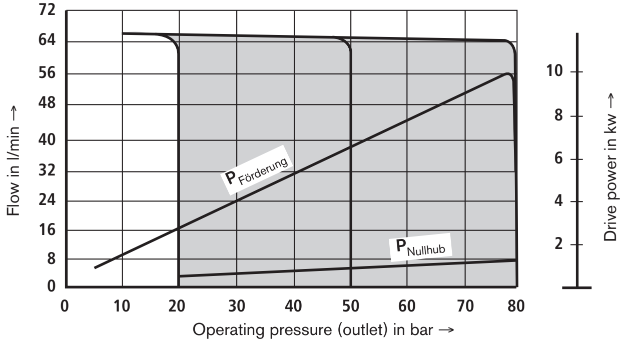
– – – $n = 1000$ min^{-1}

Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50\,°\text{C}$)

PV7/25-30



PV7/25-45



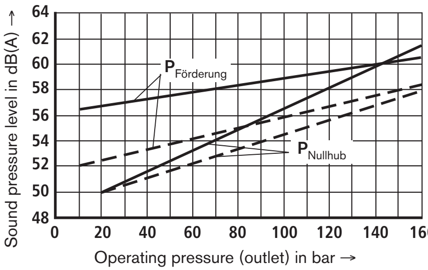
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

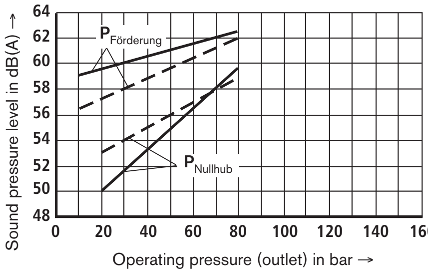
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe the engineering notes on pages 28 and 30.

PV7/25-30



PV7/25-45



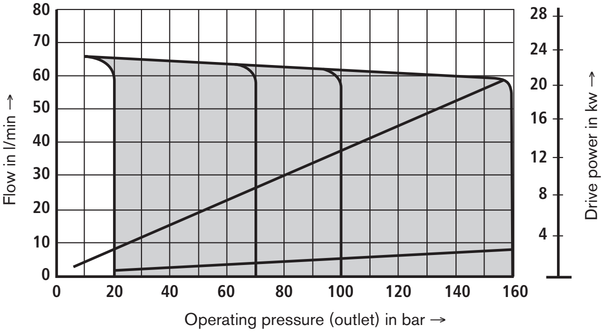
Drive speed: ——— $n = 1450\ \text{min}^{-1}$

– – – $n = 1000\ \text{min}^{-1}$

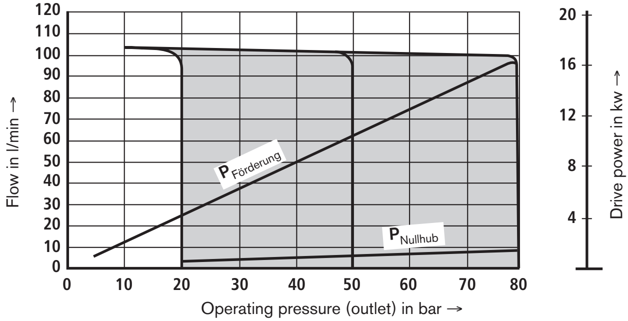
6

Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50°\text{C}$)

PV7/40-45



PV7/40-71



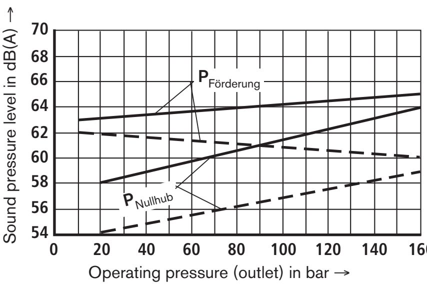
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

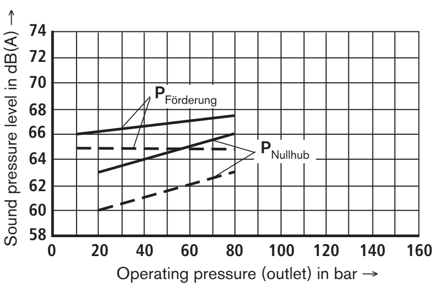
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe the engineering notes on pages 28 and 30.

PV7/40-45



PV7/40-71

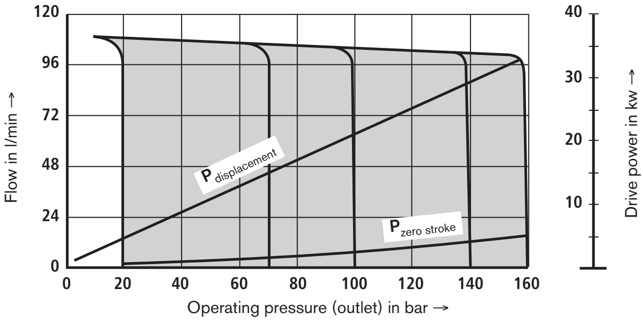


Drive speed: ——— $n = 1450\ \text{min}^{-1}$

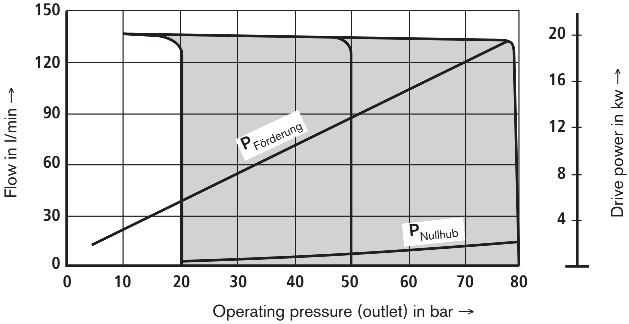
– – – $n = 1000\ \text{min}^{-1}$

Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50°\text{C}$)

PV7/63-71



PV7/63-94



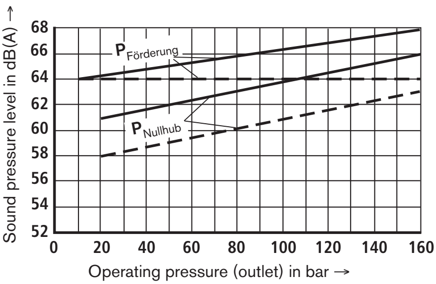
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

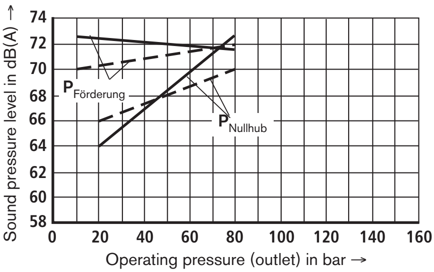
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe the engineering notes on pages 28 and 30.

PV7/63-71



PV7/63-94



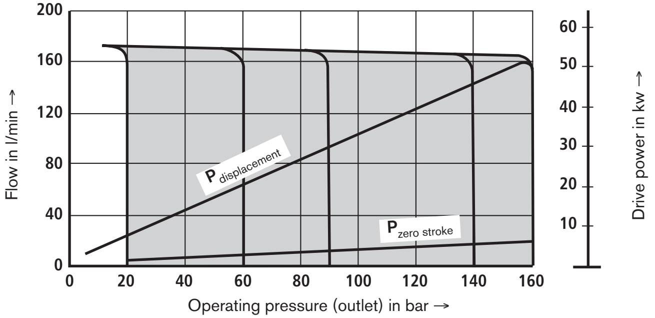
Drive speed: —— $n = 1450\ \text{min}^{-1}$

– – – $n = 1000\ \text{min}^{-1}$

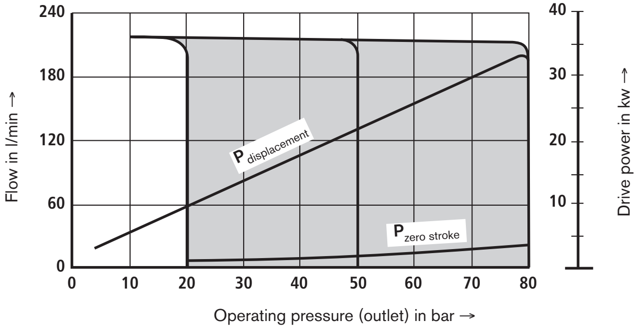
6

Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50°\text{C}$)

PV7/100-118



PV7/100-150



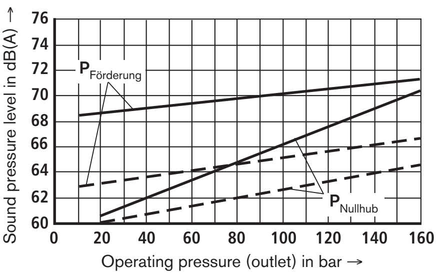
Sound pressure level measured in the anechoic chamber according to DIN 45635 part 26. Distance between microphone – pump = 1 m.

Please take this into account for the order!

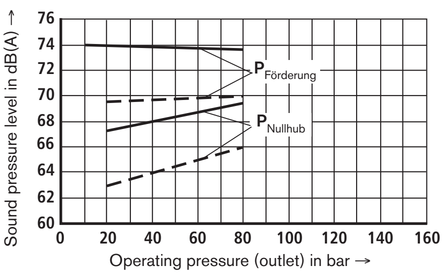
The pump setting is selected so that the most favourable sound pressure level is obtained at the relevant highest zero stroke pressure. It is therefore essential to specify the required zero stroke pressure on the order, unless it corresponds to the nominal pressure.

Observe the engineering notes on pages 28 and 30.

PV7/100-118



PV7/100-150

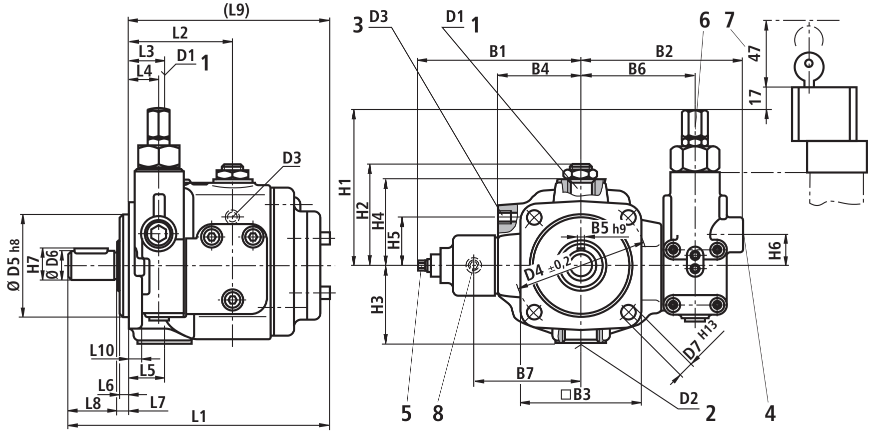


Drive speed: ——— $n = 1450\ \text{min}^{-1}$

- - - - $n = 1000\ \text{min}^{-1}$

Unit dimensions (nominal dimensions in mm)

Single pump with C, D and N controller



1 Pressure port [1)]

2 Suction port [2)]

3 Leakage port

4 In the case of a controller for hydraulic pressure remote control
Ordering code **...D...** and flow controller
Ordering code **...N...**, plug screw G1/4, 12 deep

5 Flow adjustment
Note on the adjustment:
- Turning clockwise: Reduction of the flow
- Turning counter-clockwise: Increase in the flow
- The set flow should not be less than 50 % of the maximum value

6 Pressure adjustment
Note on the adjustment:
- Turning clockwise: Increase in operating pressure
- Turning counter-clockwise: Reduction of the operating pressure

Note: The zero stroke pressure changes by approx. 19 bar with one turn of the adjustment screw.

7 Space required to remove the lock cover (the pressure can only be adjusted when the lock cover is removed)

8 Test point G1/4, 12 deep

FS	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	B1	B2	□B3	B4	$B5_{h9}$	B6	B7
10	193	78.5	26	22	26	7	8	36	149	9	130	125	96	65	6	90	88
16	217	86	37	20	37	9	10	42	165	10	134.5	131	120	69	8	93	92
25	229	86	34	20	38	9	10	42	177	10	140.7	137	120	75	8	99	98
40	254.6	86	26.5	21.5	43	9	10	58	186.6	12	157.8	161	141.2	94	10	125	115.5
63	279	99	39	34.5	51	9	10	58	211	13	163.7	165	141.2	100	10	130	121
100	334	111	45.5	28.5	60.5	9	10	82	242	16	191.7	184.5	200	121	12	149.5	150

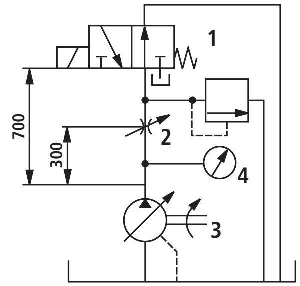
FS	H1	H2	H3	H4	H5	H6	H7	D1 [1)]	D2 [2)]	D3	D4±0,2	$\varnothing D5_{h8}$	$\varnothing$ D6	$D7^{H13}$
10	117	74	58	64	37	25	22.5	G1/2	G1	G1/4	103	80	20_{j6}	9
16	118.5	81.5	68	72	40	26.5	28	G3/4	G1 1/4	G3/8	125	100	25_{j6}	11
25	118.5	91.5	92	80	40	26.5	28	G1	G1 1/2	G3/8	125	100	25_{j6}	11
40	118	105.5	89	94	45	26	35	G1	SAE1 1/2“	G1/2	160	125	32_{k6}	14
63	118	111.5	105	100	47	26	35	SAE1 1/4“	SAE 2“	G1/2	160	125	32_{k6}	14
100	118	123.5	126	111	52	26	43	SAE1 1/2“	SAE2 1/2“	G3/4	200	160	40_{k6}	18

1) Frame sizes 10, 16, 25 and 40
Pipe thread “G...“ to ISO 228/1
Frame sizes 163 and 100, flange connection to SAE

2) Frame sizes 110, 16 and 25
Pipe thread “G...“ to ISO 228/1
Frame sizes 140, 63 and 100, flange connection to SAE

Dynamic characteristics of the pressure control

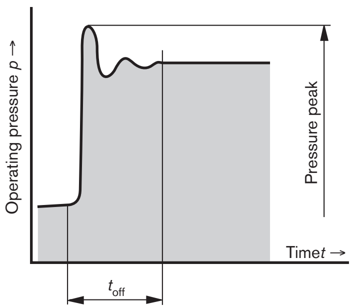
Test set-up



1 Directional valve (switching time 30 ms)
2 Throttle for adjusting the pressure during displacement
3 Hydraulic pump
4 Pressure measurement point

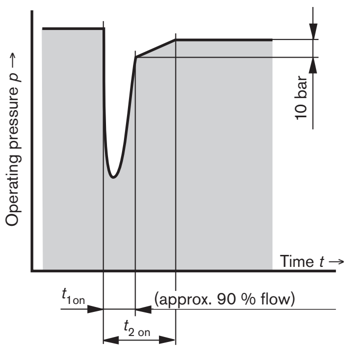
Off-stroke control

$q_{V\ displacement} \rightarrow q_{V\ zero\ stroke}$



On-stroke control

$q_{V\ zero\ stroke} \rightarrow q_{V\ displacement}$



Control times	Off-stroke control time in ms (average values)						On-stroke control time in ms (average values)					
	$q_{V\ displacement} \rightarrow q_{V\ zero\ stroke}$						$q_{V\ zero\ stroke} \rightarrow q_{V\ displacement}$					
	20 → 160 bar		20 → 80 bar		20 → 40 bar		160 → 130 bar		80 → 60 bar		40 → 30 bar	
Frame sizes and sizes	t_{off}	p_{max} 1)	t_{off}	p_{max}	t_{off}	p_{max}	$t_{1\ on}$	$t_{2\ on}$	$t_{1\ on}$	$t_{2\ on}$	$t_{1\ on}$	$t_{2\ on}$
10-14	100	180	–	–	150	80	60	80	–	–	60	80
10-20	–	–	100	130	150	100	–	–	60	80	50	100
16-20	100	200	–	–	120	100	50	80	–	–	50	90
16-30	–	–	100	140	150	110	–	–	50	80	50	100
25-30	100	220	–	–	120	120	80	100	–	–	70	100
25-45	–	–	100	150	120	120	–	–	80	100	80	130
40-45	100	240	–	–	120	140	70	100	–	–	60	100
40-71	–	–	100	180	120	150	–	–	80	100	80	140
63-71	150	220 2)	–	–	150	180	80	120	–	–	100	140
63-94	–	–	200	150 2)	220	150	–	–	120	150	130	210
100-118	200	220 2)	–	–	250	200	100	150	–	–	150	250
100-150	–	–	250	150 2)	280	150	–	–	150	200	180	280

1) Permissible pressure peaks

2) Pressure relief valve required for limiting pressure peaks

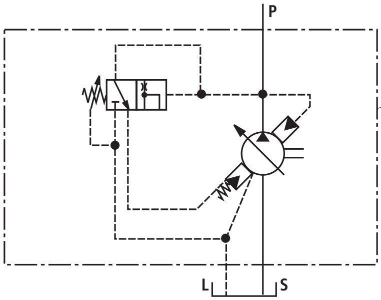
Controller programme

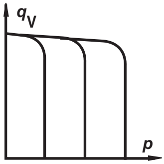
C controller

Pressure controller

with mechanical pressure adjustment, ordering code **...C0-...**
(in lockable version, ordering code **...C3-...**)

Symbol





Order example:

1 Pump: PV7-1X/16-20RE01MC0-16
or PV7-1X/63-94RE07MC0-08

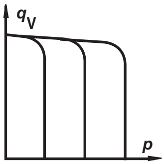
Spare controller V7-1X/...CO-16
Material no. **R900540478**

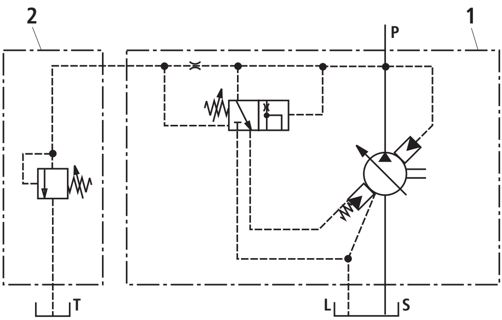
D controller

Pressure controller

with hydraulic pressure remote control, ordering code **...D0-...**
(in lockable version, ordering code **...D3-...**)

Symbol





Order example:

1 Pump: PV7-1X/25-45RE01MD0-08

2 Optional pressure relief valve; must be ordered separately

The remote control line between controller and pressure relief valve (2) should not be longer than 2 m.

Note: The zero stroke pressure results from the addition of the pressures set on the pump and on the pressure relief valve. The remote control port must not be plugged, since otherwise, the pump does not destroke!

Spare controller V7-1X/...DO-16
Material no. **R900540596**

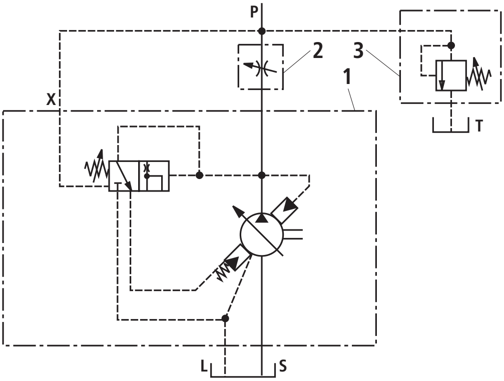
Controller programme

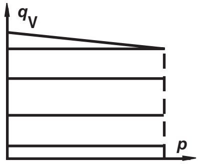
N controller

Flow controller

with mechanical flow adjustment, ordering code **...N0-...**
(in lockable version, ordering code **...N3-...**)

Symbol





Order example:

1 Pump: PV7-1X/16-20RE01MN0-16
or PV7-1X/63-94RE07MN3-08

2 Optional metering orifice (e.g. throttle to RE 27219)

3 Optional pressure relief valve
(this valve is required, since the control is not related to the zero stroke)

Items 2 and 3 must be ordered separately.

The control line between controller port "X" and the metering orifice should not be longer than 1.5 m.

Differential pressure approx. 13 bar

Spare controller V7-1X/...NO-16

Material no. **R900543510**

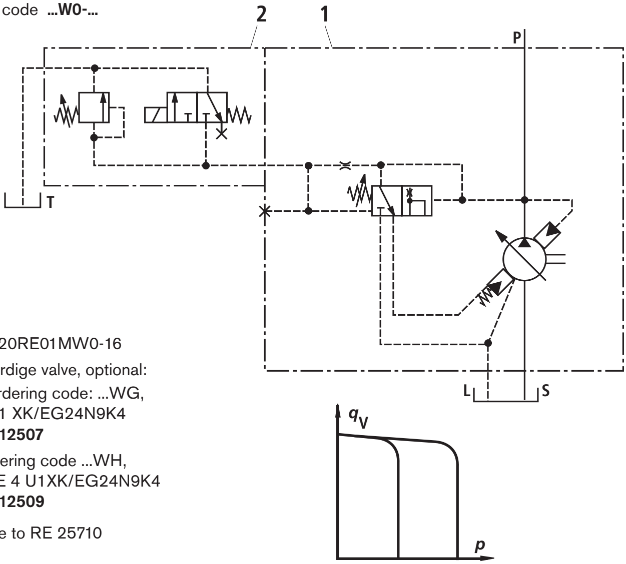
Controller programme

W controller

Pressure controller

with electrically switchable 2-stage pressure adjustment element, ordering code **...W0-...**

Symbol



Order example:

1 Pump: PV7-1X/16-20RE01MW0-16

2.1 3/2 directional cartrdige valve, optional:
Normally closed, ordering code: ...WG, includes 3WE 4 C1 XK/EG24N9K4
Material no. **R900712507**
Normally open, ordering code ...WH, includes valve 3WE 4 U1XK/EG24N9K4
Material no. **R900712509**

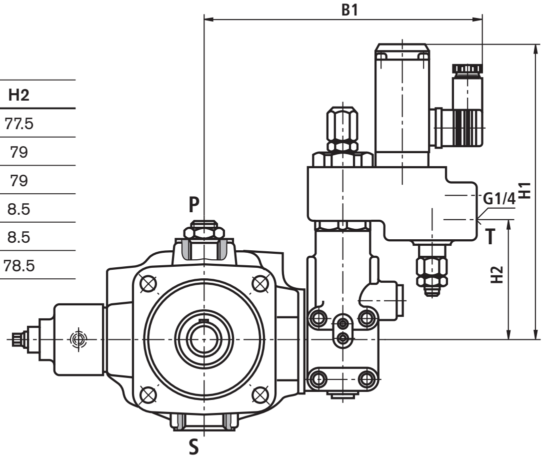
2.2 Pressure relief valve to RE 25710

Unit dimensions (nominal dimensions in mm)

W controller

For further unit dimensions, see page 13.

Frame size	B1	H1	H2
10	189	187.5	77.5
16	192	189	79
25	198	189	79
40	224	188.5	8.5
63	229	188.5	8.5
100	248.5	188.5	78.5



6

Controller programme

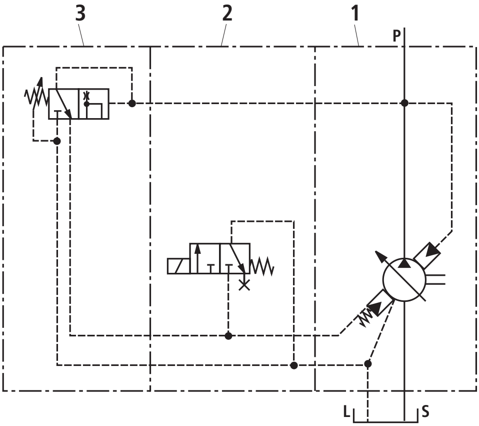
Hydraulic start-up aid (K plate)
Sandwich plate
with unloading valve for starting up at lowest zero stroke pressure.

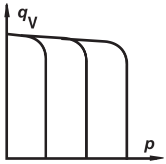
Zero stroke pressure approx. 20 bar (depending on application)

Ordering code: **...5-...**
(in lockable version, ordering code **...7-...**)

Note
Not suitable as 2-stage control!

Symbol





Order example:

1 Pump: PV7-1X/40-71RE37MC5-08

2 3/2 directional cartridge valve, optional:
Normally closed, ordering code: ...WG,
includes valve 3WE 4 C1 XK/EG24N9K4
Material no. **R900712507**

Normally open, ordering code ...WH,
includes valve 3WE 4 U1XK/EG24N9K4
Material no. **R900712509**

The figure shows type ...WG

3 Optional C, D or N controller

Accessories for conversions

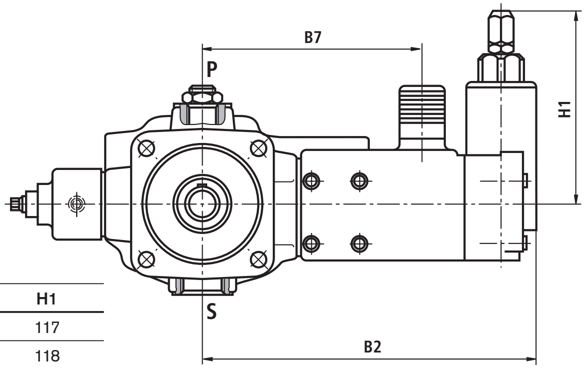
From controller variant **...0-...** to **...5-...**:

Plate V7-1X/.K, material no. **R900854415**

Unit dimensions (nominal dimensions in mm)

K plate

For futher unit dimensions, see page 13.



Frame size	B2	B7	H1
10	204.5	143.5	117
16	207.5	146.5	118
25	214	153	118
40	240	179	118
63	244.5	183.5	118
100	264	203	118

Controller programme

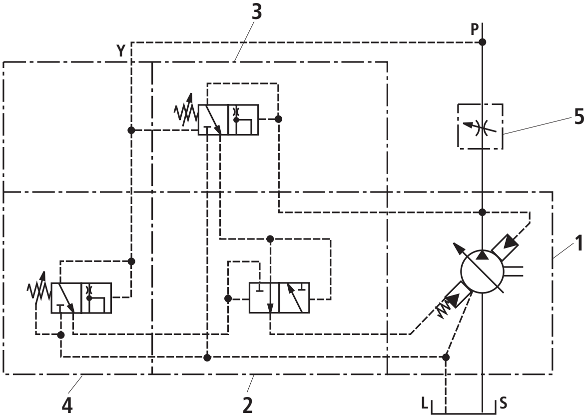
Flow/pressure controller (Q plate)

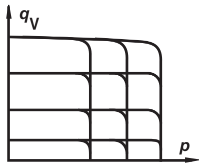
Sandwich pump

– For combining a flow controller with a pressure-compensated pump
– With built-on standard flow controller

Ordering code: **...6-...**
(in lockable version, ordering code **...8-...**)

Symbol





Order example:

1 Pump: PV7-1X/63-712RE07MC6-16
2 Sandwich plate for combining the pressure controller and the flow controller function
3 Flow controller as described on page 16
4 Pressure controller optionally of types C, D, E or W as described on pages 15 and 16
5 Optional metering orifice (e.g. throttle to RE 27219), must be ordered separately

The control line between controller port "Y" and the metering orifice should not be longer than 1.5 m.

Accessories for conversions
From controller variant **...0-...** to **...6-...** , includes items 2 and 3:

Plate V7-1X/...Q

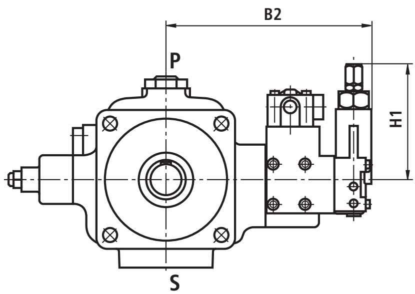
Material no. **R900860093**

Unit dimensions (nominal dimensions in mm)

Q plate

For further unit dimensions, see page 13.

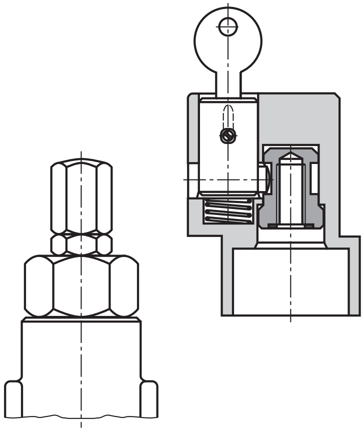
Frame size	B2	H1
10	173.5	117
16	176.5	118.5
25	182.5	118.5
40	208.5	118
63	213.5	118
100	233	118



Lock

Material no.: R900844598

This lock is included in the scope of supply for pumps with controller options of versions **...3...**, **...7...** or **...8...**



Functional description

After unlocking (by turning the key clockwise) the complete lock cover can be removed from the controller, which allows free access to the adjustment element.

To lock, the lock cover must be placed over the controller adjustment element and pressed home, the lock cylinder pressed down and the key turned to the left.

The lock can be easily retrofitted to a standard pump.

– Unscrew the cap nut from the controller adjustment element.

– Fit the cap nut that is provided with the key

– Plug on the lock as shown in the functional description.

Notes on the engineering of multiple pumps

– PV7 pumps can be combined as a standard. Each pump is fitted with a splined, second shaft end.

– When the PV7 is operated as fixed displacement pump, the fixed displacement pump must be used as rear pump.

– The general technical data are the same as that of the single pump (see page 6).

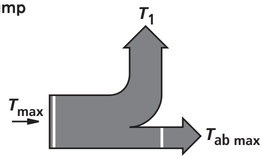
– The pump that is subjected to higher loads (pressure x flow) should be the first pump stage.

– When several pumps are combined, the torques that occur can reach impermissibly high values.
The sum of torques must not exceed the permissible values (see table)

– Combination parts must be listed as separate items on the order.

– The combination parts include the required seals and screws

Single pump



PV7 frame size	Max. perm. input torque T_{max}	Max. perm. output torque $T_{out\ max}$
10	90	45
16	140	70
25	180	90
40	280	140
63	440	220
100	680	340

Calculation example:

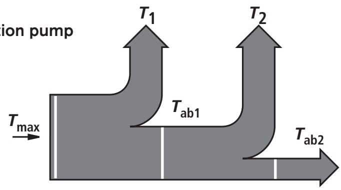
V = Displacement volume in cm^3

$\eta_{hydr.-mech.}$ = Hydraulic-mechanical efficiency

T = Torque in Nm

Δp = Pressure in bar

Combination pump



Pump combination: P2V7/25-30... + V7/25-30

Required max. pressure: p_n = 160 bar

$$T = \frac{\Delta p \times V \times 0.0159}{\eta_{hydr.-mech.}} \text{ (Nm)}$$

$$T_{1,2} = \frac{160 \times 30 \times 0.0159}{0.85} \text{ (Nm)}$$

$$T_{1,2} = 90 \text{ Nm} \leq T_{off\ max}$$

$$T = T_1 + T_2 = 180 \text{ Nm} \leq T_{max}$$

Teh pump combination can be operated on the basis of the calculated data .

Combination options

All pumps of type PV7 can be combined. Each pump with E-shaft is provided with an output spline.

All combinations of a PV7 + optional rear pump are sealed against each other by means of the shaft seal ring of the rear pump. The seal is direction-related. In the case of more stringent requirements with regard to a reliable separation of media, please consult the technical sales department.

Possible combinations and the material no. of the required combination parts can be found in the following table.

Rear pump	Front pump			
	PV7-1X/**10**	PV7-1X/**16/25**	PV7-1X/**40/63**	PV7-1X/**100**
PV7-1X/06-...RA01M...	R900540811	R900540812	R900540814	R900543034
PV7-1X/10-...RE01M...	R900540811	R900540812	R900540814	R900543034
PV7-1X/16-...RE01M...	–	R900540813	R900540815	R900543035
PV7-2X/20-...RA01M...	–	R900540813	R900540815	R900543035
PV7-1X/25-...RE01M...	–	R900540813	R900540815	R900543035
PV7-1X/40-...RE37M...	–	–	R900540816	R900543036
PV7-1X/63-...RE07M...	–	–	R900540816	R900543036
PV7-1X/100-...RE07M...	–	–	–	R900543037
PGF1-2X/...RE01VU2	R900857584	R900857585	–	–
PGF2-2X/...RJ...VU2	R900541209	R900541210	R900541203	R900544959
PGF3-3X/...RJ...VU2	–	R900888267	R900880623	R900880624
PGP2-2X/...RJ20VU2	R900541209	R900541210	R900541203	R900544959
PGP3-3X/...RJ...VU2	–	R900888267	R900880623	R900880624
PGH2-2X/...RR...VU2	R900541209	R900541210	R900541203	R900544959
PGH3-2X/...RR...VU2	R900541209	R900541210	R900541203	R900544959
PGH4-2X/...RR...VU2	–	–	R900876578	R900876576
PVV/Q1/2-1X/...RJ15...	–	R900888267	R900880623	R900880624
PVV/Q4/5-1X/...RJ15...	–	–	R900876023	R900875983
AZPF.....	R900541209	R900541210	R900541203	R900544959
PR4-1X/0,40...2,00-...WG...	R900541204	R900541205	R900541206	–
PR4-3X/1,60...20,00-...RG...	R900541214	–	–	–
PR4-3X/1,60...20,00-...RA...	–	R900541207	R900541208	R900543767
A10VSO10...U	R900541209	R900541210	R900541203	R900544959
A10VSO18...U	R900541209	R900541210	R900541203	R900544959
A10VO28...S	–	R900888267	R900880623	R900880624

Ordering codes of multiple pumps

P2	V7/100-150	C0	+	V7/100-150	C0	R	E	07	+		07	E4	*

Double = **P2**

Series of the first pump

Size of the first pump

Controller of the first pump

Series of the second pump

Size of the second pump

Controller of the second pump

Direction of rotation

Further details in clear text

Mounting flange of the first pump

Pipe connection of the second pump

Shaft version of the second pump (if required) [1]

Pipe connection of the first pump!

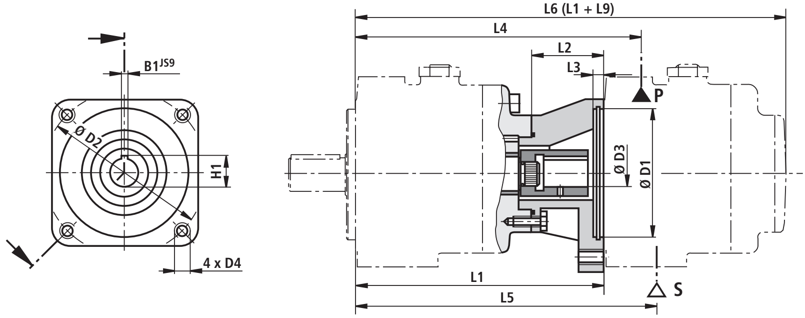
Shaft version of the first pump

[1] With PGF2 and PGF3

Triple and quadruple pumps are coded by analogy!

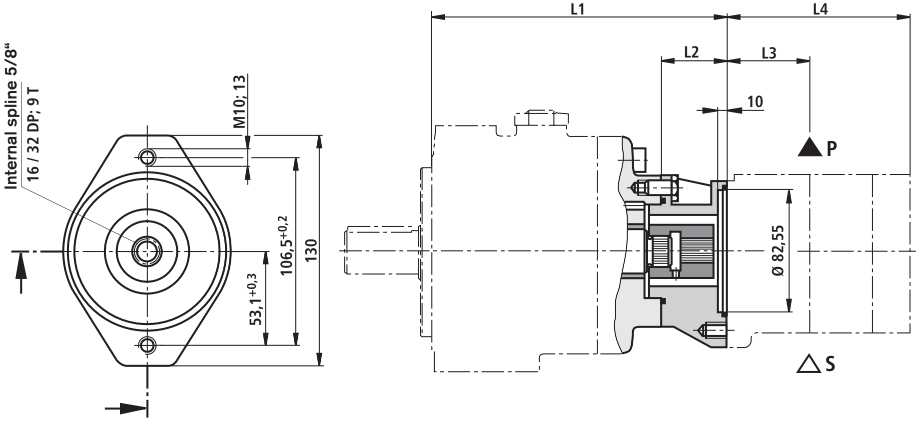
6

Pump combination P2V7... + V7/... (nominal dimensions in mm)



1st pump FS	2nd pump FS	L1	L2	L3	ØD1	ØD2	ØD3	D4	H1	B1	L4	L5	L6
10	**06**	182	50	8	80	103	20	M8	22.8	6	199	202.5	283
	10	182	50	8	80	103	20	M8	22.8	6	208	208	331
16	**06**	200	55	8	80	103	20	M8	22.8	6	217	220.5	301
	10	200	55	8	80	103	20	M8	22.8	6	226	226	349
	16	208	63	10	100	125	25	M10	28.3	8	245	245	373
	20	208	63	10	100	125	25	M10	28.3	8	238	233	343
25	**06**	212	55	8	80	103	20	M8	22.8	6	229	232.5	313
	10	212	55	8	80	103	20	M8	22.8	6	238	238	361
	16	220	63	10	100	125	25	M10	28.3	8	257	257	385
	20	220	63	10	100	125	25	M10	28.3	8	245	245	354
	25	220	63	10	100	125	25	M10	28.3	8	254	258	397
40	**06**	221.6	55	8	80	103	20	M8	22.8	6	238.6	242.1	322.6
	10	221.6	55	8	80	103	20	M8	22.8	6	247.6	247.6	370.6
	16	229.6	63	10	100	125	25	M10	28.3	8	266.6	266.6	394.6
	20	229.6	63	10	100	125	25	M10	28.3	8	254.6	254.6	363.6
	25	229.6	63	10	100	125	25	M10	28.3	8	263.6	267.6	406.6
	40	246.6	80	10	125	160	32	M12	35.3	10	273.1	289.6	433.2
63	**06**	244.5	55	8	80	103	20	M8	22.8	6	261.5	265	345.5
	10	244.5	55	8	80	103	20	M8	22.8	6	270.5	270.5	393.5
	16	252.5	63	10	100	125	25	M10	28.3	8	289.5	289.5	417.5
	20	252.5	63	10	100	125	25	M10	28.3	8	277.5	277.5	386.5
	25	252.5	63	10	100	125	25	M10	28.3	8	286.5	290.5	429.5
	40	269.5	80	10	125	160	32	M12	35.3	10	296	312.5	456.1
	63	269.5	80	10	125	160	32	M12	35.3	10	308.5	320.5	480.5
100	**06**	276.5	55	8	80	103	20	M8	22.8	6	293.5	297	277.5
	10	276.5	55	8	80	103	20	M8	22.8	6	302.5	302.5	425.5
	16	284.5	63	10	100	125	25	M10	28.3	8	321.5	321.5	449.5
	20	284.5	63	10	100	125	25	M10	28.3	8	309.5	309.5	418.5
	25	284.5	63	10	100	125	25	M10	28.3	8	318.5	322.5	461.5
	40	301.5	80	10	125	160	32	M12	35.3	10	328	344.5	488.1
	63	301.5	80	10	125	160	32	M12	35.3	10	340.5	352.	515.5
	100	321.5	100	10	160	200	40	M16	47.3	12	367	382	563.5

Pump combination P2V7... + GF2 / GP2 / GH2 / GH3 / AZPF / A10VSO (nominal dimensions in mm)



PV7 frame size	L1	L2
10	168	36
16	192	47
25	204	47
40	213.6	47
63	236.5	47
100	268.5	47

PGF2/PGP2 size	L3	L4
006	65	116
008	67	119.5
011	69.5	125
013	72	130
016	74.5	135
019	77.5	141
022	80.5	147

PGH2 size	L3	L4
003	51	102.5
005	54	110
006	55.5	112.5
008	57	116

PGH3 size	L3	L4
011	60	121.5
013	62.5	126.5
016	65	131.5

AZPF size	L3	L4
004	40	85
005	41	87.5
008	43	91.5
011	47	96.5
014	47.5	101.5
016	47.5	105
019	47.5	110
022	55	115.5

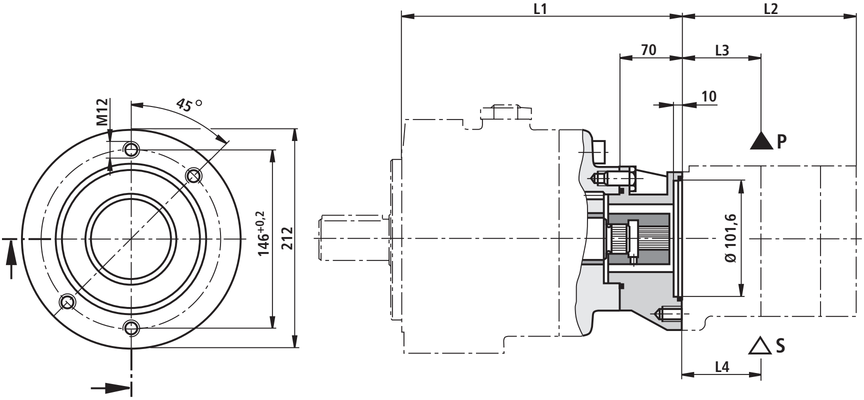
A10VSO size	L3	L4
010	148 [1]	164; 179 [2]
018	145	195

[1] Pipe connections axial

[2] Depending on contoller (see RE 92713)

6

Pump combination P2V7... + GF3 / GP3 / VV1 / VV2 / GH4 / A10VO28 (nominal dimensions in mm)



PV7 frame size	L1
16	215
25	227
40	237
63	259.5
100	291.5

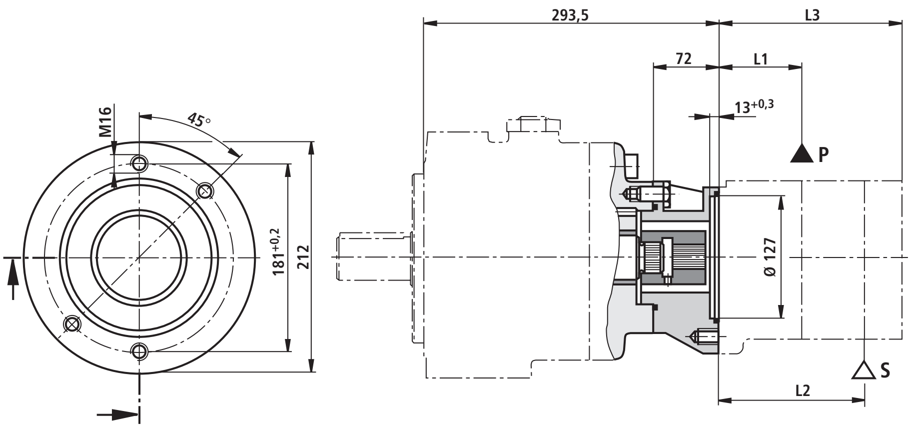
PGF3/PGP3 size	L2	L3;L4
020	144.5	79.5
022	146.5	80.5
025	150.5	82.5
032	159.5	87
040	169.5	92
050	182.5	98.5

PGH4 size	L2	L3,L4
020	147	70.5
025	152	73
032	159	76.5
040	166	80
050	176	85
063	190	92
080	204	99
100	224	109

PVV.UMB	L2	L3 (P)	L4 (S)
PVV1	156	133	63.5
PVV2	163	38.1	120.6

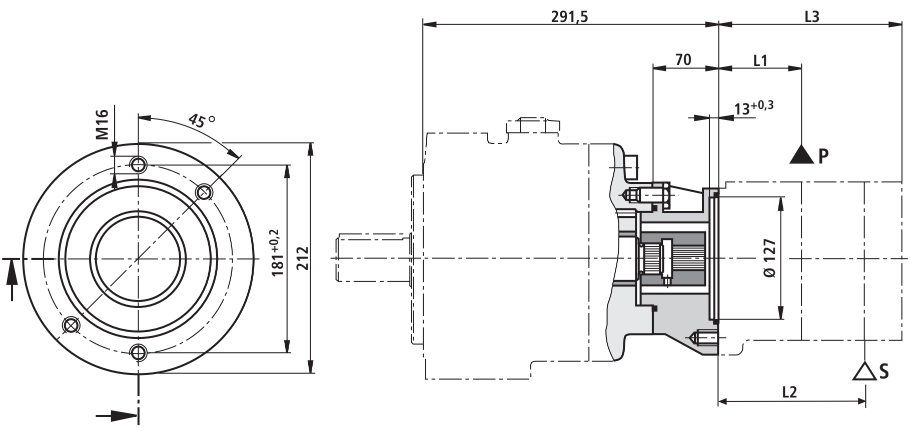
A10VO size	L2	L3	L4
028	194	164.5	164.5

Pump combination P2V7/63... + VV4 / VV5 (nominal dimensions in mm)



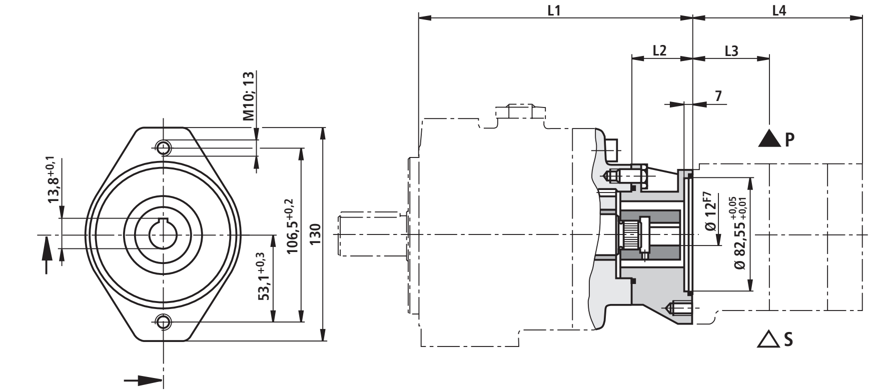
	L1	L2	L3
PVV4...UMC	38.1	125.5	186
PVV5...UMC	42.9	153.2	216

Pump combination P2V7/100... + VV4 / VV5 (nominal dimensions in mm)



	L1	L2	L3
PVV4...UMC	38.1	125.5	186
PVV5...UMC	42.9	153	216

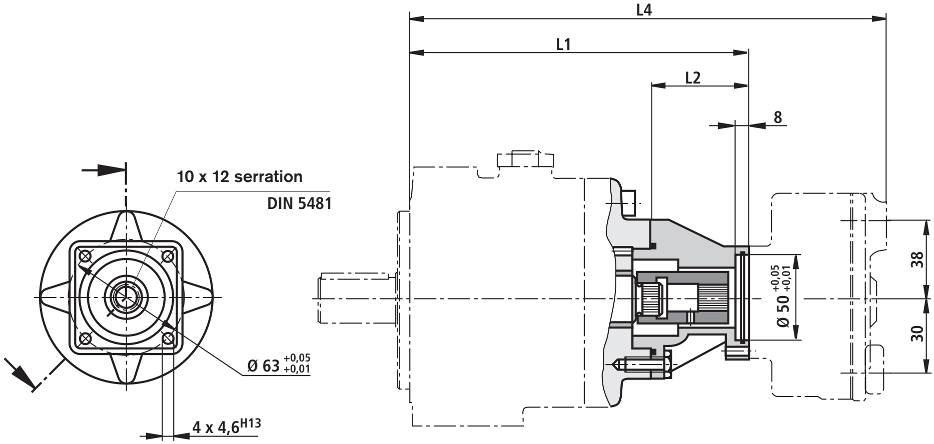
Pump combination P2V7... + GF1... (nominal dimensions in mm)



PV7 frame size	L1	L2
10	168	36
16	192	47
25	204	47

GF1 size	L3	L4
1.7	8.6	86
2.2	48.6	86
2.8	49.7	88.6
3.2	50.5	89.9
4.1	52.4	93.6
5.0	54.2	97.3

Pump combination P2V7... + PR4-Mini (nominal dimensions im mm)



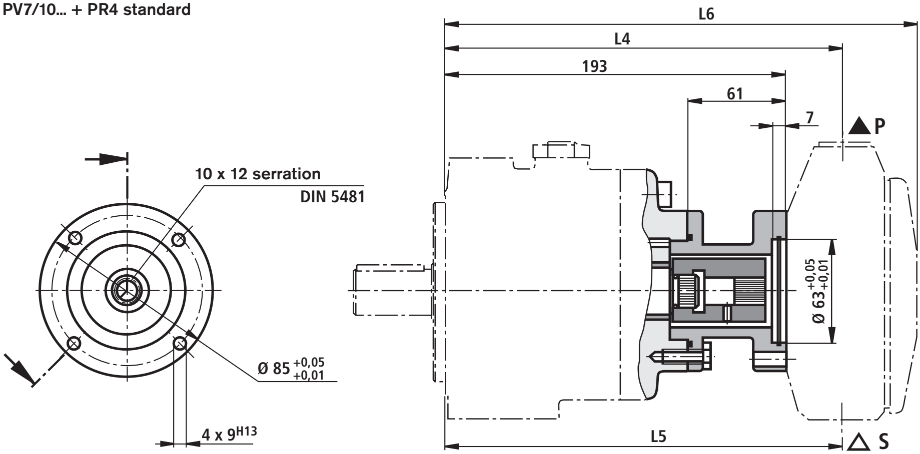
PV7 frame size	L1	L2	L4
10	178	46	247
16	208	63	277
25	220	63	289

PV7 frame size	L1	L2	L4
40	229.6	63	298.6
63	252.5	63	321.5
100	284.5	63	353.5

Note: The suction port of PR4 should be located above the pressure port!

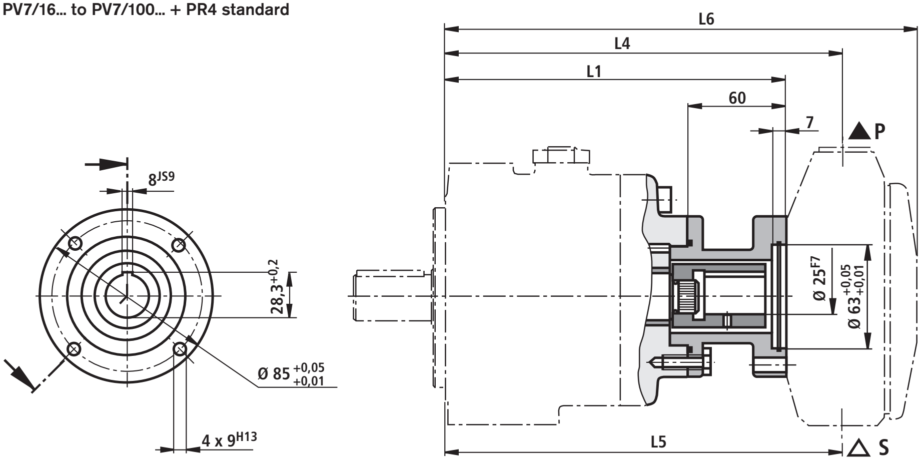
Pump combination P2V7... + PR4 standard (nominal dimensions in mm)

PV7/10... + PR4 standard



Piston	L4	L5	L6
3;5	231.5	231.5	279
10	231.5	240.5	312.5

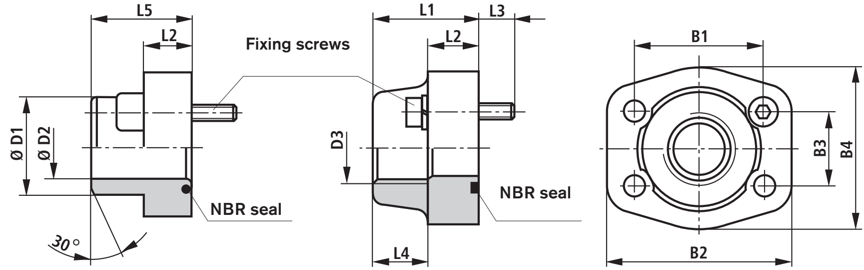
PV7/16... to PV7/100... + PR4 standard



PV7 frame size	L1	L4		L5		L6	
		3/5 pistons	10 pistons	3/5 pistons	10 pistons	3/5 pistons	10 pistons
16	205	243.5	243.5	243.5	252.5	291	324.5
25	217	255.5	255.5	255.5	264.5	303	336.5
40	226.6	265.1	265.1	265.1	274.1	312.6	346.1
63	249.5	288	288	288	297	335.5	369
100	281.5	320	320	320	329	367.5	401

6

SAE connection flanges, max. operating pressure 210 bar (3000 PSI)



with welded connection to AB 22-15 **with threaded connection**

The material nos. include the flange, the O-ring and the fixing screws.
Pipe thread "G" to ISO 228/1

Size	Seal material	Material no.		For pump type	
		Welded connection	Threaded connection	Suction port	Pressure port
1 1/4	NBR	R900012946	R900014153	–	PV7/63-...
1 1/2	NBR	R900013501	R900014827	PV7/40-...	PV7/100-...
2"	NBR	R900013502	R900014829	PV7/63-...	–
2 1/2"	NBR	R900013503	R900024205	PV7/100-...	–

Size	B1	B2	B3	B4	D1	D2	D3	L1	L2	L3	L4	L5	Fixing screws
1 1/4	58.7	79	30.2	68	38	30	G1 1/4	41	21	18	22	42	M10-8.8
1 1/2	69.9	95	35.7	76	42	36	G1 1/2	44	25	18	24	57	M12-8.8
2"	77.8	102	42.9	90	61	49	G2	45	25	18	26	46	M12-8.8
2 1/2"	88.9	114	50.8	104	76	62	G2 1/2	50	25	18	30	50	M12-8.8

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3, RE 00281, "Planning and design of hydraulic systems".

When using vane pumps, we recommend that the following notes are observed in particular:

- **Technical data**
  All technical data mentioned depend on manufacturing tolerances and are valid under certain boundary conditions. Please note that small tolerances are therefore possible and that different boundary conditions (e.g. viscosity) can also result in changes in the technical data.
- **Characteristic curves**
  Characteristic curves for flow and absorbed power. Please take the possible maximum operating data into account when dimensioning the drive motor.
- **Noise/sound pressure level**
  The sound pressure level values given on pages 6 to 11 were measured in accordance with DIN 45635 part 26.

This means that only the sound emission of the pump is shown. Ambient influences (such as place of installation, piping, etc.) were eliminated. The values are valid for only one pump.

If, for example, two pumps of the same frame size are operated under the same load conditions, the noise level increases according to the following formula:

$$L_\Sigma = 10 \lg (10^{0.1 \cdot L1} + 10^{0.1 \cdot L2})$$

L_Σ = Total noise level

$L_1 \ldots L_i$ = Sound pressure level of the individual pump

Example: PV7/16 + PV7/16

p = 120 bar

L_1 = 56 dB(A)

L_2 = 56 dB(A)

L_Σ = 10 log $(10^{0.1 \cdot 56} + 10^{0.1 \cdot 56})$

= 59.01 dB(A)

Engineering notes

Caution!

The power unit design and influences at the final place of installation of the pump result in the fact that the sound pressure level is usually 5 to 10 dB(A) higher than the value of the pump alone.

Leakage oil

The external leakage fluid of the pump dissipates a part of the frictional heat. The leakage fluid should be directed with low line resistance directly into the tank. The distance between the leakage line and the suction line must be sufficiently large so that the returning leakage fluid **cannot** be directly re-aspired. The flow of average, external leakage is shown on page 5. These values must not be used for dimensioning the tanks. The relevant variable for the selection of the tank size is the zero stroke power (see pages 7 to 12).

Leakage fluid cooler

The values for external leakage fluid given on page 6 are average values that are valid for continuous operation.

When the pump goes off stroke, the leakage fluid volume briefly increases due to the pilot fluid of the controller. Reductions in cross-sections, long leakage lines, or also leakage fluid coolers can lead to impermissibly high pressure peaks. Suitable measures, e.g. a check valve in the by-pass must prevent the leakage fluid pressure (p_{max} = 2 bar) from exceeding the permissible values. Otherwise, the shaft seal ring could be damaged.

Commissioning notes

Bleeding

- All vane pumps of type PV7 are self-priming.
- Before initial commissioning, the pump must be bled in order to protect it against damage.
- We recommend that the housing be filled via the leakage port for initial commissioning. Observe the filter rating! This increases the operational reliability and prevents wear under unfavourable installation conditions.
- Should the pump not displace bubble-free oil after approx. 20 s, check the system again. After the operating values have been reached, inspect the pipe connections for leakage and check the operating temperature.

Commissioning

- Check that the system has been properly and thoroughly assembled.
- Observe the direction-of-rotation arrows of the motor and the pump.
- Let the pump start up under no-load conditions and let it displace fluid at zero pressure for some seconds in order to provide sufficient lubrication.
- **In no case may the pump be operated without fluid!**

Important notes

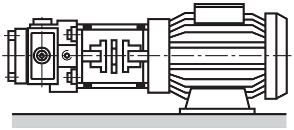
- Adjustments, servicing and repairs of the pump may only be carried out by authorised, trained and instructed personnel!
- Use only genuine spare parts of Bosch Rexroth!
- The pump may only be operated with the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. installation or removal), the system must be de-energised and de-pressurised!
- Unauthorised conversions or changes to the system, which affect safety and function, are not permitted!
- Fit protective equipment (e.g. coupling guard)!
- Do not remove any existing protective guards!
- Strictly observe generally valid safety regulations and regulations for the prevention of accidents!

6

Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump



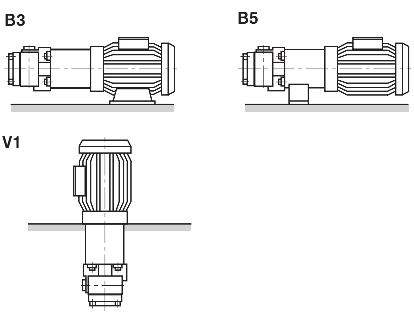
Caution!

- Radial and axial forces acting on the pump drive shaft are not permitted!
  → Motor and pump must be exactly aligned
  → Use a flexible drive coupling

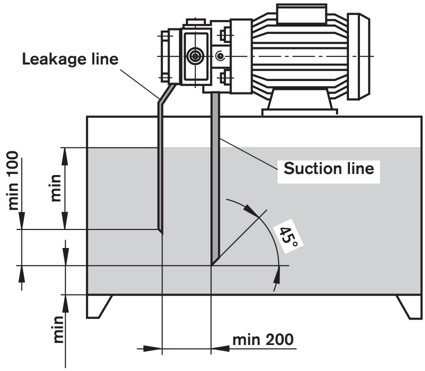
Installation notes

Installation positions

– Horizontal position preferred



Piping suggestions (nominal dimensions in mm)



Fluid tank

– Adapt the useful capacity of the tank to the operating conditions.

Caution!

– The permissible fluid temperature must not be exceeded → if required, provide cooler!

Lines and connections

– Cut off at an angle of 45°.
– Remove protective plug from the pump.
– We recommend the use of seamless precision steel pipes according to DIN 2391 and removable pipe connections.
– Select the clear width of the pipes according to the ports.
– Thoroughly clean all pipes and fittings before installing them.
– **Minimum distance to the tank bottom 120 mm**
– Lay the leakage line so that the pump can **not** drain!
– Do **not** pipe a pump **without** controller!
– Leakage and return flow fluid must **under no circumstances** be directly re-aspired!

Filters

– Whenever possible, use return flow or pressure filters. (Suction filters only in conjunction with underpressure switch / clogging indicator)

Hydraulic fluid

– Please observe our regulations according to data sheet RE 07075.
– We recommend the use of brand name hydraulic fluids.
– Different hydraulic fluid types must not be mixed, since this can result in decomposition and a deterioration of the lubricating properties. Observe the manufacturer‘s information!
– The fluid must be changed at regular intervals according to the operating conditions. In this context, the fluid tank must be cleaned from residues.

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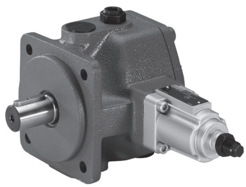
The Drive & Control Company

Rexroth
Bosch Group

Variable Vane Pump, Direct Controlled
PV7...A Series 1X / 2X

RE 10522
Issue: 01.2013
Replaces: 08.2008



- Sizes 10 to 25
- Maximum pressure 100 bar
- Displacement volume 10 to 25 cm^3

Features
- Very short control times
- Low noise
- Mounting and connection dimensions to VDMA 24560/1 and ISO 3019-2
- Good efficiency
- Long service life
- Variable displacement volumes

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Ordering code

01		02		03	04	05	06	07	08	09		10	11
PV7	–		/		**R**	**A**	**01**	**M**	**A**		–		

Type

01	Vane pump, direct controlled, maximum operating pressure 100 bar	**PV7**

Series of devices

02	Frame size 06, device series 10 to 19, unchanged mounting and connection dimensions	**1X**
	Frame size 20, device series 20 to 29, unchanged mounting and connection dimensions	**2X**

	Frame size BG	Size NG [cm^3]	
03	BG 06	10	**06-10**
		14	**06-14**
	BG 20	20	**20-20**
		25	**20-25**

Direction of rotation

04	Viewed on drive shaft, right	**R**

Drive shaft

05	Parallel keyed shaft	**A**

Pipe connections

06	Suction and pressure port with pipe thread according to DIN EN ISO 228-1	**01**

Seals

07	NBR seals, suitable for HLP mineral oil according to DIN 51524	**M**

Control unit

08	Direct controlled	**A**

Control device

09	Adjustment screw (Standard)	**0**
	Controller with lock	**3**

Zero stroke pressure range[1)]

10	V7/06-10	25 to 50 bar	**05**
		50 to 100 bar	**10**
	V7/06-14	15 to 40 bar	**04**
		40 to 70 bar	**07**
	V7/20	25 to 50 bar	**05**
		50 to 100 bar	**10**

11	Further details in clear text	

Preferred type (available on short notice)

Type	Material number
PV7-1X/06-10RA01MA0-05	R900561857
PV7-1X/06-10RA01MA0-10	R900563233
PV7-1X/06-14RA01MA0-04	R900919235
PV7-1X/06-14RA01MA0-07	R900919237
PV7-2X/20-20RA01MA0-05	R900950952
PV7-2X/20-20RA01MA0-10	R900950953
PV7-2X/20-25RA01MA0-05	R900950954
PV7-2X/20-25RA01MA0-10	R900950955

Pump with customer-specific settings:

- PV7-1X/06-14RA01MA0-07-P50, $p_{\text{zero stroke}}$ = 50 bar
- PV7-1X/06-14RA01MA0-07-Q20, $q_{V\ max}$ = 20 L/min

The pump will be set to the required values. The optimum operating noise will be set at the required zero stroke pressure. Without any clear text setting information the flow and the zero stroke pressure will be set to the relevant maximum values.

1) As delivered the zero stroke pressure is set to the smallest value!

Functional description

Hydraulic pumps, type PV7...A are direct controlled vane pumps with variable displacement.
The basically comprise of the housing (**1**), cover (**2**), rotor (**3**), vanes (**4**), stator ring (**5**), pressure spring (**6**), adjustment screw (**7**) and control plate (**8**).
For limiting the maximum flow, the pump is fitted with an adjustment screw (**9**).
The driven rotor (**3**) rotates within the stator ring (**5**). The vanes (**4**) which are guided in the rotor (**3**) are pressed against the inner running surface of the stator ring (**5**) by centrifugal force.

Suction and displacement process

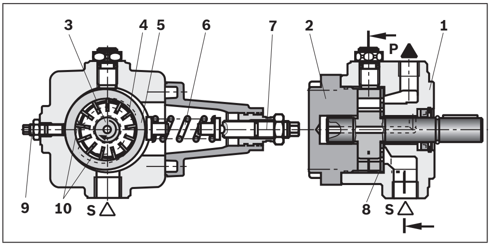
The chambers (**10**) which are required for the transport of the hydraulic fluid are formed by the vanes (**4**), the rotor (**3**), the stator ring (**5**), the control plate (**8**) and the cover plate (**2**).

The chamber volume increases as the rotor (**3**) rotates and the chambers are filled with hydraulic fluid via the suction channel (**S**). When the largest chamber volume is reached, the chambers (**10**) are separated from the suction side.
As the rotor (**3**) continues to rotate the connection to the pressure side is opened, the chambers decrease in size and force the hydraulic fluid into the system via the pressure port (**P**).

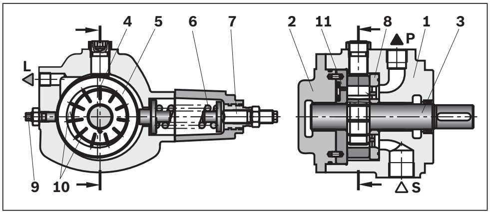
Pressure control

The stator ring (**5**) is held in its initial excentric position by spring (**6**). The maximum operating pressure required in the system is set at the adjustment screw (**7**) via the spring (**6**).
The pressure which builds up due to the work resistance acts on the pressure side of the inner running surface of the stator ring (**5**), against the force of the spring (**6**).
When the relevant pressure is reached, which is determined by the set spring force, the stator ring (**5**) is moved out of its excentric position in the direction of the zero position. The flow adjusts itself to the value which is being demanded at that time. When the maximum pressure, which has been set at the spring (**6**), has been reached then the pump regulates the flow back to virtually zero. The operating pressure is maintained and only the case drain is replaced. Losses and heating of the hydraulic fluid is thereby minimized.

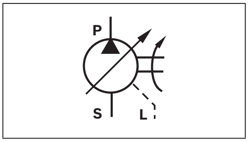
▼ **PV7-1X/06...A...**



▼ **PV7-2X/20...A...**



▼ **Symbol**



6

Technical data

Frame size			**BS**	**06**	**06**	**20**	**20**
Displacement		V	cm^3	10	14	20	25
Speed		n	rpm	900 to 1800	900 to 1800	900 to 1800	900 to 1800
Torque maximum		T	Nm	50	50	110	110
Operating pressure, absolute	Inlet	$p_{\text{min-max}}$	bar	0.8 to 2.5	0.8 to 2.5	0.8 to 2.5	0.8 to 2.5
	Outlet	p_{max}	bar	100	70	100	100
	Case drain outlet	p_{max}	bar	2	2	2	2
Case drain flow at zero stroke (at outlet operating pressure= $p_{\text{zero stroke max}}$		q_V	l/min	1.7	1.7	2.0	2.4
Shaft loading			Radial and axial forces are not permissible				
Flow maximum [1] (at n = 1450 rpm p = 10 bar; ν = 41 mm^2/s)		q_V	l/min	14.5	20	29	36
Weight		m	kg	6.3	6.3	11.4	11.4
Flow change (at one revolution of the adjustment screw and n = 1450 rpm		q_V	l/min	7.5	7.5	14	14
Hydraulic fluid				Mineral oil HLP according to DIN 51524 part 2 Please take the specifications stated in data sheet 90220 into account! Further fluids on request.			
Hydraulic fluid temperature range		θ	°C	–10 to +70, take the permissible viscosity range into account!			
Viscosity range		ν	mm^2/s	16 to 160 at operating temperature maximum 800 at pump start with an operating flow maximum 200 at pump start in zero flow condition			
Maximum permissible degree of contamination of the hydraulic fluid, cleanliness level according to ISO 4406 (c)				Class 19/16/13[2]			
Mounting style				Flange mounting			

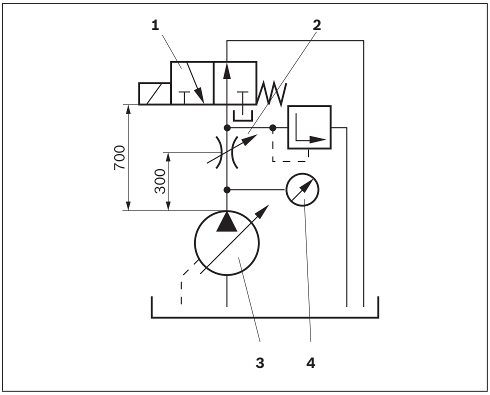
Note
Please contact us if the unit is to be used outside the specified values!

1) Flow deviations (due to manufacturing tolerances) of a max. of + 6 % is possible
2) Cleanliness levels specified for the components must be maintained in the hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see data sheets 50070, 50076, 50081, 50086, 50087 and 50088.

Dynamic characteristics measuring layout

The control times are valid for the measurement build-up as shown. For other set-ups and line lengths the control times will change.

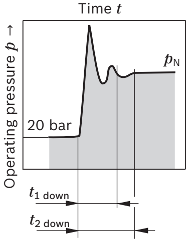
▼ **Schematic**



1 Directional valve (switching time 30 ms)
2 Throttle for setting the pressure during displacement
3 Hydraulic pump
4 Pressure measuring point

Control down

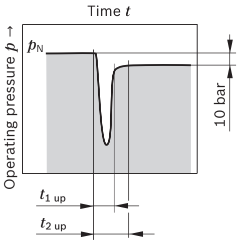
q_v displacement → q_v zero stroke



Pump type	Pressure		Control times (median values)	
	p_N [bar]	p_{max} 1)	$t_{1\ down}$	$t_{2\ down}$
06-10...10	100	150	85	90
06-10...05	50	130	70	110
06-14...07	70	130	80	100
06-14...04	40	100	65	90
20-20...10	100	170	80	125
20-25...10	100	170	80	125
20-25...05	50	120	60	85

Control up

q_v zero stroke → q_v displacement

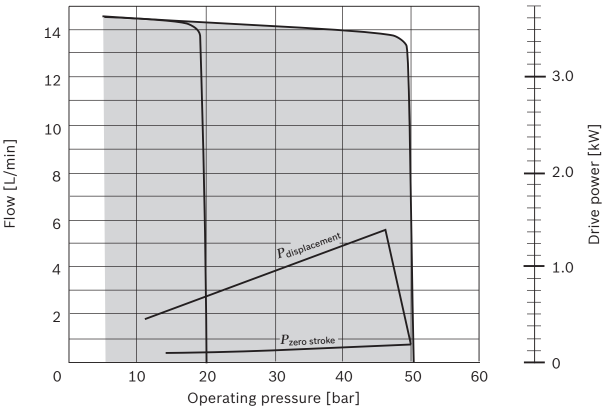


Pump type	Pressure	Control times (median values)	
	p_N [bar]	$t_{1\ up}$	$t_{2\ up}$
06-10...10	100	35	60
06-10...05	50	20	30
06-14...07	70	30	50
06-14...04	40	20	35
20-20...10	100	25	45
20-25...10	100	25	45
20-25...05	50	20	40

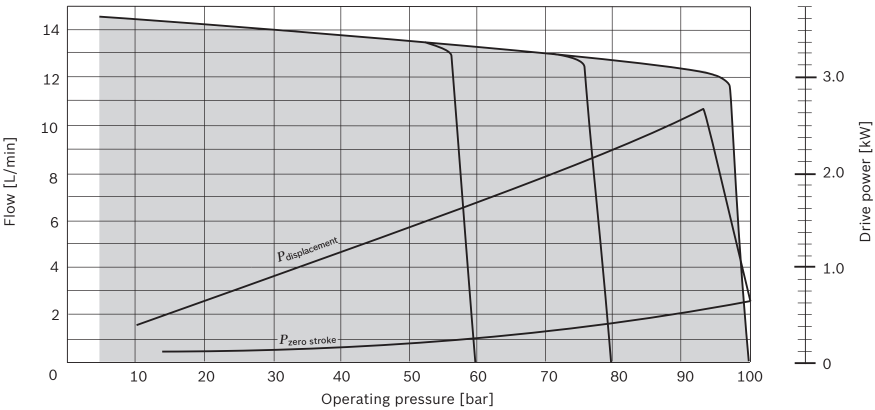
1) Permissible pressure spikes

Characteristics PV7–../06-10

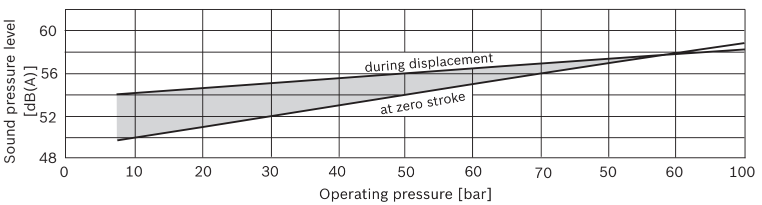
▼ **PV7–../06-10....A0-05...**



▼ **PV7–../06-10....A0-10...**



▼ **Sound pressure level**



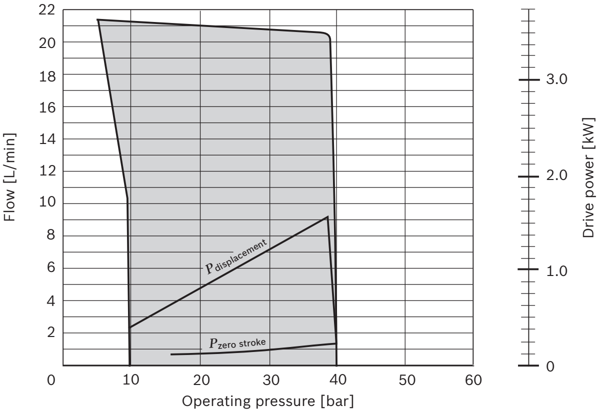
Note

Characteristics measured at n = 1450 rpm; ν = 41 mm^2/s; θ =50 °C

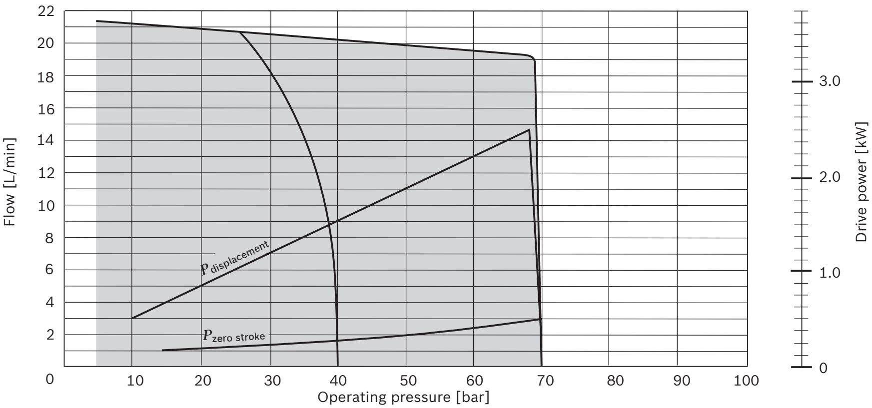
Sound pressure level measured in acoustic room according to DIN 45635, page 26; distance: microphone – pump = 1 m

Characteristics PV7–../06-14

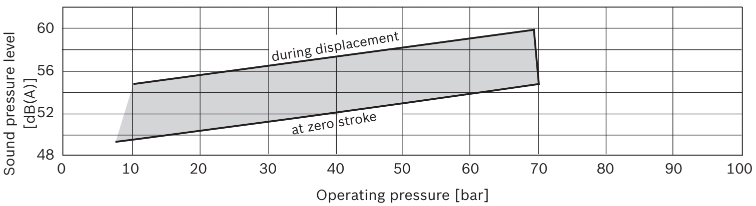
▼ **PV7–../06-14....A0-04...**



▼ **PV7–../06-14....A0-07...**



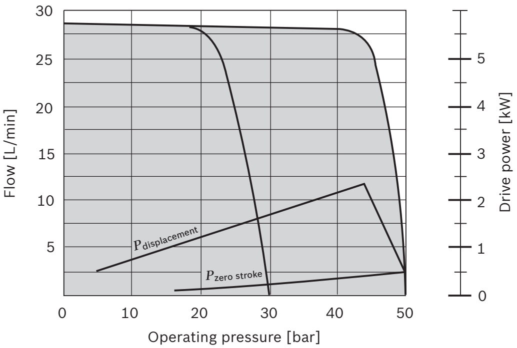
▼ **Sound pressure level**



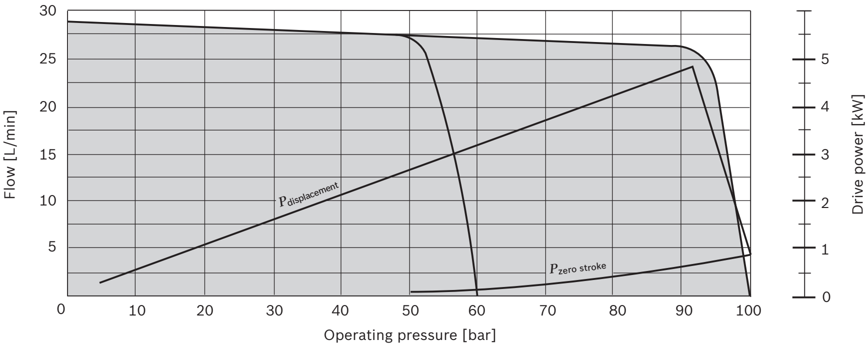
Note
Characteristics measured at n = 1450 rpm ; ν = 41 mm²/s; θ =50 °C
Sound pressure level measured in acoustic room according to DIN 45635, page 26; distance: microphone – pump = 1 m

Characteristics PV7–../20-20

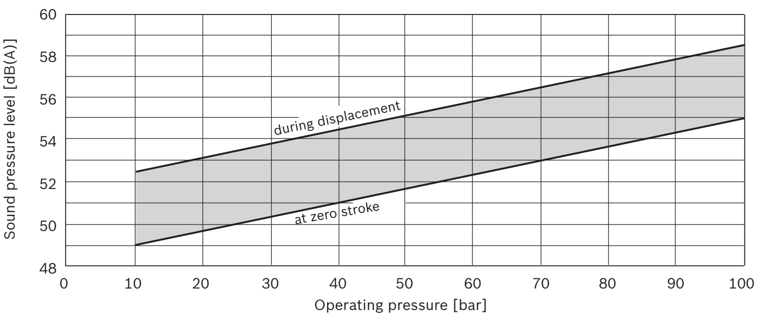
▼ **PV7–../20-20....A0-05...**



▼ **PV7–../20-20....A0-10...**



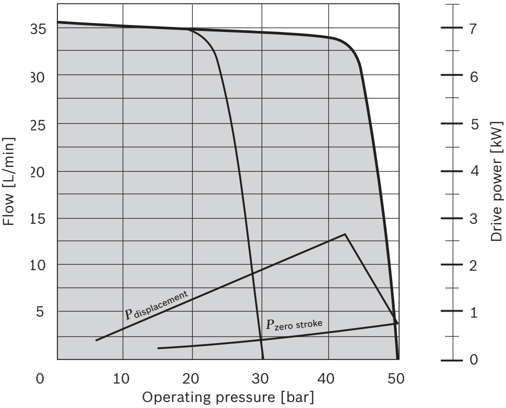
▼ **Sound pressure level**



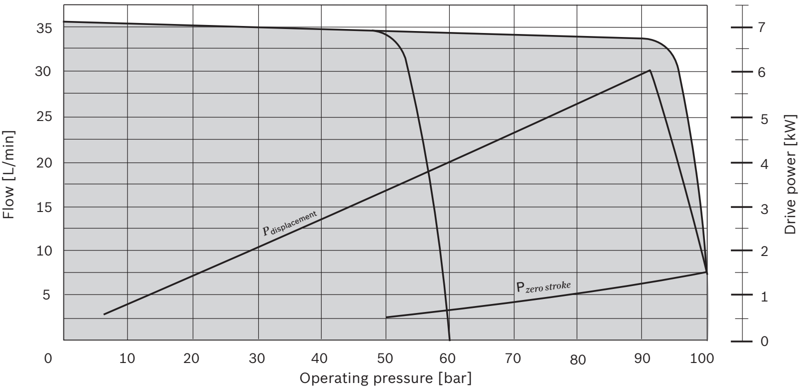
Note
Characteristics measured at n = 1450 rpm ; ν = 41 mm²/s; θ =50 °C
Sound pressure level measured in acoustic room according to DIN 45635, page 26; distance: microphone – pump = 1 m

Characteristics PV7–../20-25

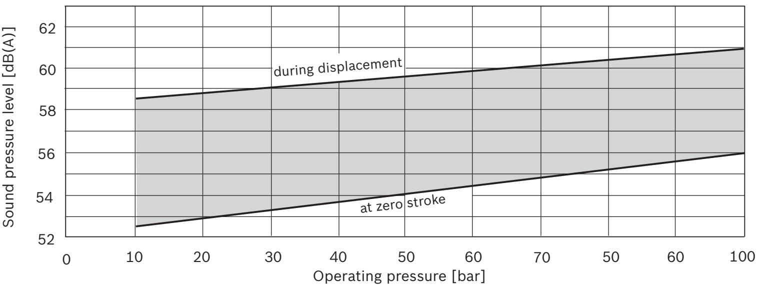
▼ **V7–../20-25....A0-05...**



▼ **V7–../20-25....A0-10...**



▼ **Sound pressure level**



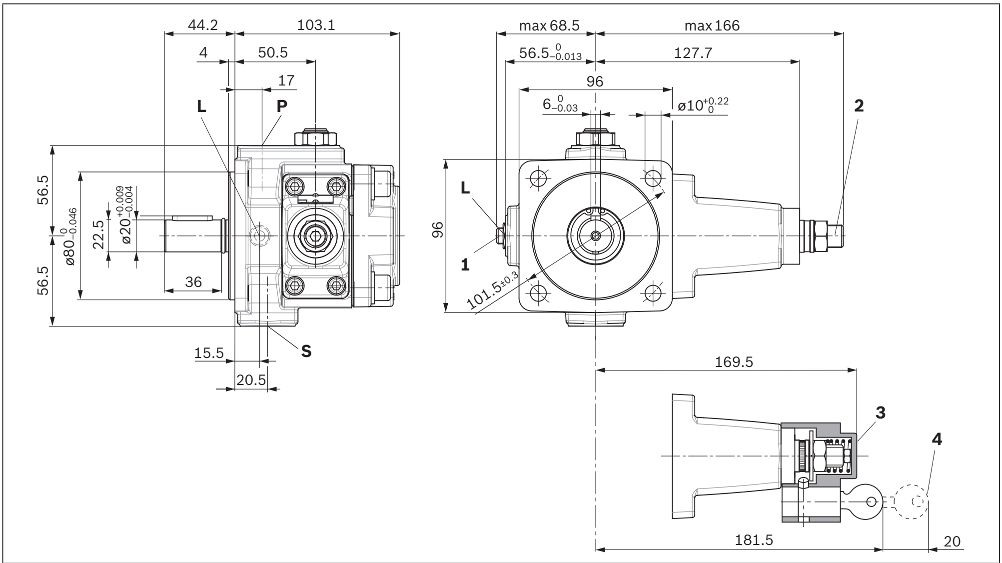
Note

Characteristics measured at n = 1450 rpm ; ν = 41 mm^2/s; θ =50 °C

Sound pressure level measured in acoustic room according to DIN 45635, page 26; distance: microphone – pump = 1 m

6

Dimensions PV7-../06



1 Flow adjustment
2 Pressure adjustment with adjustment screw (Standard), ordering code ...0...
3 Lock (optional), ordering code ...3...
4 Space required to remove key

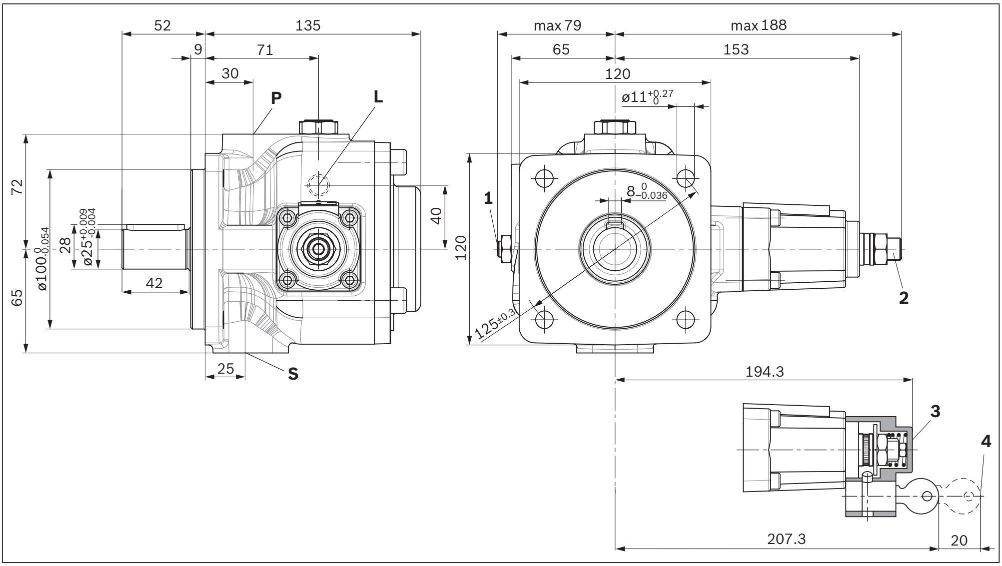
Ports

Designation		Size
S	Suction port	G1/2
P	Pressure port	G3/8
L	Case drain port	G1/4

Notes for adjustments

- Flow adjustment (**1**)
  - at clockwise rotation, decrease of flow
  - at counter clockwise rotation, increase of flow
- Pressure adjustment (**2**)
  - at clockwise rotation, increase of operating pressure
  - at counter clockwise rotation, decrease of operating pressure

Dimensions PV7-../20



1 Flow adjustment
2 Pressure adjustment with adjustment screw (Standard), ordering code ...0...
3 Lock (optional), ordering code ...3...
4 Space required to remove key

Ports

Designation		Size
S	Suction port	G3/4
P	Pressure port	G1/2
L	Case drain port	G1/4

Notes for adjustments

- Flow adjustment (**1**)
  - at clockwise rotation, decrease of flow
  - at counter clockwise rotation, increase of flow
- Pressure adjustment (**2**)
  - at clockwise rotation, increase of operating pressure
  - at counter clockwise rotation, decrease of operating pressure

6

Project planning notes

When using vane pumps we recommend that the following instructions are particularly taken into account.
Project planning, installation and commissioning of the vane pumps require the involvement of qualified personnel.

Technical data
All the technical data are dependent on manufacturing tolerances and are valid with certain operating conditions. Please therefore take into account that minor variations are possible and technical data can be affected by differing conditions (e.g. viscosity).

Characteristics for flow and absorbed power
Please take into account when dimensioning the engine the maximum possible application data.

Noise
The values for sound pressure levels as shown on pages 6 to 9 were measured according to DIN 45635 part 26. That means, only the noise emission of the pump is depicted. Ambient influences (such as place of installation, piping, etc.) are not taken into consideration. The values only refer to one pump.

Note
The power unit design and the influences at the unit‘s final place of installation, result in general in the fact that the sound pressure levels lie 5 to 10 dB(A) higher than that of the pump alone.

Case drain
On page 4 the average external case drain of the pump is stated. Consider, that these values are only meant to be project planning for determining cooler and pipeline sizes. The zero stroke power is the relevant factor for the dimensioning of the reservoir (see page 6 to 9). Restrictions in pipeline cross sections but also the use of a case drain cooler can cause impermissible high pressure spikes in the case drain line.

Pressure safeguarding
Pressure controller are not backups against pressure overload. A separate pressure-relief valve is to be provided in the hydraulic system.

Installation instructions

Fluid reservoir

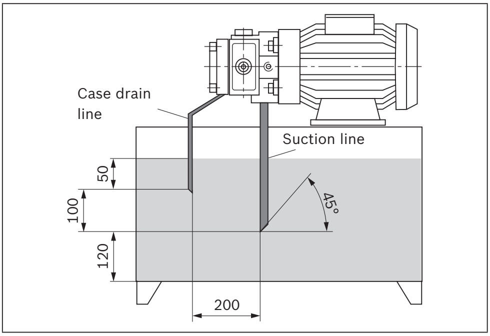
- Match the usable reservoir volume to the operating conditions.
- The permissible fluid temperature may not be exceeded, if required, provide a cooler!

Lines and ports

- Remove protective plugs from the pump.
- We recommend the use of seamless precision steel pipes according to DIN 2391 and removable pipe connections.
- Select the pipe inside diameters according to the port size.
- Throughly clean pipelines and fittings prior to installing.

Proposal for laying of pipelines

Minimum dimension [mm]



- The case drain line to install in such a manner, that the pump cannot drain empty!
- Under no circumstances may case drain and return fluid be directly taken up in the pump suction port!

Filter

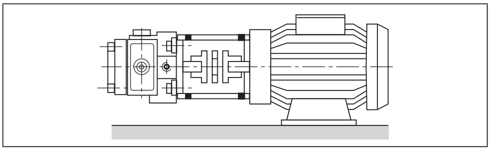
If possible, use return-line filters or pressure-line filters. (Suction filter only in conjunction with low pressure switch/ clogging indicator)

Hydraulic fluid

- Please observe our specifications according to data sheet 90220.
- We recommend brand name hydraulic fluids.
- Do not mix hydraulic fluids of different types since this can result in decomposition and deterioration of the lubricating quality.
- The hydraulic fluid must be replaced at regular intervals relevant to the operating conditions. In connection with this, the oil reservoir must also be cleaned of residues.

Drive

Electric motor + pump support + coupling + pump

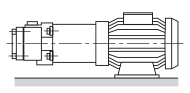


- No radial or axial forces permissible on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Use torsionally flexible couplings.

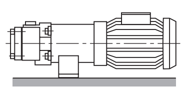
Installation position

Horizontal position preferred

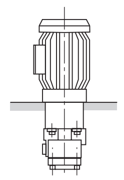
B3



B5



V1



Commissioning instructions

Air bleeding

- All of the PV7...A type vane pumps are self-priming.
- Before initial commissioning , the pump must be air-bled to protect it against damage.
- During the initial commissioning, we recommend to fill the housing through the case drain line. Take into account the filter grade! This increases operating safety and prevents wear in the case of unfavorable installation conditions.
- If the pump flow is not bubble-free after approx. 20 seconds, the system has to be rechecked. After the operating values have been reached, check the pipe connections for leakage and check the operating temperature.

Commissioning

- Check whether the system is thoroughly and properly installed.
- Take into account the motor and pump direction of rotation arrows.
- Start the pump without load and let the flow run without pressure for a few seconds in order to provide sufficient lubrication.
- **On no account let the pump run without hydraulic fluid!**

Note

- Adjustment, maintenance and repair of the pump may only be carried out by authorized, trained and instructed personnel!
- Use only original Rexroth spare parts!
- The pump may only be operated within the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. mounting and removal) switch the system to zero pressure and isolate from the mains supply!
- Unauthorized conversions and changes, affecting the safety and function are not permissible!
- Mount safety devices (e.g., coupling protection)!
- Do not remove any existing safety devices!
- The generally valid safety and accident prevention regulations must be adhered to!

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Notes

6

Notes

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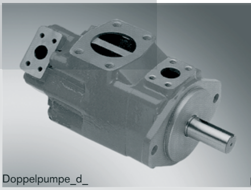
Rexroth
Bosch Group

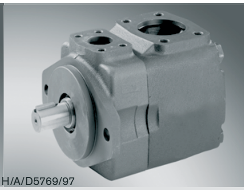
Fixed displacement vane pumps

RE 10335/10.05
Replaces: 11.02

Types PVV and PVQ


Doppelpumpe_d_

Double pump
Type PVV21-1X/...A15DD..


H/A/D5769/97

Single pump
Type PVV2-1X/...A15D..

Nominal sizes 18 to 193
Series 1X
Maximum operating pressure 210 bar
Maximum displacement 18 to 193 cm^3

Overview of contents

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Technical data	6; 7
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Drive power	9
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• PVV / PVQ 2; 4; 5	12
• PVV / PVQ 2…K..	13
• PVV / PVQ 4…K..	14
• PVV / PVQ 5…K..	15
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• PVV / PVQ 54	17
Drive shaft BS 2 to 54	18
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Accessories	20
Engineering and commissioning guidelines	21
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For information regarding the available spare parts see:
www.boschrexroth.com/spc

Features

– Fixed displacement
– Long bearing life due to hydraulically unloaded shaft
– Low wear due hydraulically unloaded vanes
– Low operating noise
– Easy to service due to exchangable pump cartridges
– Good efficiency
– Optional positioning of the pressure connection
– Clockwise or anti-clockwise direction of rotation
– Drive shaft optionally; cylinderical or splined

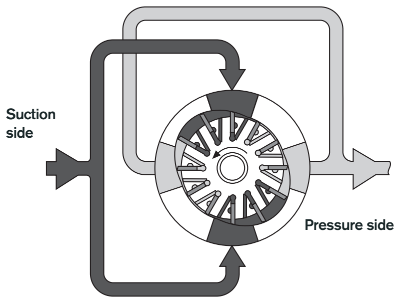
Double pump:
– Very compact design
– The position of the pressure connections can be individually selected

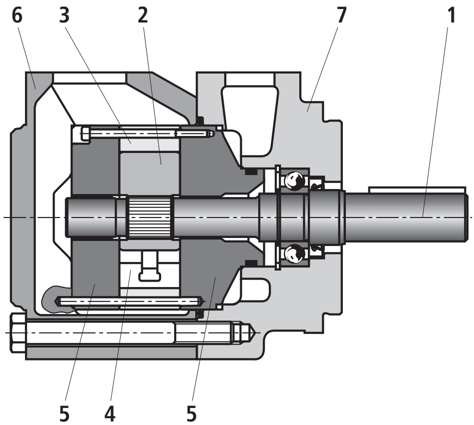
Function, section

The PVV and PVQ hydraulic pumps are fixed displacement vane pumps.

The rotor (2) is fitted onto the splines of the drive shaft (1) which rotates inside the stator ring (3). The vanes (4) are fitted into slots in the rotor and are pressed onto the inner surface of the stator ring by centrifugal force as the rotor turns. The displacement chambers are sealed on the sides by the control plates (5). Due to the double extentric form of the stator ring there are two pressure and two suction chambers opposite to each other. The drive shaft is thereby hydraulically unloaded. It only has to carry the torque forces. The vanes are partially unloaded as they pass through the suction areas. This unloading results in reduction in wear and makes it possible to obtain a high efficiency.

By simply removing the cover (6) it is possible to remove the pump cartridge (comprising of rotor, vanes, stator ring and control plates) without having to remove the housing (7) from the pump mounting bracket. This makes it possible to quickly repair and maintain the pump.

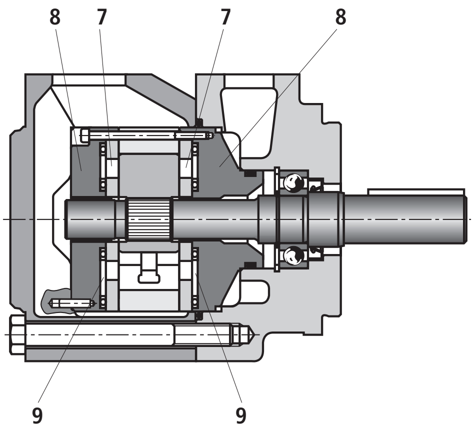




Type PVV..-1X/...A15D...

The design of the type PVQ pump makes it particularly suitable for mobile applications.

The special design of the control plates makes it possible to compensate for the heat expansion of the rotor and to act against sudden pressure changes. Due to the division of the control plates (7) into flexible discs and the cover plates (8), counter pressure chambers (9) are created that are balanced against the pressures that are in the displacement chambers. Due to this, the optimum clearance between the rotor and the flexible discs is guaranteed and thus the best volumetric efficiency is made possible.

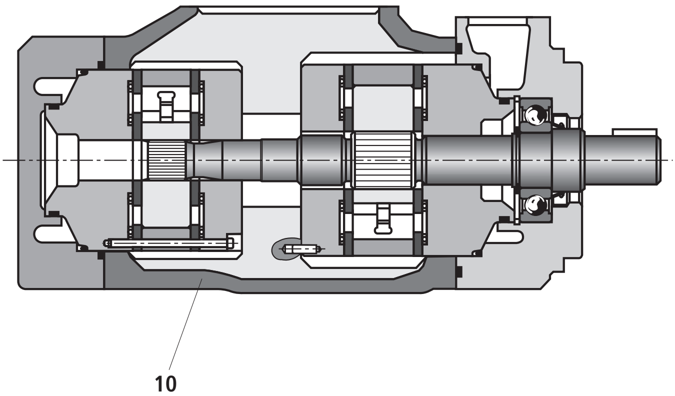


Type PVQ..1X/...A15D...

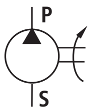
Function, section

The PVV and PVQ double pumps are created by fitting a scond pump cartridge onto a mutual shaft. The oil inlet is via a common suction connection in the centre housing (10). The oil outputs is separate via the pump cartridge. The pressure connection for the front pump cartridge is in the flange housing and for the rear pump cartridge in the cover plate.

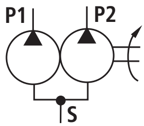
The largest pump cartridge is always fitted at the flange housing end. It is not possible to have identically sized pump cartridges as a double pump.



Symbols



Single pump



Double pump

Ordering details

PV		–1X/			15						*

Pump type
Industrial version = **V**
Mobile version = **Q**

Build size
See table on page 5
(e.g. single pump = **2**
Double pump = **52**)

Component series = **1X**
Component series 10 to 19 (10 to 19, unchanged installation and connection dimensions)

Displacement flow
See table on page 5
(e.g. 55.2 cm^3 = **055**)

Dirrection of rotation (viewed on the shaft end)
Clockwise = **R**
Anti-clockwise = **L**

Shaft end
Cylindrical drive shaft (standard) = **A**[1)]
Cylinderical drive shaft (strengthened version) only BS2 to BS54 = **B**
Splined drive shaft = **J**

Connections
SAE suction and pressure connections, UNC fixing screws = **15**

Position of the pressure connection on the flange (when viewed on the cover)
Top (0° from the inlet) = **D**
Right (90° to the right of the inlet) = **R**
Left (90° to the left of the inlet) = **L**
Bottom (180° from the inlet) = **U**

Only for double pumps
Pressue connection location on the cover
(viewed on the cover)

BS 21 to 52:
D = Top (45° to the right of the inlet)
R = Right (135° to the right of the inlet)
L = Left (45° to the left of the inlet)
U = Bottom (135° to the left of the inlet)

BS 54:
D = Top (0° from the inlet)
R = Right (90° to the right of the inlet)
L = Left (90° to the left of the inlet)
U = Bottom (180° from the inlet)

Seal material
M = NBR seals
V = FKM seals

Flange version
B = 101-2 (SAE-B); (BS1; 2; 21)
C = 127-2 (SAE-C); (BS4; 5 and BS41 to 54)

Through drive
No code = Without through drive
K01 = 82-2,16-4 (SAE-A, 9T)
K02 = 101-2,22-4 (SAE-B, 13T)
K07 = 127-2,32-4 (SAE-C, 14T)

Further details in clear text

Ordering example
Single pump: Industrial version (also in mobile version)
PVV 2-1X/055RA15DMB
Doble pump: Mobile version (also in industrial version)
PVQ 52-1X/154-068RB15DDMC

1) Not available for through drive pumps

Ordering details (build size, displacement flows)

Single pumps	
Build size	**Displacement flows**
1	18,0 cm^3 = **018** 27,4 cm^3 = **027** 36,4 cm^3 = **036** 39,5 cm^3 = **040** 45,9 cm^3 = **046**
2	40,1 cm^3 = **040** 45,4 cm^3 = **045** 55,2 cm^3 = **055** 60,0 cm^3 = **060** 67,5 cm^3 = **068**
4	69,0 cm^3 = **069** 81,6 cm^3 = **082** 97,7 cm^3 = **098** 112,7 cm^3 = **113** 121,6 cm^3 = **122**
5	138,6 cm^3 = **139** 153,5 cm^3 = **154** 162,2 cm^3 = **162** 183,4 cm^3 = **183** 193,4 cm^3 = **193**

Double pumps		
Build size	**Flange side**	**Cover side**
	Displacement flows	
21	40,1 cm^3 = **040** 45,4 cm^3 = **045** 55,2 cm^3 = **055** 60,0 cm^3 = **060** 67,5 cm^3 = **068**	18,0 cm^3 = **018** 27,4 cm^3 = **027** 36,4 cm^3 = **036** 39,5 cm^3 = **040** 45,9 cm^3 = **046**
41	69,0 cm^3 = **069** 81,6 cm^3 = **082** 97,7 cm^3 = **098** 112,7 cm^3 = **113** 121,6 cm^3 = **122**	18,0 cm^3 = **018** 27,4 cm^3 = **027** 36,4 cm^3 = **036** 39,5 cm^3 = **040** 45,9 cm^3 = **046**
42	69,0 cm^3 = **069** 81,6 cm^3 = **082** 97,7 cm^3 = **098** 112,7 cm^3 = **113** 121,6 cm^3 = **122**	40,1 cm^3 = **040** 45,4 cm^3 = **045** 55,2 cm^3 = **055** 60,0 cm^3 = **060** 67,5 cm^3 = **068**
51	138,6 cm^3 = **139** 153,5 cm^3 = **154** 162,2 cm^3 = **162** 183,4 cm^3 = **183** 193,4 cm^3 = **193**	18,0 cm^3 = **018** 27,4 cm^3 = **027** 36,4 cm^3 = **036** 39,5 cm^3 = **040** 45,9 cm^3 = **046**
52	138,6 cm^3 = **139** 153,5 cm^3 = **154** 162,2 cm^3 = **162** 183,4 cm^3 = **183** 193,4 cm^3 = **193**	40,1 cm^3 = **040** 45,4 cm^3 = **045** 55,2 cm^3 = **055** 60,0 cm^3 = **060** 67,5 cm^3 = **068**
54	138,6 cm^3 = **139** 153,5 cm^3 = **154** 162,2 cm^3 = **162** 183,4 cm^3 = **183** 193,4 cm^3 = **193**	69,0 cm^3 = **069** 81,6 cm^3 = **082** 97,7 cm^3 = **098** 112,7 cm^3 = **113** 121,6 cm^3 = **122**

Single pumps with through drive	
Build size	**Displacement flows**
2	40,1 cm^3 = **040** 45,4 cm^3 = **045** 55,2 cm^3 = **055** 60,0 cm^3 = **060** 67,5 cm^3 = **068**
4	69,0 cm^3 = **069** 81,6 cm^3 = **082** 97,7 cm^3 = **098** 112,7 cm^3 = **113** 121,6 cm^3 = **122**
5	138,6 cm^3 = **139** 153,5 cm^3 = **154** 162,2 cm^3 = **162** 183,4 cm^3 = **183** 193,4 cm^3 = **193**

6

Technical data (for applications outside these parameters, please consult us!)

General

Mounting style	Flange mounting to SAE J744
Pipe connections	SAE flange version (fixing threads: UNC)
Direction of rotation	Clockwise or anti-clockwise
Direction of flow	Inlet and outlet are independent of the direction of rotation
Installation	Optional, inlet connection preferably at the top
Drive	Direct, co-axial drive; radial and axial forces cannot be taken up

Weight														
	BS	1	2	2K	4	4K	5	5K	21	41	42	51	52	54
	kg	12	14,8	19,4	23	28,7	34	38,1	20	34	34,5	43	46	54

Hydraulic

Build sizes 1 and 2 (pump cartridge)			**BS1**					**BS2**				
Nominal size (≈ V in cm^3)		NS	18	27	36	40	46	40	45	55	60	68
Max. flow at $n = 1500\ min^{-1}$, $p = 0{,}7$ bar and $\nu = 25\ mm^2/s$	q_v	l/min	26	39	53	59	70	59	66	80	89	100
Operating pressure, absolute								When using fluids containing water and phosphate ester min. 0,9 bar				
Inlet	$p_{min\text{-}max}$	bar	0.83 to 2.4 (recommended: 1...1.35)									
Outlet continuous for PVV	p_{max}	bar	210	210	210	160	140	175	175	175	175	175
Outlet continuous for PVQ	p_{max}	bar	210	210	210	160	140	210	210	210	210	210
Peak	p_{max}		A max. of 10% continuous output pressure; not longer than 0.5 seconds									
RPM	n_{min}	min^{-1}	600					600				
*) At 1 bar	n_{max} bei PVV	min^{-1}*)	1800					1800				
Inlet pressure	n_{max} bei PVQ	min^{-1}*)	2700					2700		2500		
Min. drive power required at $\Delta p \approx 0$ bar, $n \approx 1.450\ min^{-1}$		kW	1.1	1.5	2,2					3		4
Pressure fluid For use with the above stated operating data			HLP mineral oil to DIN 51524 part 2									
Only with FKM seals („V")	Perm. p_{max}	bar	210	210	210	160	140	175	175	175	175	175
Phosphate ester (HFD-R)	Perm. n_{max}	min^{-1}	1200									

Build sizes 4 and 5 (pump cartridge)			**BS4**					**BS5**				
Nominal sizes (≈ V in cm^3)		NS	69	82	98	113	122	139	154	162	183	193
Max. flow at $n = 1500\ min^{-1}$, $p = 0{,}7$ bar and $\nu = 25\ mm^2/s$	q_v	l/min	101	120	141	167	177	203	223	234	267	285
Operating pressure, absolute								When using fluids containing water and phosphate ester min. 0,9 bar				
Inlet	$p_{min\text{-}max}$	bar	0.83 to 2.4 (recommended: 1...1,35)									
Outlet continuous for PVV	p_{max}	bar	175	175	175	175	175	175	175	175	175	175
Outlet continuous for PVQ	p_{max}	bar	210	210	210	210	210	175	175	175	175	175
Peak	p_{max}		A max. of 10% continuous output pressure; not longer than 0.5 seconds									
RPM	n_{min}	min^{-1}	600					600				
*) At 1 bar	n_{max} bei PVV	min^{-1}*)	1800					1800				
Inlet pressure	n_{max} bei PVV	min^{-1}*)	2500			2400		2200				
Min. drive power required At $\Delta p \approx 0$ bar, $n \approx 1.450\ min^{-1}$		kW	4		5.5		7.5			11		

Technical data (for applications outside these parameters, please consult us!)

Continuation from page 6

Hydraulic

Build sizes 4 and 5 (pump cartridge)			**BS4**					**BS5**				
Pressure fluid For use with the operating data shown on page 7			HLP mineral oil DIN 51524 part 2									
Only with FKM seals („V“)	Perm. p_{max}	bar	175	175	175	175	175	175	175	175	175	175
Phosphate ester (HFD-R)	Perm. n_{max}	min^{-1}	1200									
Pressure fluid temperature range		°C	–10 to +70. (recommended: +30 to +60) Take into account the permissible viscosity range									
Viscosity range		mm^2/s	13 to 860 (recommended: 13 to 54)									
Max. permissible degree of pressure fluid contamination Cleanliness class to ISO 4406 (E) /(c)			Class 20/18/15 [1]									
Alternative pressure fluids			HFB					HFC				
Max. permissible operating pressure		bar	70					140				
			Only in conjunction with a return filter with a retention rate of $\beta_{10} \geq 100$ or more. The permissible pressure fluid temperature range is +15 °C to +50 °C. Maximum permissible RPM: 1200 min^{-1}									

Please consult us before using our fixed displacement vane pumps with these pressure fluids!

[1] The cleanliness class stated for the components must be adhered to in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

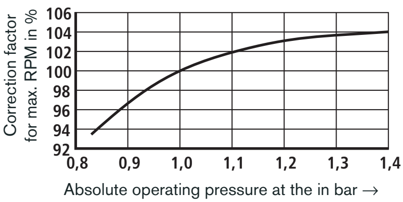
For the selection of filters see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

On pages 6 and 7 the stated values for the maximum RPM are valid for an absolute pressue of 1 bar at the inlet.

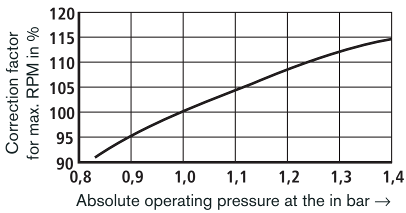
The maximum permissible RPM has to be corrected in accordance with the following diagrams in relation to the absolute pressure present at the inlet.

PVV/PVQ

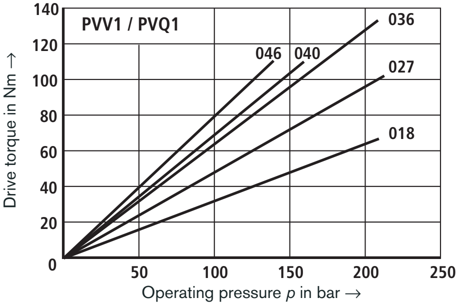
BS1; BS2; BS4; BS21; BS41; BS42

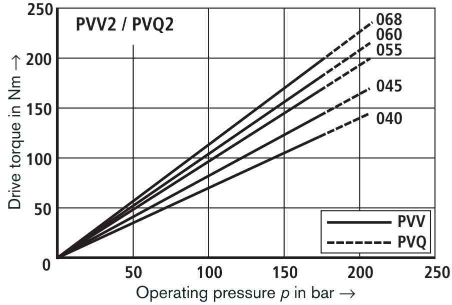


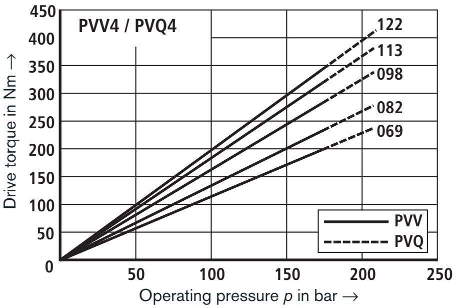
BS5; BS51; BS52; BS54

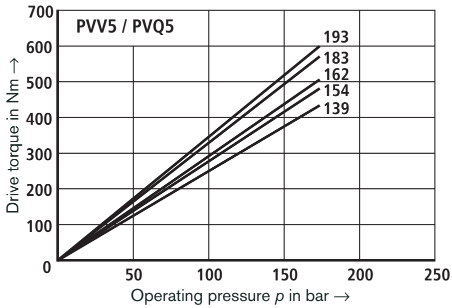


Drive torque (measured with $\nu = 41\ mm^2/s$; $\vartheta = 50\ °C$)



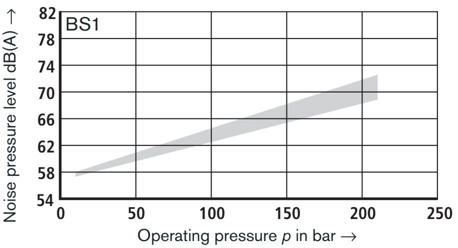


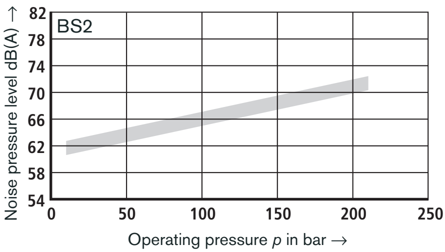


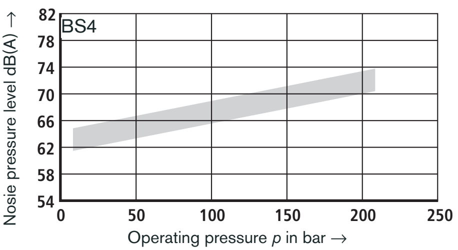


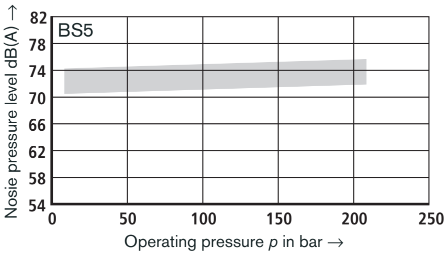
Nosie pressure level measured in a low noise room to DIN 45635 part 26.

Distance of noise sensor to pump = 1 m. $\nu = 41\ mm^2/s$; $n = 1500$ and $\vartheta = 50\ °C$





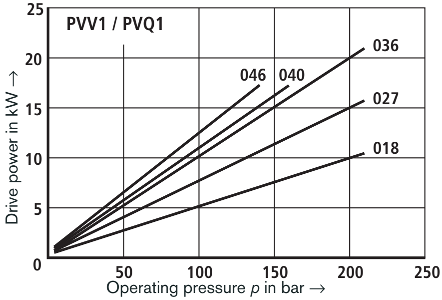


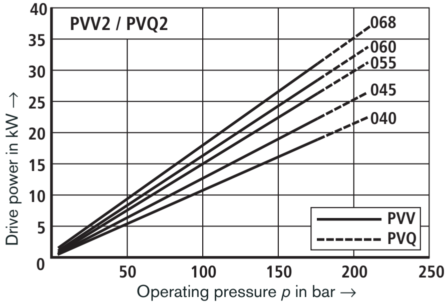


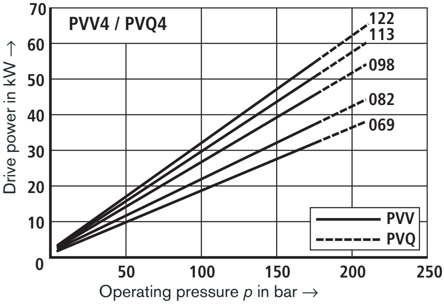
The noise pressure levels for double pumps lie on average 1 to 3 dB(A) above the values for single pumps.

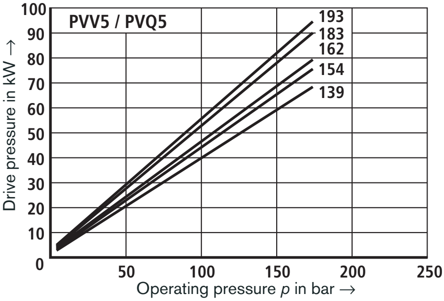
Drive power (measured at $\nu = 41\ mm^2/s$; $\vartheta = 50\ °C$)

$n = 1500\ min^{-1}$

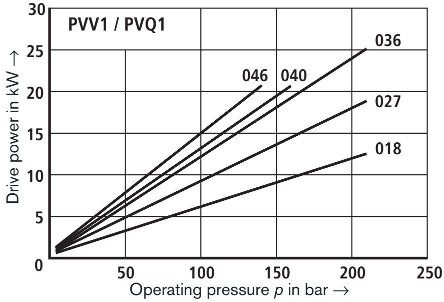


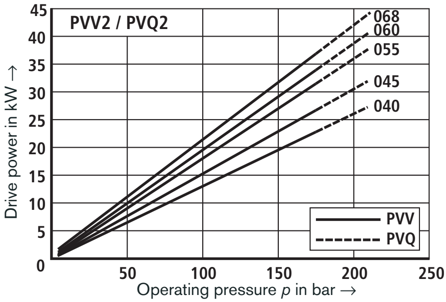


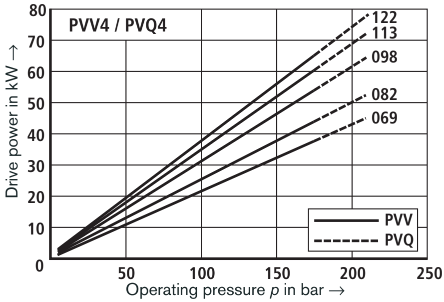


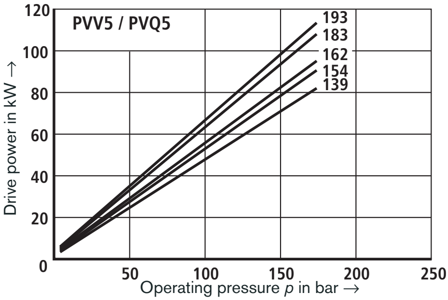


$n = 1800\ min^{-1}$

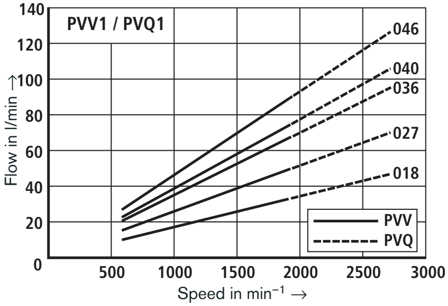


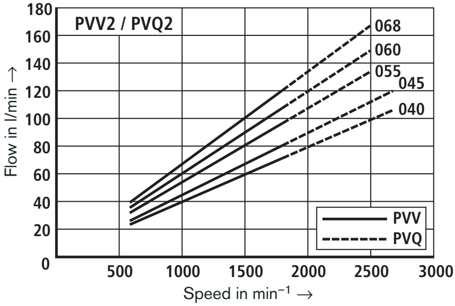


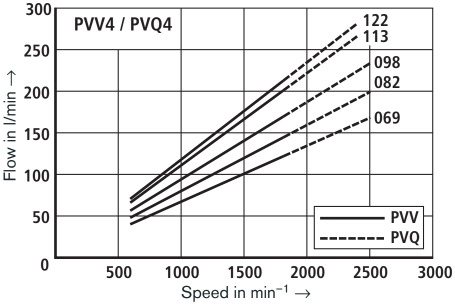


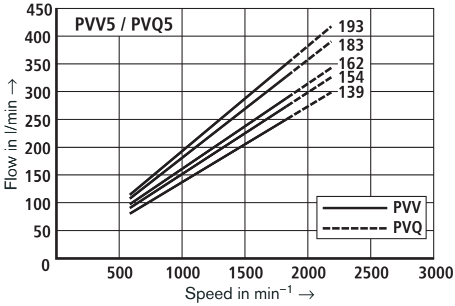


Flow, speed dependent (measured at $\nu = 41\ mm^2/s$; $\vartheta = 50\ °C$; $p = 7$ bar)

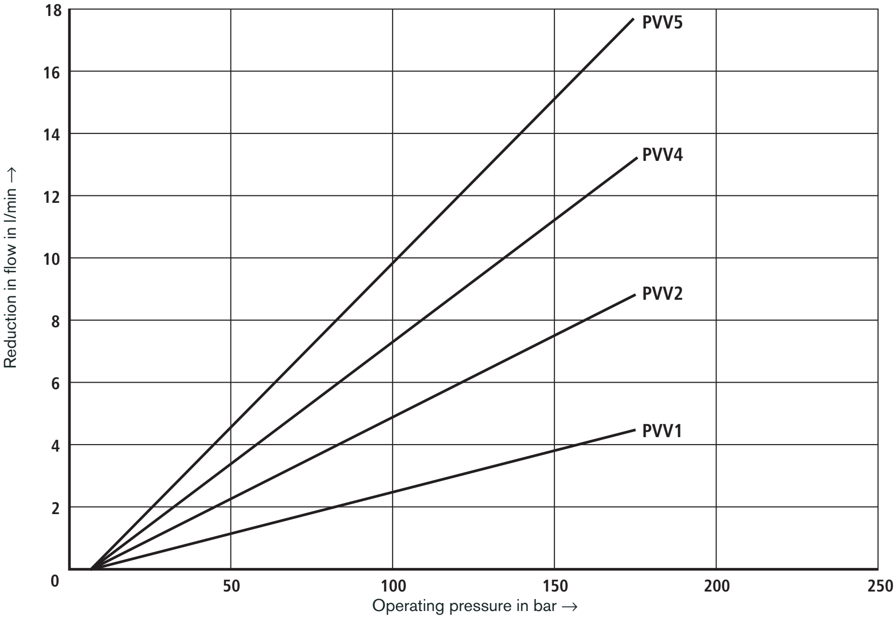




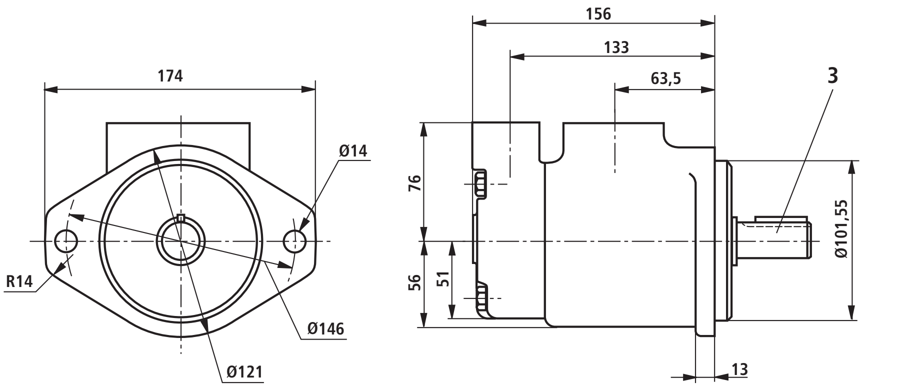


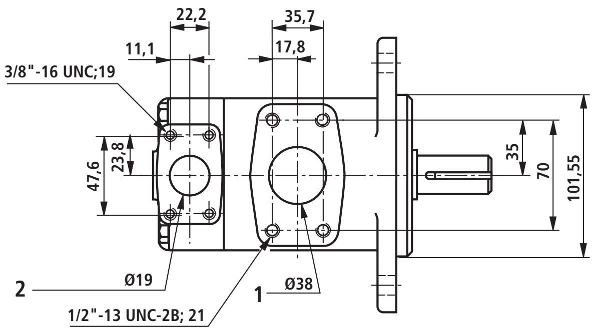


Flow losses, pressure dependent (measured at $\nu = 41\ mm^2/s$; $\vartheta = 50\ °C$)



Unit dimensions: single pumps PVV / PVQ, BS1 (nominal dimensions in mm)



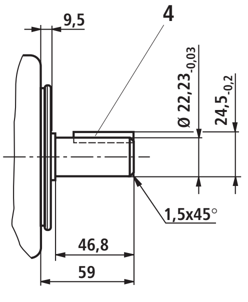


1 Suction connection SAE 1 1/2“
2 Pressure connection SAE 3/4“
3 Cylinderical drive shaft

Shaft for BS1

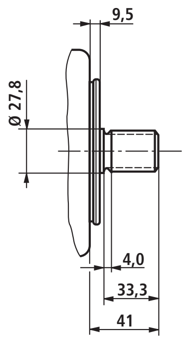
Version A
Cylinderical drive shaft
(standard)

4 Key □ 4.76 x 31.8



Permissible torque 250 Nm

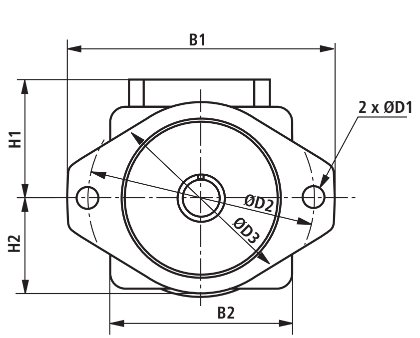
Version J
Splined drive shaft SAE-B 7/8“
13 teeth 16/32DP
Tooth thickness t = 2.261

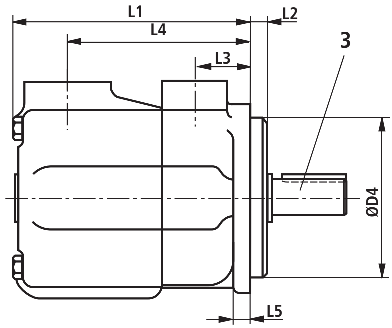


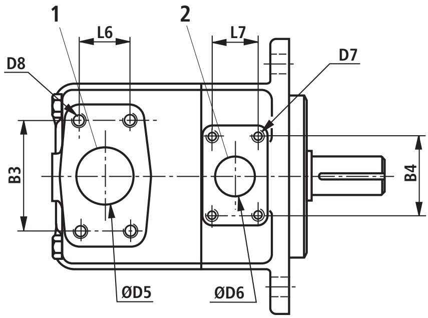
Permissible torque 316 Nm

6

Unit dimensions: single pumps PVV / PVQ, BS2; 4; 5 (nominal dimensions in mm)







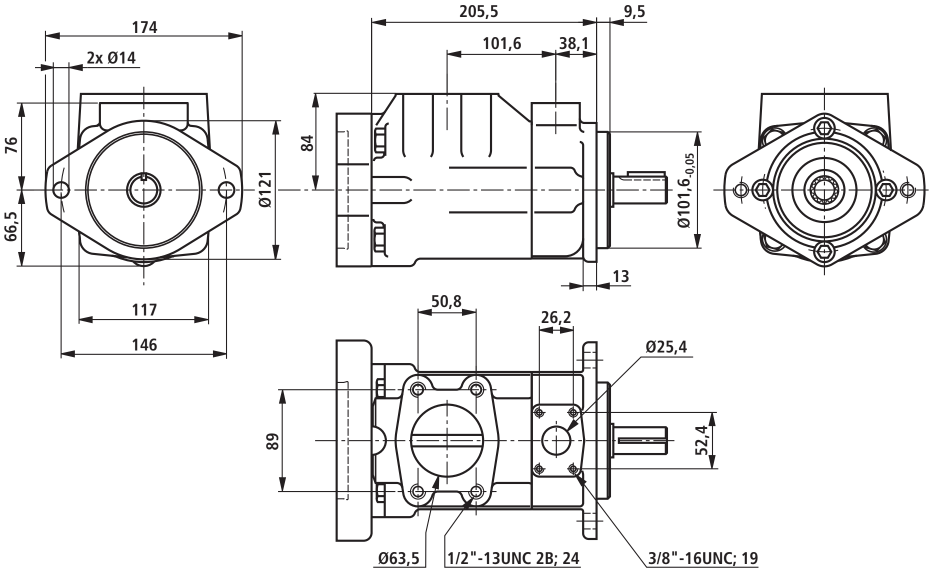
1 Suction connection
2 Pressure connection
3 Cylinderical drive shaft (for drive shaft dimensions see page 17)

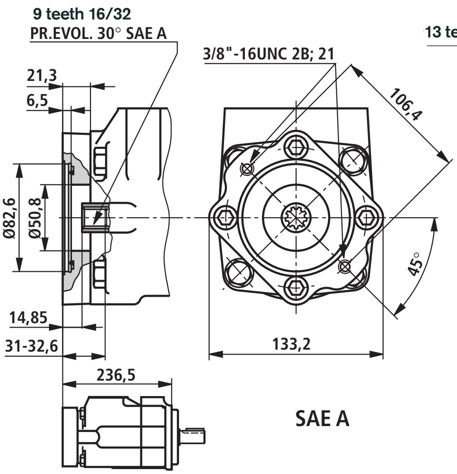
BS	Suction connection	ØD5	$D8_{-2B}$	B3	L6	L4	H1
2	SAE 1 1/2"	38	1/2"-13UNC; 22	69,9	35,7	120,6	76,2
4	SAE 2"	50,8	1/2"-13UNC; 23,8	77,7	42,8	125,5	82,6
5	SAE 3"	76,2	5/8"-11UNC; 28,6	106,3	61,9	153,2	93,6

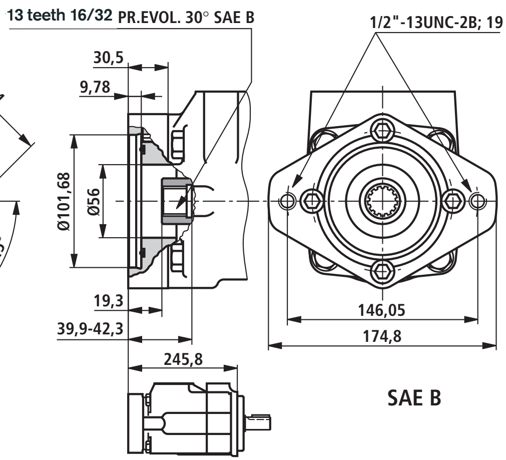
BS	Pressure connection	ØD6	$D7_{-2B}$	B4	L7	L3
2	SAE 1"	25,4	3/8"-16UNC; 19	52,4	26,2	38,1
4	SAE 1 1/4"	31,8	7/16"-14UNC; 22	58,7	30,1	38,1
5	SAE 1 1/2"	38,1	1/2"-13UNC; 23,8	69,9	35,7	42,9

BS	Mounting flange	B1	ØD1	ØD2	ØD3	$ØD4_{-0,05}$	L2	L5	B2	L1	H2
2	SAE-B	174	14	146	121	101,6	9,5	13	117	163	64
4	SAE-C	212	17,5	181	148	127	9,5	16	140	186	70
5	SAE-C	212	17,5	181	148	127	12,7	16	159	216	83

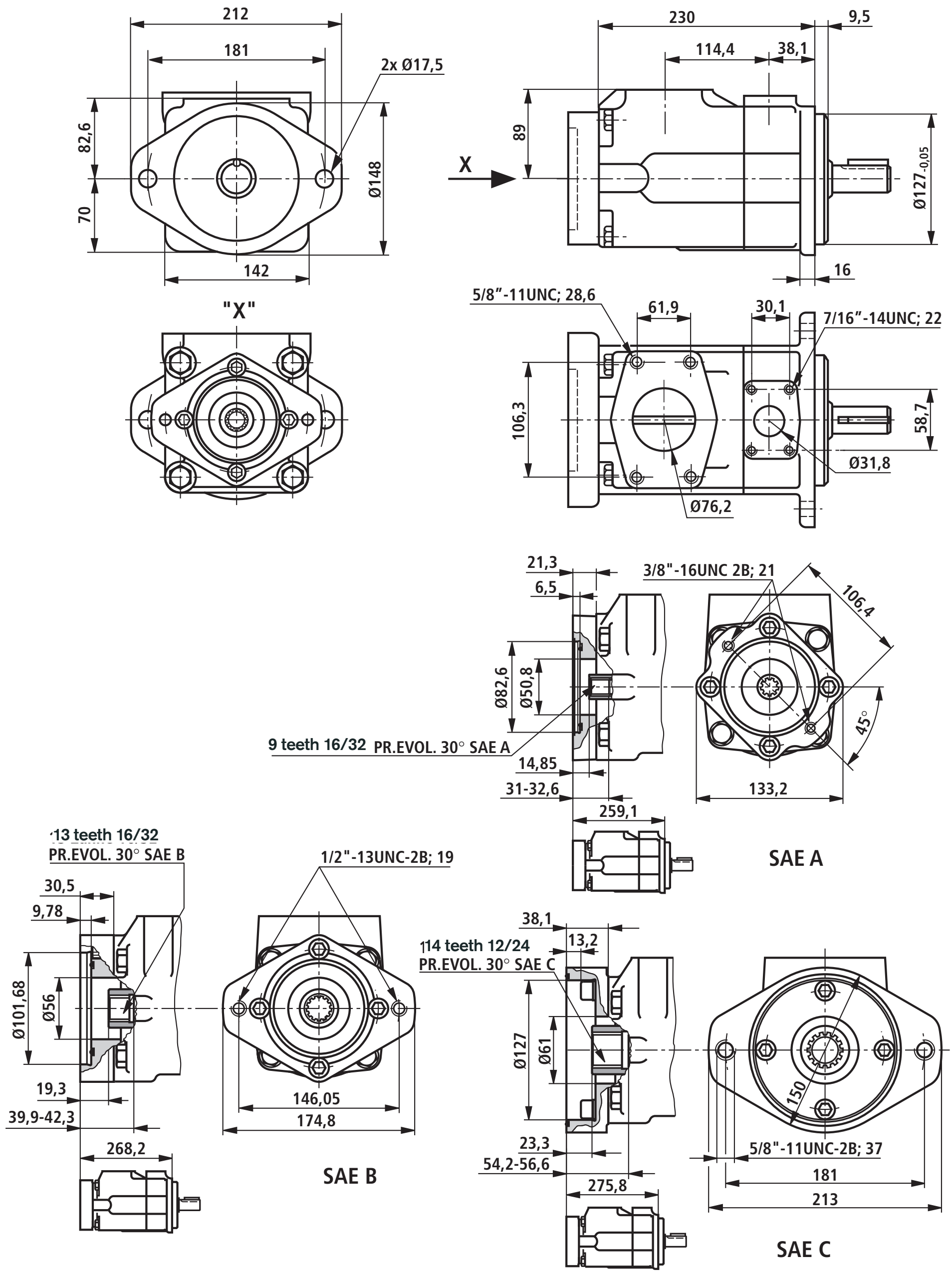
Unit dimensions: PVV / PVQ 2…K.. – with through drive (nominal dimensions in mm)



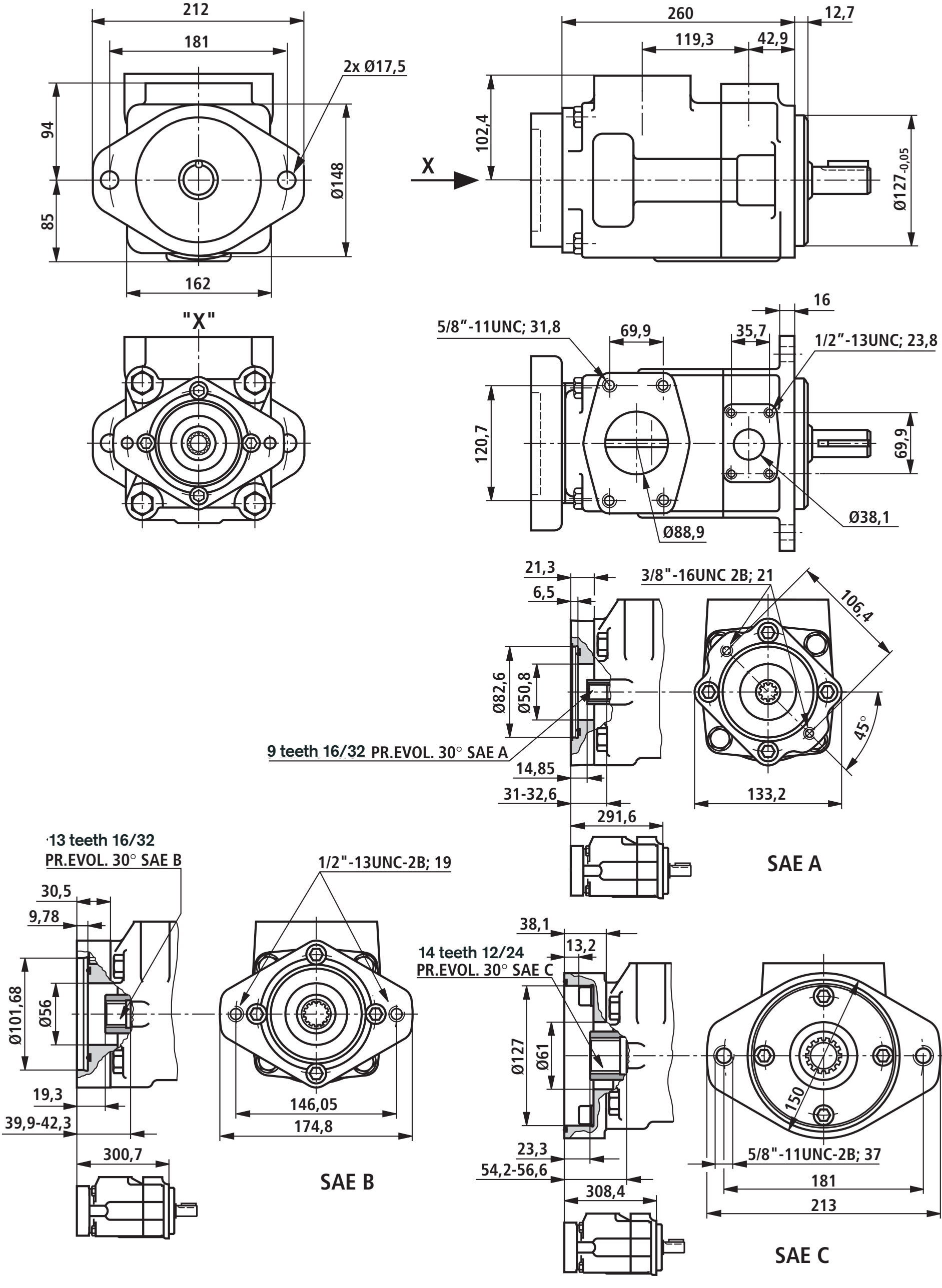




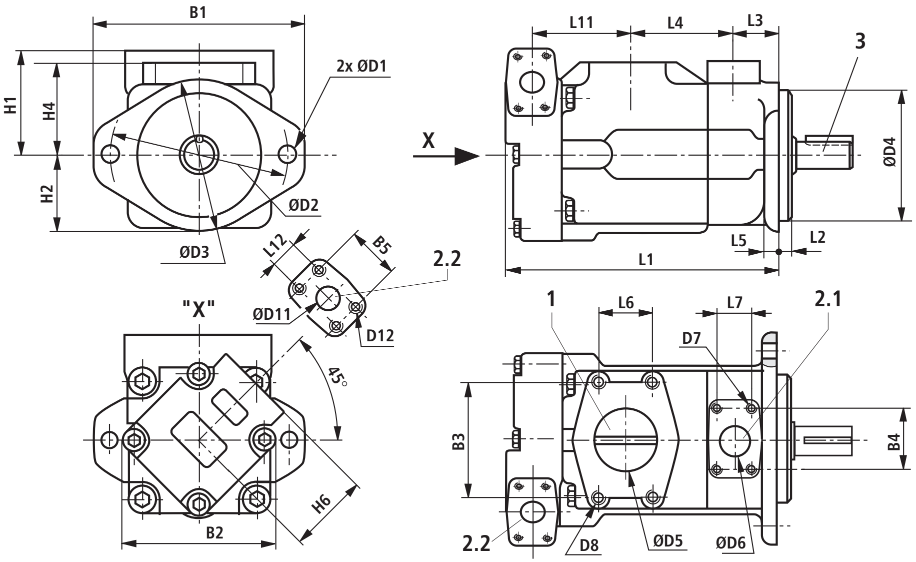
Unit dimensions: PVV / PVQ 4…K.. – with through drive (nominal dimensions in mm)



Unit dimensions: PVV / PVQ 5…K.. – with through drive (nominal dimensions in mm)



Unit dimensions: double pumps PVV / PVQ, BS21; 41; 42; 51; 52 (nominal dimensions in mm)



BS	Mounting flange	B1	ØD1	ØD2	ØD3	ØD4 $_{-0,05}$	L2	L5
21	SAE-B	174	14	146	121	101,6	9,5	13
41; 42	SAE-C	212	17,5	181	148	127	9,5	16
51; 52	SAE-C	212	17,5	181	148	127	12.7	16

BS	Suction connection	ØD5	D8 $_{-2B}$	B3	L6	L4	H1
21	SAE 2 1/2"	63,5	1/2"-13UNC; 23,8	88,5	50,8	101,6	84,1
41; 42	SAE 3"	76,2	5/8"-11UNC; 28,6	106,3	61,9	114,4	88,9
51; 52	SAE 3 1/2"	88,9	5/8"-11UNC; 31,8	120,7	69,9	119,3	102,4

BS	Pressure connection - flange side	ØD6	D7 $_{-2B}$	B4	L7	L3	H4
21	SAE 1"	25,4	3/8"-16UNC; 19,1	52,4	26,2	38,1	76,2
41; 42	SAE 1 1/4"	31,8	7/16"-14UNC; 21,6	58,7	30,1	38,1	82,6
51; 52	SAE 1 1/2"	38,1	1/2"-13UNC; 23,8	69,9	35,7	42,9	93,6

BS	Pressue connection - cover side	ØD11	D12 $_{-2B}$	B5	L12	L11	H6	B2	L1	H2
21	SAE 3/4"	19,1	3/8"-16UNC; 19,1	47,6	22,2	88	76,2	132	252	64
41	SAE 3/4"	19,1	3/8"-16UNC; 19,1	47,6	22,2	99,5	74,7	140	275	70
42	SAE 1"	25,4	3/8"-16UNC; 19,1	52,4	26,2	109,5	76,2	143	288	74
51	SAE 3/4"	19,1	3/8"-16UNC; 19,1	47,6	22,2	119,5	74,7	162	306	85
52	SAE 1"	25,4	3/8"-16UNC; 19,1	52,4	26,2	135,8	76,2	162	324	85

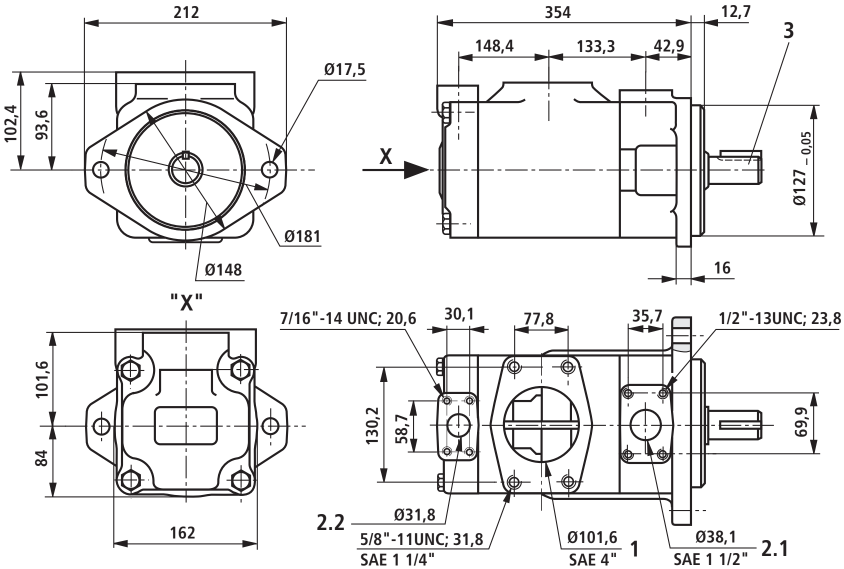
1 Suction connection

2.1 Pressue connection, flange side

2.2 Pressue connection, cover side

3 Cylinderical drive shaft (for drive shaft dimensions see page 18)

Unit dimensions: double pumps PVV / PVQ, BS54 (nominal dimensions in mm)



1 Suction connection

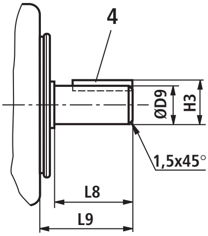
2.1 Pressure connection, flange side

2.2 Pressue connection, cover side

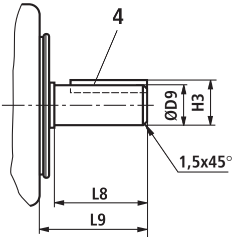
3 Cylindrical drive shaft (for drive shaft dimensions see table)

4 Key (for dimensions see table)

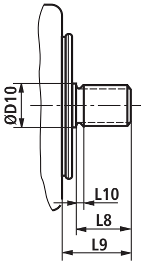
Drive shaft for BS2 to 54



Version A
Cylindrical drive shaft
(standard)



Version B
Cylindrical drive shaft
(strengthened)



Version J
Splined drive shaft SAE-B or C

	Drive shaft version A						**Drive shaft version B**					
BS	L8	L9	H3	ØD9	Key	T_{max} in Nm	L8	L9	H3	ØD9	Key	T_{max} in Nm
2; 21	46,8	59	$24{,}5_{-0{,}2}$	$22{,}23_{-0{,}03}$	□ 4,76 x 31,8	250	64	78	$28{,}3_{-0{,}2}$	$25{,}37_{-0{,}02}$	□ 6,36 x 50,8	400
4; 41; 42	61,9	73,2	$35{,}2_{-0{,}3}$	$31{,}75_{-0{,}03}$	□ 7,9 x 38,1	407	74,6	86	$38{,}6_{-0{,}3}$	$34{,}9_{-0{,}03}$	□ 7,9 x 54,6	600
5; 51; 52; 54	47,8	62	$35{,}2_{-0{,}3}$	$31{,}75_{-0{,}03}$	□ 7,9 x 28,4	610	73	88	$42{,}37_{-0{,}23}$	$38{,}07_{-0{,}02}$	□ 9,5 x 54,6	810

	Drive shaft version J					
BS	L8	L9	L10	ØD10	T_{max} in Nm	Teeth details
2; 21	33,3	41	4,0	27,8	316	SAE-B 7/8", 13 teeth, 16/32 DP
4; 41; 42	42,1	56	3,04	35,05	580	SAE-C 1 1/4", 14 teeth, 12/24 DP
5; 51; 52; 54	46,6	56	9,7	41,28	818	SAE-C 1 1/4", 14 teeth, 12/24 DP

Maximum permissible through drive torques in Nm

	Through drive		
BS	**K01** (SAE-A, 9T)	**K02** (SAE-B, 13T)	**K07** (SAE-C, 14T)
2	131	316	–
4	131	316	437
5	131	384	702

Pump cartridges for PVV / PVQ

Features

– Service friendly due to exchangable pump cartridges
– Within a build size it is possible to change the flow by exchanging the pump cartridges
– The pump can be changed from type PVV to PVQ or PVQ to PVV by changing the cartridges.

H/A/D5768/97

Type: CARTRIDGE PVV1-1X/018R

Ordering details

EINBAUSATZ	PV		–1X /		

Pump type

Industril version	= V
Mobile version	= Q

Build size 1	= 1
Build size 2	= 2
Build size 4	= 4
Build size 5	= 5

Component series

Component series 10 to 19 = 1X
(10 to 19: unchanged installation and connection dimensions)

No code =	Cartridge for single pumps or flange size for double pumps
D =	Cartridge for cover side installation for double pumps

Direction of rotation

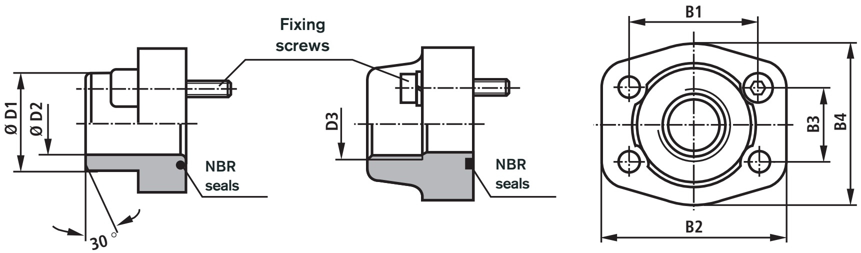
R =	Clockwise
L =	Anti-clockwise

Nominal size / displacement flow

018 =	Build size 1	18,0 cm^3
027 =		27,4 cm^3
036 =		45,4 cm^3
040 =		39,5 cm^3
046 =		45,9 cm^3
040 =	Build size 2	40,1 cm^3
045 =		45,4 cm^3
055 =		55,2 cm^3
060 =		60,0 cm^3
068 =		67,5 cm^3
069 =	Build size 4	69,0 cm^3
082 =		81,6 cm^3
098 =		97,7 cm^3
113 =		112,7 cm^3
122 =		121,6 cm^3
139 =	Build size 5	138,6 cm^3
154 =		153,5 cm^3
162 =		162,2 cm^3
183 =		183,4 cm^3
193 =		193,4 cm^3

6

SAE connection flanges (nominal dimensions in mm)



With welded connections
to AB 22-15

With threaded connections
to AB 22-13

Suction connec-tion	Pressure connection for PVV / PVQ *)	NS	Seal mate-rial	Material No. for flange with Welded connection	Material No. for flange with Threaded connection	B1	B2	B3	B4	ØD1	ØD2	D3	Fixing screws
	1; 21; 41;51	3/4“	NBR	R900211169	R900063050	47,6	65	22,2	52	25	19	G3/4	3/8“-16UNC
	2; 21; 42; 52	1“	NBR	R900211170	R900211175	52,4	70	26,2	59	30	22	G1	3/8"-16UNC
	4; 41; 42; 54	1 1/4"	NBR	R900211363	R900211172	58,7	79	30,2	68	38	28	G1 1/4	7/16"-14UNC
	5; 51; 52; 54	1 1/2"	NBR	R900211168	R900211171	69,9	95	35,7	76	38	30	G1 1/2	1/2"-13UNC
1; 2		1 1/2"	NBR	R900211165	R900211171	69,9	95	35,7	76	48	39	G1 1/2	1/2"-13UNC
4		2"	NBR	R900211434	R900211173	77,8	102	42,9	90	60	49	G2	1/2"-13UNC
21		2 1/2"	NBR	R900063063	R900211174	88,9	114	50,8	104	76	62	G2 1/2	1/2"-13UNC
5; 41; 42		3"	NBR	R900211362	–	106,3	135	61,9	131	76	70	–	5/8"-11UNC
51; 52		3 1/2"	NBR	R900211166	–	130,7	152	69,9	140	89	82	–	5/8"-11UNC
54		4"	NBR	R900211167	–	130,2	162	77,8	152	114	107	–	5/8"-11UNC

*) The numbers in bold states the stage (for double pumps) for which the flange is intended.

The material numbers contain the flange, the O-ring and the fixing screws.

Pipe thread “G” to ISO 228/1

Pump safety block

To limit the working pressure or (and) for solenoid operated unloading of the operating pressure we recommend the use of our pump safety blocks to RE 25880 and RE 25890.

Engineering guidelines

Comprehensive guidelines and proposals can be found in the Hydraulic Trainer, Volume 3, RE 00281, "Planning and design of hydraulic power systems."

When using vane pumps we recommend that the following guidelines are partically taken into account.

Technical data

All the technical data are dependent on manufacturing tolerances and are valid with certain operating conditions.

Please take into account that minor variations are possible and technical data can be affected by differing conditions (e.g. viscosity).

Characteristic curves

Please take into account when dimensioning the drive motor, the maximum possible application data as shown by the characteristic curves on pages 8 to 10.

Noise

The sound pressure level values given on page 8 are measured according to DIN 45635, sheet 26. This means that only the noise emission of the pump is given. Ambient influences (such as place of installation, piping, etc.) are not taken into account.

The values only refer to one pump.

Unfavourable influences can cause the noise pressue level at the units final place of installation to be 5 to 10 dB (A) higher than that of the pump values alone.

Commissioning guidelines

Commissioning

– Check to see if the system has been carefully, correctly and cleanly assembled.
– Only fill the pressure fluid via a filter which has the necessary retention rate.
– Take into account the direction of rotation arrow.
– Start the pump without load and let it displace oil without pressure for a few seconds, in order to provide sufficient lubrication.
– Never run the pump without oil.
– If the pump, after approx. 20, does not displace oil without any bubbles then the system has to be rechecked.
  After the operating values have been reached, check the pipe connections for leakage and check the operating temperature.

Bleeding

– Before commissioning we recommend that the housing and suction line are filled with oil. This increaes the operating safety and prevents wear in the case of unfavourable installation conditions.
– For the first commissioning the oil, which has foamed, can be released by carefully lossening the pressure flange (danger of oil spray) when the system is in a de-pressurised condition. Only when bubble-free oil is being released retighten the fittings to the required torque level.

General

– The pumps supplied by ourselves have been tested for function and performance. Changes in any form or manner to the pump are not permitted, as this would invalidate any guarantee claims!
– Repairs may only be carried out by the manufacturer of authorised agent or subsidary. No guarantee will be accepted for commissioning carried.

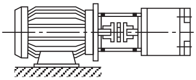
☞ **Note!**

– Assembly, maintenance and servicing must only be carried out by authorised, trained and instructed personnel!
– The pumps must only be operated within the permitted limits (see pages 6 and 7)!
– The pump may only be operated in a sound condition!
– When carrying out any work on the pump, switch the system to zero pressure!
– Unauthorised conversions and modifications which affect the safety and function of the pump are not permitted!
– Provide protective measures (e.g. coupling guard) and do not remove any axisting protective devices!
– Ensure that the fixing bolts are correctly fitted!
  (Take into account the prescribed tightening torques)
– The general valid safety and accident prevention regulations must be adhered to!

Installation guidelines

Drive

E-motor + pump mounting bracket + coupling + pump



⚠ Attention!

– Radial and axial forces on the pump drive shaft are not permitted!
– Motor and pump must be exactly aligned!
– Use flexible drive couplings

Fluid tank

– Match the service capacity of the tank to the operating conditions.

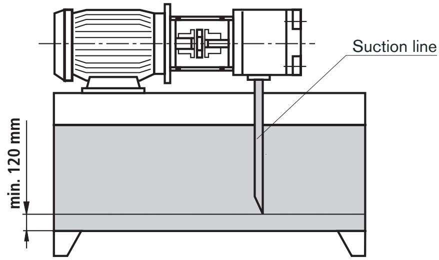
⚠ Attention!

The permissible fluid temperature must not be exceeded
- If required, provide a cooler!

Lines and connections

– Cut at a 45° angle
– Remove protective plugs from the pump
– We recommend the use of seamless precision steel pipes to DIN 2391 and removable pipe connections.
– Select the inside diameter of the pipes according to the ports
– Thoroughly clean the pipes and fittings before assembly. **– min. distance to the tank bottom 120 mm**
  - Dirt deposits will not be sucked up or whirled up
– Maintain a minimum immersion depth of 50 mm, even at the lowest permissible fluid level
  - Foaming will be prevented
– Under no circumstances must leakage and return fluid be directly taken up by the pump!
  - Fluid temperature remain low
– For inlet pressure see page 6

Piping recommendations



– **Under no circumstances** may return fluid be directly taken up, therefore select the greatest possible distance between the suction and return lines
– The exit of the return line must always lie under the oil level
– Ensure that the suction lines are assembled leak-proof

Filter

– Whenever possible, use return line or pressure filters. (Suction filter only in connection with low pressure switch/ clogging indicator)

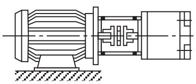
Pressure fluid

– Please take into account the specification stated in catalogue sheet RE 07075.
– We recommend the use of brand name fluids.
– Do not mix hydraulic fluid of different types since this can result in decomposition or deterioration of the lubricating quality.
– The fluid must be replaced at regular intervals according to the operating conditions. In connection with this, the tank must also be cleaned of residues.

Permissible installation positions

– Horizontal position preferred

B3



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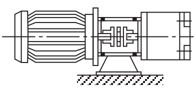
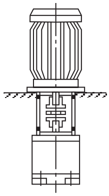


V1



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Radial piston pumps

Designation	Type	Size	Component series	p_{max} in bar	Data sheet	Page
Fixed displacement	PR4	0,4 ... 2	1X	700	11260	1465
Fixed displacement	PR4	1,6 ... 20	3X	700	11263	1473

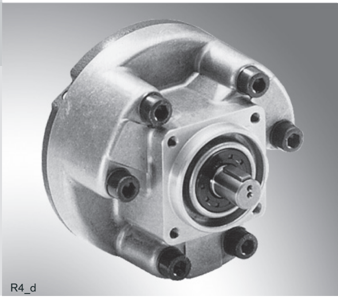
Rexroth
Bosch Group

Radial piston pump, fixed displacement

RE 11260/08.05
Replaces: 07.02

Type PR4

Sizes 0.40 to 2.00 cm^3
Component series 1X
Maximum operating pressure 700 bar



PR4-1X/1,00-450WA01M01

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Contents	Page
Ordering code	2
Symbol	2
Function, section	3
Technical data, noise pressure level	4
Characteristic curves	5
Unit dimensions	6
Installation notes	7
Engineering notes	8
Commissioning notes	8

Features

– Self-priming, valve-controlled
– Very low noise
– Long service life due to hydrodynamically lubricated plain bearings
– Very compact design, therefore installation-friendly dimensions
– Can be combined with fixed and variable displacement vane pumps
– 5 sizes

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

PR	4 – 1X /		W		01		01	*

Type of component
Pump, radial = **PR**

Series = **4**

Component series
Component series 10 to 19 = **1X**
(10 to 19: unchanged installation and connection dimensions)

Component size
Component size pressure stage (maximum)

0.40 cm^3	**= 0.40-700**
0.63 cm^3	**= 0.63-700**
1.00 cm^3	**= 1.00-450**
1.60 cm^3	**= 1.60-250**
2.00 cm^3	**= 2.00-175**

Direction of rotation
Clockwise and counter-clockwise rotation = **W**

Shaft version
A = Cylindrical shaft end
G = Splined shaft end for combination with vane pumps

Pipe connection
01 = Pipe thread to ISO 228/1

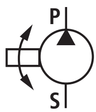
Seal material
M = NBR seals
V = FKM seals

Number of pressure ports
01 = 1 pressure port

Further details in clear text

Note:
All five sizes are pumps with 3 pistons!

Symbol



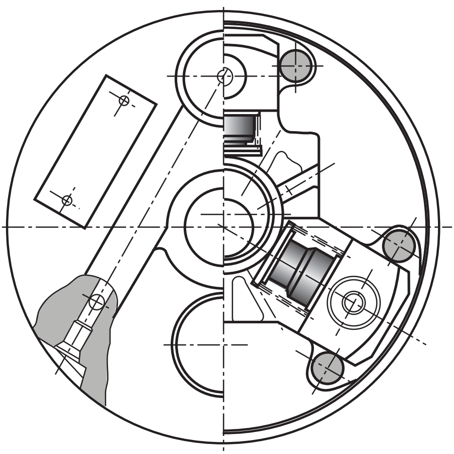
Function, section

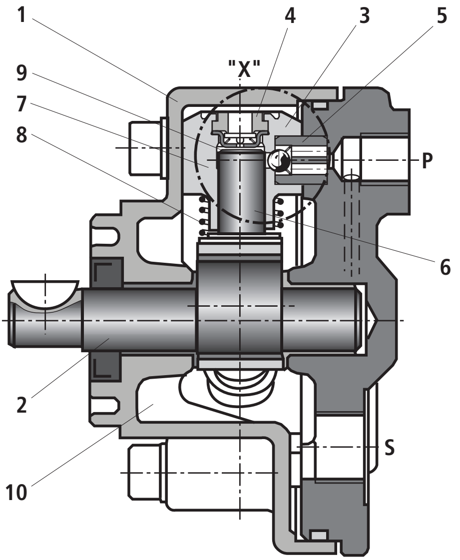
These pumps are valve-controlled, self-priming radial piston pumps with fixed displacement.

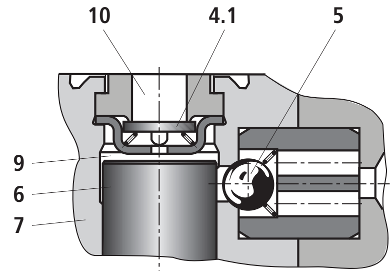
They basically consist of housing (1), eccentric shaft (2) and pump elements (3), with suction valve (4), pressure valve (5) and piston (6).

Suction and displacement process

Pistons (6) are arranged radially to eccentric shaft (2). Piston (6) is guided in cylinder (7) and pressed by spring (8) onto eccentric (2). During the downward stroke of piston (6), the working chamber (9) in cylinder (7) increases in size. The resulting negative pressure lifts suction valve plate (4.1) from the sealing edge. This opens the connection between suction chamber (10) to working chamber (9). The working chamber fills with fluid. During the upward movement of piston (6), the suction valve closes and pressure valve (5) opens. Fluid can now flow via pressure port (P) to the system.







"X"

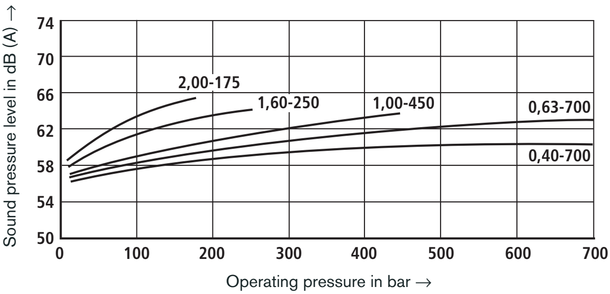
Technical data (for applications outside these parameters, please consult us!)

Speed range		min $^{-1}$	Size 0.40 1000 to 3400 min $^{-1}$ Size 0.63 1000 to 3000 min $^{-1}$ Size 1.00 1000 to 2000 min $^{-1}$ Size 1.60 1000 to 2000 min $^{-1}$ Size 2.00 1000 to 2000 min $^{-1}$
Operating pressure	Inlet	bar	0.8 to 1.5 absolute
	Outlet	bar	Size 0.40 700 bar Size 0.63 700 bar Size 1.00 450 bar Size 1.60 250 bar Size 2.00 175 bar
Max. permissible torque (drive shaft)		Nm	10
Installation orientation			Size 0.40-700 Horizontal installation: The suction port should be located vertically above the pressure port. This arrangement improves bleeding of the pump. Vertical installation: No restrictions. All other sizes can be installed at any position.
Shaft loading			Radial and axial forces **cannot** be absorbed!
Type of mounting			Face mounting
Pipe connections			Screw-in fittings
Direction of rotation (viewed to shaft end)			Counter-clockwise or clockwise, has no influence on the direction of flow
Hydraulic fluid			HLP mineral oil to DIN 51524 part 2 **Please note the regulations laid down in RE 07075!**
Hydraulic fluid temperature range		°C	–10 to +70
Viscosity range		mm^2/s	10 to 200
Max. permissible degree of contamination of the hydraulic fluid - cleanliness classes to ISO 4406 (c)			Class 20/18/15 [1)]
Weight		kg	2.6

[1)] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheet RE 51144.

Sound pressure level (average value): (measured at $n = 1450$ min^{-1}, $\nu = 41$ mm^2/s and $\vartheta = 50$ °C)



Measured in an anechoic chamber to DIN 45 635, part 26

Distance:

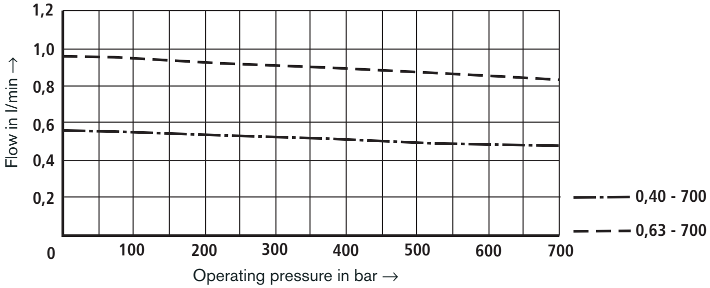
Microphone – pump = 1 m

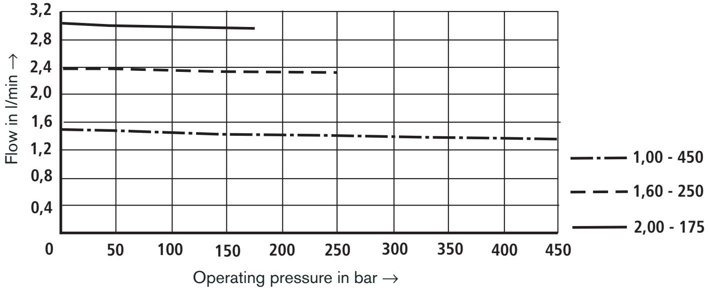
At a system pressure below 4 bar and a viscosity > 150 mm^2/s, audible valve noise may occur.

Sound pressure level at system pressure < 4 bar: ≤ 58 dB(A)

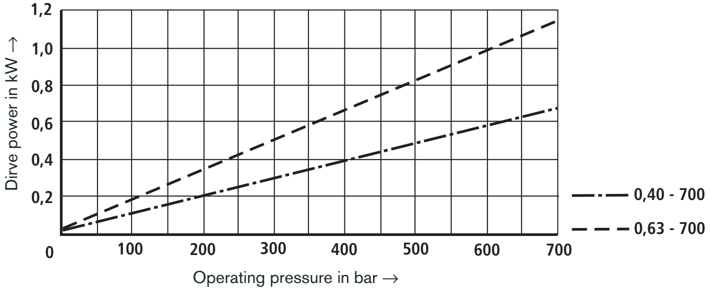
Characteristic curves (measured at $n = 1450\ \text{min}^{-1}$, $\nu = 41\ \text{mm}^2/\text{s}$ and $\vartheta = 50\ °\text{C}$)

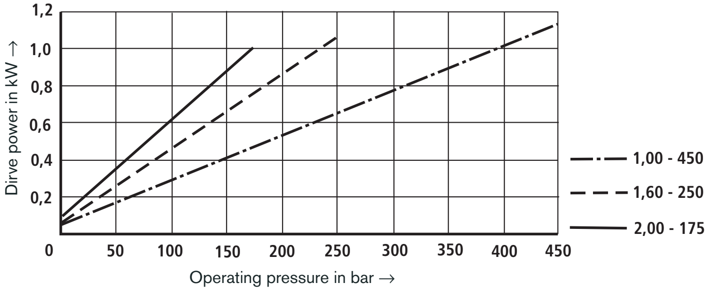
Flow



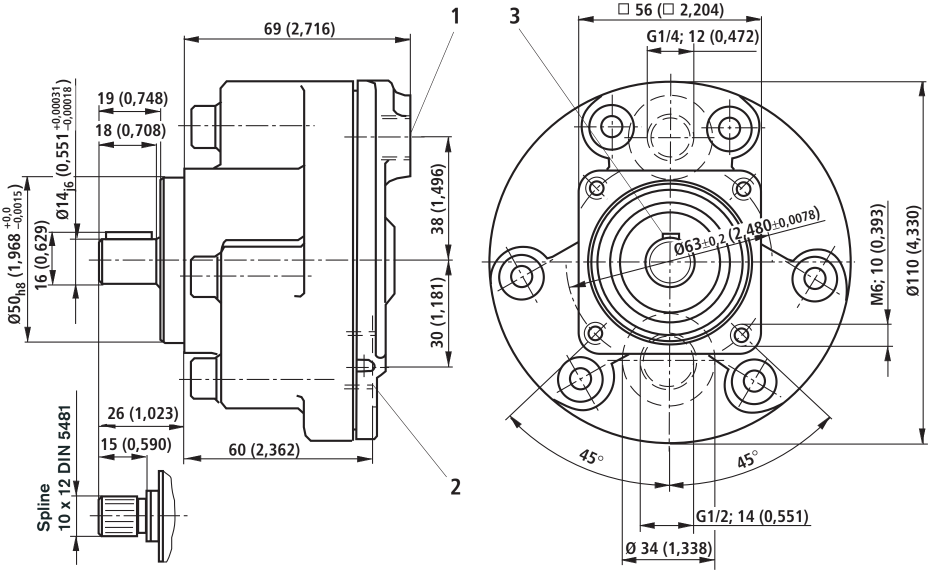


Drive power





Unit dimensions: Nominal dimensions in mm (inch)



1 Pressure port P
2 Suction port S
3 Plate spring 5 x 6.5 DIN 6888

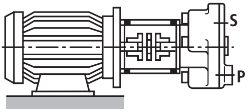
Seal kit (NBR):
Material no. **R900312138**
(valid for all sizes)

Seal kit (FKM)
Material no. **R900313049**
(valid for all sizes)

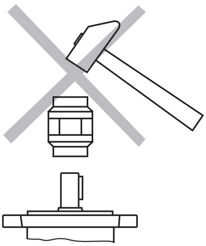
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

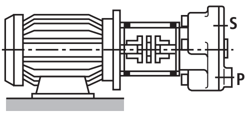


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!



Installation positions

B3



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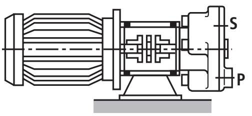
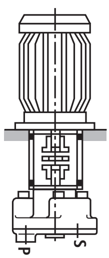


V1



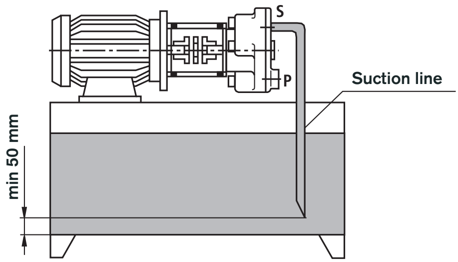
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s)
- For inlet pressure, see page 4
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters.
  (Use suction filters only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, "notes on the planning and design of hydraulic systems".

When using radial piston pumps, the following notes should be observed in particular.

Technical data

All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.

Please note that certain deviations are therefore possible, and that technical data may vary when boundary conditions (e.g. viscosity) change.

Characteristic curves

Characteristic curves for flow and required power.
When dimensioning the drive motor, observe the permissible maximum data.

Noise

The sound pressure level values given on page 4 were measured in line with DIN 45635 part 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated. The values always refer to only one pump

Caution!

Due to the power unit design and influences at the final place of installation of the pump, the noise pressure level is usually 5 to 10 dB(A) higher than the value of the pump itself.

Commissioning notes

Bleeding

- All radial piston pumps of type PR4 are self-priming.
- Fill the housing with filtered oil via port S.
- For initial commissioning, set the pump to pressureless circulation. To this end, disconnect the pressure hose and route it to the tank.
- Before initial commissioning, the pump must be bled in order to protect it from damage.
- Switch over to pressureless circulation or route the pressure line or pressure hose back to the tank.
- Briefly switch the pump on (inching mode).
- Should the pump not displace bubble-free oil after approx. 20 seconds, re-check the system. After having reached operating values, check the pipe connections for leakage. Check the operating temperature.
- Take note of the generation of noise.

Commissioning

- Check that the system is properly and correctly installed.
- Start the pump under no-load conditions and let it displace fluid for some seconds at zero pressure to ensure sufficient lubrication.
- **In no case may the pump be operated without fluid!**

⚠ Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorised, trained and instructed personnel!
- Use only genuine Rexroth spare parts!
- The pump may only be operated at the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. installation or removal), the system must be switched off and depressurised!
- Unauthorised conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection)!
- Any existing protective guards must not be removed!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

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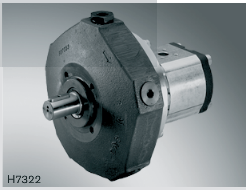
Fixed displacement radial piston pump

RE 11263/10.05
Replaces: 03.05

Type PR4



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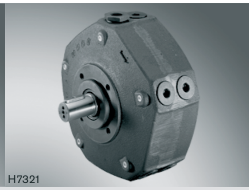

PR4-3X/16,00-500RA01M01

Sizes 1.60 to 20.00 cm^3
Component series 3X
Maximum operating pressure 700 bar

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Characteristic curves	7
Unit dimensions	8 and 9
Seal kits	10
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Ordering code for P2R4 and P3R4	11
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Unit dimensions	13 and 14
Installation notes	15
Engineering notes	16
Commissioning note	16

Features

- Self-priming, valve-controlled
- 14 sizes, favourable gradations for optimum pump selection
- Long service life due to hydrodynamically lubricated sliding bearings
- Several pressure ports with various cylinder combinations

Ordering code

PR	4	–	3X	/		R					*

Type of device = PR

Series = 4

Component series
Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Component size
Component size - pressure stage (maximum)

1.51 cm3	(3)	= **1.60-700**
2.14 cm^3	(3)	= **2.00-700**
2.59 cm^3	(3)	= **2.50-700**
3.57 cm^3	(5)	= **3.15-700**
4.32 cm^3	(5)	= **4.00-700**
7.14 cm^3	(10)	= **6.30-700** 1)
8.63 cm^3	(10)	= **8.00-700** 2)
3.39 cm^3	(3)	= **3.15-500**
4.82 cm^3	(3)	= **5.00-500**
5.83 cm^3	(3)	= **6.30-500**
8.03 cm^3	(5)	= **8.00-500**
9.71 cm^3	(5)	= **10.00-500**
16.07 cm^3	(10)	= **16.00-500** 1)
19.43 cm^3	(10)	= **20.00-500** 2)

Direction of rotation
Clockwise rotation = **R**

Shaft version

A = Cylindrical shaft end
G = Serrated shaft 21x24 to DIN 5481
K = Cylindriical shaft with output for mounting an AZPF or AZPFF

Line connection

01 = BSP thread to ISO 228/1
12 = SAE thread to ANSI B1.1

Seal material

M = NBR seals
V = FKM seals

Number of pressure ports

Code	Number of pressure ports	Combination of cylinders – Radial piston pump with 3 pistons	5 pistons	10 pistons
01 =	1	3	5	10
02 =	2	1+2		5+5
03 =	3	1+1+1		
08 =	5		1+1+1+1+1	2+2+2+2+2
11 =	6			2+2+2+2+1+1
12 =	10			10x1

Further details in clear text

1) not available with shaft end (versions “G“ and „K“)
2) not available with shaft end (version “K“)

Function, section, symbol

Hydraulic pumps of type PR4 are valve-controlled, self-priming radial piston pumps with fixed displacement.

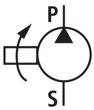
Radial piston pump type PR4 mainly consists of the housing (1), eccentric shaft (2) and 3, 5 or 10 pumping elements (3) with suction valve (4), pressure valve (5) and piston (6).

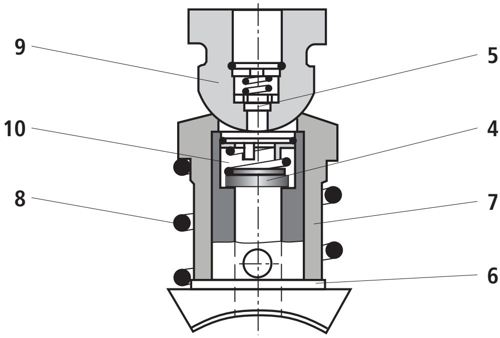
Suction and displacement process

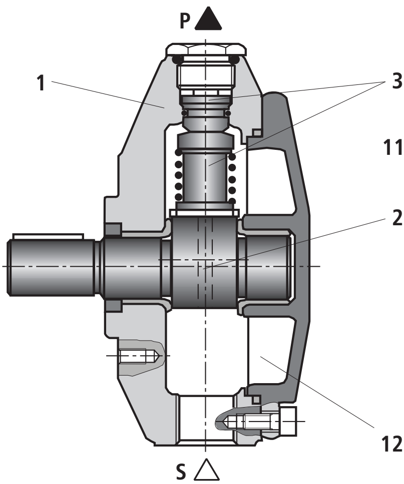
The pistons (6) are arranged radially to the eccentric shaft (2). The hollow piston (6) with suction valve (4) is guided in a cylinder (7) and pressed by a spring (8) onto the eccentric shaft (2). The radius of the piston running face corresponds to the radius of the eccentric shaft. The cylinder (7) seals against a semi-spherical element (9).

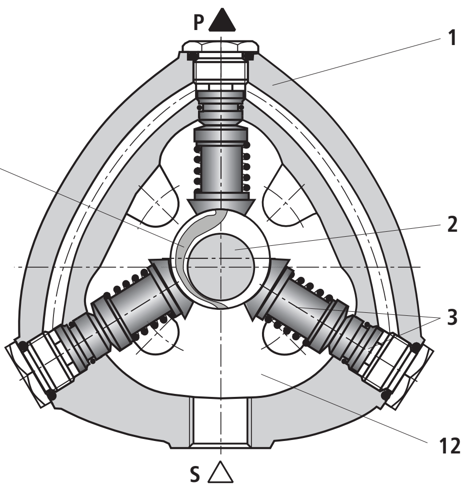
As the piston (6) moves downwards, the working chamber (10) enlarges in cylinder (7). The ensuing negative pressure causes the suction valve plate to lift off the sealing edge. At the same time, the connection from suction chamber (12) to working chamber (10) is opened via a radial groove (11) in the eccentric shaft (2).

The working chamber fills with fluid. As the piston (6) moves upwards, suction valve (4) closes and pressure valve (5) opens. The fluid now flows via pressure port (P) into the system.









Design options for multi-circuit pumps

The following can be seen from the schematic diagrams below:
– The number and position of pressure ports,
– which cylinders are interconnected.

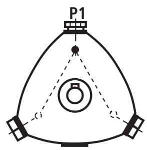
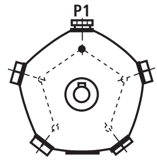
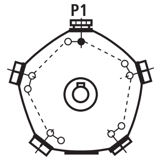
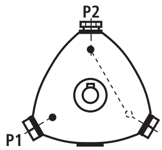
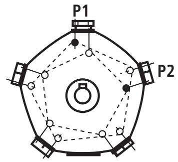
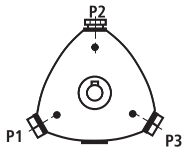
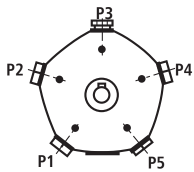
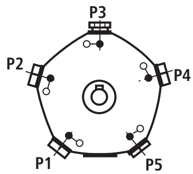
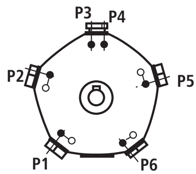
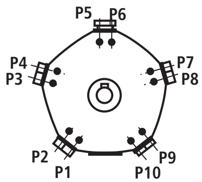
The dots indicate the cylinders that are connected directly to the pressurised pressure port.

The circles indicate the cylinders that are not connected directly to the pressurised pressure port.

The dotted and chain-dotted lines show, which cylinders are interconnected.

The pressurised pressure ports are numbered clockwise.

The pressure port, which - in the clockwise direction - is closest to the suction port, is identified with "P1".

Code	Number of pressure ports	Combination of cylinders		
		3 pistons	5 pistons	10 pistons
01	1			
02	2			
03	3			
08	5			
11	6			
12	10			

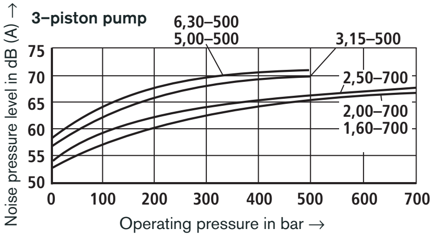
Technical data (for applications outside these parameters, please consult us!)

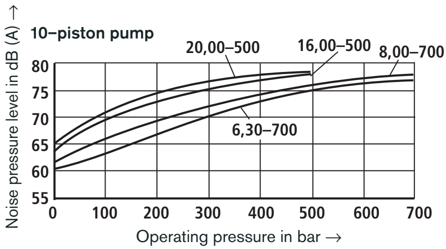
Speed range	min^{-1}	1000 to 2000		
Operating pressure Inlet	bar	0.8 to 2.5 absolute		
Cylinder ID	mm	Ø 10	Ø 15	
Outlet	bar	700	500	
Max. permissible torque (drive shaft)	Nm	160		
Installation position		Optional		
Shaft loading		Radial and axial forces **cannot** be absorbed		
Type of mounting		Face mounting		
Line connections		Screw-in fittings		
Direction of rotation (viewed to shaft end)		Clockwise		
Hydraulic fluid		HLP mineral oil to DIN 51524 part 2 **Please observe the regulations according to RE 07075!**		
Hydraulic fluid temperature range	°C	–10 to +70		
Viscosity range	mm^2/s	10 to 200		
Max. permissible degree of contamination of the hydraulic fluid - cleanliness classes to ISO 4406 (c)		Class 20/18/15 [1]		
		3 pistons	5 pistons	10 pistons
Weight	kg	9.2	12.4	16.4

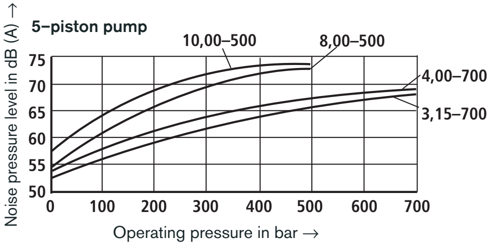
[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of the components. For the selection of filters, see data sheet RE 51144.

Noise pressure level (average value): (measured at $n = 1450\ min^{-1}$, $\nu = 41\ mm^2/s$ and $\vartheta = 50\ °C$)

The characteristic curves are not valid for multi-circuit variants.







Measured in the anechoic chamber according to DIN 45635, part 26,
distance from pump to microphone = 1 m

7

Flow and drive power (average value): referred to 1 cylinder ($n = 1450\ \text{min}^{-1}$)

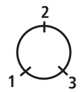
Cylinder ID in mm	Stroke in mm	V_{geom} in cm³		Operating pressure p in bar: 50	100	150	200	250	300	350	400	450	500	550	600	650	700
10	6.4	0.509	$q_{V.eff}$ L/min	0.71	0.7	0.69	0.69	0.69	0.685	0.68	0.68	0.675	0.67	0.67	0.665	0.66	0.66
			P_a kW	0.093	0.164	0.231	0.29	0.358	0.42	0.481	0.54	0.605	0.67	0.739	0.81	0.888	0.97
10	9.1	0.714	$q_{V.eff}$ L/min	1.02	1.01	1.0	0.995	0.99	0.985	0.98	0.975	0.97	0.965	0.96	0.955	0.95	0.94
			P_a kW	0.129	0.23	0.328	0.41	0.503	0.58	0.677	0.77	0.856	0.94	1.046	1.16	1.257	1.36
10	11.0	0.864	$q_{V.eff}$ L/min	1.22	1.21	1.205	1.2	1.195	1.19	1.184	1.18	1.174	1.17	1.163	1.157	1.147	1.14
			P_a kW	0.15	0.275	0.392	0.49	0.594	0.7	0.804	0.91	1.018	1.13	1.244	1.37	1.486	1.61
15	6.4	1.13	$q_{V.eff}$ L/min	1.6	1.59	1.58	1.567	1.56	1.556	1.546	1.54	1.53	1.523				
			P_a kW	0.213	0.4	0.547	0.7	0.85	1.0	1.14	1.27	1.433	1.566				
15	9.1	1.61	$q_{V.eff}$ L/min	2.28	2.26	2.25	2.24	2.23	2.22	2.20	2.19	2.18	2.17				
			P_a kW	0.27	0.49	0.71	0.91	1.11	1.31	1.51	1.7	1.91	2.12				
15	11.0	1.94	$q_{V.eff}$ L/min	2.74	2.73	2.71	2.7	2.68	2.67	2.65	2.64	2.62	2.6				
			P_a kW	0.32	0.57	0.826	1.06	1.31	1.55	1.8	2.05	2.29	2.53				

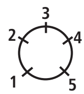
Factor "f" for uneven running at $n = 1450\ \text{min}^{-1}$

The values given in the table "flow and drive power" refer to only 1 cylinder. In order to determine the required drive power, the value must be multiplied by the number of cylinders.

At the same time, the uneven running factor "f" must be applied.

Radial piston pump: 3 cylinders		5 or 10 cylinders	
Cylinders under load	Factor f	Cylinders under load	Factor f
1	3.13	1	3.13
		1+2	1.89
1+2	1.57	1+3	1.57
		1+2+3	1.60
		1+3+4	1.35
		1+2+3+4	1.30
1+2+3	1.00	1+2+3+4+5	1.00





For pumps with 10 cylinders, 2 cylinders each are connected to a pressure port.

Example

Pump PR4–3X/1,60-700/RA01M02

Ports 1 and 2 are connected together and loaded to 450 bar, 3 is circulating at zero pressure.

P_a = 2 x 0.605 kW = 1.21 kW
f = 1.57
P_{erf} = 1.21 kW x 1.57 = 1.90 kW

Port 3 loaded to 300 bar,
1 and 2 circulating at zero pressure.

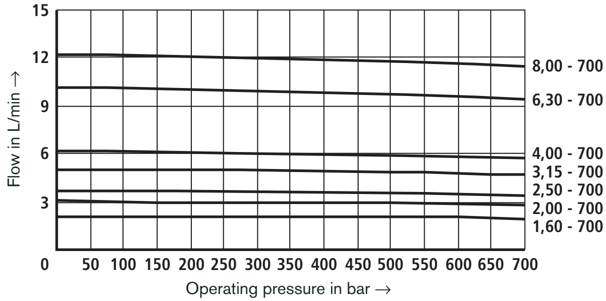
P_a = 0.42 kW
f = 3.13
P_{erf} = 0.42 kW x 3.13 = 1.31 kW

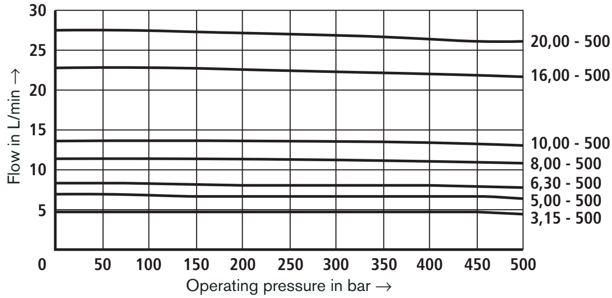
Ports 1, 2 and 3 loaded to 200 bar.

P_a = 3 x 0.29 kW = 0.87 kW
P_{erf} = 0.87 kW x 1.0 = 0.87 kW

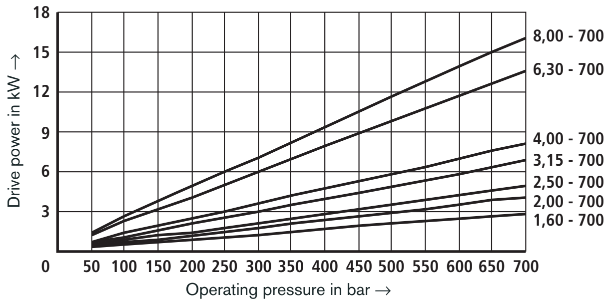
Characteristic curves (measured at $n = 1450$ min^{-1}, $\nu = 41$ mm^2/s and $\vartheta = 50$ °C)

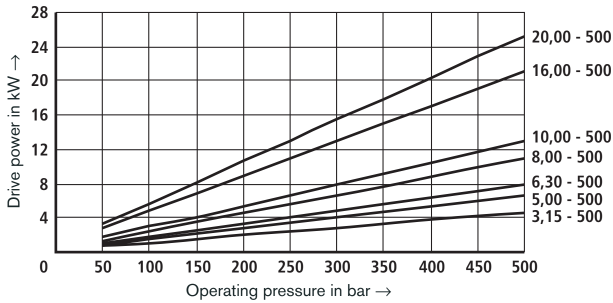
Flow



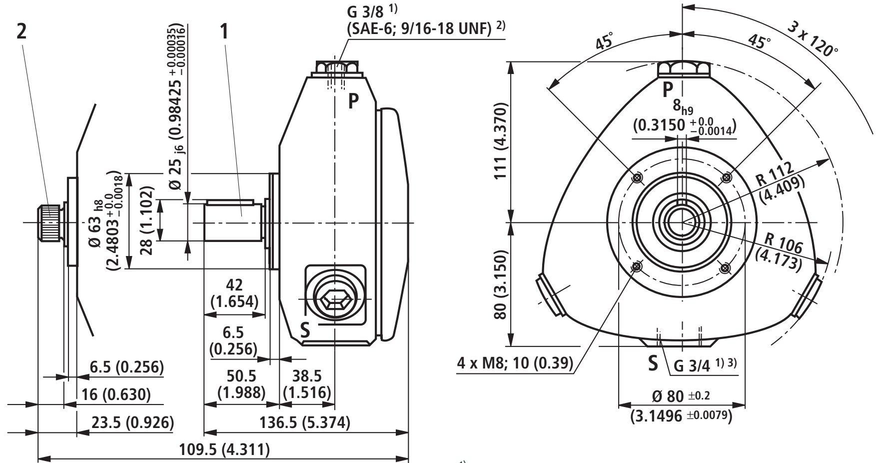


Drive power





Unit dimensions: Radial piston pump with 3 pistons, nominal dimensions in mm (inch)



1) BSP thread to ISO 228/1

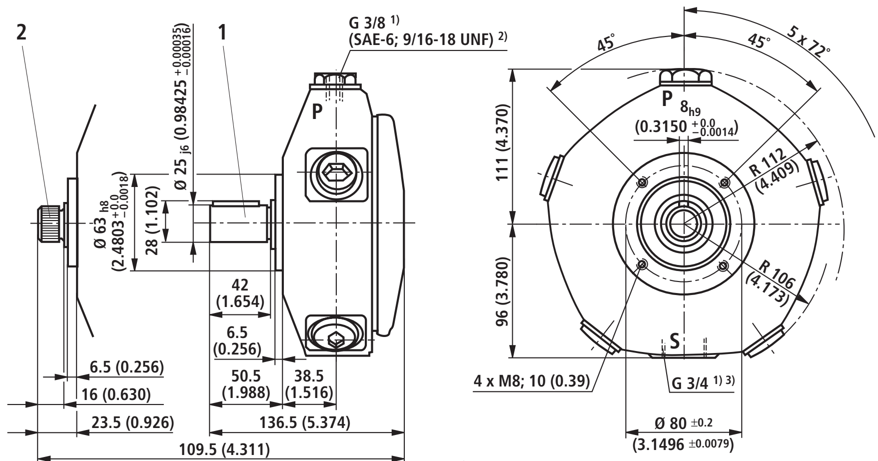
2) For line connection with code 12 to ANSI B 1.1

3) For line connection with code 12, connection adapter (SAE-12; 1 1/16-12 UN) to ANSI B 1.1 not included in the scope of supply

1 Cylindrical shaft end

2 Splined shaft to DIN 5481

Unit dimensions: Radial piston pump with 5 pistons, nominal dimensions in mm (inch)



1) BSP thread to ISO 228/1

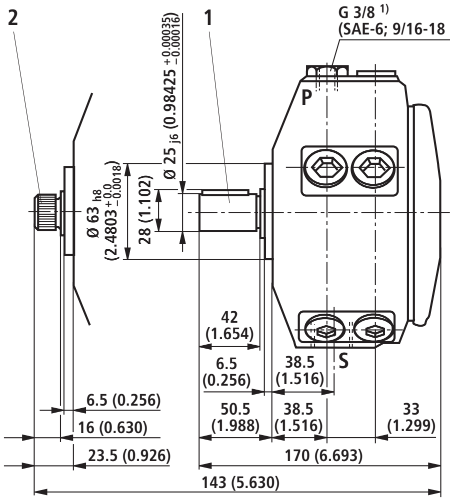
2) For line connection with code 12 to ANSI B 1.1

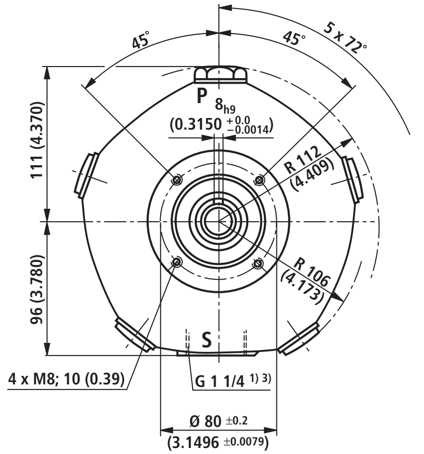
3) For line connection with code 12, connection adapter (SAE-12; 1 1/16-12 UN) to ANSI B 1.1 not included in the scope of supply

1 Cylindrical shaft end

2 Splined shaft to DIN 5481

Unit dimensions: Radial piston pump with 10 pistons, code 08, nominal dimensions in mm (inch)

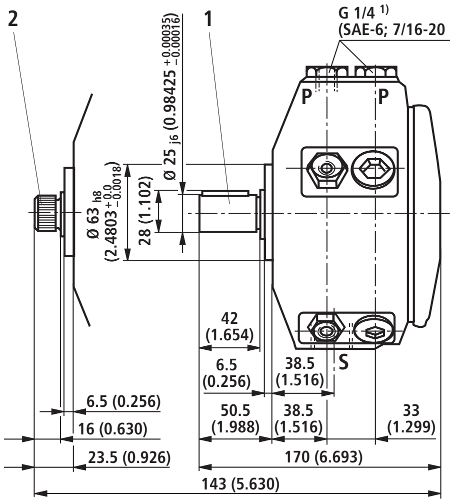


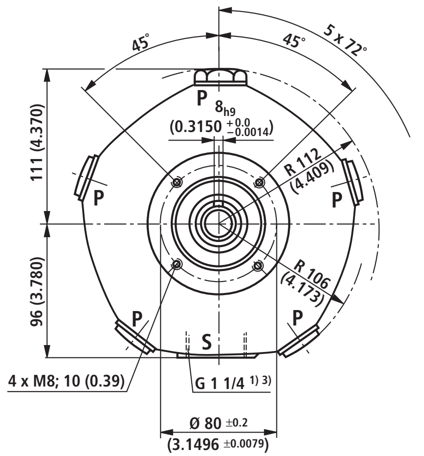


1 Cylindrical shaft end
2 Splined shaft end to DIN 5481

1) BSP thread to ISO 228/1
2) For line connection with code 12
3) For line connection with code 12, connection adapter (SAE-20; 1 5/8-20 UN) to ANSI B 1.1 not included in the scope of supply

Unit dimensions: Radial piston pump with 10 pistons, codes 11 and 12, nominal dimensions in mm (inch)





1 Cylindrical shaft end
2 Splined shaft end to DIN 5481

1) BSP thread to ISO 228/1
2) For line connection with code 12
3) For line connection with code 12, connection adapter (SAE-20; 1 5/8-20 UN) to ANSI B 1.1 not included in the scope of supply

Seal kits

Material number for NBR seals	Material number for FKM seals	Valid for
R900307726	R900307729	3-piston pumps
R900307727	R900307730	5-piston pumps
R900307728	R900307594	10-piston pumps

Ordering code for P2R4 and P3R4 pump combinations

	R4	–	3X	/		R	K		M	+		*

Type of device
Double = **P2**
Triple = **P3**

Series = **4**

Component series
Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Component size
Component size - pressure stage (maximum)

1.51 cm³	(3)	= **1.60-700**
2.14 cm³	(3)	= **2.00-700**
2.59 cm³	(3)	= **2.50-700**
3.57 cm³	(5)	= **3.15-700**
4.32 cm³	(5)	= **4.00-700**
3.39 cm³	(3)	= **3.15-500**
4.82 cm³	(3)	= **5.00-500**
5.83 cm³	(3)	= **6.30-500**
8.03 cm³	(5)	= **8.00-500**
9.71 cm³	(5)	= **10.00-500**

Direction of rotation
Clockwise rotation = **R**

Shaft version
Cylindrical shaft end with output for mounting an AZPF or AZPFF = **K**

Line connection
BSP thread to ISO 228/1 = **01**
SAE thread to ANSI B1.1 = **12**

Seal material
NBR seals = **M**

Number of pressure ports

Code	Number of pressure ports	Combination of cylinders – Radial piston pump with 3 pistons	Combination of cylinders – Radial piston pump with 5 pistons
01 =	1	3	5
02 =	2	1+2	
03 =	3	1+1+1	
08 =	5		1+1+1+1+1

Component sizes for double pump

AZPF4 =	4 cm³	(p_{max} = 280 bar) [1]
AZPF5 =	5 cm³	(p_{max} = 280 bar) [1]
AZPF8 =	8 cm³	(p_{max} = 280 bar) [1]
AZPF11 =	11 cm³	(p_{max} = 230 bar) [1]
AZPF14 =	14 cm³	(p_{max} = 180 bar) [1]
AZPF16 =	16 cm³	(p_{max} = 160 bar) [1]
AZPF19 =	19 cm³	(p_{max} = 135 bar) [1]
AZPF22 =	22 cm³	(p_{max} = 110 bar) [1]
AZPF25 =	25 cm³	(p_{max} = 100 bar) [1]
AZPF28 =	28 cm³	(p_{max} = 90 bar) [1]

Component sizes for triple pump

AZPFF5-4 =	5 cm³ - 4 cm³
AZPFF8-4 =	8 cm³ - 4 cm³
AZPFF8-8 =	8 cm³ - 8 cm³
AZPFF11-4 =	11 cm³ - 4 cm³
AZPFF11-5 =	11 cm³ - 5 cm³
AZPFF11-8 =	11 cm³ - 8 cm³
AZPFF16-8 =	16 cm³ - 8 cm³
AZPFF16-16 =	16 cm³ - 16 cm³

Further details in clear text

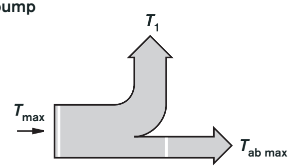
[1] Observe the note on the engineering of multiple pumps (page 12)

Notes on the engineering of multiple pumps

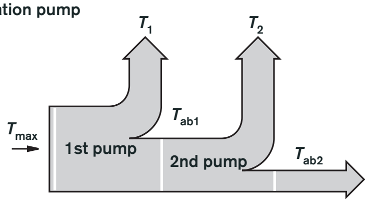
- The general technical data of the single pumps are also valid for multiple pumps (see below and page 5).
- The pump that is subjected to greater loads (pressure x flow) should be the first pump stage.
- When several pumps are combined, the occurring torque can reach impermissibly high values.
- The sum of torques must not exceed the permissible values (see table below)

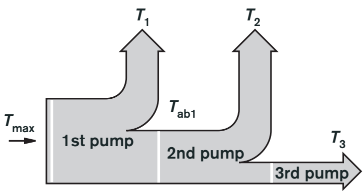
Pump type	Max. permissible input torque T_{max}	Max. permissible output torque T_{max}
PR4…	160 Nm	45 Nm
AZPF…	45 Nm	45 Nm
AZPFF…	45 Nm	45 Nm

Single pump



Combination pump





Calculation example:

V = displacement in cm^3

$\eta_{hydr.-mech.}$ = hydraulic-mechanical efficiency

T = torque in Nm

Δp = pressue in bar

$$T = \frac{\Delta p \cdot V \cdot 0.0159}{\eta_{hydr.-mech.}} \text{ (Nm)}$$

Example: Pump combination P3R4-3X/3,15-700… + AZPFF8-4

$$T_1 = \frac{700 \text{ bar} \cdot 3.57 \text{ cm}^3 \cdot 0.0159}{0.9} = 44.2 \text{ Nm}$$

$$T_2 = \frac{100 \text{ bar} \cdot 8 \text{ cm}^3 \cdot 0.0159}{0.85} = 15.0 \text{ Nm}$$

$$T_3 = \frac{50 \text{ bar} \cdot 4 \text{ cm}^3 \cdot 0.0159}{0.85} = 3.8 \text{ Nm}$$

$T_{ab2} = 45$ Nm

$T_3 = 3.8 \text{ Nm} \leq T_{ab2\ max}$

$T_{ab1} = 45$ Nm

$T_{1,2} = T_2 + T_3$

$T_{1,2} = 18.8 \text{ Nm} \leq T_{ab1\ max}$

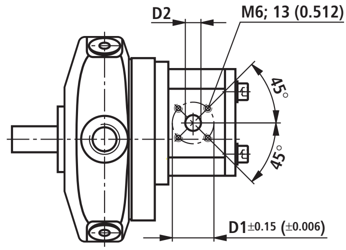
$T_{max} = 160$ Nm

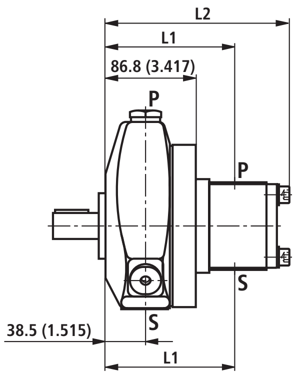
$T = T_1 + T_2 + T_3$

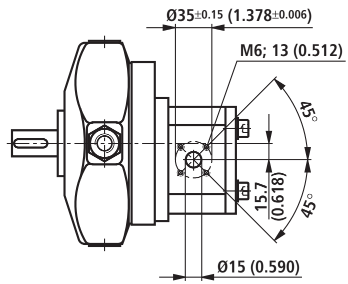
$T = 63 \text{ Nm} \leq T_{max}$

The pump combination can be operated at the calculated technical data.

Unit dimensions: P2R4…, nominal dimensions in mm (inch)



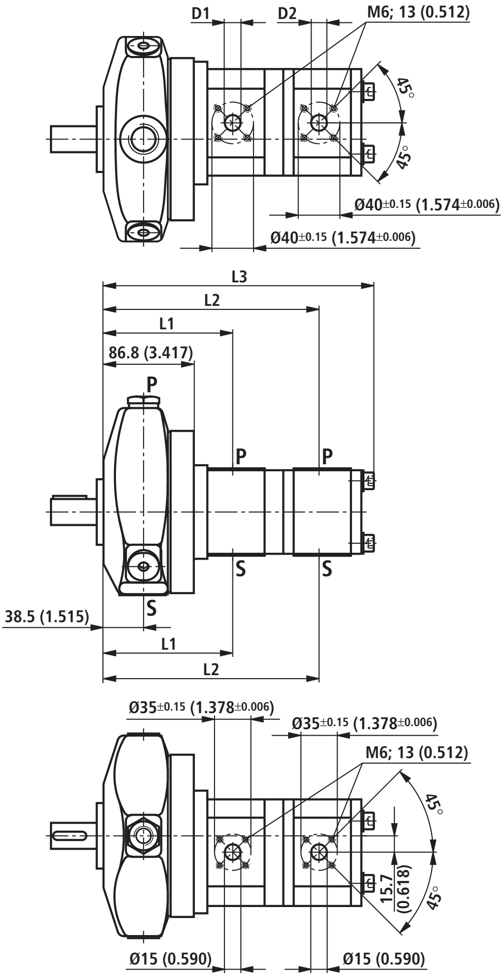




Type P2R4- …+	D1 ±0.15 (±0.006)		D2		L1		L2	
	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
AZPF4	40.00	(1.575)	15.00	(0.591)	124.2	(4.890)	170.5	(6.713)
AZPF5	40.00	(1.575)	15.00	(0.591)	125.4	(4.937)	173.0	(6.811)
AZPF8	40.00	(1.575)	20.00	(0.787)	127.5	(5.020)	177.1	(6.972)
AZPF11	40.00	(1.575)	20.00	(0.787)	131.3	(5.169)	182.1	(7.169)
AZPF14	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	187.1	(7.366)
AZPF16	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	190.5	(7.500)
AZPF19	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	195.5	(7.697)
AZPF22	40.00	(1.575)	20.00	(0.787)	139.4	(5.488)	200.9	(7.909)
AZPF25	55.00	(2.165)	26.00	(1.024)	147.5	(5.807)	217.3	(8.555)
AZPF28	55.00	(2.165)	26.00	(1.024)	148.1	(5.831)	222.1	(8.744)

For dimensions missing for R4, see pages 8 and 9.

Unit dimensions: P3R4…, nominal dimensions in mm (inch)



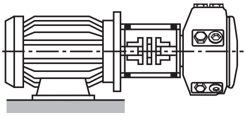
Type P3R4- …+	D1		D2		L1		L2		L3	
	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
AZPFF5-4	15.00	(0.591)	15.00	(0.591)	125.4	(4.937)	208.4	(8.205)	254.7	(10.028)
AZPFF8-4	20.00	(0.787)	15.00	(0.591)	127.5	(5.02)	212.5	(8.366)	258.8	(10.189)
AZPFF8-8	20.00	(0.787)	20.00	(0.787)	127.5	(5.020)	215.8	(8.496)	265.4	(10.449)
AZPFF11-4	20.00	(0.787)	15.00	(0.591)	131.3	(5.169)	217.5	(8.563)	263.8	(10.386)
AZPFF11-5	20.00	(0.787)	15.00	(0.591)	131.3	(5.169)	218.7	(8.610)	266.3	(10.484)
AZPFF11-8	20.00	(0.787)	20.00	(0.787)	131.3	(5.169)	220.8	(8.693)	270.4	(10.646)
AZPFF16-16	20.00	(0.787)	20.00	(0.787)	131.8	(5.189)	233.5	(9.193)	292.2	(11.504)

For dimensions missing for R4, see pages 8 and 9.

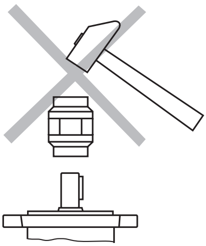
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

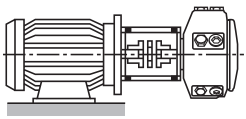


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

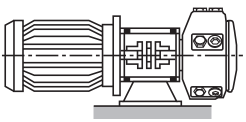


Installation positions

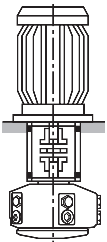
B3



B5



V1



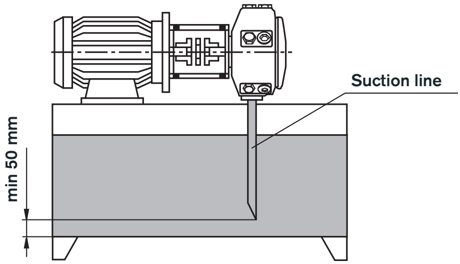
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s)
- For inlet pressure, see page 5
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters.
  (Use suction filter only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, "notes on the planning and design of hydraulic systems".

For the use of radial piston pumps, we recommend that the notes given in the following be strictly observed.

Technical data

All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.

Please note that certain tolerances are therefore possible, and that technical data may vary when boundary conditions (e.g. viscosity) are changed.

Characteristic curves

Characteristic curves for flow and required power.
When selecting the drive motor, take the max. possible operating data into account.

Noise

The noise pressure level values given on page 5 are measured in accordance with DIN 45635 part 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated. The values always refer to only one pump.

Caution!

The power unit design and influences at the place of final installation of the pump result in the fact that the noise pressure level is usually 5 to 10 10 dB(A) higher than the value of the pump alone.

Commissioning notes

Bleeding

- All radial piston pumps of type PR4 are self-priming.
- Before initial commissioning, the pump must be bled in order to protect it from damage.
- **During initial commissioning, foaming oil must be drainedn by opening the pressure flange or the pressure line (if required, provide splash guard) while the pump is running in absolutely pressureless circulation. Only when bubble-free oil starts to flow out can the flange be re-tightened to the specified torque.**
- Should the pump not displace bubble-free oil after approx. 20 seconds, check the system again. When the operating values are reached, check the pipe connections for leakage. Check the operating temperature.

Commissioning

- Check that the system is thoroughly and properly installed.
- Observe the arrows for the direction of rotation of the motor and the pump.
- Start the pump up under no load and let it displace at zero pressure for some seconds in order to ensure sufficient lubrication.
- **The pump may in no case be operated without fluid!**

⚠ Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorised, trained and instructed personnel!
- Use only genuine Rexroth spare parts!
- The pump may only be operated at the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. installation or removal), the system must be switched off and depressurised!
- Unauthorised conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection)!
- Any existing protective guards must not be removed!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

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documentation@boschrexroth.de
www.boschrexroth.de

Electro-hydraulic pumps

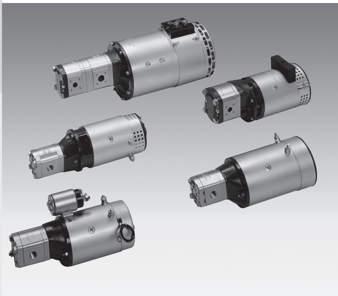
Designation	**Type**	**Size**	**Component series**	p_{max} in bar	**Data sheet**	**Page**
Electro-hydraulic pumps	EHP	1 ... 22,5			10104	1491

Rexroth
Bosch Group

Electrohydraulic pumps

RE 10 104/03.10 1/76
Replaces:
RE 1 987 760 401/06.96

EHP



Nominal voltage (DC): 12...80 V
Size of pump: 1.0...22.5 cm^3/rev

Table of contents

Content	Page
Ordering code	2
Program overview	4
Technical data	5
Project planning notes	6
Commissioning	7
Unit dimensions	8…68
Characteristics	9...69
Accessories, spare parts	70...71
Project specifications	72...75

Features

The staged modular principle means that electric motor and pump can be combined according to the required performance, guaranteeing:
– high efficiency
– low noise
– high operating pressure
– compact dimensions
– long service life
– consistent quality

Application areas
As drive groups in vehicles, they are employed primarily for the lifting and steering functions.

Ordering code

Electrohydraulic pumps with one pump

Product designation
Electrohydraulic pump

Electric motor size:
I = Terminal case diameter: 110...<120 mm
K = Terminal case diameter: 120...<130 mm
P = Terminal case diameter: 150...<160 mm
S = Terminal case diameter: 160...<170 mm
T = Terminal case diameter: 170...<180 mm

Electric motor
Switch type for exciter windings to anchor:
D = Compound winding
N = Shunt winding
R = Series winding

Electric motor
Cooling:
L = Motor open with fan
O = Motor open without fan
G = Motor closed (convection only)

EHP	12	I	D	G	66	F	011	–	20	C	0654	R	0	D120	–	S000

Electric motor
Nominal voltage (DC):
(in V)

Electric motor
Protection class Case:
e.g.: 66 = IP 66
e.g.: 54 = IP 54

External gear pump
Series:
B (1.0 – 7.1)
F (004 – 22.5)
S (004 – 22.5)
(as per AZ pump, Ordering code as per RNM 01310-00)

External gear pump
Size:
1.0 – 7.1 (size B)
004 – 022 (size F, S)

External gear pump
Case connection:
20 = Square flange, DIN 3901/3902
12 = Thread UNF-2B, SAE, O-ring
02 = Metric thread, DIN 3852 T1

Special design
SXXXX = Serial number

Special equipment
Valves:
= No valves
D = PRV
120 = Pressure setting 120 bar

Special equipment
Thermal protection switch for electric motor:
0 = No TPS
2 = TPS with 2 cable end sleeves
4 = TPS with cable end sleeve and cable terminal
6 = TPS with connector and cable terminal
(4, 6 not available in all combinations)

Special equipment
Switch relay:
N = No relay
R = Relay radially mounted
A = Relay axially mounted
L = Relay supplied loose

EHP characteristic
Figures = The last 4 digits of the characteristic number
e.g.: 0654 = Y 541 000 654
e.g.: 1246 = Y 541 001 246

External gear pump
Mounting angle (with respect to electric ports):
e.g.: C = 90° (clockwise, looking at pump)
A = 0°, B = 45°, C = 90°, D = 135°, E = 180°, F = 225°, G = 270°, H = 315°

Ordering code

Electrohydraulic pumps with multiple pump

Product designation
Electrohydraulic pump

Electric motor size:
I = Terminal case diameter: 110...<120 mm
K = Terminal case diameter: 120...<130 mm
P = Terminal case diameter: 150...<160 mm
S = Terminal case diameter: 160...<170 mm
T = Terminal case diameter: 170...<180 mm

Electric motor
Switch type for exciter windings to anchor:
D = Compound winding
N = Shunt winding
R = Series winding

Electric motor
Cooling:
L = Motor open with fan
O = Motor open without fan
G = Motor closed (convection only)

EHP	24	K	D	L	54	FF	032	/	022	–	20	20	A	0654	R	0	D120	–	S000

Electric motor
Nominal voltage:
(in V)

Electric motor
Protection class Case:
e.g.: 66 = IP 66
e.g.: 54 = IP 54

External gear pump
Pump 1 and pump 2
Series:
B (1.0 – 7.1)
F (004 – 22.5)
S (004 – 22.5)
(as per AZ pump, ordering code as per RNM 01310-00)

External gear pump
Size:
pump section 1/pump section 2

External gear pump
Case connection:

20 = Square flange, DIN 3901/3902
12 = Thread UNF-2B, SAE, O-ring
02 = Metric thread, DIN 3852 T1

Special design
SXXXX = Serial number

Special equipment
Valves:
= No valves
D = PRV
120 = Pressure setting 120 bar

Special equipment
Thermal protection switch for electric motor:
0 = No TPS
2 = TPS with 2 cable end sleeves
4 = TPS with cable end sleeve and cable terminal
6 = TPS with connector and cable terminal
(4, 6 not available in all combinations)

Special equipment
Switch relay:
N = No relay
R = Relay radially mounted
A = Relay axially mounted
L = Relay supplied loose

EHP characteristic
Figures = The last 4 digits of the characteristic number
e.g.: 0654 = Y 541 000 654
e.g.: 1246 = Y 541 001 246

External gear pump
Mounting angle (with respect to electric ports):
e.g.: C = 90° (clockwise, looking at pump)
A = 0°, B = 45°, C = 90°, D = 135°, E = 180°, F = 225°, G = 270°, H = 315°

Program overview

Part number	Page	Characteristic	Quotation drawing	Ordering code
0 541 200 082	8	Y 541 001 049	A 541 020 330	EHP12IDG54F004-20E1049A0D040
0 541 100 075	10	Y 541 000 416	A 541 110 111	EHP12IDG66B3.0-02A0416N0
0 541 000 025	12	Y 541 001 008	A 541 110 190	EHP12IDG54B1.0-02A1008L0
0 541 000 024	13	Y 541 001 015	A 541 110 190	EHP24IDG54B1.0-02A1015L4
0 541 100 070	14	Y 541 001 016	A 541 110 190	EHP24IDG54B2.0-02A1016L4
0 541 100 077		Y 541 001 016	A 541 110 190	EHP24IDG54B2.0-02A1016R0
0 541 100 067		Y 541 001 018	A 541 110 190	EHP24IDG54B3.0-02A1018N0
0 541 100 071		Y 541 001 018	A 541 110 190	EHP24IDG54B3.0-02A1018L4
0 541 100 072		Y 541 001 018	A 541 110 190	EHP24IDG54B3.0-02A1018R0
0 541 100 074		Y 541 001 018	A 541 110 190	EHP24IDG54B3.0-02A1018N2
0 541 200 063	16	Y 541 000 388	A 541 020 083	EHP24IDG43F004-20A0388N0
0 541 300 057	18	Y 541 000 402	A 541 020 085	EHP24IDG54F005-20A0402N6
0 541 400 065	20	Y 541 001 043	A 541 020 305	EHP24IDG54F008-20A1043N0
0 541 500 076	22	Y 541 001 238	A 541 020 326	EHP24IDG66F011-20A1238L2D050
0 541 100 046	24	Y 541 000 406	A 541 110 101	EHP24IDG43B2.0-02A0406N0
0 541 100 052	26	Y 541 000 902	A 541 110 130	EHP24IDL12B3.0-20C0902N0
0 541 100 053		Y 541 000 903	A 541 110 130	EHP24IDL12B3.8-20C0903N0
0 541 200 068	28	Y 541 000 904	A 541 110 154	EHP24IDL12B4.6-20A0904N0
0 541 100 058	30	Y 541 000 902	A 541 110 162	EHP24IDL12B3.0-02A0902N0
0 541 100 064	32	Y 541 000 653	A 541 023 042	EHP24KDG66F004-20A0653N0
0 541 500 071	34	Y 541 000 656	A 541 023 062	EHP24KDG66F011-12A0656N0D060
0 541 500 078	36	Y 541 000 656	A 541 023 066	EHP24KDG66F011-20A0656L0D050
0 541 300 058	38	Y 541 000 096	A 541 026 001	EHP24KDL20FB005/1.0-2002A0096N0
0 541 100 055	40	Y 541 000 611	A 541 114 010	EHP24KDG43B3.0-02A0611N0
0 541 200 067	42	Y 541 000 613	A 541 114 014	EHP24KDG43B4.6-20C0613N0
0 541 100 054	44	Y 541 000 612	A 541 114 016	EHP24KDG43B3.8-20C0612N0
0 541 200 049	46	Y 541 000 191	A 541 021 132	EHP24PRL24F004-20E0191N0
0 541 300 038		Y 541 000 192	A 541 021 132	EHP24PRL24F005-20E0192N0
0 541 300 066		Y 541 000 192	A 541 021 132	EHP24PRL24F005-20A0192N0
0 541 400 041		Y 541 000 193	A 541 021 132	EHP24PRL24F008-20E0193N0
0 541 500 054		Y 541 000 194	A 541 021 132	EHP24PRL24F011-20E0194N0
0 541 600 041		Y 541 001 264	A 541 021 132	EHP24PRL24F016-20E1264N0
0 541 400 046	48	Y 541 000 297	A 541 021 148	EHP24PRL24F008-20E0297N0
0 541 500 055		Y 541 000 298	A 541 021 148	EHP24PRL24F011-20E0298N0
0 541 600 036		Y 541 000 300	A 541 021 148	EHP24PRL24F016-20E0300N0
0 541 400 067	50	Y 541 001 145	A 541 021 329	EHP24PRL24S008-20E1145N0
0 541 500 072		Y 541 000 175	A 541 021 329	EHP24PRL24S011-20E0175N0
0 541 400 072	52	Y 541 001 145	A 541 021 337	EHP24PRL24S008-20G1145N0
0 541 300 040	54	Y 541 000 085	A 541 021 136	EHP24PRL24FB005/3.0-2002E0085N0
0 541 300 064		Y 541 001 180	A 541 021 136	EHP48PRL24FB005/2.0-2002E1180N0
0 541 300 054	56	Y 541 000 939	A 541 021 185	EHP24PRL24FF005/003-2020E0939N0
0 541 300 055		Y 541 000 983	A 541 021 185	EHP48PRL24FF005/003-2020E0983N0
0 541 300 043	58	Y 541 000 201	A 541 021 186	EHP48PRL24F005-20E0201N0
0 541 400 052		Y 541 000 202	A 541 021 186	EHP48PRL24F008-20E0202N0
0 541 300 046	60	Y 541 000 201	A 541 021 189	EHP48PRL24F005-20A0201N0
0 541 400 068	62	Y 541 000 143	A 541 021 327	EHP48PRL24S008-20C0143N0
0 541 500 074	64	Y 541 001 173	A 541 022 166	EHP48SDL14S011-20A1173N0
0 541 400 074	66	Y 541 001 262	A 541 022 170	EHP48TRL23FF008/005-2020A1262N2
0 541 300 032	68	Y 541 001 003	A 541 023 013	EHP72KDO14F005-20A1003N0

Other versions on request.

Technical data

General	
Installation position	Vertical, hydraulic pump at bottom; horizontal as shown in dimensions drawing. Condensation opening, if fitted, at bottom
Ambient temperature range	between −25 °C and +60 °C
Mounting	Saddle mounting with wire tie

Pump																			
Design		External gear pump																	
Type		AZPB…				AZPF…							AZPS…						
Displacement	cm^3/rev	1	2	3	3.8	4	5.5	8	11	14	16	19	4	5	8	11	14	16	19
Suction pressure	bar	min. 0.7 max. 3 (absolute)																	
max. continuous pressure p_1	bar	210			170	250						210	250						210
max. intermittent pressure p_2	bar	230			180	280						230	280						230
max. peak pressure p_3	bar	250			180	300						250	300						250
Speeds		Depending on operating pressure, see Characteristics																	
Line ports		AZPB/F/S: Thread, flange, others on request																	
Fluids		– Mineral oil compliant with DIN 51524, 1–3, however under higher load at least HLP compliant with DIN 51524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation																	
Viscosity		12 … 800 mm^2/s permitted range 20 … 100 mm^2/s recommended range … 2000 mm^2/s permitted for start up																	
Temperature of hydraulic fluid		−25 … +80 °C																	
Filtration *)		At least cleanliness level 21/18/15 compliant with ISO 4406 (1999)																	

Electric motor					
Design	DC motor with compound or series winding				
Size (code)	I	K	P	S	T
Terminal case Ø mm	110 .. < 120	120 .. < 130	150 .. < 160	160 .. < 170	170 .. < 180
Voltage (volts)	12, 24, 40, 48, 72, 80 see overview of range				
Power output (kW)	1.5 … 8.1, other outputs on request				
Protection class	up to IP 66				
Diagrams	These are valid for operation with a 12 V, 24 V starter battery, or a number of 24 V starter batteries wired in series, each with 180 Ah 1/2 full after 20-hour discharge. Ambient temperature +20 °C Electrolyte temperature +20 °C Motor temperature +20 °C Oil temperature +50 °C Viscosity $\nu = 32$ mm^2/s S2, S3, ED see VDE 0530				

Relay (not available in every version)		
Voltage	12 V	24 V
Exciter current	1.5 A	0.9 A
Contact current 5 sec.	800 A	
Contact current, continuous	150 A	
Protection class	IP 54 / IP 6K9K / IP 66 on request	

*) On hydraulic systems or devices with critical counter-reaction, such as steering valves, brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.
Safety requirements pertaining to the whole systems are to be observed.
Please contact us with respect to applications with high numbers of load cycles.

8

Project planning notes

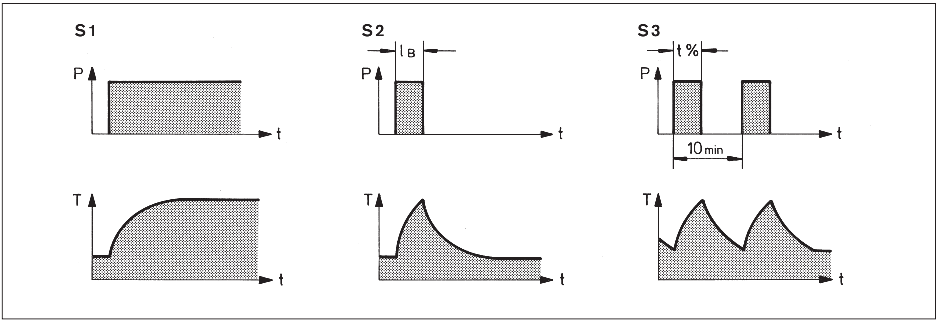
1. Operating modes

The starting points for dimensioning electrohydraulic pump are pressure p and flow rate Q.
However, the resulting power output P depends on the **operating mode**.
Here, a distinction is made between:

Continuous operation S 1
Operation with constant load, with a duration long enough for thermal equilibrium to be reached.

Short-term operation S 2
Operation with constant load.
Of short duration so that thermal equilibrium is not reached.
Example: S 2–60 min.

Intermittent operation S 3
Operation comprising a series of similar cycles (cycle duration 10 min), which include a time with constant load and a pause. Example: S 3–10%



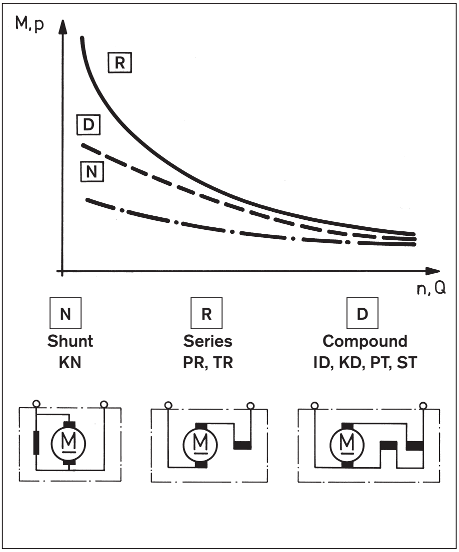
2. Motor characteristics

Speed and torque of a DC motor and thus the flow rate and pressure of the pump being driven are interdependent in accordance with the curves shown.
The curve is determined by both the power output and the type of winding. A distinction is made between:

Shunt winding
Benefit: Small change in speed with load fluctuation.
Drawback: Low start-up torque, current peaks.

Series winding
Benefit: High start-up torque
Drawback: “Motor overspeeding” without load

Compound winding
Compromise between shunt and series winding.



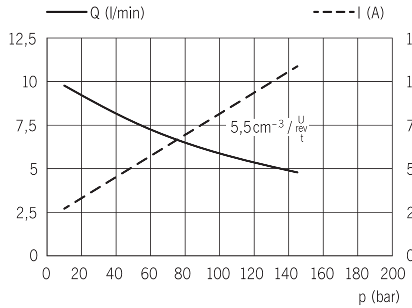
Project planning notes (continued)

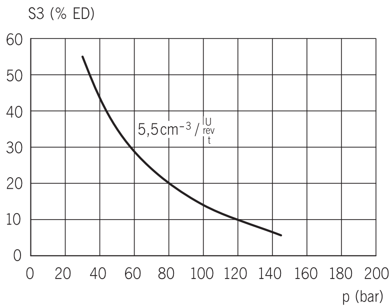
3. Selection

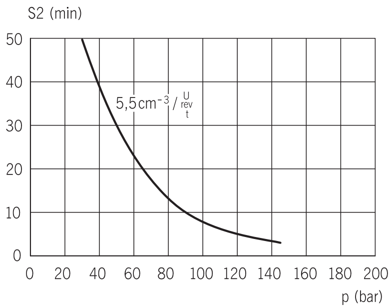
It is not the power output figure (in watts) that is decisive for the selection, but rather the actuated time under the required operating conditions, see Characteristics. This prevents the motor from being either overloaded or dimensioned too large. It is expedient to select a suitable electrohydraulic pump on the basis of the diagrams for the different combinations. These show:

a) the flow rate Q (l/min) and the electric current consumption I (A) depending on pressure p.

b) the permissible pressure p depending on the operating mode S 3 (%) or S 2 (min).







Commissioning

Installation and commissioning

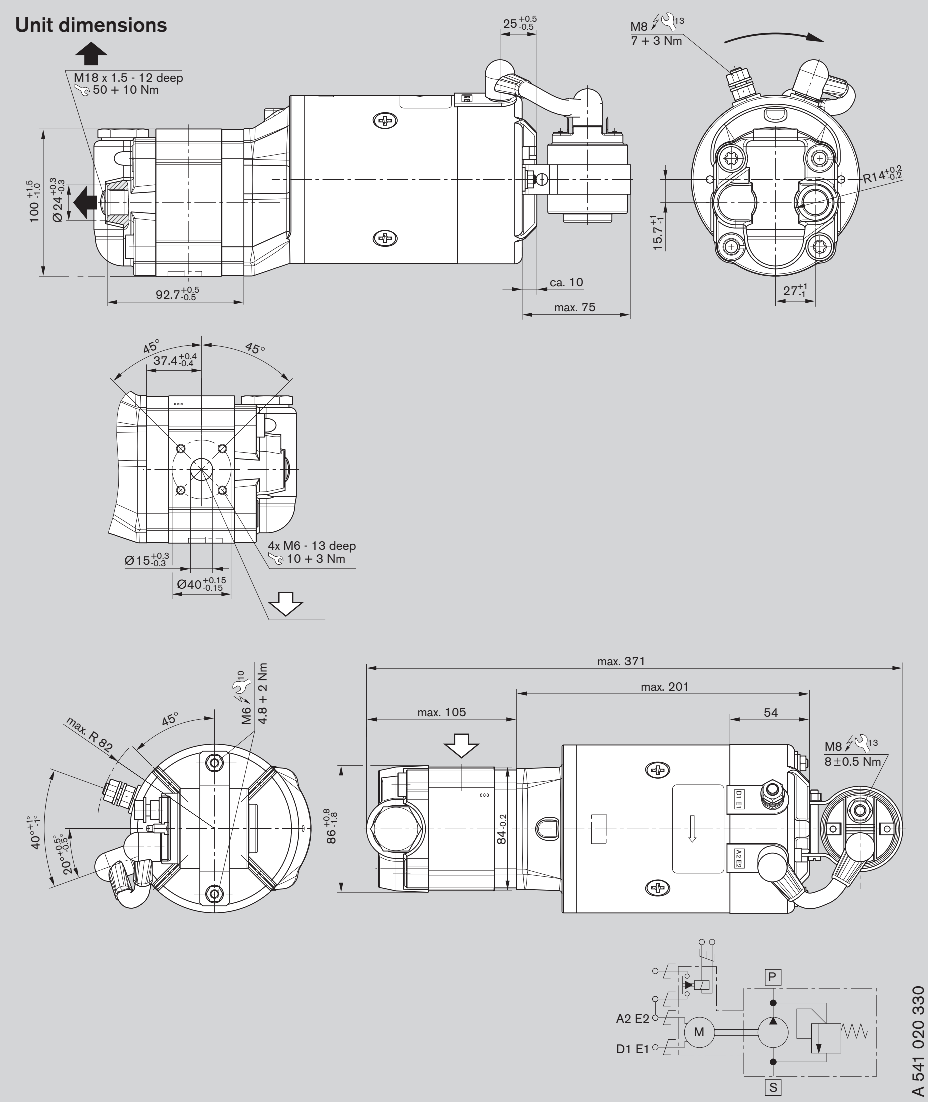
– Fill pump with hydraulic fluid before installation.
– Pipelines to be cleaned of dirt, cinders, sand, chips etc. before installation.
  Pipes, in particular must be pickled or rinsed.
– Before the 1st commissioning, the overall hydraulic system is to be carefully vented.
– Cover up the radial lip-type shaft seal ring and the air vents when spraying and painting.
– Observe characteristics, in particular, speeds and pressures as well as negative pressure in the suction line.

You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Filter recommendation
We recommend that a full-flow filter always be used.

Electrical installation
Dimension the line cross section in accordance with the maximum current.
Polarity without influence on the direction of rotation.
Note the protection class and environmental conditions.

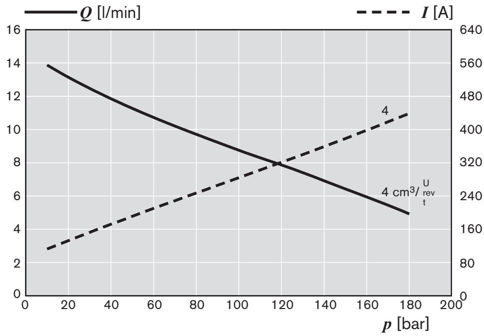
Unit dimensions

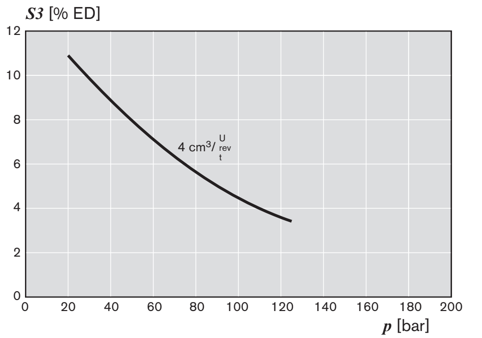


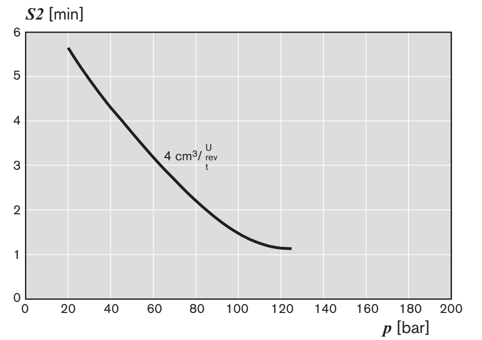
Protection class:
Motor case IP 54
Ports IP 00

Ordering code	Displacement V [cm^3/rev]	Dimension [mm] A	 B	 C	PRV [bar]	Weight [kg]	Part number
EHP12IDG54F004-20E1049A0D040	4	–	–	–	40^{+5}	2.7	**0 541 200 082**

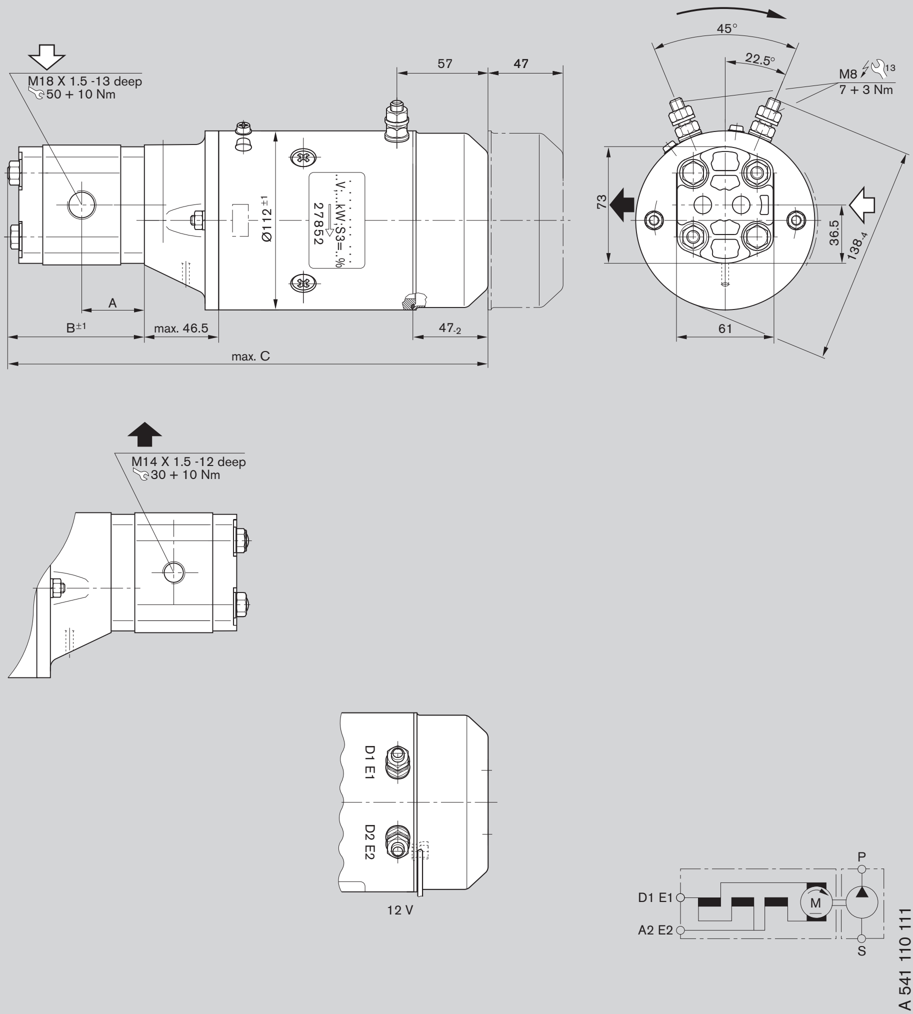
Characteristics
for A 541 020 330







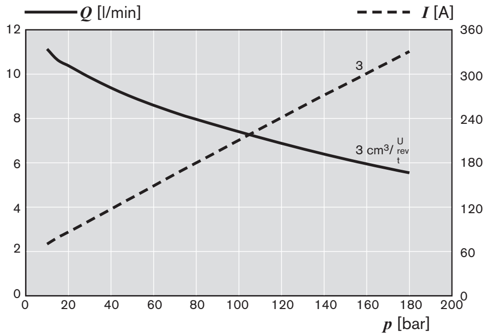
Unit dimensions

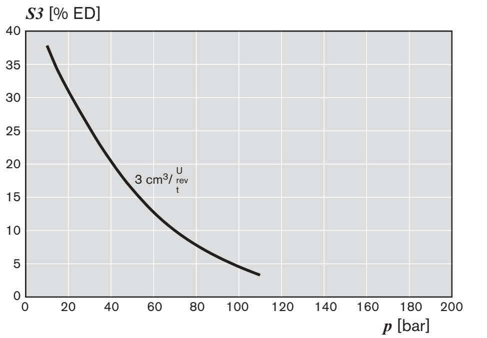


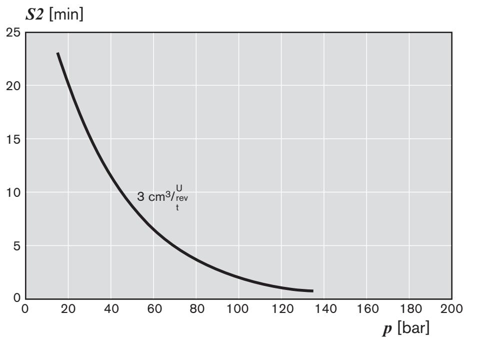
Protection class:
Motor case IP 66
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP12IDG66B3.0-02A0416N0	3.0	39.2	86	302	8.5	**0 541 100 075**

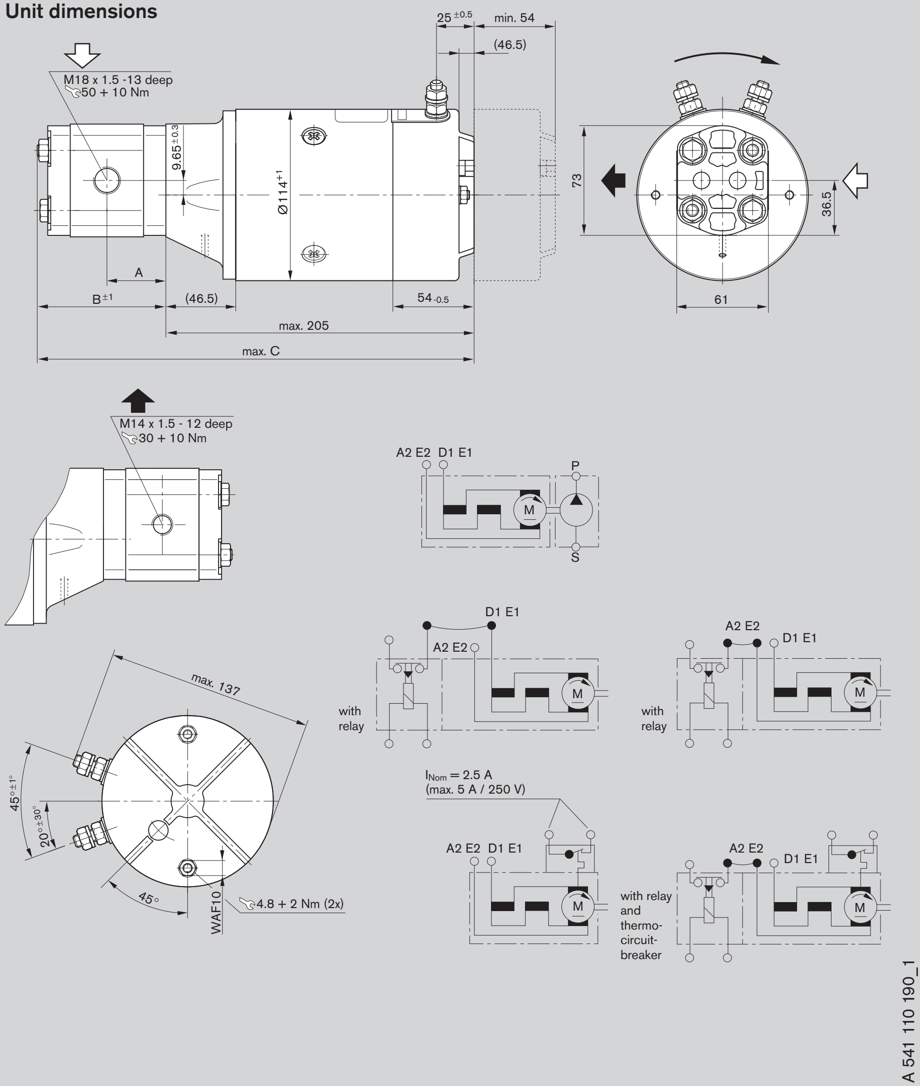
Characteristics
for A 541 110 111







Unit dimensions

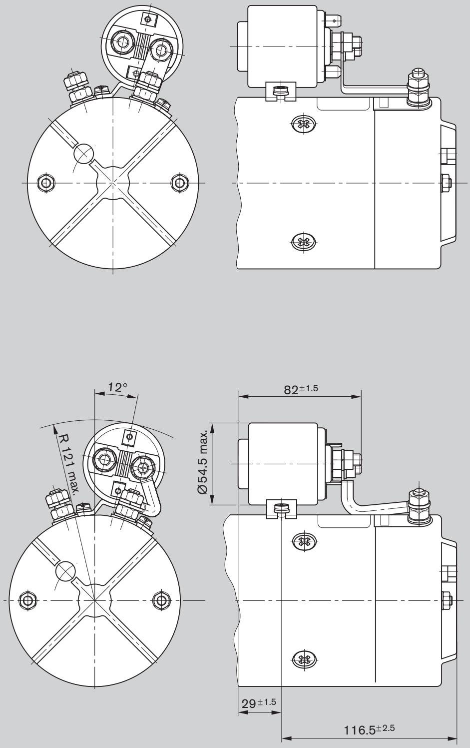


Protection class:
Motor case IP 54
Ports IP 00

Ordering code	Displace-ment V [cm³/rev]	Dimension [mm] A	 B	 C	TPS *)	Relay mounted	Relay loose	Weight [kg]	Part number
EHP12IDG54B1.0-02A1008L0	1.0	35	76	282	–	–	1 547 211 008	8.4	**0 541 000 025**
EHP24IDG54B3.0-02A1018N0	3.0	39.2	86	292	–	–		8.7	**0 541 100 067**

*) Thermal protection switch

Unit dimensions

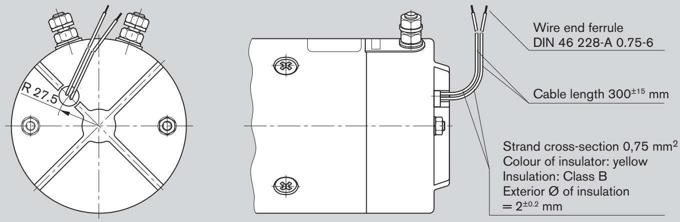


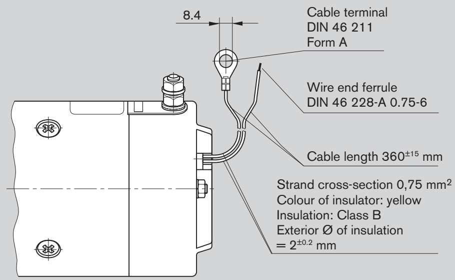
Protection class:
Motor case IP 54
Ports IP 00

Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	B	C	TPS *)	Relay mounted	Relay loose	Weight [kg]	Part number
EHP24IDG54B3.0-02A1018R0	3.0	39	86	292	–	×		9.4	**0 541 100 072**
EHP24IDG54B2.0-02A1016R0	2.0	37	81	287	–	×		9.2	**0 541 100 077**

*) Thermal protection switch

Unit dimensions





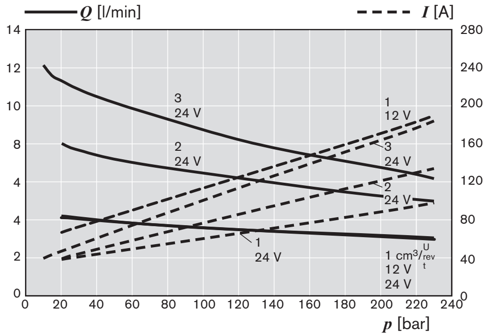
A 541 110 190_3

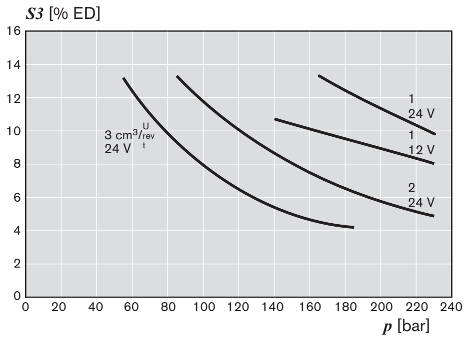
Protection class:
Motor case IP 54
Ports IP 00

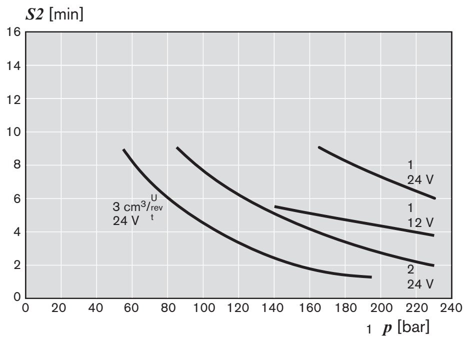
Ordering code	Displace-ment V [cm^3/rev]	Dimension [mm] A	B	C	TPS *)	Relay mounted	Relay loose	Weight [kg]	Part number
EHP24IDG54B1.0-02A1015L4	1.0	35.0	76.0	282	×	–	1 547 211 007	8.4	**0 541 000 024**
EHP24IDG54B2.0-02A1016L4	2.0	37.1	81.0	287	×	–	1 547 211 007	8.5	**0 541 000 070**
EHP24IDG54B3.0-02A1018L4	3.0	39.0	86.0	292	×	–	1 547 211 007	8.7	**0 541 100 071**
EHP24IDG54B3.0-02A1018N2	3.0	39.2	86.0	292	×	–		8.7	**0 541 100 074**

*) Thermal protection switch

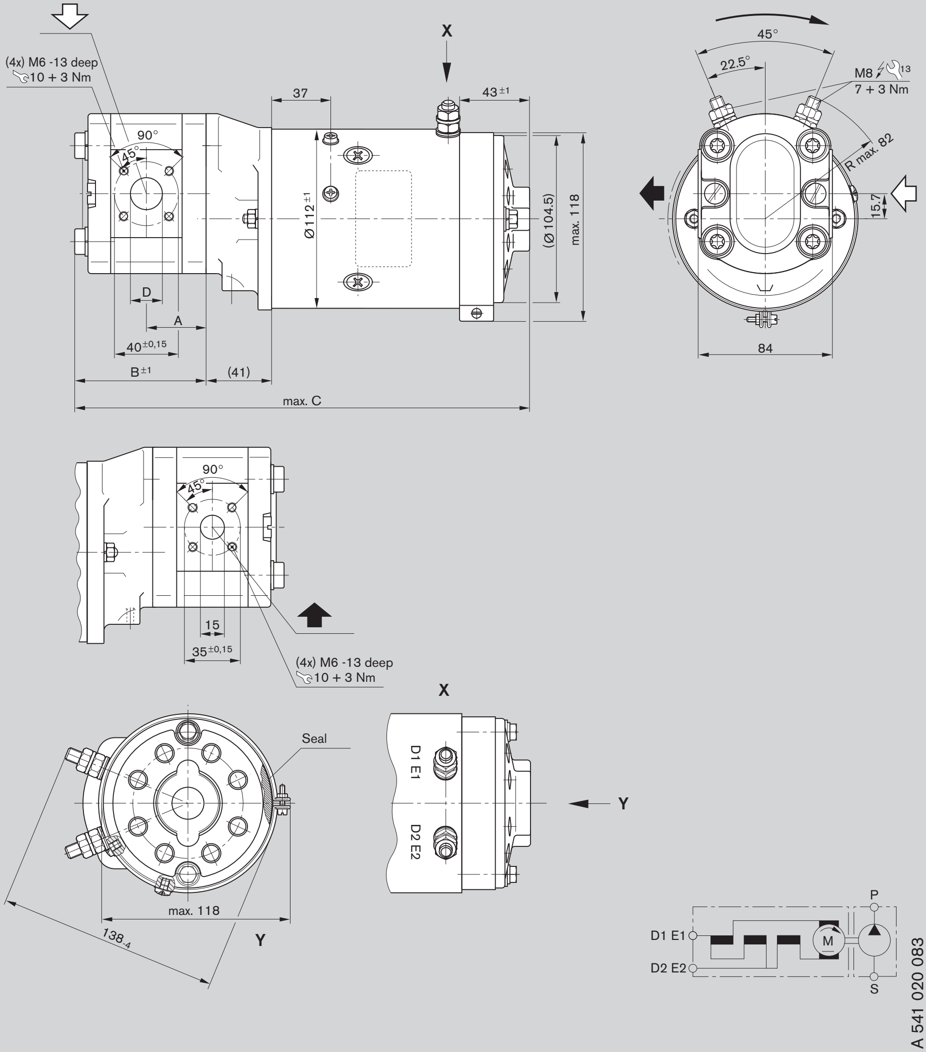
Characteristics for A 541 110 190







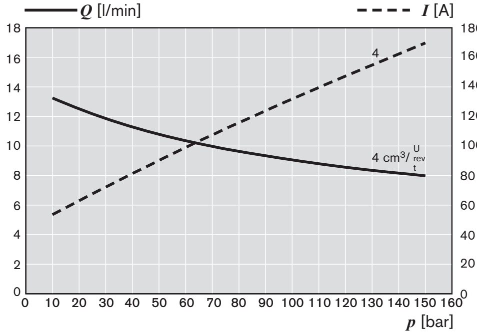
Unit dimensions

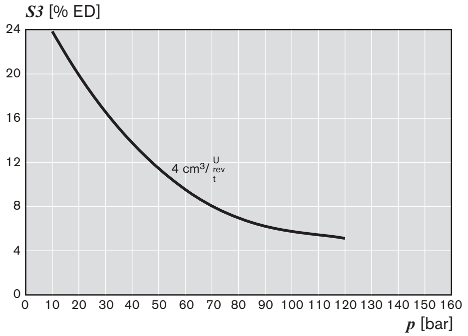


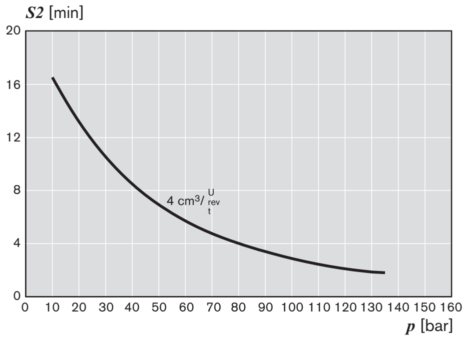
Protection class:
Motor case IP 43
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP24IDG43F004-20A0388N0	4.0	37.3	82.5	293.5	15.0	10.0	**0 541 200 063**

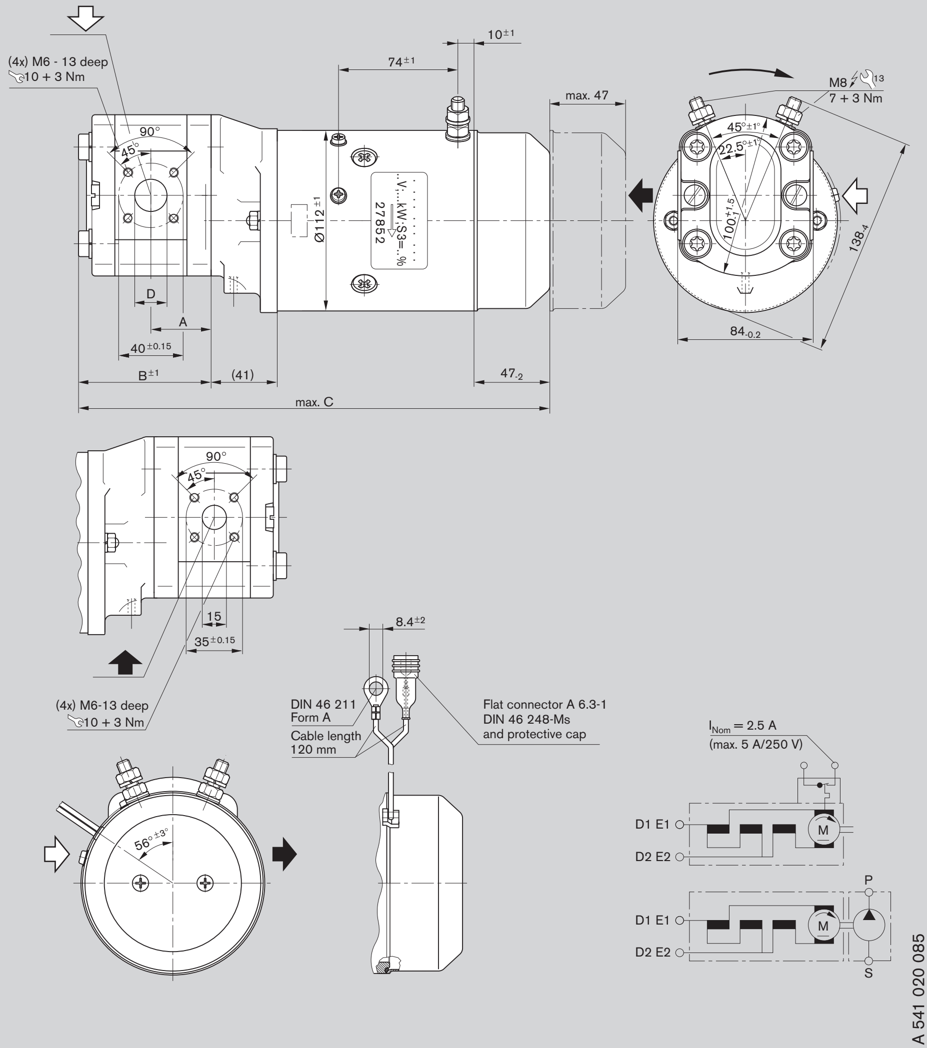
Characteristics
for A 541 020 083







Unit dimensions

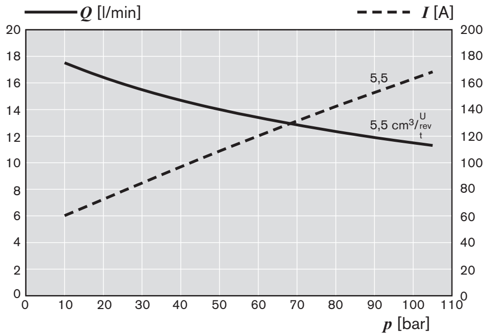


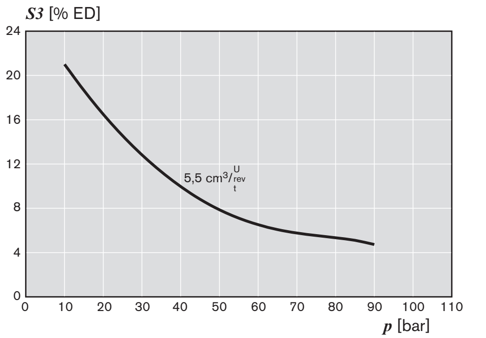
Protection class:
Motor case IP 54
Ports IP 00

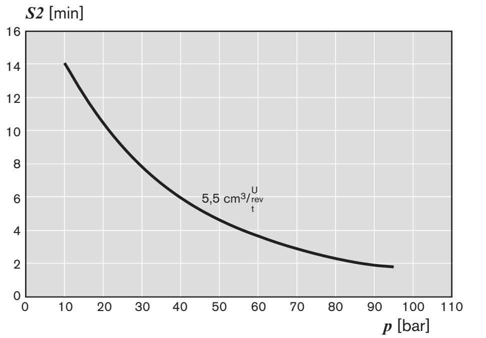
Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	 B	 C	 D	TPS*)	Weight [kg]	Part number
EHP24IDG54F005-20A0402N6	5.0	38.6	85.0	296.0	15.0	×	10.1	**0 541 300 057**

*) Thermal protection switch

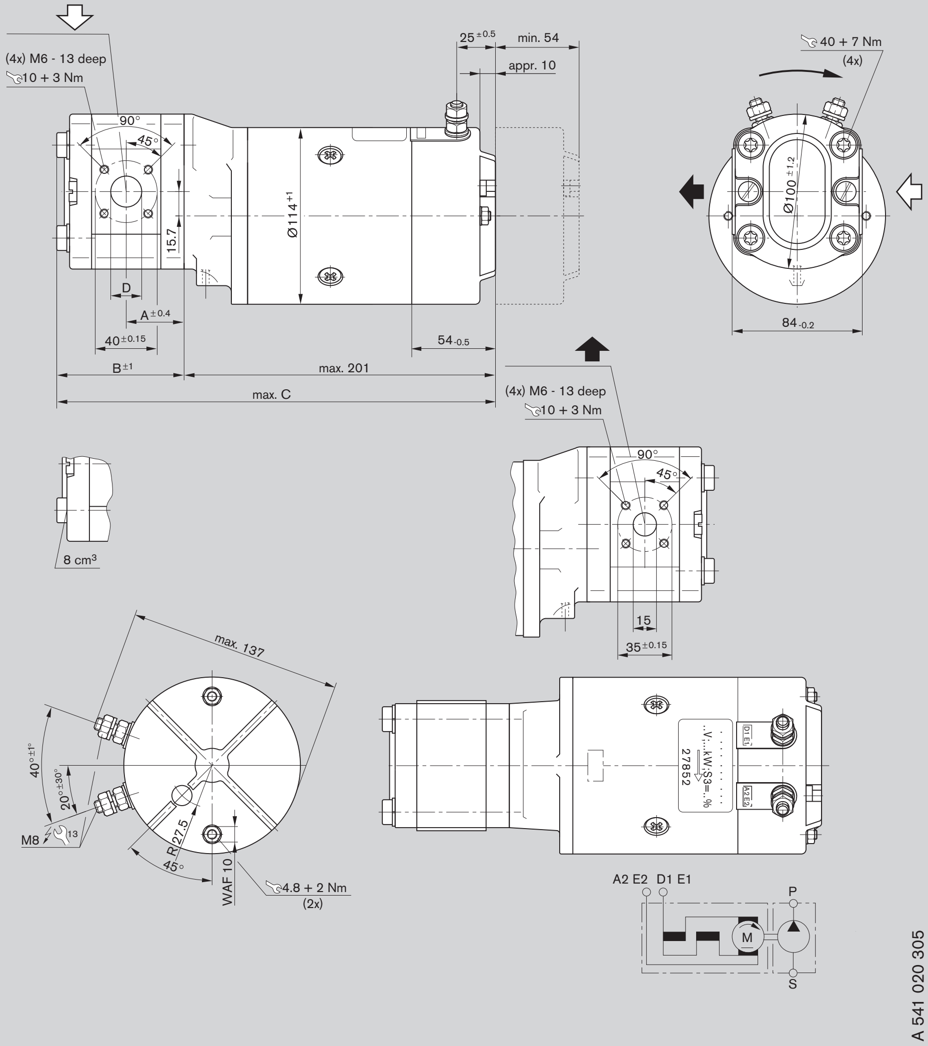
Characteristics for A 541 020 085







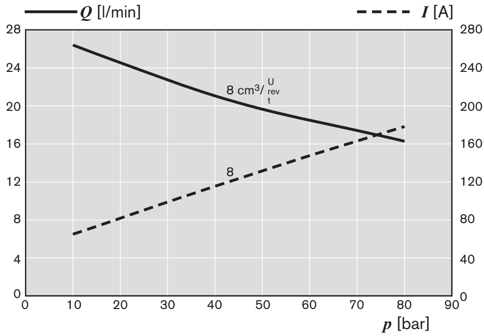
Unit dimensions

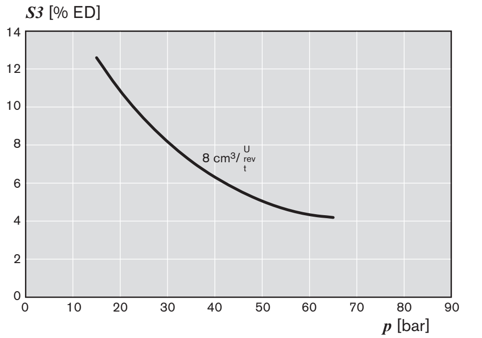


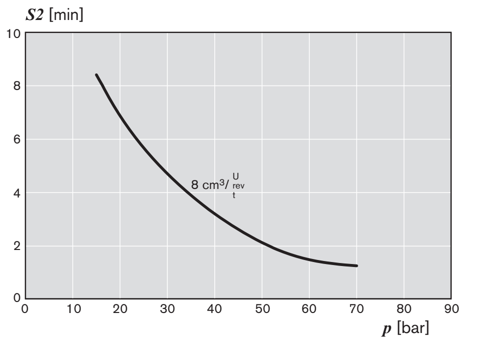
Protection class:
Motor case IP 54
Ports IP 00

Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	B	C	D	Weight [kg]	Part number
EHP24IDG54F008-20A1043N0	8.0	40.7	88.6	290.6	20.0	10.4	**0 541 400 065**

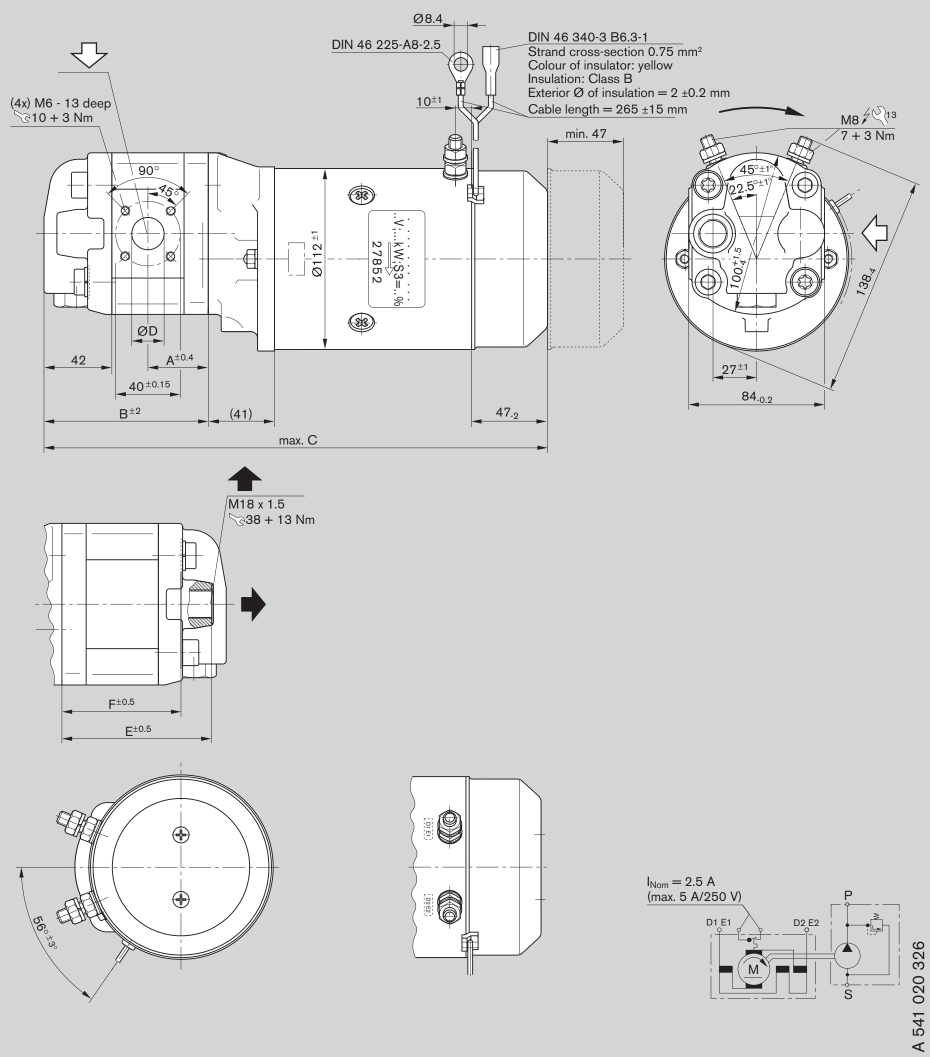
Characteristics
for A 541 020 305







Unit dimensions

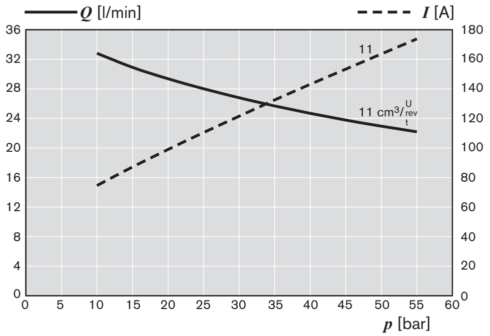


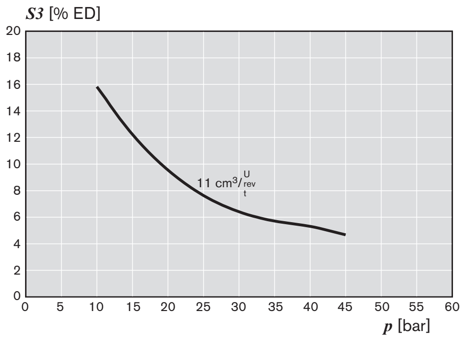
Protection class:
Motor case IP 66
Ports IP 00

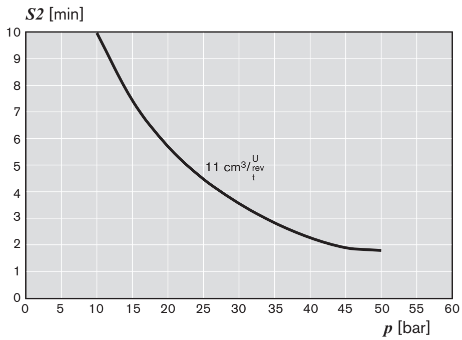
Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	B	C	D	TPS *)	PRV [bar]	Weight [kg]	Part number
EHP24IDG66F011-20A1238L2D050	11.0	45.0	112.3	324.3	20.0	×	50^{+5}	10.5	**0 541 500 076**

*) Thermal protection switch

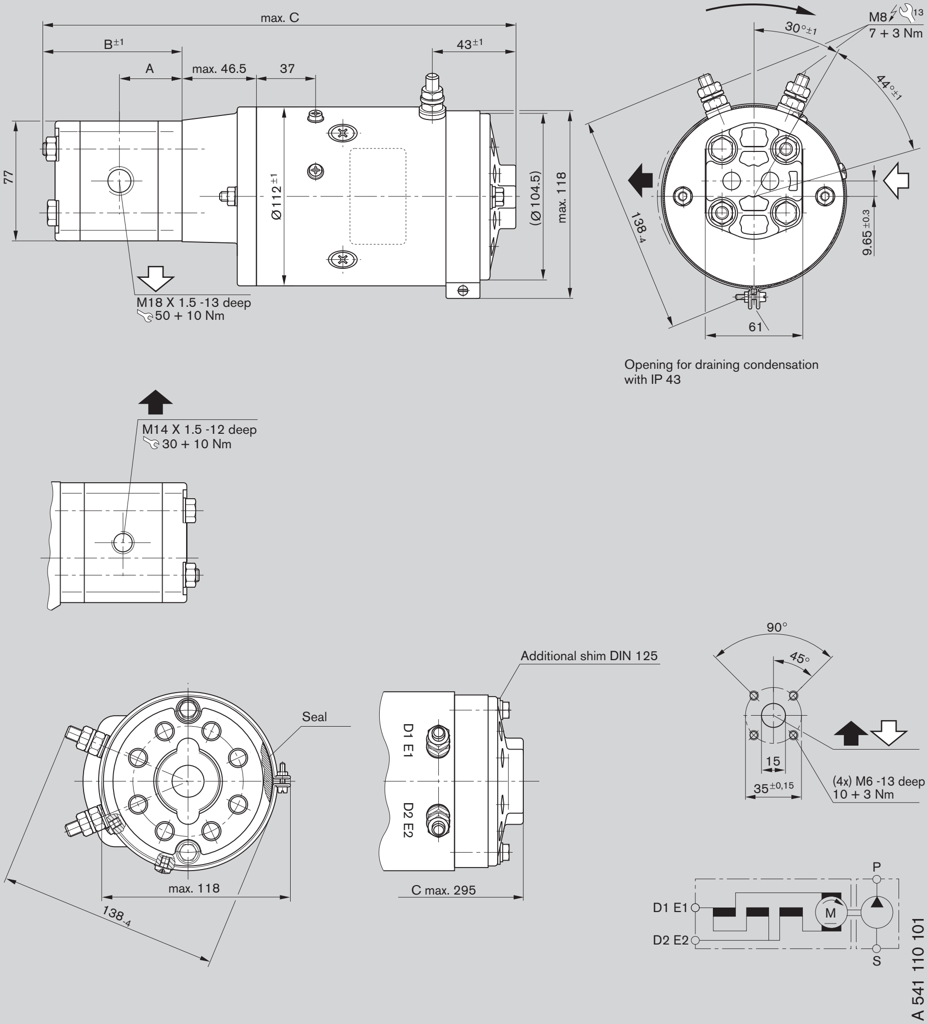
Characteristics for A 541 020 326







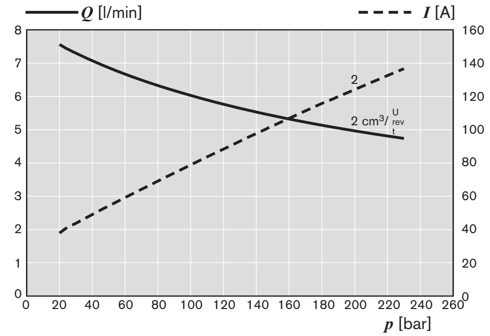
Unit dimensions

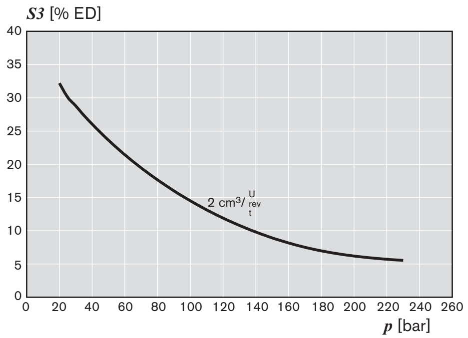


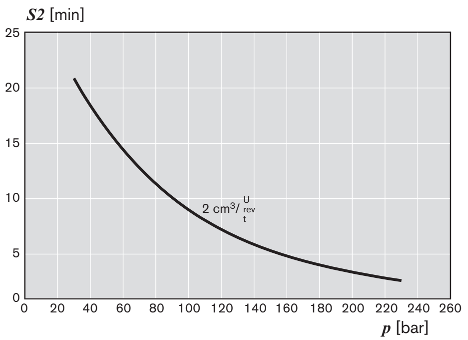
Protection class:
Motor case IP 43
Ports IP 00

Ordering code	Displacement V [cm^3/rev]	Dimension [mm] A	B	C	Weight [kg]	Part number
EHP24IDG43B2.0-02A0406N0	2.0	37.0	81.0	297.0	9.25	**0 541 100 046**

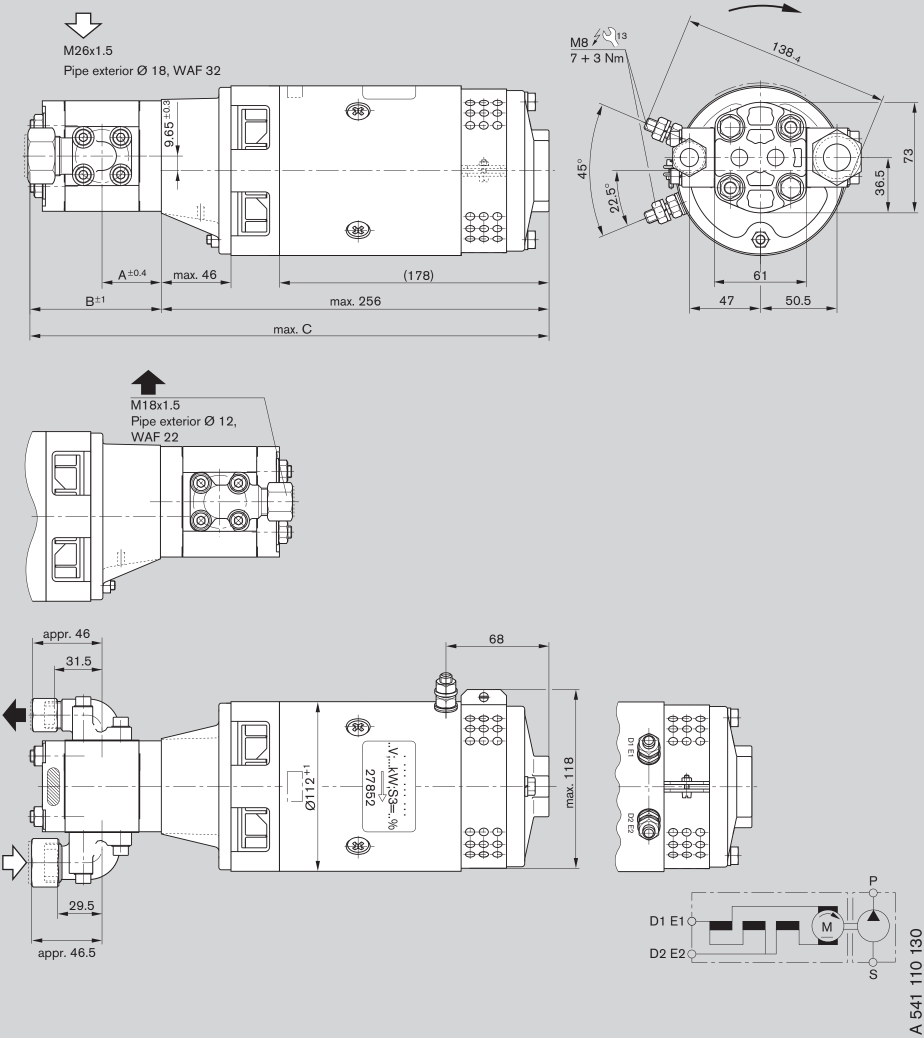
Characteristics for A 541 110 101







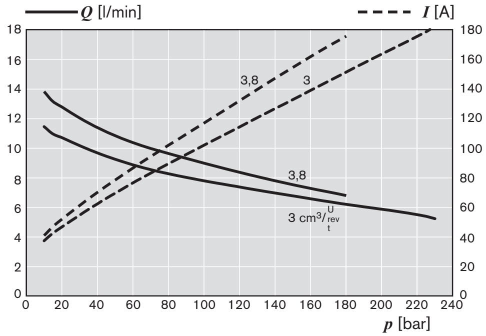
Unit dimensions

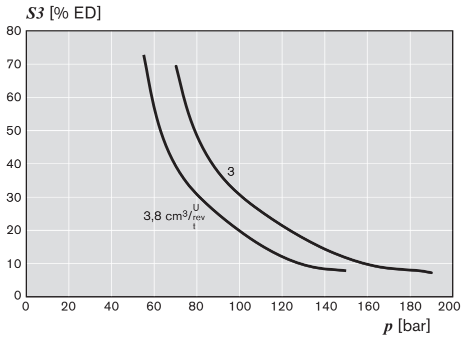


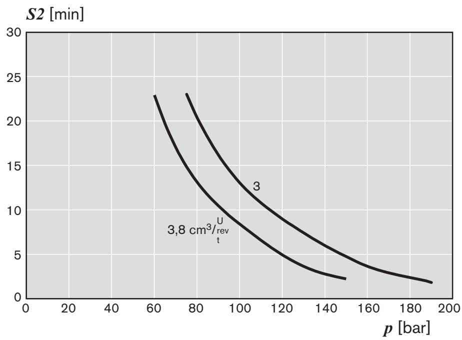
Protection class:
Motor case IP 10
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm^3/rev]	A	B	C	[kg]	
EHP24IDL12B3.0-20C0902N0	3.0	39.2	86.0	343.0	10.5	**0 541 100 052**
EHP24IDL12B3.8-20C0903N0	3.8	40.7	91.0	348.0	10.6	**0 541 100 053**

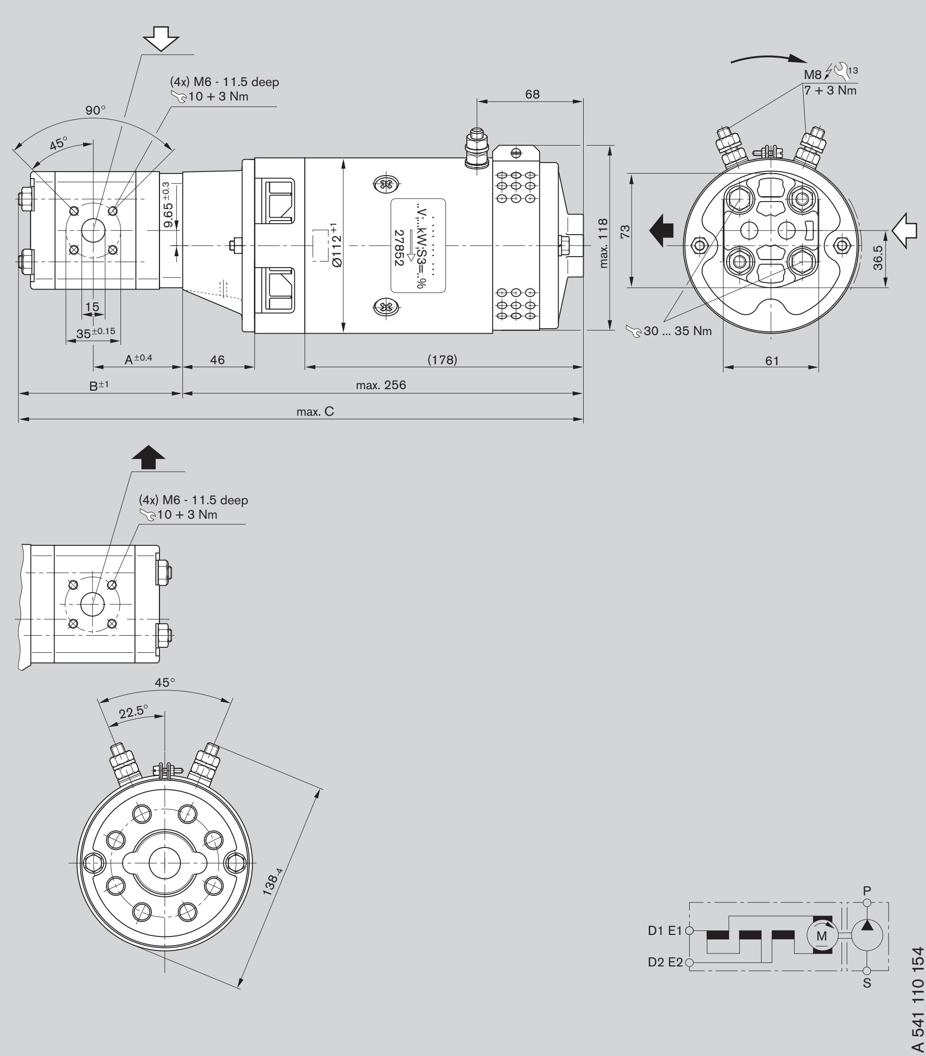
Characteristics for A 541 110 130







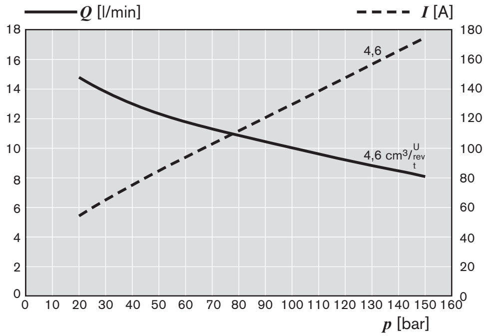
Unit dimensions

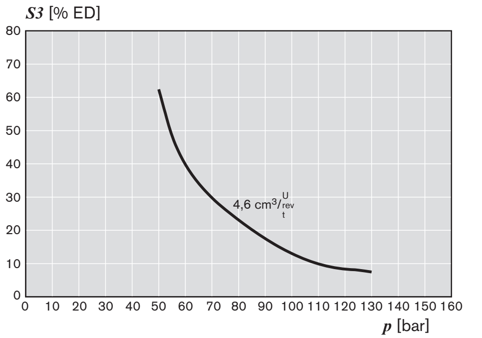


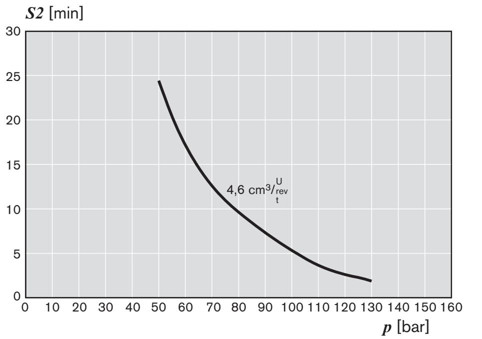
Protection class:
Motor case IP 10
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24IDL12B4.6-20A0904N0	4.6	42.0	91.0	348.0	10.7	**0 541 200 068**

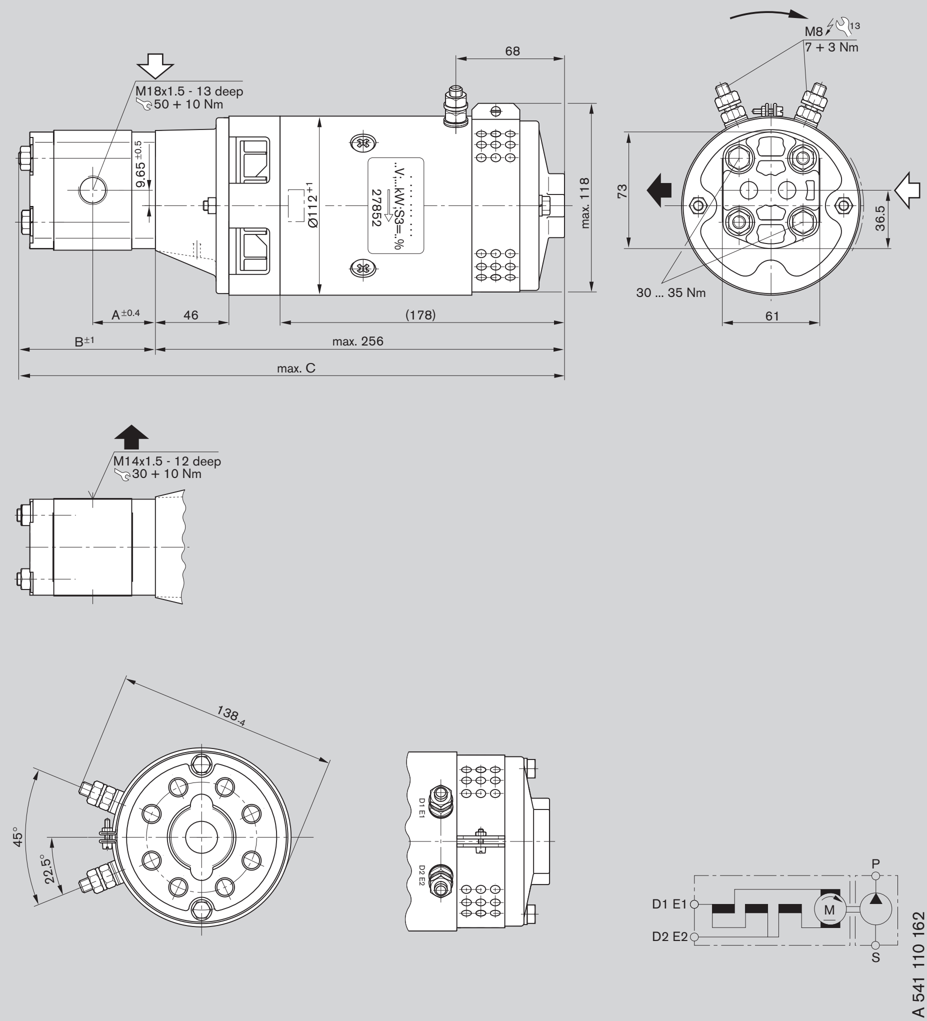
Characteristics for A 541 110 154







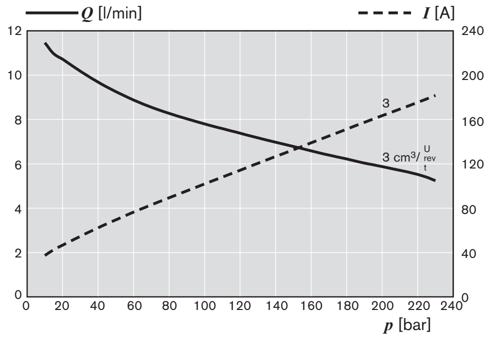
Unit dimensions

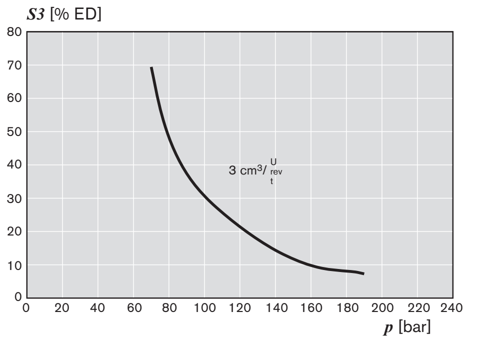


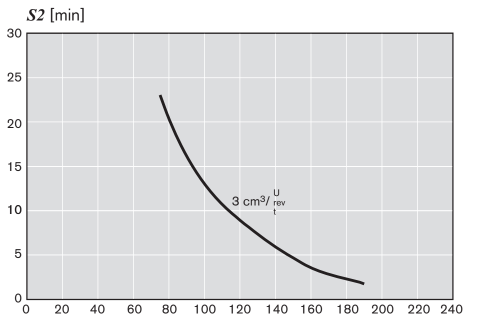
Protection class:
Motor case IP 10
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24IDL12B3.0-02A0902N0	3.0	39.0	86.0	343.0	9.9	**0 541 100 058**

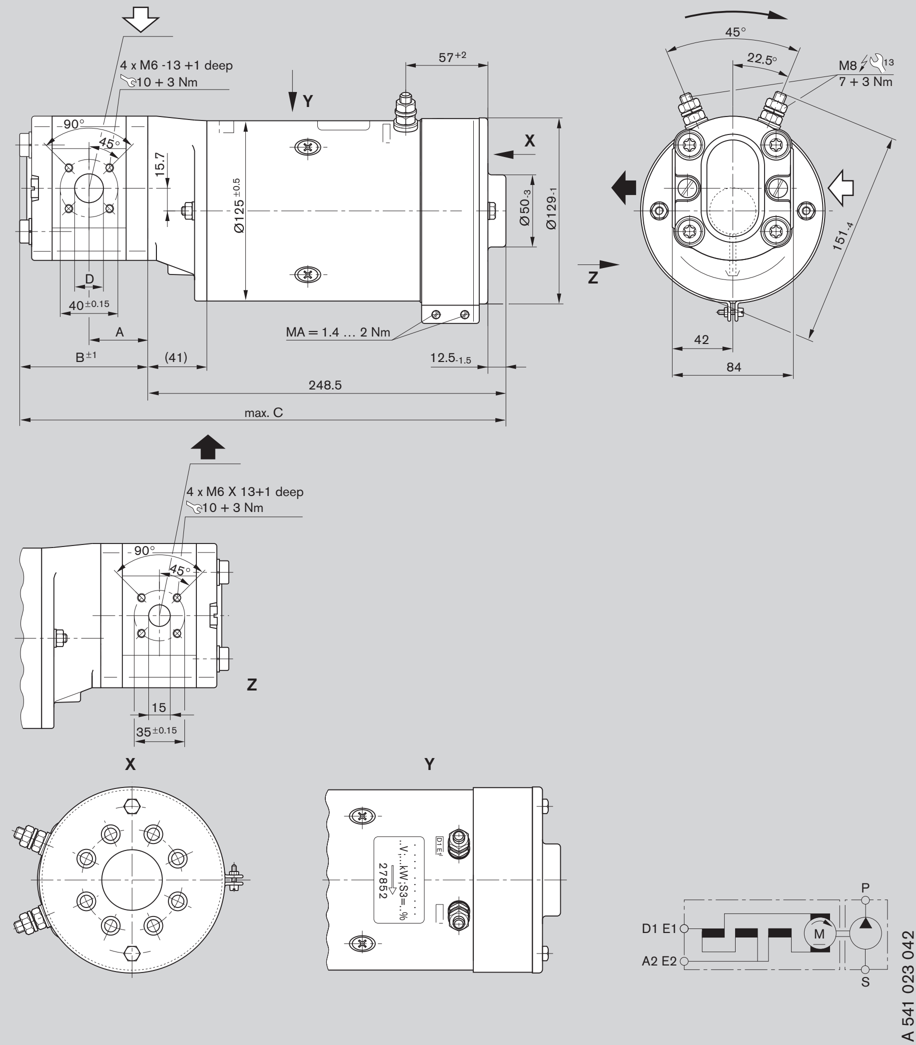
Characteristics
for A 541 110 162







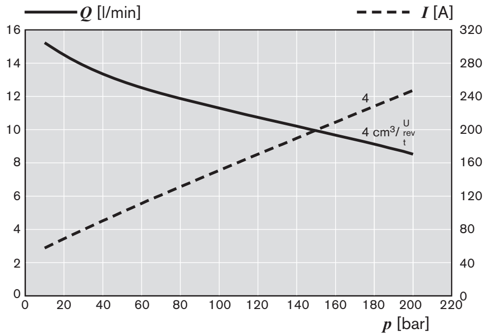
Unit dimensions

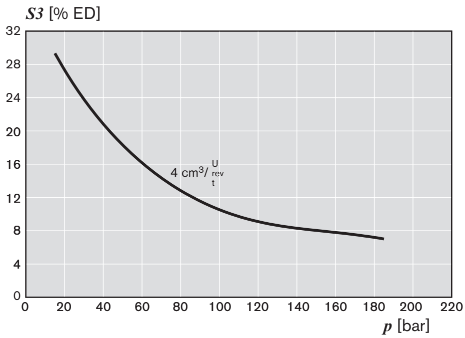


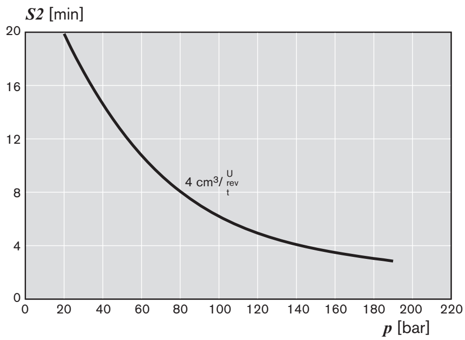
Protection class:
Motor case IP 66
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP24KDG66F004-20A0653N0	4.0	37.4	82.3	332.0	15.0	14.9	**0 541 200 064**

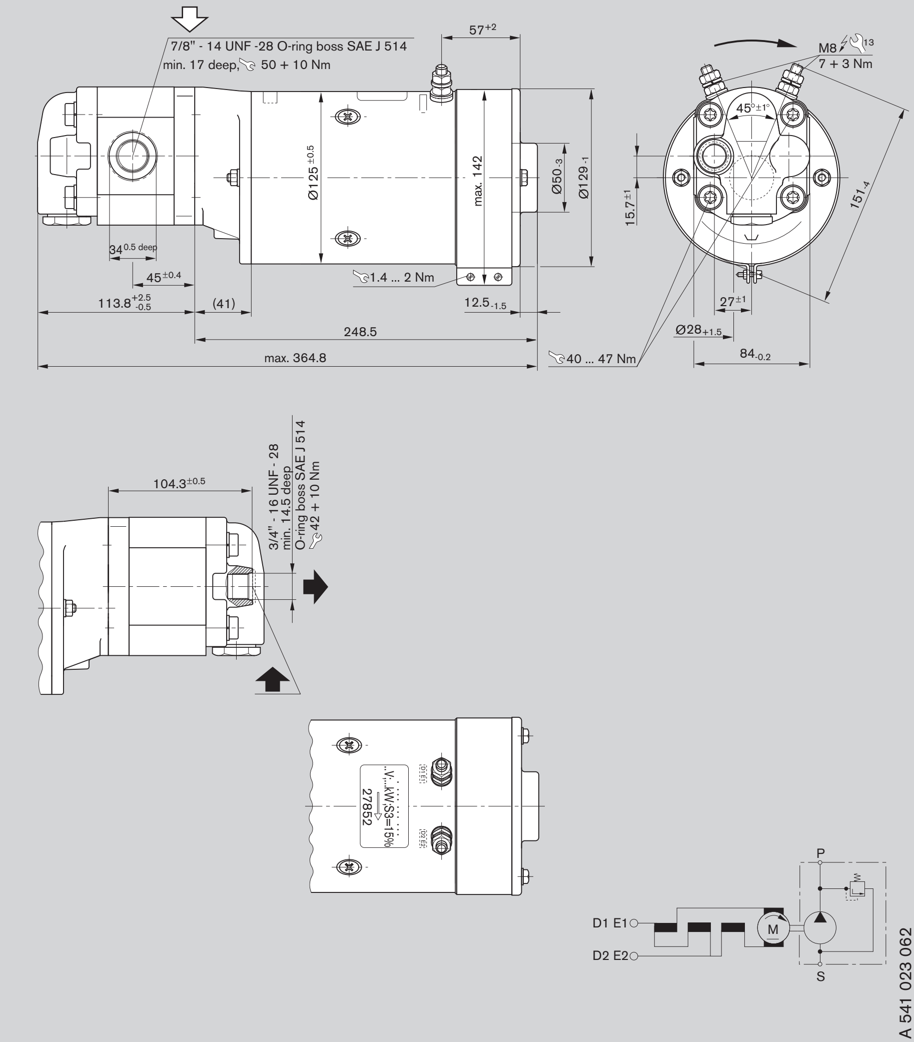
Characteristics for A 541 023 042







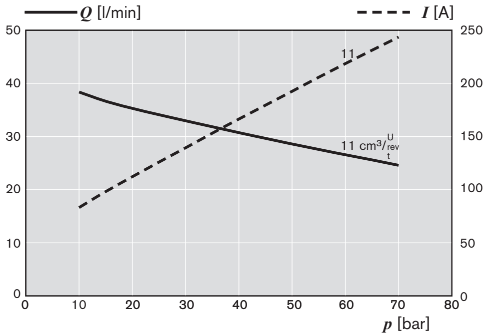
Unit dimensions

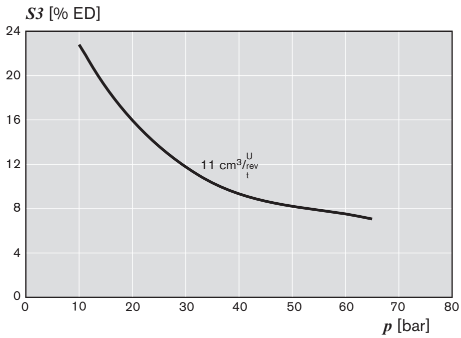


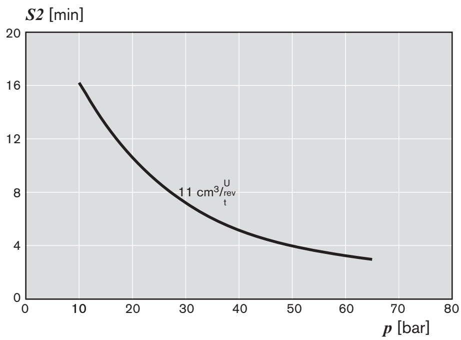
Protection class:
Motor case IP 66
Ports IP 00

Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	 B	 C	PRV [bar]	Weight [kg]	Part number
EHP24KDG66F011-12A0656N0D060	11.0	–	–	–	60^{+5}	16.7	**0 541 500 071**

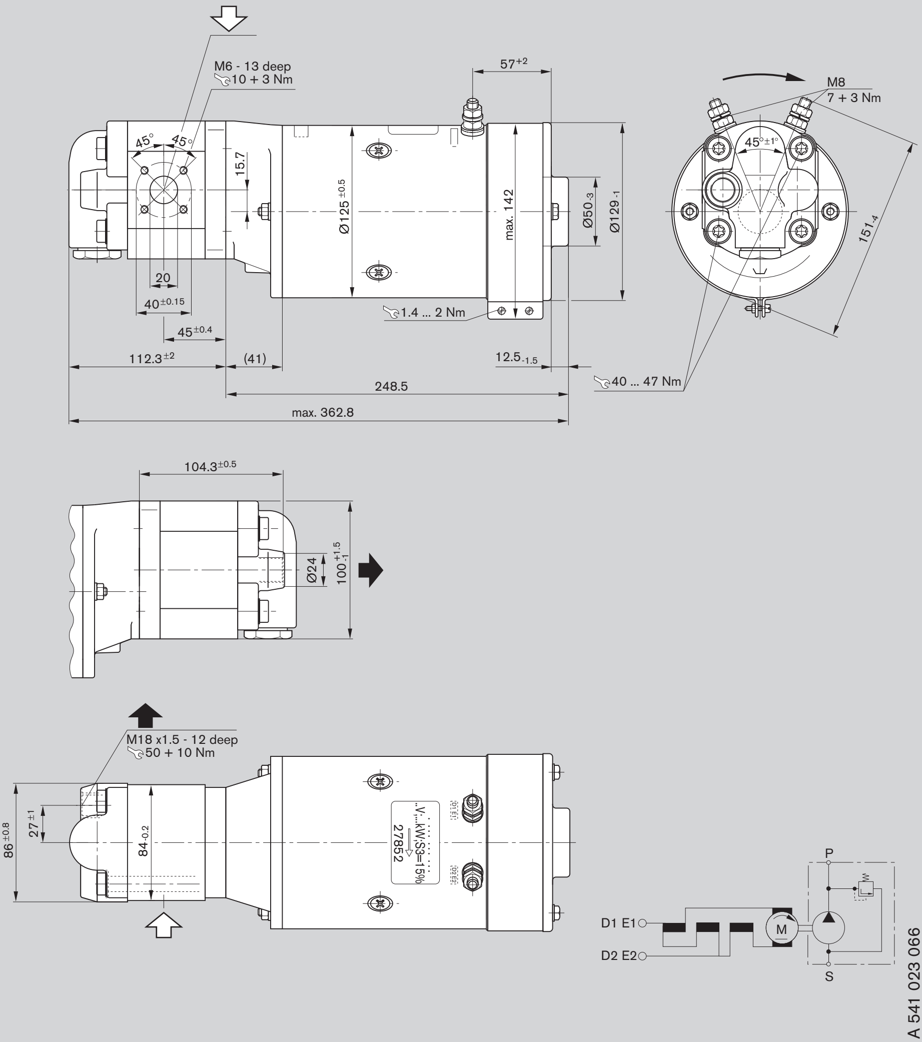
Characteristics
for A 541 023 062







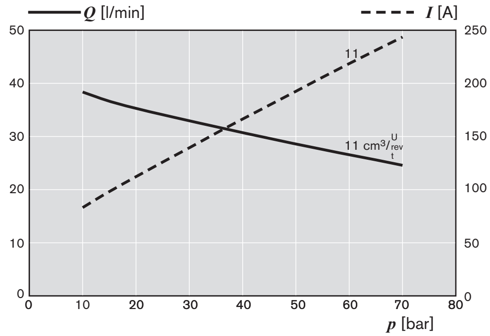
Unit dimensions

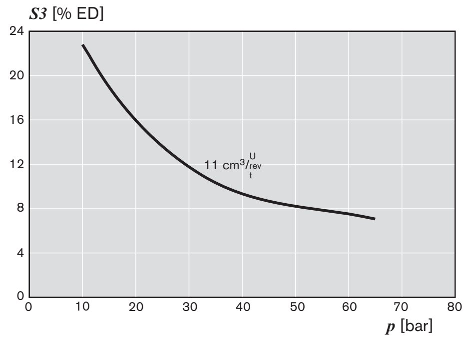


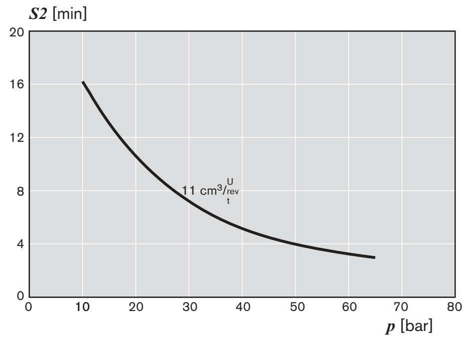
Protection class:
Motor case IP 66
Ports IP 00

Ordering code	Displace-ment	Dimension [mm]			Relay, supplied loose	PRV	Weight	Part number
	V [cm³/rev]	A	B	C		[bar]	[kg]	
EHP24KDG66F011-20A0656L0D050	11.0	–	–	–	1 547 211 007	50^{+5}	16.7	**0 541 500 078**

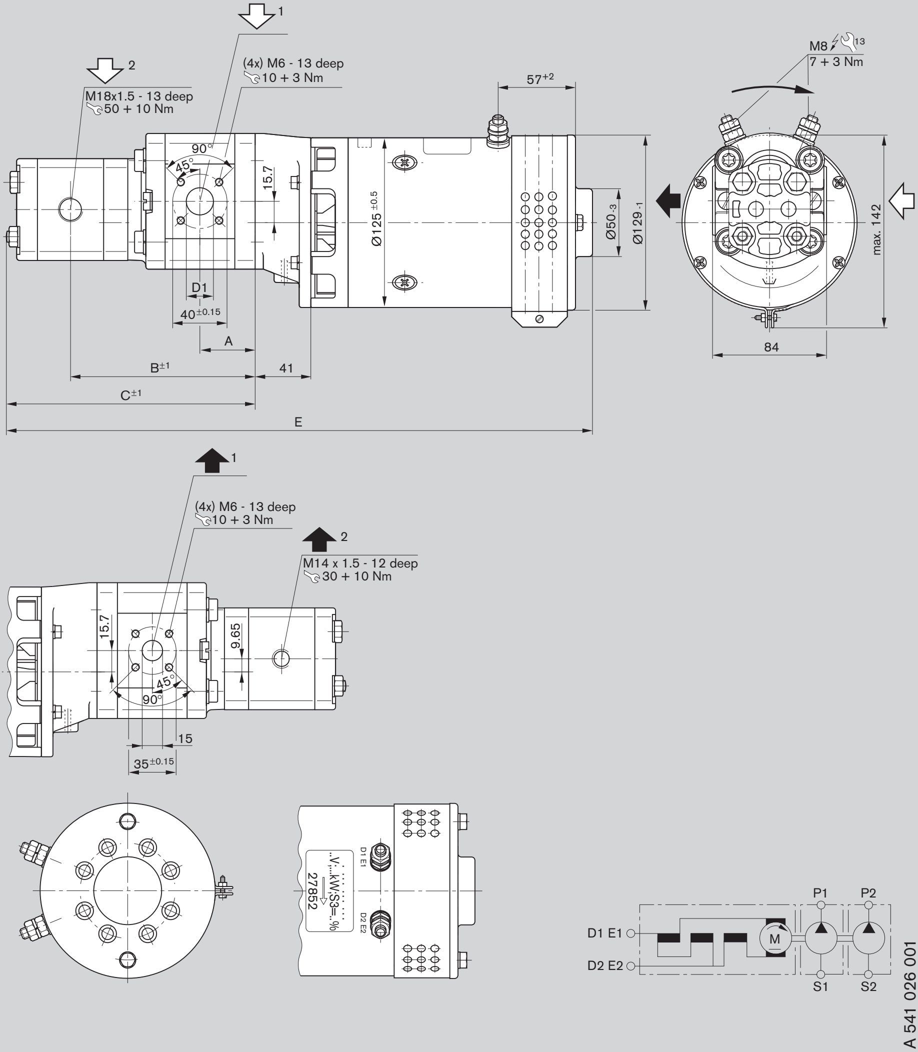
Characteristics for A 541 023 066







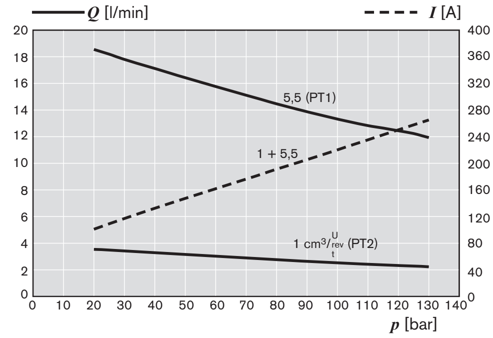
Unit dimensions

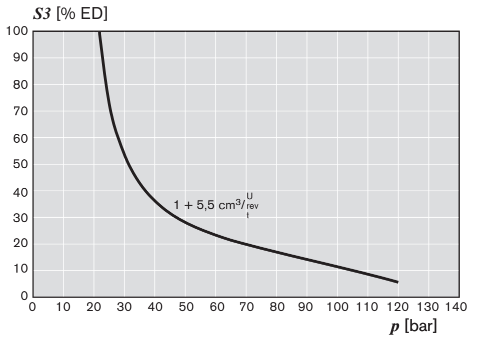


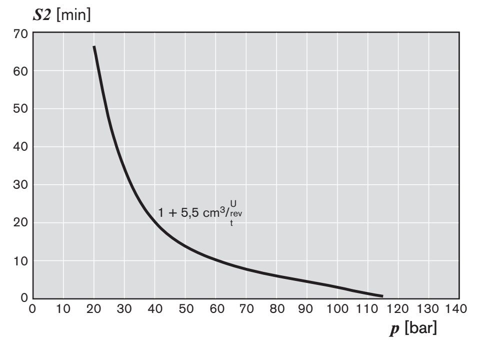
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displace-ment V [cm³/rev]	Dimension [mm] A	B	C	D	E	Weight [kg]	Part number
EHP24KDL20FB005/1.0-2002A0096N0	5.5 + 1.0	39.0	124.7	165.7	15.0	443.3	20	**0 541 300 058**

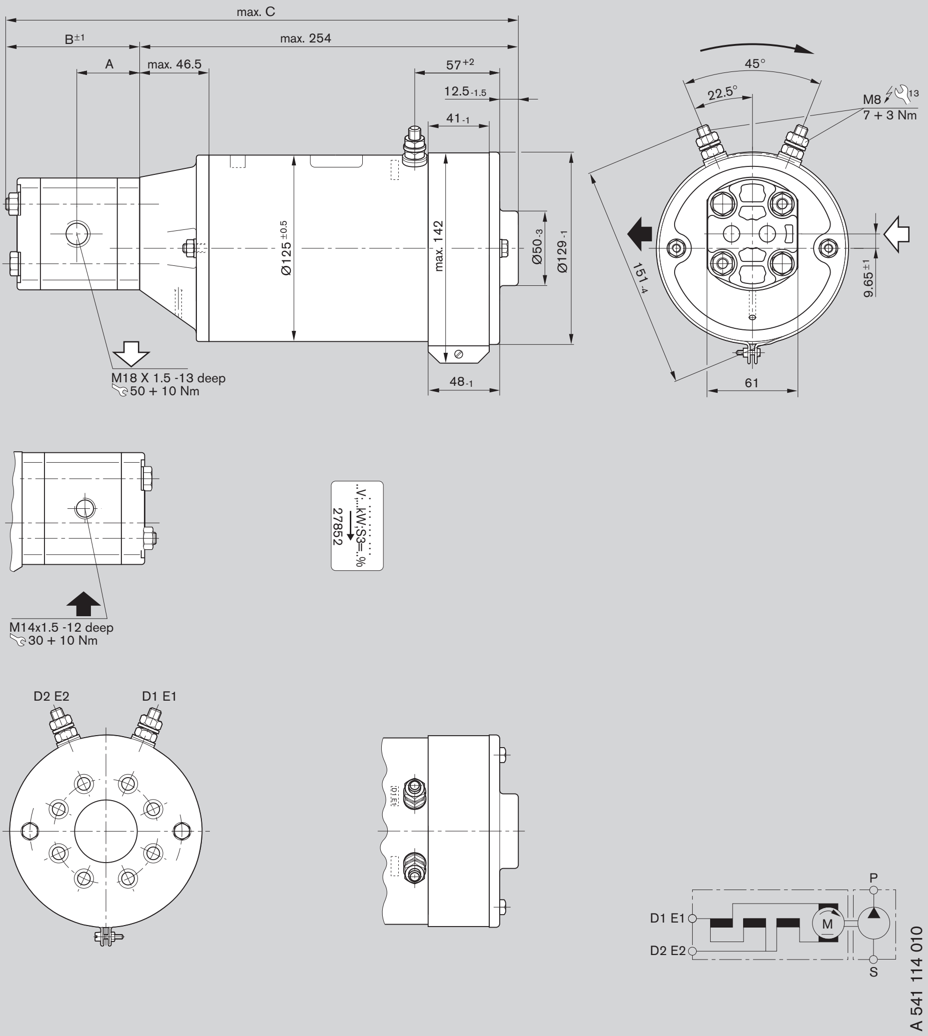
Characteristics for A 541 026 001







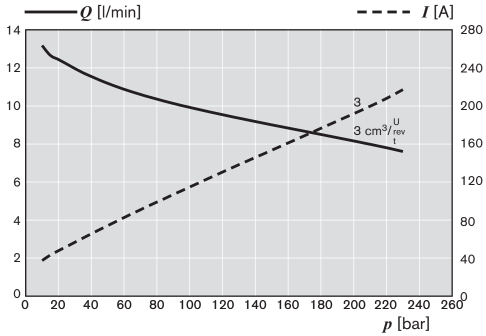
Unit dimensions

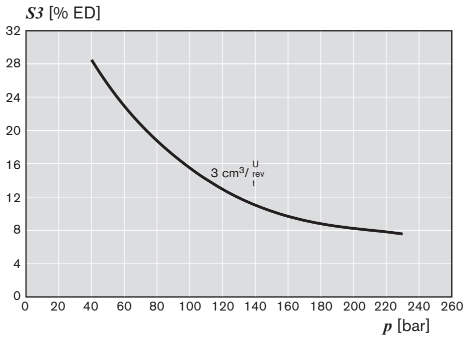


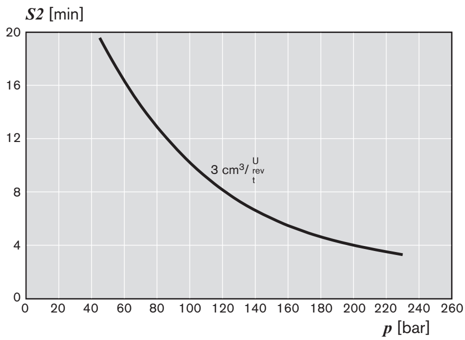
Protection class:
Motor case IP 43
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24KDG43B3.0-02A0611N0	3.0	39.2	86.0	341.0	13.5	**0 541 100 055**

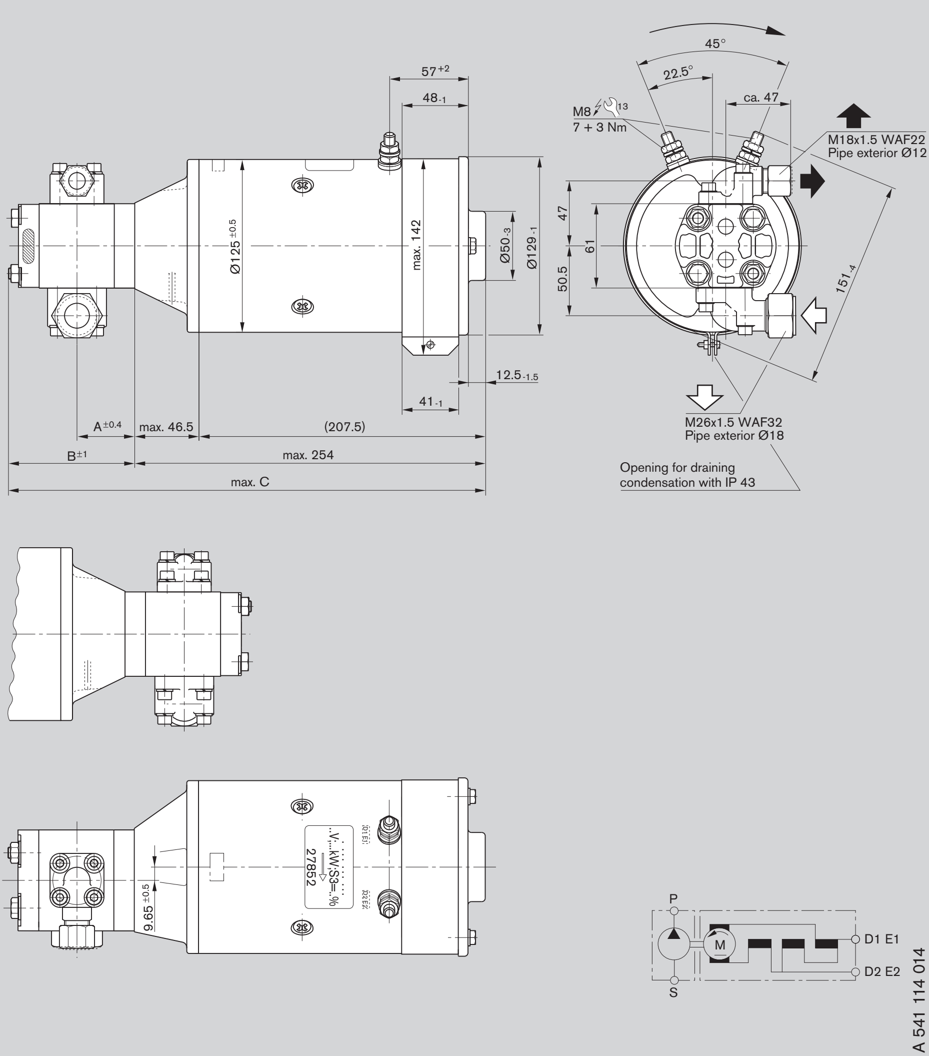
Characteristics for A 541 114 010







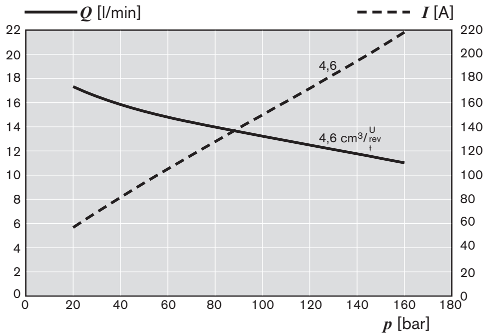
Unit dimensions

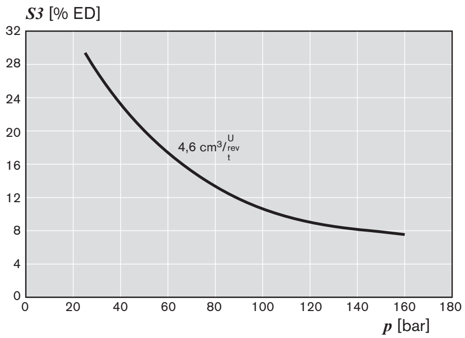


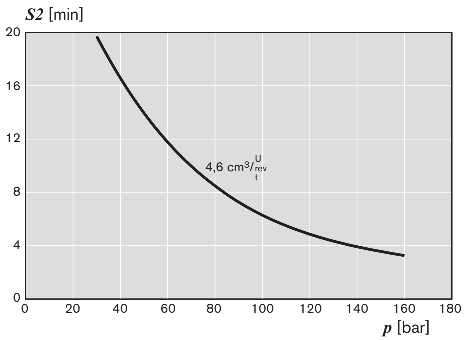
Protection class:
Motor case IP 43
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24KDG43B4.6-20C0613N0	4.6	42.0	91.0	346.0	14.1	**0 541 200 067**

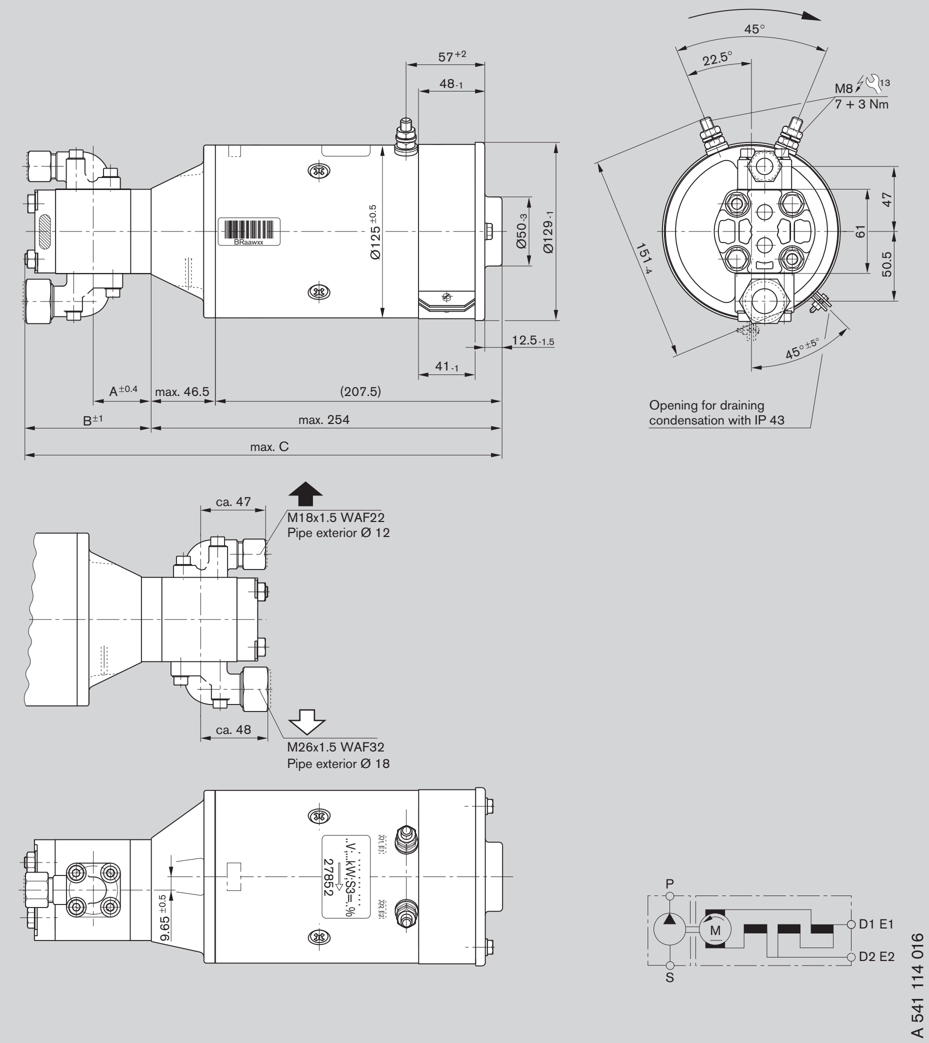
Characteristics
for A 541 114 014







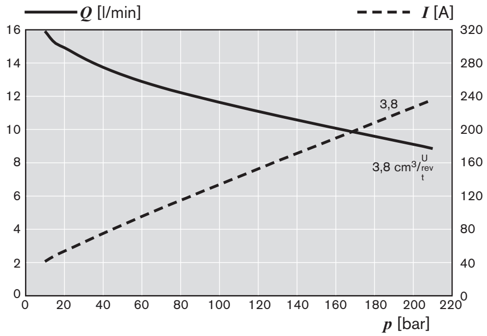
Unit dimensions

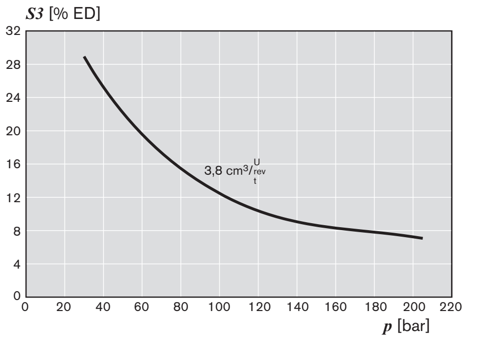


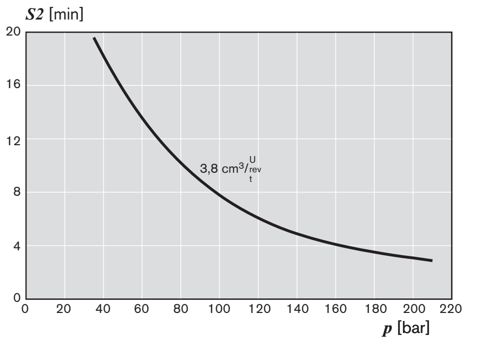
Protection class:
Motor case IP 43
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24KDG43B3.8-20C0612N0	3.8	41.0	91.0	346.0	14.3	**0 541 100 054**

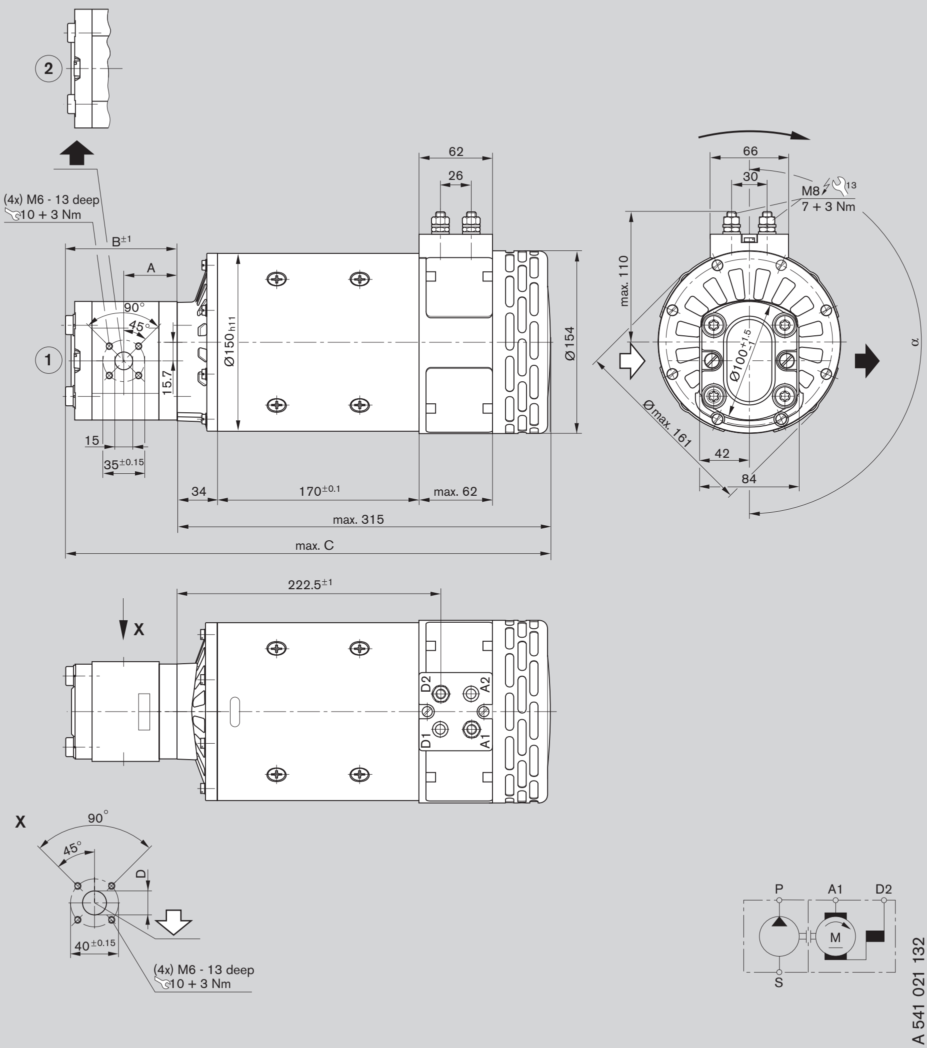
Characteristics for A 541 114 016







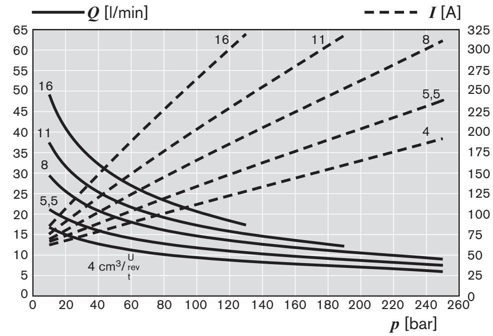
Unit dimensions

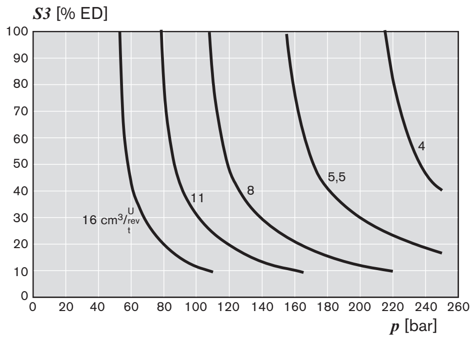


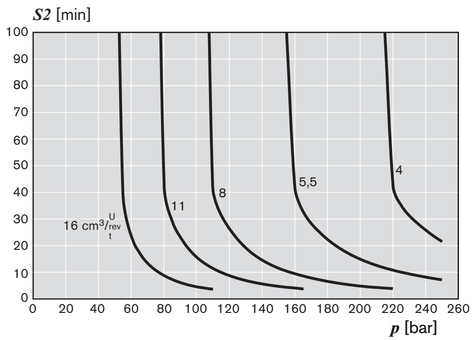
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	B	C	Weight [kg]	Part number
EHP24PRL24F004-20E0191N0	4.0	37.0	83.0	398.0	22.4	**0 541 200 049**
EHP24PRL24F005-20E0192N0	5.5	39.0	85.0	400.0	22.45	**0 541 300 038**
EHP24PRL24F005-20A0192N0	5.5	39.0	85.0	400.0	22.45	**0 541 300 066**
EHP24PRL24F008-20E0193N0	8.0	41.0	89.0	404.0	22.5	**0 541 400 041**
EHP24PRL24F011-20E0194N0	11.0	45.0	94.0	409.0	22.6	**0 541 500 054**
EHP24PRL24F016-20E1264N0	16.0	45.0	102.0	419.0	22.75	**0 541 600 041**

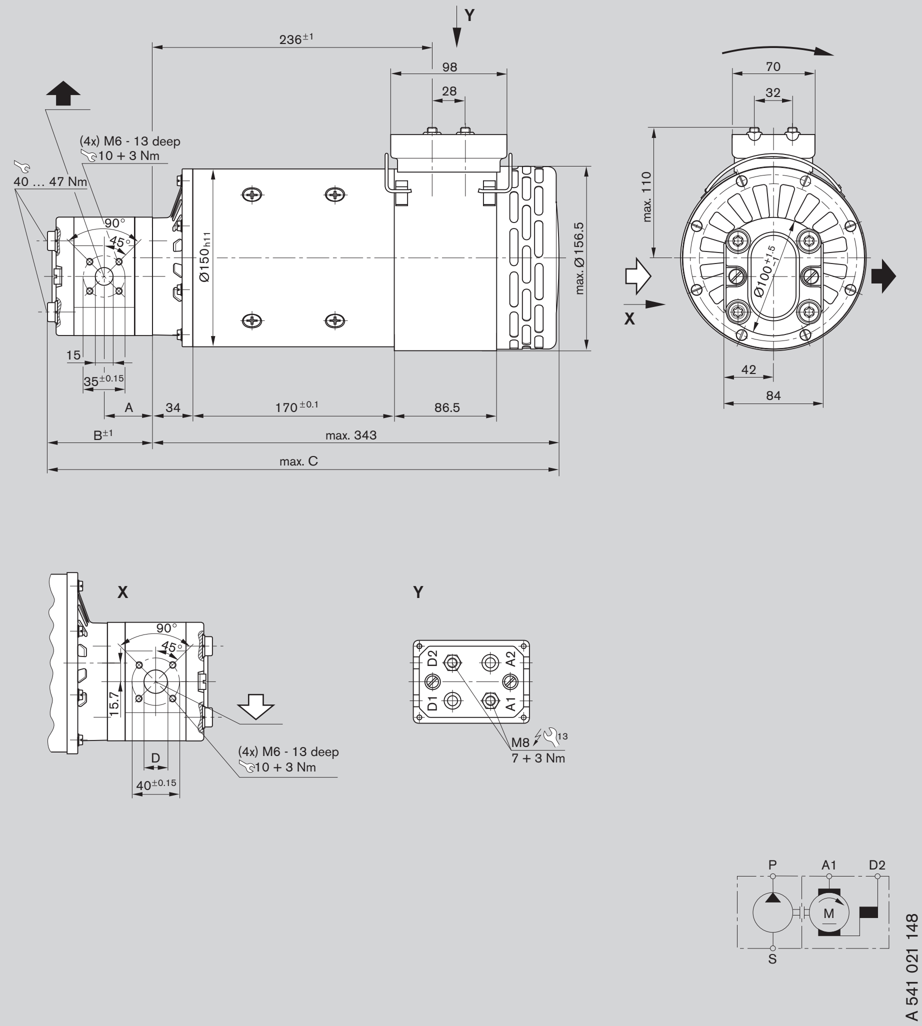
Characteristics for A 541 021 132







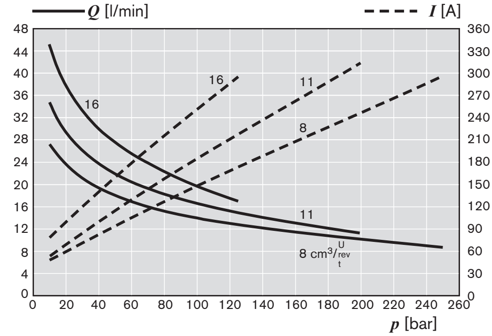
Unit dimensions

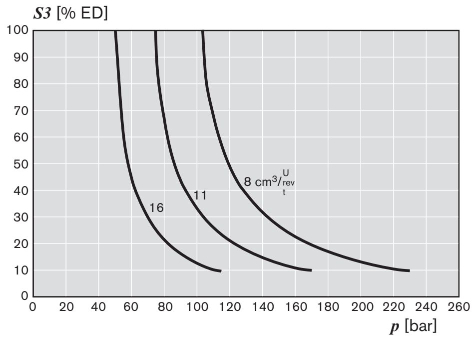


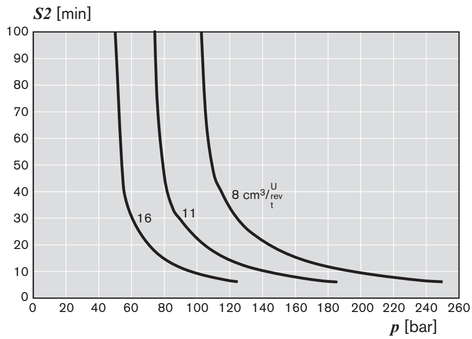
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Weight	Part number
	V [cm³/rev]	A	B	C	[kg]	
EHP24PRL24F008-20E0297N0	8.0	41.0	89.0	431.0	24.5	**0 541 400 046**
EHP24PRL24F011-20E0298N0	11.0	45.0	94.0	436.0	24.6	**0 541 500 055**
EHP24PRL24F016-20E0300N0	16.0	45.0	103.0	445.0	25.0	**0 541 600 036**

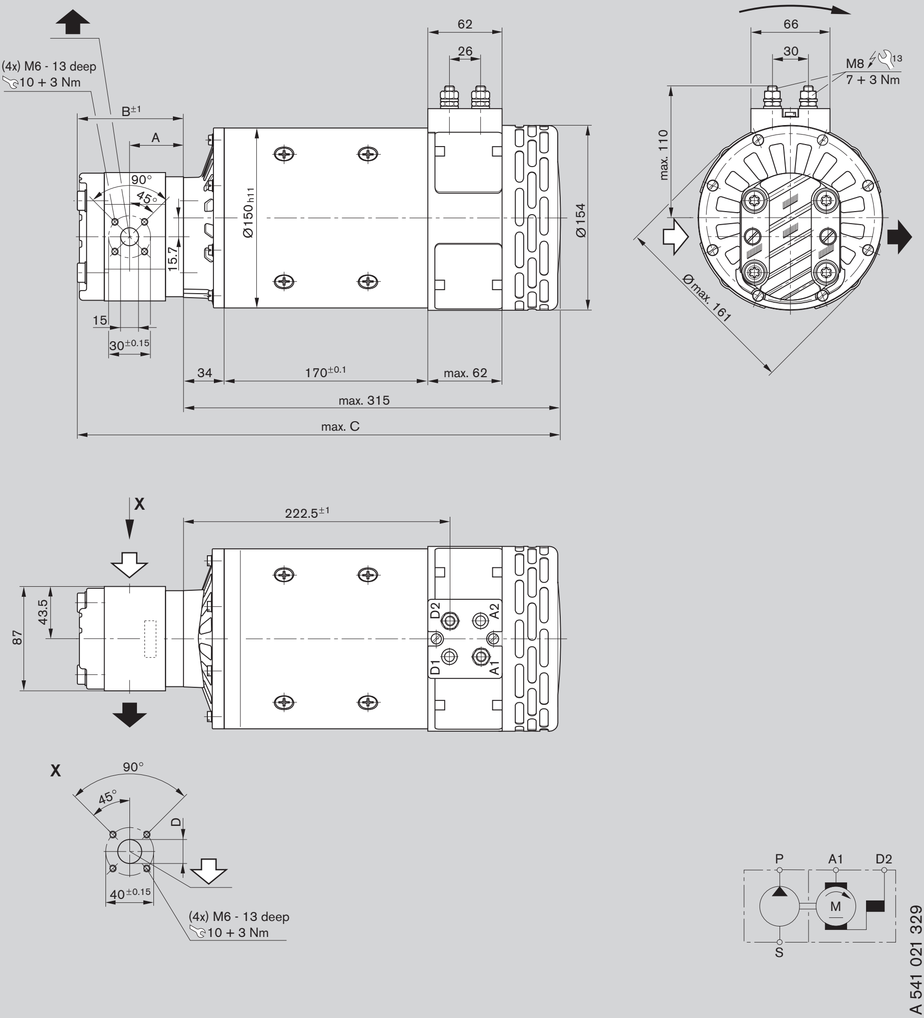
Characteristics
for A 541 021 148







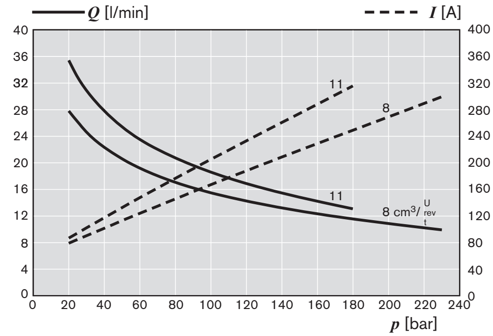
Unit dimensions

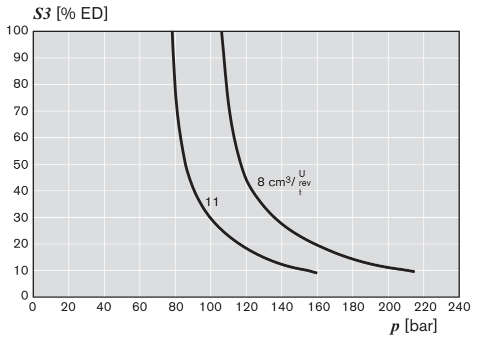


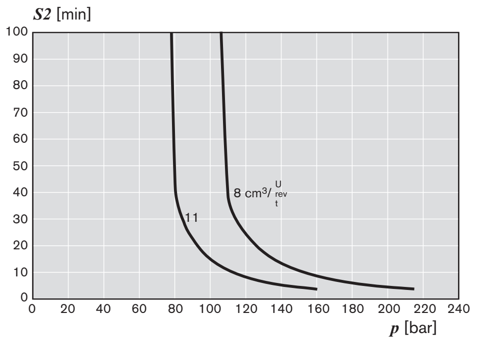
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm^3/rev]	A	B	C	D	[kg]	
EHP24PRL24S008-20E1145N0	8.0	40.7	88.6	404.6	20.0	22.5	**0 541 400 067**
EHP24PRL24S011-20E0175N0	11.0	44.5	93.8	410.0	20.2	22.6	**0 541 500 072**

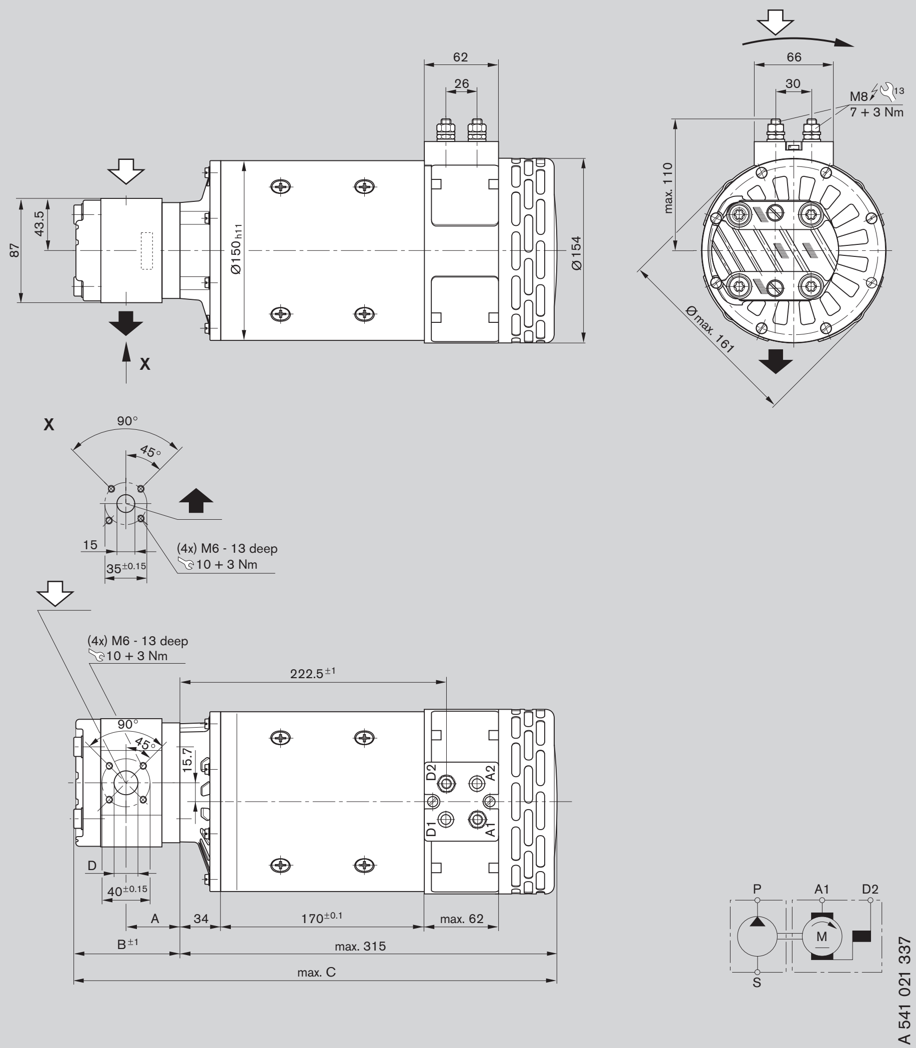
Characteristics
for A 541 021 329







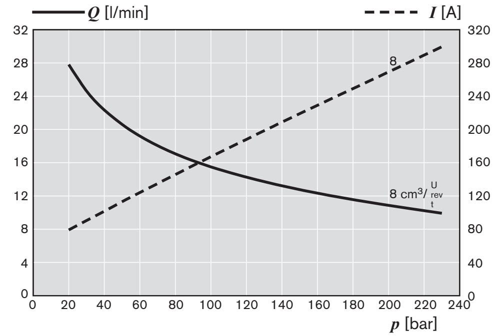
Unit dimensions

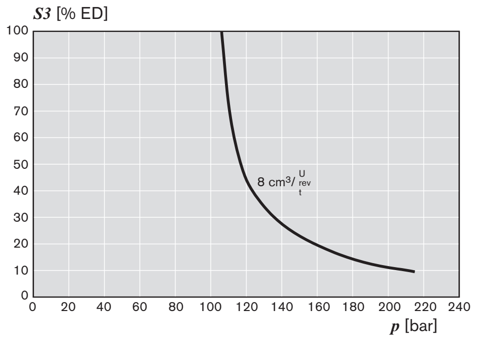


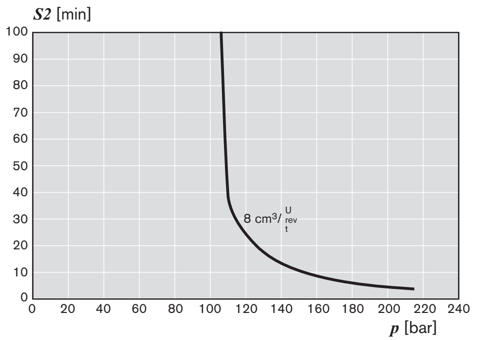
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP24PRL24S008-20G1145N0	8.0	41.0	88.8	404.6	20.0	22.5	**0 541 400 072**

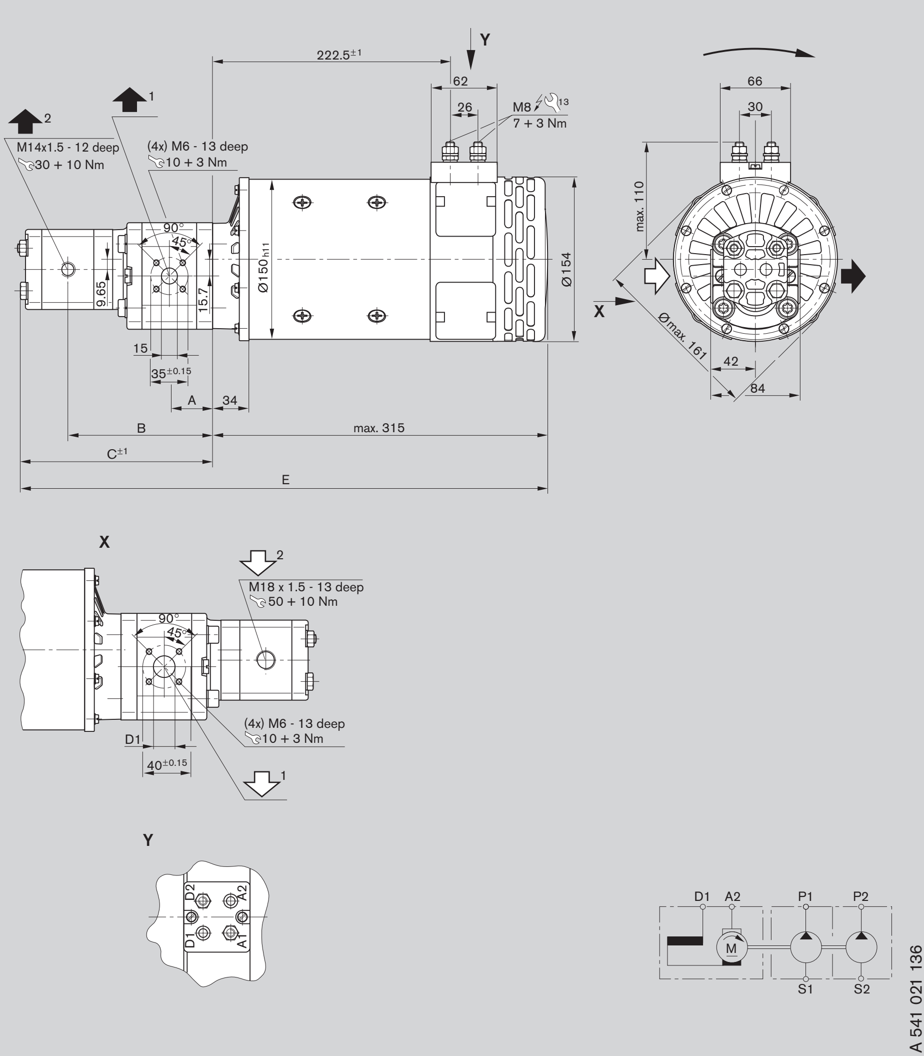
Characteristics
for A 541 021 337







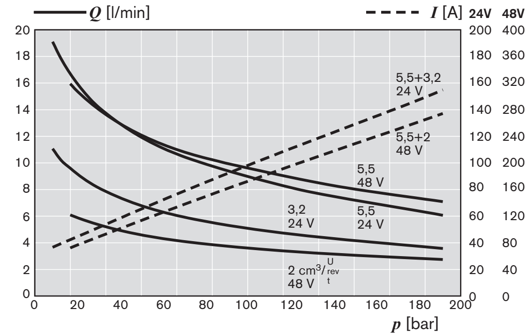
Unit dimensions

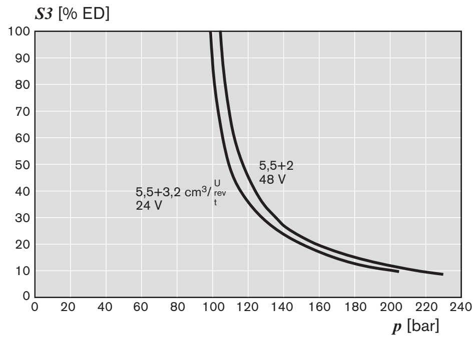


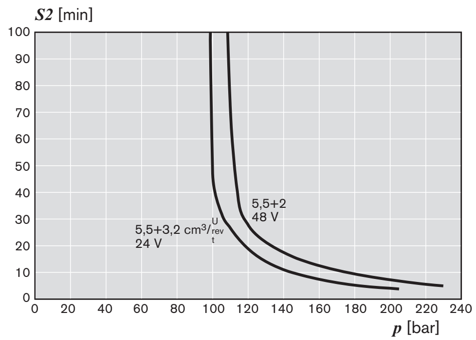
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]					Weight	Part number
	V [cm³/rev]	A	B	C	D	E	[kg]	
EHP48PRL24FB005/2.0-2002E1180N0	5.5 + 2.0	39.0	126.8	170.1	15.0	485.7	24.6	**0 541 300 064**
EHP24PRL24FB005/3.0-2002E0085N0	5.5 + 3.0	39.0	129.0	176.0	15.0	491.0	24.5	**0 541 300 040**

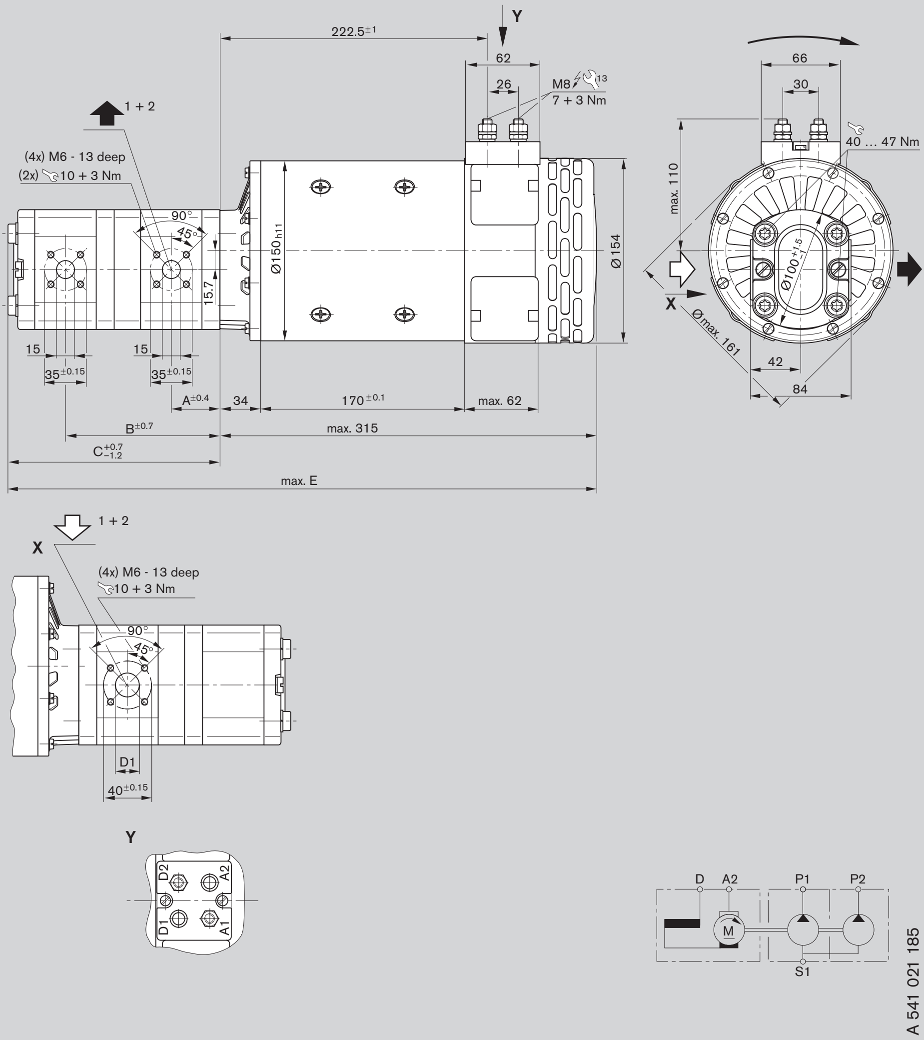
Characteristics
for A 541 021 136







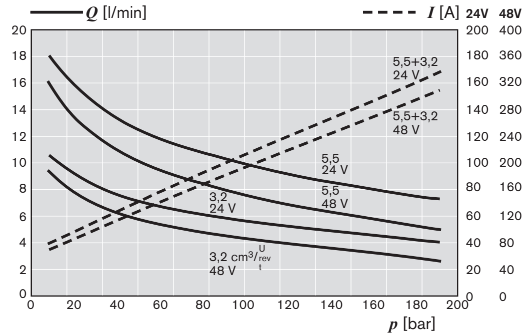
Unit dimensions

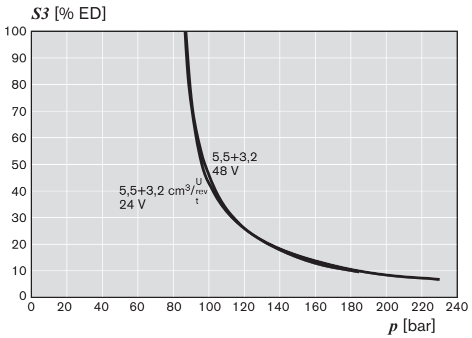


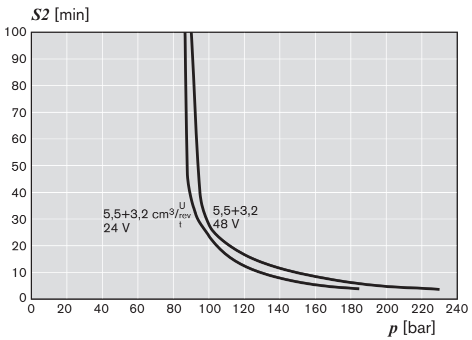
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]			Pump 1		Weight	Part number
	V [cm³/rev]	A	B	C	D	E	[kg]	
EHP24PRL24FF005/003-2020E0939N0	5.5 + 3.2	38.6	120.9	164.9	20.0	480.6	24.8	**0 541 300 054**
EHP48PRL24FF005/003-2020E0983N0	5.5 + 3.2	38.6	120.9	164.9	20.0	480.6	24.8	**0 541 300 055**

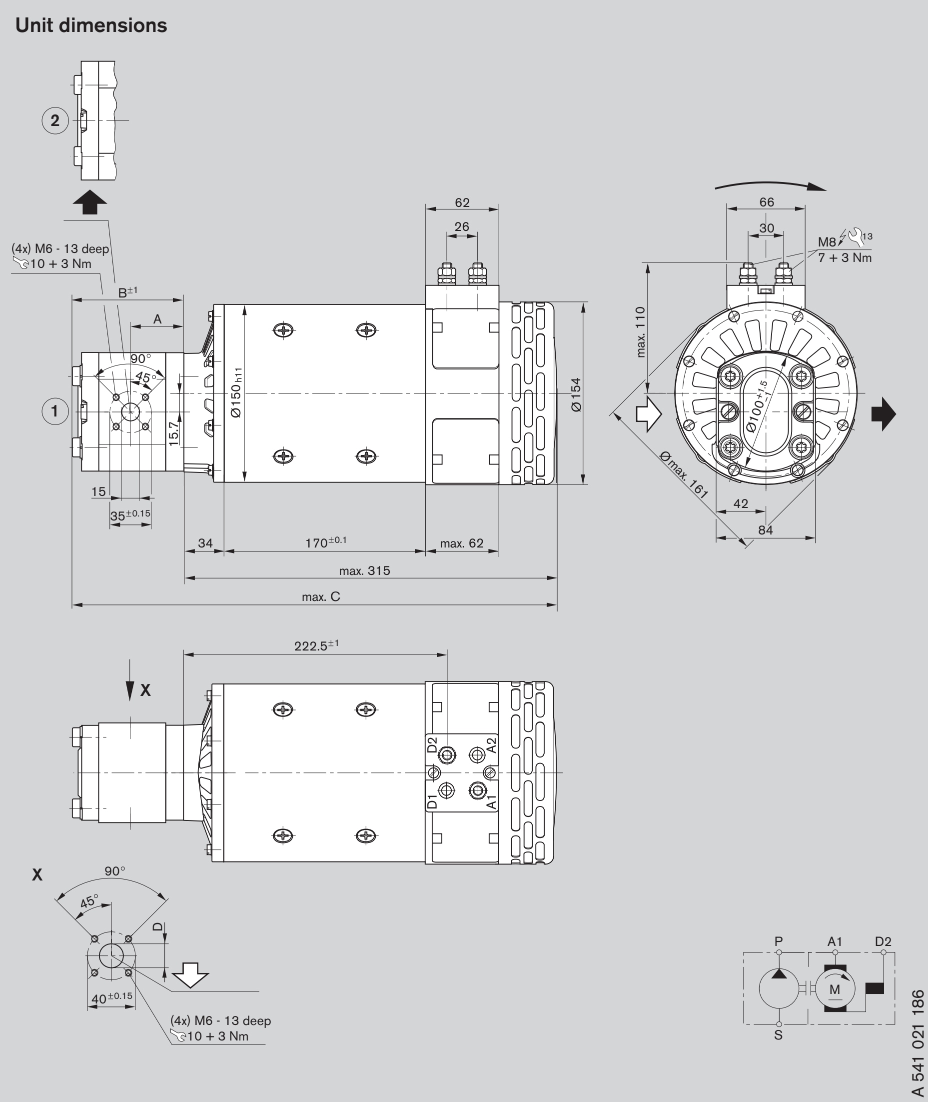
Characteristics
for A 541 021 185







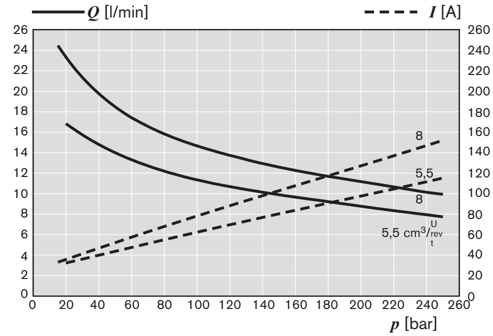
Unit dimensions

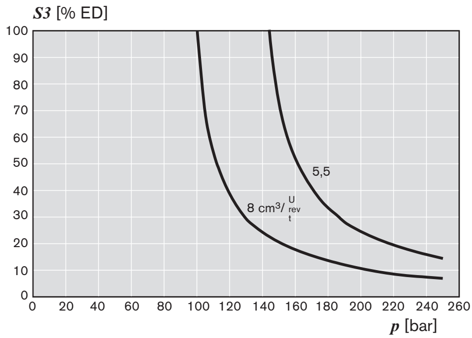


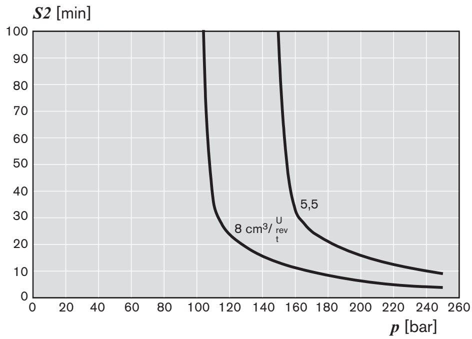
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP48PRL24F005-20E0201N0	5.0	39.0	85.0	400.0	15.0	22.45	**0 541 300 043**
EHP48PRL24F008-20E0202N0	8.0	41.0	88.0	403.0	20.0	22.6	**0 541 400 052**

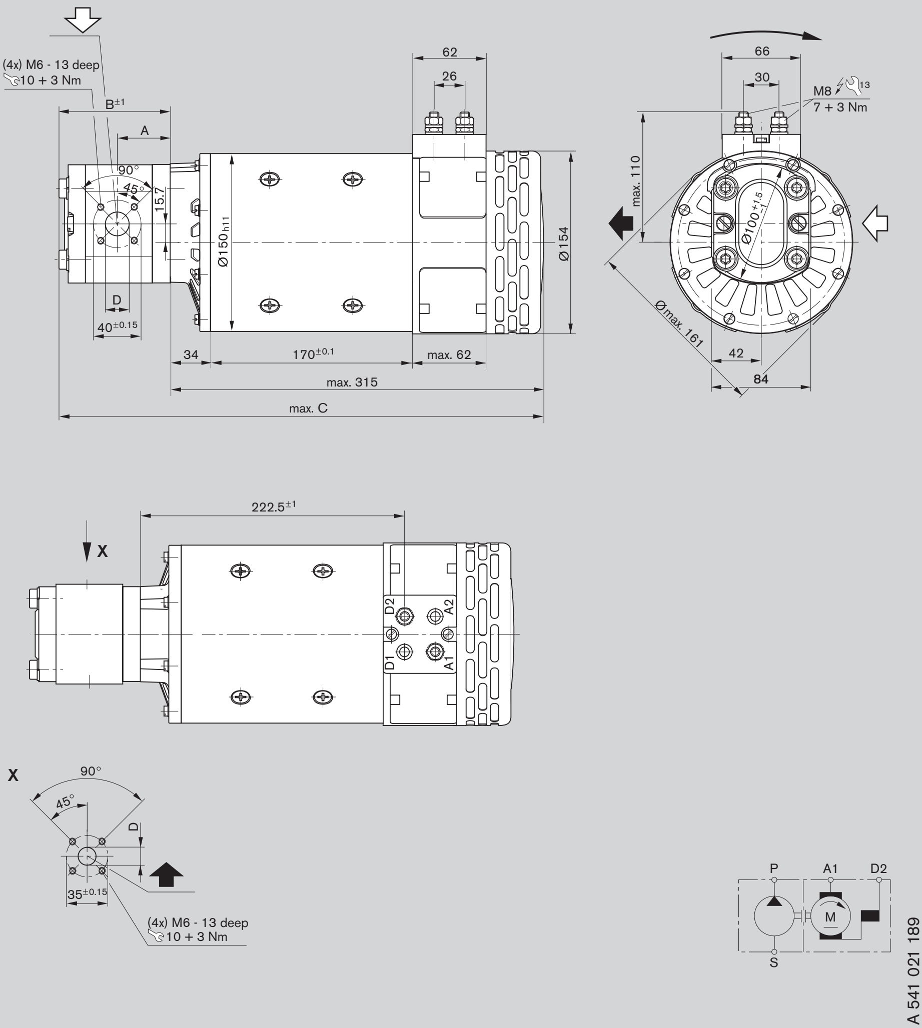
Characteristics
for A 541 021 186







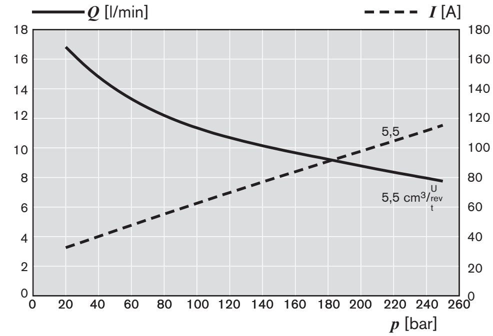
Unit dimensions

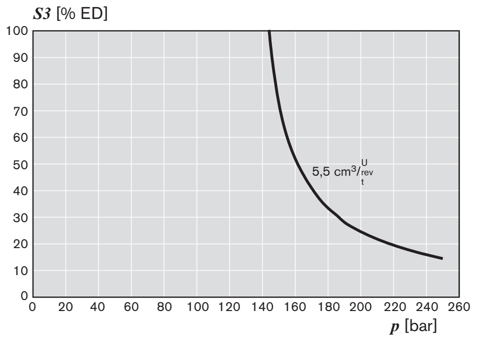


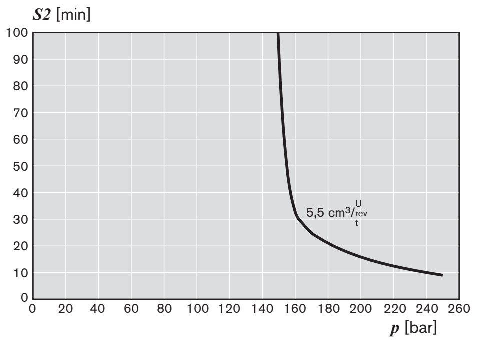
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP48PRL24F005-20A0201N0	5.0	39.0	84.2	400.2	15.0	22.45	**0 541 300 046**

Characteristics
for A 541 021 189

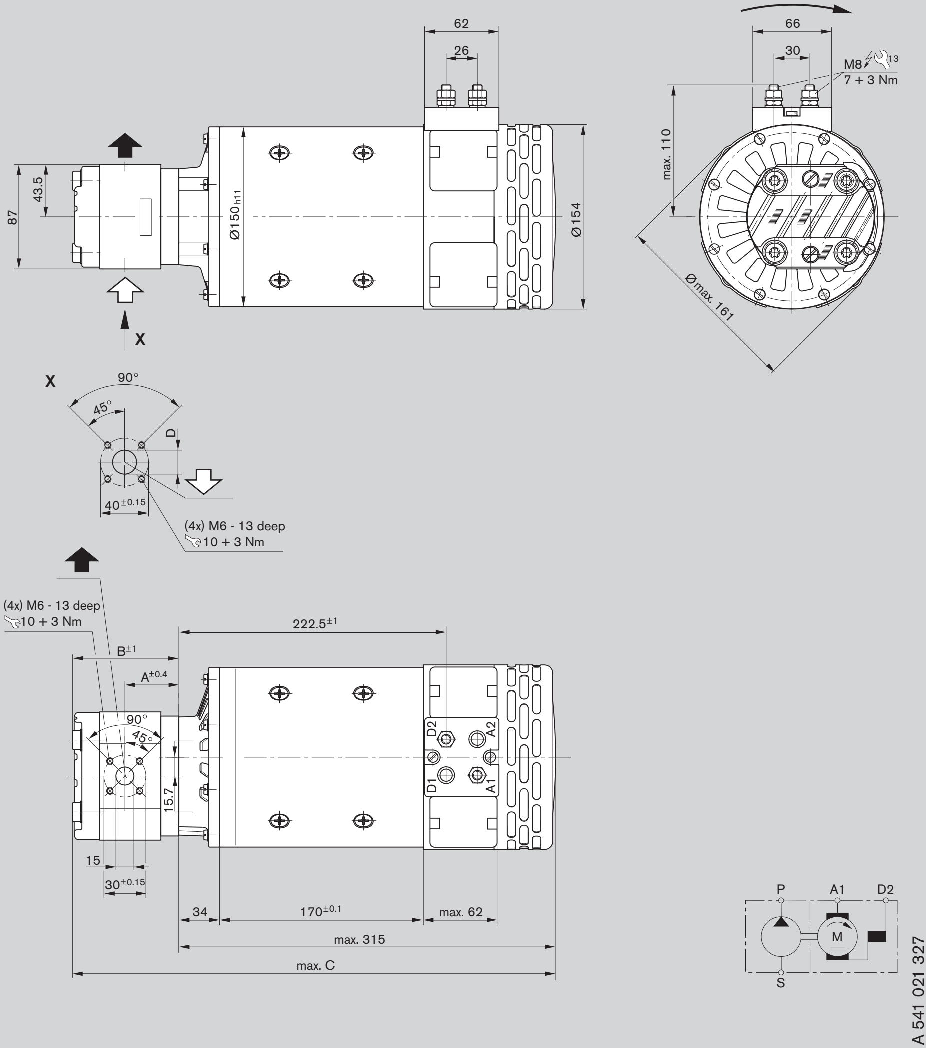






8

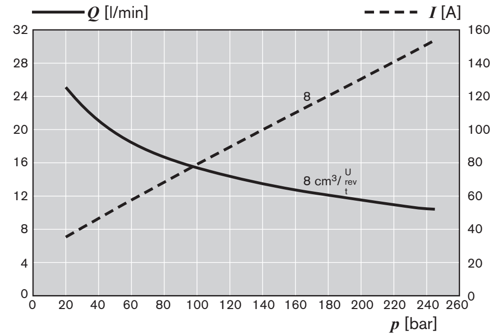
Unit dimensions

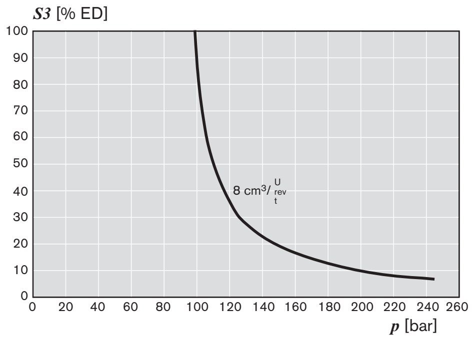


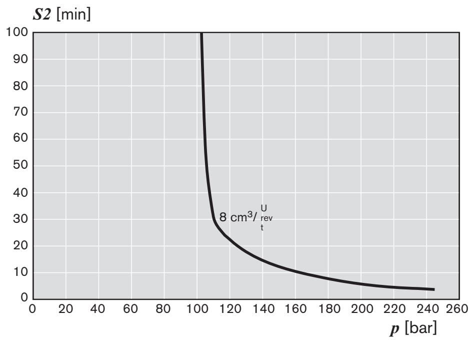
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement	Dimension [mm]				Weight	Part number
	V [cm³/rev]	A	B	C	D	[kg]	
EHP48PRL24S008-20C0143N0	8.0	41.0	88.6	404.6	20.0	22.5	**0 541 400 068**

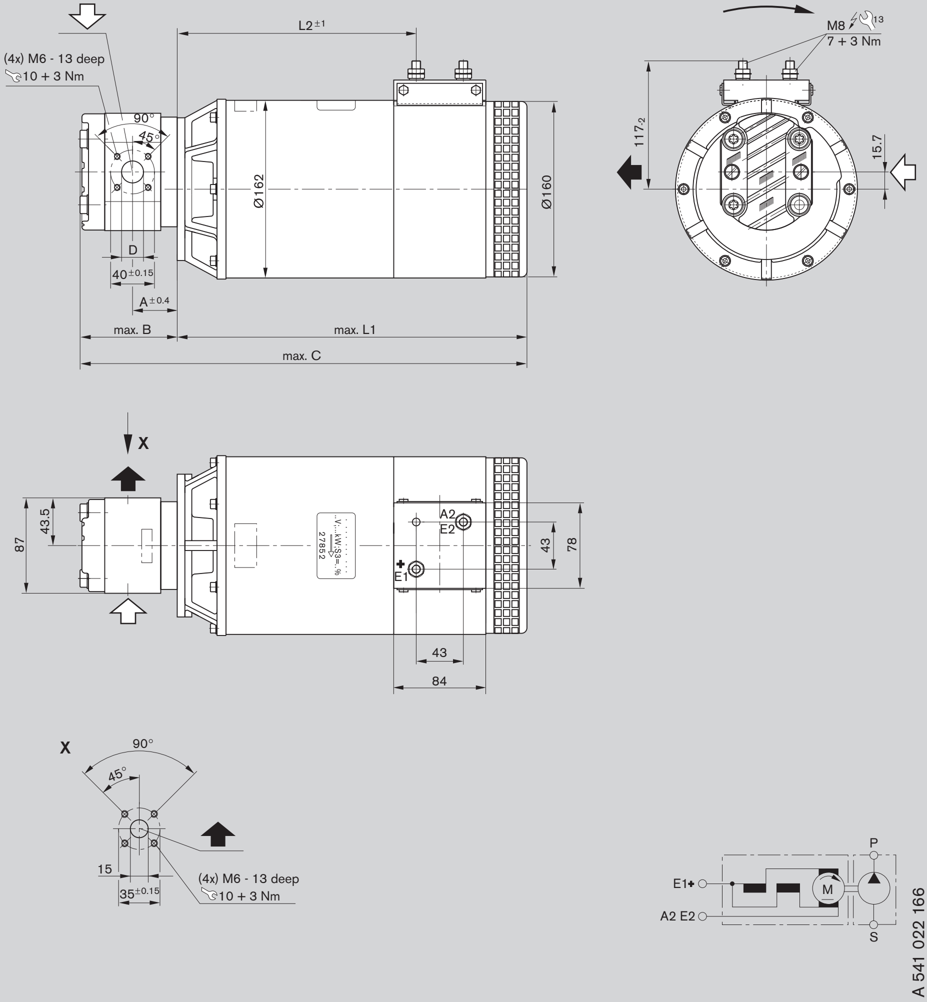
Characteristics for A 541 021 327







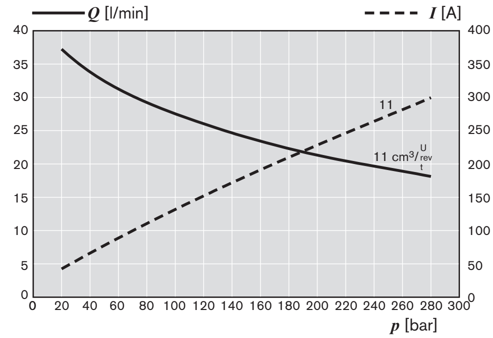
Unit dimensions

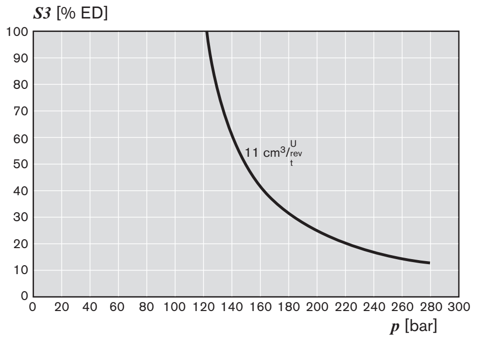


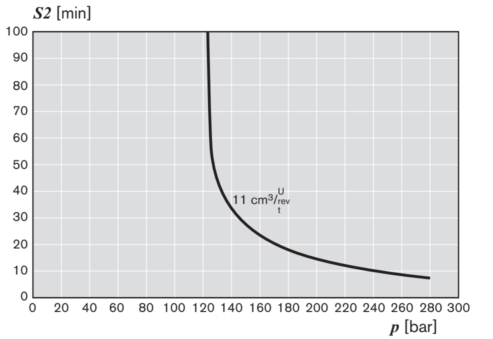
Protection class:
Motor case IP 10
Ports IP 00

Ordering code	Displace-ment V [cm^3/rev]	Dimension [mm] A	B	C	D	L1	L2	Weight [kg]	Part number
EHP48SDL14S011-20A1173N0	11.0	45.5	94.2	461.0	20.0	366.0	262.5	26	**0 541 500 074**

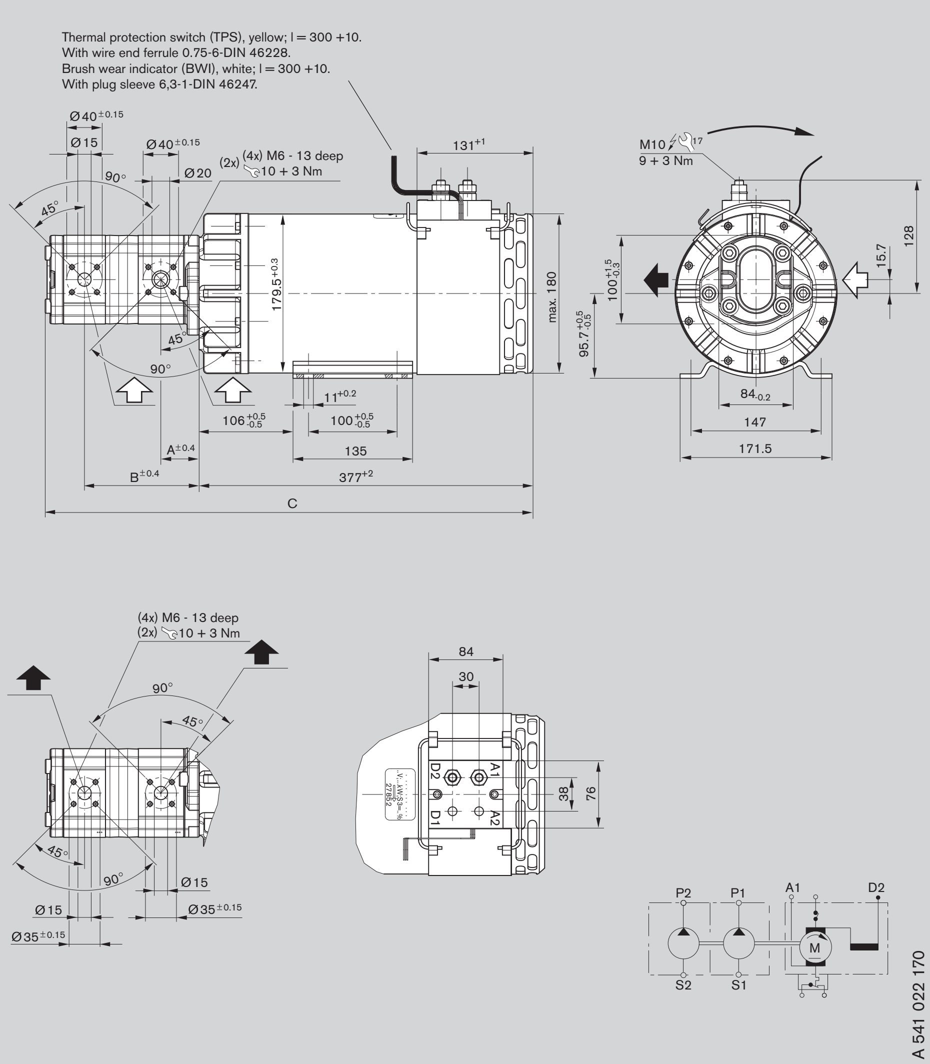
Characteristics
for A 541 022 166







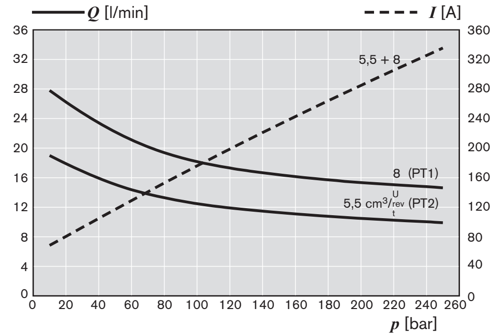
Unit dimensions

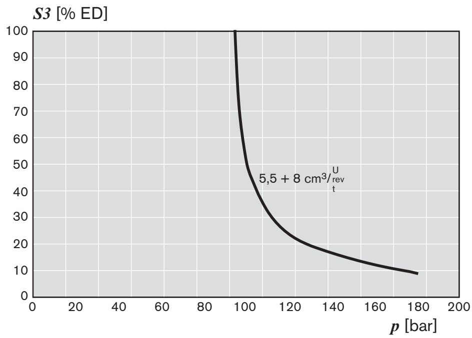


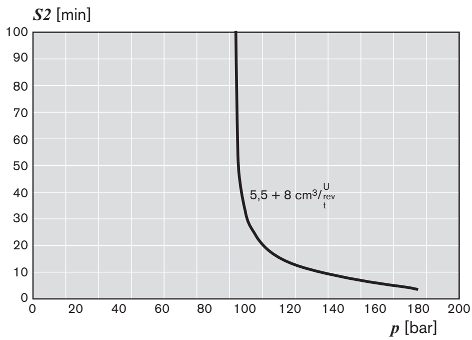
Protection class:
Motor case IP 20
Ports IP 00

Ordering code	Displacement V [cm³/rev]	Dimension [mm] A	B	C	Weight [kg]	Part number
EHP48TRL23FF008/005-2020A1262N2	8.0 + 5.5	43.2	129.5	552.0	44	**0 541 400 074**

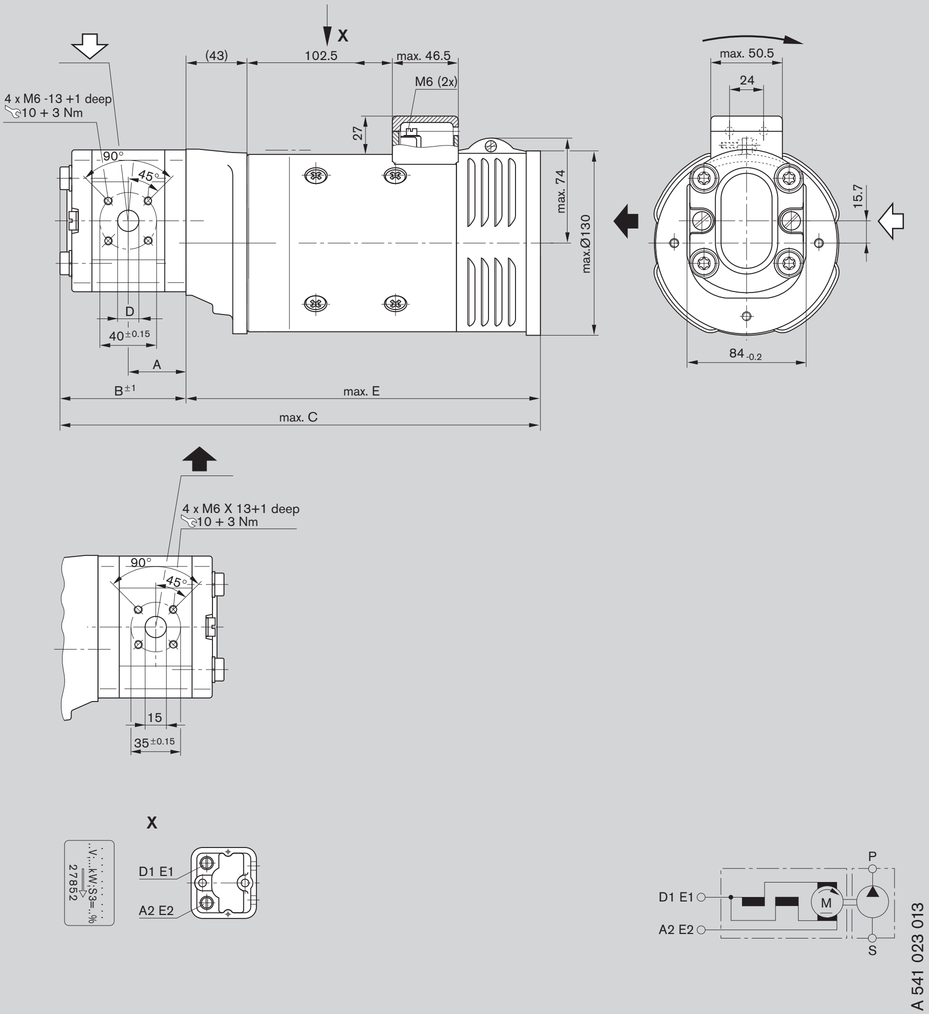
Characteristics for A 541 022 170







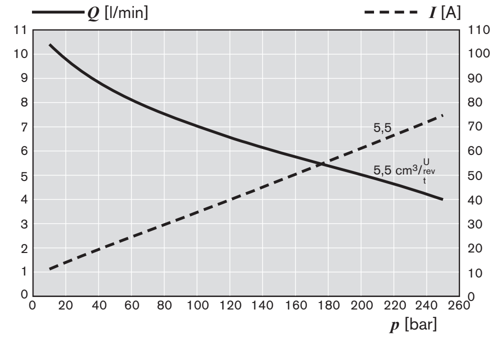
Unit dimensions

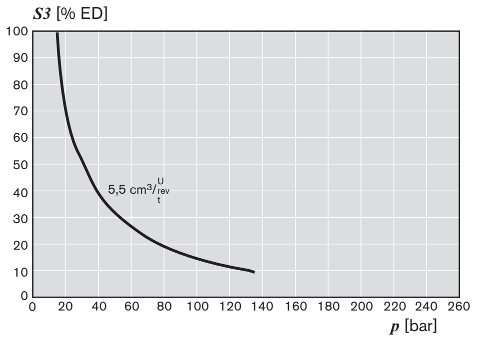


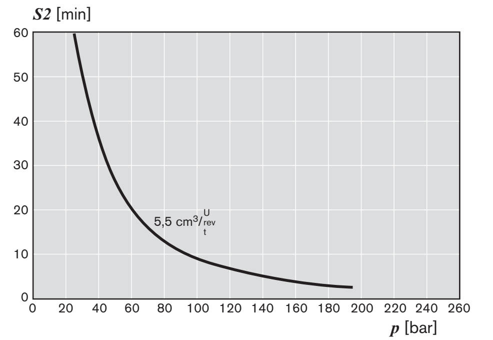
Protection class:
Motor case IP 10
Ports IP 44

Ordering code	Displacement	Dimension [mm]					Weight	Part number
	V [cm^3/rev]	A	B	C	D	E	[kg]	
EHP72KDO14F005-20A1003N0	5.5	38.6	85.0	336.0	15.0	250.0	15.0	**0 541 300 032**

Characteristics for A 541 023 013





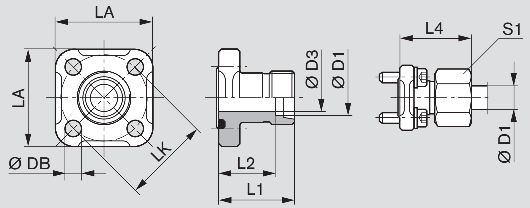


8

Accessories

Fittings that can be used for square flange 20

Gear pump flange, straight

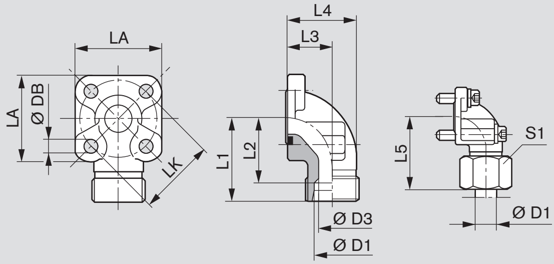


LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws (metric) 4x	Seal ring	Part number	*p* [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M 6 x 22	20 x 2.5	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M 6 x 22	20 x 2.5	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M 6 x 22	20 x 2.5	**1 515 702 066**	250
40	15L	12	35	28.0	43.0	42	27	6.4	M 6 x 22	24 x 2.5	**1 515 702 067**	100
40	18L	15	35	27.5	44.0	42	32	6.4	M 6 x 22	24 x 2.5	**1 515 702 068**	100
40	22L	19	35	27.5	44.5	42	36	6.4	M 6 x 22	24 x 2.5	**1 515 702 069**	100
40	28L	24	42	27.5	44.5	42	41	6.4	M 6 x 22	24 x 2.5	**1 515 702 008**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Fittings that can be used for square flange 20

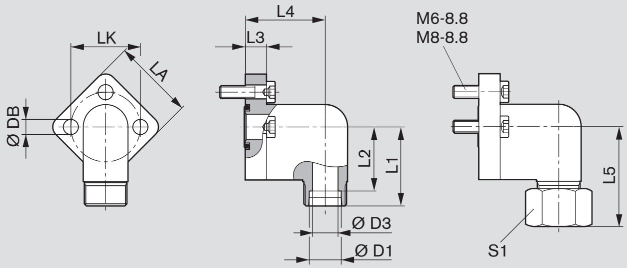
Gear pump flange, 90° angle



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	Screws 2x	Seal ring	Part number	*p* [bar]
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M 6 x 22	M 6 x 35	20 x 2.5	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M 6 x 22	M 6 x 35	20 x 2.5	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M 6 x 22	M 6 x 35	20 x 2.5	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M 6 x 22	M 6 x 40	20 x 2.5	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M 6 x 22	M 6 x 40	20 x 2.5	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M 6 x 22	M 6 x 45	20 x 2.5	**1 515 702 017**	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M 6 x 22	M 6 x 22	24 x 2.5	**1 515 702 076**	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M 6 x 22	M 6 x 22	24 x 2.5	**1 515 702 074**	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M 6 x 22	M 6 x 45	24 x 2.5	**1 515 702 011**	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M 6 x 22	M 6 x 22	24 x 2.5	**1 515 702 075**	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M 6 x 20	M 6 x 50	24 x 2.5	**1 515 702 010**	100
40	35L	31	41	30.5	32.0	55.0	52.0	42	50	6.4	M 6 x 22	M 6 x 60	24 x 2.5	**1 515 702 018**	100

Complete fittings with seal ring, metric screw set, nuts and olive.

Fittings that can be used for square flange 30
Gear pump flange, 3-hole, 90° angle



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 3x	Seal ring NBR *)	Weight [kg]	Part number	p [bar]
30	12L	10	37	30.0	10	37.5	46	38	22	6.4	M 6 x 22	16 x 2.5	0.13	**1 515 702 146**	250
30	15L	12	37	30.0	10	37.5	47	38	27	6.4	M 6 x 22	16 x 2.5	0.14	**1 515 702 147**	250
30	18L	15	37	30.0	10	37.5	47	38	32	6.4	M 6 x 22	16 x 2.5	0.17	**1 515 702 148**	160
40	22L	19	43	35.5	14	41.0	53	48	36	8.4	M 8 x 30	24 x 2.5	0.29	**1 515 702 149**	160
40	28L	24	43	35.5	14	41.0	53	48	41	8.4	M 8 x 30	24 x 2.5	0.40	**1 515 702 150**	160

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Note
The permissible tightening torques can be found in our publication:
“General operating instructions for external gear units”
RE 07 012-B1.

For further information about the product electrohydraulic pump with regard to new projects, accessories and spare parts, and for general questions, please contact

BRM-AZ.info@boschrexroth.de

You will also find the EHP configurator in the internet, at:

www.boschrexroth.com/azconfigurator

Rexroth Bosch Group	Project specification Electrohydraulic pump (EHP)	Hydraulics DCH/STE 1/4

This project specification is intended as a guide for customer-specific projects, from the initial inquiry to the approval for a new product.
Full details under **1. Project details** are the basis for effective project management.
Detailed figures are the requirement for optimal design.
2. Project management is maintained internally by DCH/STE.
If any details are missing under **3. Technical data**, the Bosch Rexroth AG terms and conditions of supply and the figures stated in the catalogs and general operating conditions shall apply.
4. Customer requirements are to be submitted as completely as possible.

1. Project details

Sales person: e-mail: Telephone:	Department: Date: Customer number:
Customer/contact: e-mail:	Customer number: Telephone:

Customer vehicle/project

Application, project description (task of EHP in the system, e.g. implement hydraulics, emergency steering, etc.)

	Proposal	A sample	B sample	C sample	D sample	SOP	Year 1	Year 2	Year 3	Year 4
Deadline										
Quantity										
€/unit										

Additional business ☐	Competition
Replacement business ☐	Target price

Description of product (e.g. EHP24KDG66F004-20A0653N0)

Particular technical requirements and application conditions to be stated in section 3.
If any details are missing, compliance with the operating conditions Y 541... (see table on page 4) and the figures in the catalog will be assumed.

Particular features (ZA 08916) and systems (remarks, sketches, notes, specifications, drawings, etc.)

2. Project management

Development location	Project category* S	
	* R = Fundamental R&D development V = Variant development M = Modification to series	N = Platform/new development A = Application development S = Series

Modification no.	Description	Date	Originator	Checked

Produceability declaration required? Yes ☐ No ☐	Project Manager: Project number:

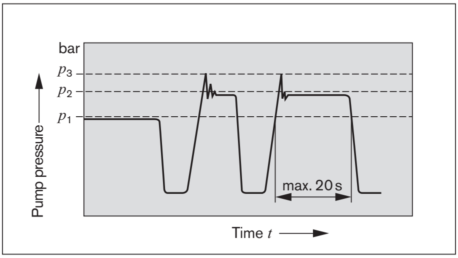
Rexroth Bosch Group	Project specification Electrohydraulic pump (EHP)	Hydraulics DCH/STE 2/4

3. Technical data

Operating voltage of motor (volts)				
Motor voltage type	Direct current (DC) ☐ Alternating current (AC) ☐			
Protection class Motor (IP)				
Thermal contact (yes/no)				
Relay (yes/no) If yes: axial or radial				
Displacement [l/min] at working pressure [bar]	PT1	PT2	PT3	PT4
Displacement [l/min] at maximum pressure [bar]	PT1	PT2	PT3	PT4
Actuated time S2 in min				
Actuated time S3 in %				
Seals	FPM ☐ NBR ☐ HNBR ☐ Radial shaft seal ring FPM/otherwise NBR ☐			
Multiple pumps	Tang (light through drive) ☐ Splined shaft (heavy through drive) ☐ Separation of medium ☐ Common suction port ☐			
Auxiliary function	PRV adjustment ± bar at l/min SRV adjustment ± l/min Residual current, external ☐ Residual current, internal ☐ Electrical connection Prop. PRV 12 V ☐ 24 V ☐ Connector AMP Junior Timer (C4) ☐ DEUTSCH) (K40) ☐			
Particular notes (e.g. surface protection …)				
Other (load complex etc.)				
Medium temperature	min °C max °C			
Ambient temperature	min °C max °C			
Operating medium				
Viscosity range				
Cleanliness level				
Filter grade	β ≧ – Suction filter β ≧ – Pressure filter			
Ambient conditions (e.g. dust, spray water)				
Additional stress				
Noise requirements				
Installation position				
Interfaces				

Rexroth Bosch Group	Project specification Electrohydraulic pump (EHP)	Hydraulics DCH/STE 3/4

4. Customer demands	Legislation, standards			
	Patents, licenses			
	Additional customer demands (e.g. documentation, modification announcements, QM system, APQG, …)			
	Safety functions or limitations			
	Acceptance	Without testing	☐	
		Testing at customer	☐	
		BR acceptance	☐	(subject to charge)
		Initial sample test report	☐	
		Volume		
		Additional examination		
		Additional documentation		
	Certificate			
	Terms of delivery			
	Labeling			
	Packaging	Differing from standard packaging ☐ Lattice box (reusable, EU only) ☐ SLC (= small load carrier, reusable, EU only) ☐ Wooden crate (disposable, sea freight only) ☐ Non-reusable packaging (rest of world) ☐ Customer wish		
	Customer specification			
	Prototype version			
	Recycling			
	Service agreement			
	Repair			
	Warranty			
	Service life	Hours	Load cycles	
	Always state load complex with service life requirement (cf. example)			



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

Date, Signature of issuing party	Date, Signature of customer	Date, Signature of DCH/STE

Rexroth Bosch Group	Project specification Electrohydraulic pump (EHP)	Hydraulics DCH/STE 3/4

Operating conditions

EHP	Y 541 … … or quotation drawing
Information Tightening torque	Y 510 202 040

Remarks:

Bosch Rexroth AG
Hydraulics
Product Unit Mobile Controls
Robert-Bosch-Straße 2
D-71701 Schwieberdingen
Fax +49 (0) 711-811 5 11 69 23
info.brh-stf@boschrexroth.de
www.boschrexroth.com/brm

The Drive & Control Company

Rexroth
Bosch Group

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Find your local contact person here:
www.boschrexroth.com/contact

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Replaces: 2008-11