

Instruction manual
according to ATEX directive
2014/34/EU

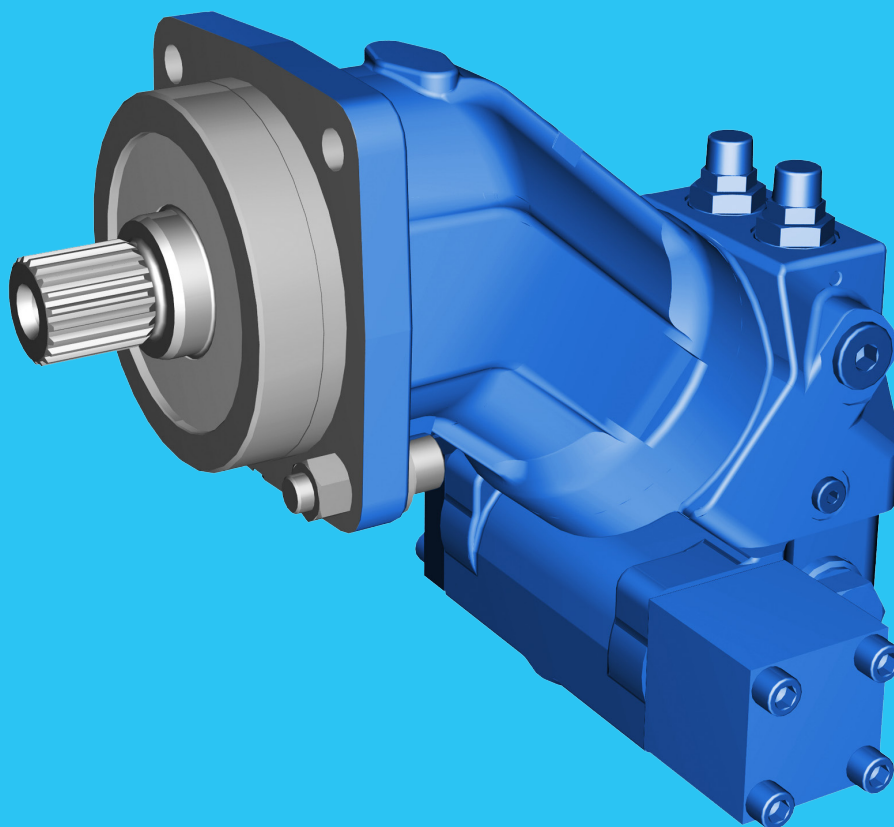
Axial Piston Fixed Motor

A2FM series 61

for explosive areas

II 2G Ex h IIB T4-T1 Gb X and

II 3G Ex h IIB T4-T1 Gc X



What you need to know about this instruction manual

The full instruction manual for the A2FM series 61 axial piston fixed motor for explosive areas according to the ATEX Directive 2014/34/EU consists of the following two parts:

Part I	Product-specific and general instructions	RE 91001-01-X-B1/2023-03-27	64 pages
Part II	Data sheet A2FM series 61	RE 91001-01-X-B2/2023-03-27	30 pages

The Declaration of Conformity can be found on the next-to-last page.

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Part I of instruction manual
according to ATEX directive
2014/34/EU
Product-specific and
general instructions

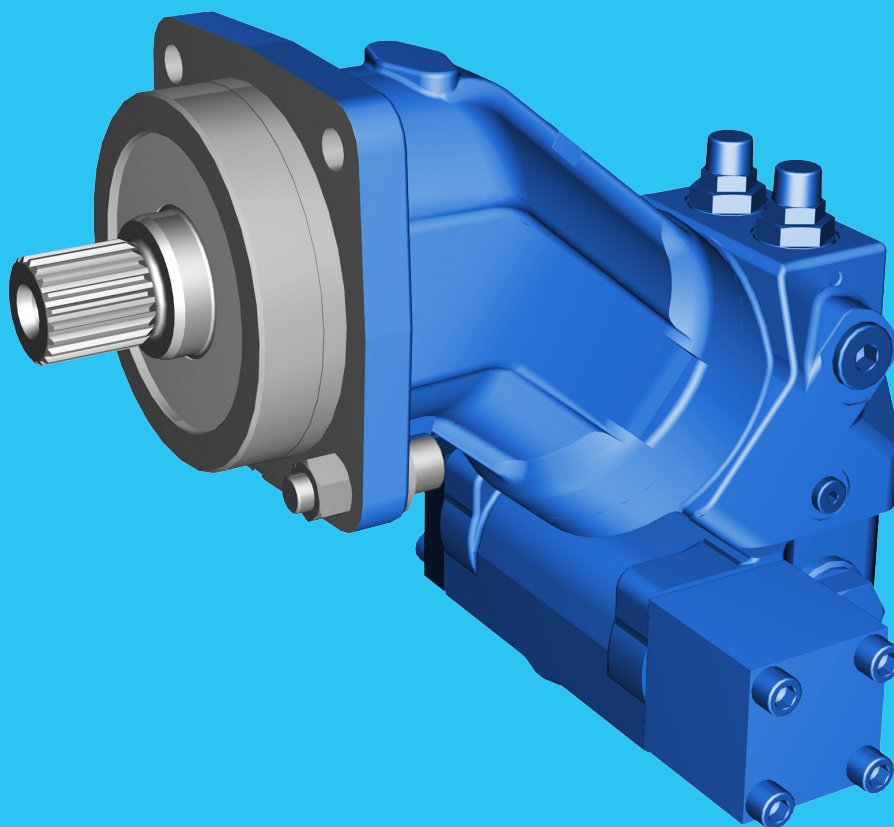
Axial piston fixed motor

A2FM Series 61

for explosive areas

II 2G Ex h IIB T4-T1 Gb X and

II 3G Ex h IIB T4-T1 Gc X



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The data specified within only serves to describe the product. No statements concerning a particular condition or suitability for a certain application 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.

The cover shows an example application.
The product delivered may differ from the image on the cover.

The original instruction manual was created in German.

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1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following products:

- Axial piston fixed motor A2FM series 61 for explosive areas
II 2G Ex h IIB T4-T1 Gb X and II 3G Ex h IIB T4-T1 Gc X

This documentation is intended for machine/system manufacturers, assemblers and service engineers.

This documentation contains important information on the safe and proper transport, installation, commissioning, operation, maintenance, removal and simple troubleshooting of the axial piston unit.

- Read this documentation completely, in particular chapter 2 "Safety instructions" on page 8 and chapter 3 "General instructions on property damage and product damage" on page 18 before you start work with the axial piston unit.

1.2 Required and supplementary documentation

- Only commission the axial piston unit if the documentation marked with the book symbol  is available to you and you have understood and observed it.

Table 1: Required and supplementary documentation

Title	Document number	Document type
 Order confirmation Contains the order-related technical data of your Axial piston fixed motor A2FM for explosive areas.	–	Order confirmation
 Installation drawing Contains the outer dimensions, all connections and the hydraulic circuit diagram for your Axial piston fixed motor A2FM for explosive areas.	Please request the installation drawing from your contact at Bosch Rexroth.	Installation drawing
 Axial piston fixed motor A2FM Series 61 for explosive areas II 2G Ex h IIB T4-T1 Gb X and II 3G Ex h IIB T4-T1 Gc X Contains the permissible technical data.	91001-01-X-B2	Data sheet
 Counterbalance valve BVD for travel, winch and track drives Contains the permissible technical data.	95522	Data sheet
 Hydraulic fluids based on mineral oils and related hydrocarbons Describes the requirements on a hydraulic fluid based on mineral oil and related hydrocarbons for operation with Rexroth hydraulic components, and assists you in selecting a hydraulic fluid for your hydraulic system.	90220	Data sheet
 Information on the application of hydrostatic drives at low temperatures Contains additional information on the application of Rexroth axial piston units at low temperatures.	90300-03-B	Manual
 Storage and preservation of axial piston units Contains additional information on storage and preservation.	90312	Data sheet

1.3
Representation of information

Standardized safety instructions, symbols, terms and abbreviations are used throughout this documentation so that you can work quickly and safely with your product. For clarification, they are explained in the sections below.

1.3.1
Safety instructions

This documentation contains safety instructions in chapter 2.6 "Product-specific safety instructions" on page 11 and in chapter 3 "General instructions on property damage and product damage" on page 18, as well as before a sequence of actions or an instruction for action involving a risk of personal injury and property damage. Always follow the measures for danger prevention associated with the use of this product.

Safety instructions are set out as follows:


SIGNAL WORD

Type and source of danger!
 Consequences of non-compliance
 ► Danger prevention measures

- **Warning sign:** draws attention to the danger
- **Signal word:** identifies the degree of the danger
- **Type and source of danger:** indicates the type and source of the danger
- **Consequences:** describes the consequences of non-compliance
- **Precautions:** states how the danger can be avoided

Table 2: Hazard classes as defined in ANSI Z535.6

Warning sign, signal word	Meaning
 DANGER	Identifies a dangerous situation that will result in death or serious injury if it is not avoided.
 WARNING	Identifies a dangerous situation that may result in death or serious injury if it is not avoided.
 CAUTION	Identifies a dangerous situation that may result in minor to moderate injury if it is not avoided.
NOTICE	Property damage: The product or surrounding area may be damaged.

1.3.2 Symbols

The following symbols indicate notices that are not safety-relevant but increase understanding of the documentation.

Table 3: Meaning of symbols

Symbol	Meaning
	If this information is disregarded, the product cannot be used and/or operated to its full extent.
►	Single, independent action
1. 2. 3.	Numbered instruction: The numbers indicate that the actions must be completed in order.

1.3.3 Designations

This documentation uses the following designations:

Table 4: Designations

Designation	Meaning
A2FM	Axial piston fixed motor for explosive areas II 2G Ex h IIB T4-T1 Gb X and II 3G Ex h IIB T4-T1 Gc X, open and closed circuit
Threaded plug	Metal screw, pressure-resistant
Protective plug	made out of plastic, not pressure-resistant, only for transportation

As an umbrella term for "Axial piston fixed motor A2FM for explosive areas", the designation "axial piston unit" will be used in the following.

1.3.4 Abbreviations

This documentation uses the following abbreviations:

Table 5: Abbreviations

Abbreviation	Meaning
ANSI	A merican N ational S tandards I nstitute is an organization that coordinates the development of voluntary standards in the United States
ATEX	EC directive on explosion protection (A tmosphère e xplosible)
DIN	D eutsche I ndustrie N orm (German Institute for Standardization)
ISO	I nternational O rganization for S tandardization
JIS	J apan I ndustrial S tandard
RE	R exroth document in the E nglish language
VDI 2230	Guideline for the systematic calculation of heavy-duty threaded connections and cylindrical screw joints from the VDI (V erein D eutscher I ngenieur e - Association of German Engineers)

2 Safety instructions

2.1 About this chapter

The axial piston unit has been manufactured to generally accepted engineering standards. There is still, however, a risk of personal injury or property damage if this chapter and the safety instructions in this documentation are not observed.

- ▶ Read this documentation completely and thoroughly before working with the axial piston unit.
- ▶ Keep this documentation in a location where it is accessible to all users at all times.
- ▶ Always include the required documentation when you pass the axial piston unit on to third parties.

2.2 Intended use

Axial piston units are hydraulic components, meaning that in their application area they are classified neither as complete nor as partly completed machinery in the sense of the EC Machinery Directive 2006/42/EC. The component is exclusively intended to form partly completed machinery or complete machinery together with other components. The component should only be commissioned after it has been installed in the machine/system for which it is intended, and the safety of the entire system has been established in accordance with the Machinery Directive.

This product is intended for the following use:

The axial piston unit is only approved as a hydraulic motor in hydrostatic drives.

- ▶ Adhere to the technical data, the application and operating conditions, and the performance limits as specified in the data sheet (Part II) and in the order confirmation. Information about approved hydraulic fluids can be found in the data sheet (Part II).

The axial piston unit is only intended for commercial use and not for private use. Intended use includes having fully read and understood this documentation, especially chapter 2 "Safety instructions" on page 8.

The axial piston units in explosion-protected design satisfy the requirements of the EU ATEX Directive (2014/34/EU).

Information on the equipment group and category as defined in the ATEX Directive (2014/34/EU) can be found on the data sheet (Part II) under application in accordance with EC directive 2014/34/EU and on the name plate of the axial piston unit.

Under EC directive 1999/92/EC, the user/operator is required to divide explosive areas into zones. chapter 5.3.2 "Explosion protection mark" on page 25 compares the zones with the equipment groups and categories.

The axial piston unit should only be used in applications specified for the equipment group and category in Directive 2014/34/EU and according to the areas specified in the type of protection or in areas (explosion group, temperature class) with lower requirements. It should be operated in accordance with the technical data and ambient conditions specified in this directive and in this instruction manual.

2.3 Improper use

Any use other than that described as intended use is considered improper.

Bosch Rexroth AG is not liable for damage resulting from improper use.

The user is solely responsible for any risks arising from improper use.

The following foreseeable misuses are also considered improper:

- Use outside the operating parameters approved in the data sheet (Part II) or in the order confirmation (unless customer-specific approval has been granted)
- Use of non-approved fluids, e.g. water or polyurethane components
- Changes to factory settings by unauthorized persons
- Use of add-ons (e.g., valves) not in combination with the specified Rexroth components
- Use of the axial piston unit under water at a depth of more than 10 meters without the necessary additional measures, e.g., pressure equalization. Units with electrical components (e.g. sensors) must not get into contact with water, depending on the IP protection class. Observe the IP protection class of the relevant product in data sheet (Part II).
- Use of the axial piston unit under a continuous pressure differential between internal and external pressure greater than 2 bar, whereby the external pressure must always be lower than the case pressure. Momentary ($t < 0.1$ s) pressure peaks of up to 10 bar are allowed. Beyond this, the maximum permissible case pressure specified in the data sheet should not be exceeded.
- Application of the axial piston unit in explosive environments unless the component or machine/system has been certified as compliant with the ATEX Directive 2014/34/EU
- Use of the axial piston unit in a corrosive atmosphere
- Use of the axial piston unit in aircraft or spacecraft
- Use of the axial piston unit in areas where propagating brush discharge could occur (as per DIN EN ISO 80079-36)
- Use of the axial piston unit in ranges with a risk of lightning strikes (e.g. exposed installation position).

2.4 Personnel qualifications

The activities described in this documentation require basic knowledge of mechanics, electricity, hydraulics and ATEX, as well as familiarity with associated technical terms. For transporting and handling the product, knowledge regarding the use of lifting devices and lifting accessories is required. In order to ensure safe use, these activities should only be performed by skilled personnel or an instructed person under the direction and supervision of skilled personnel.

Skilled personnel refers to persons who possess the professional training, knowledge and experience, as well as the understanding of the regulations relevant to the work to be done that are necessary to recognize possible dangers and take the appropriate safety measures. Skilled personnel must follow the rules relevant to their field and have the necessary hydraulic expert knowledge.

Hydraulic expert knowledge includes:

- Being able to read and fully understand hydraulic circuit diagrams
- In particular, fully understanding the relationships with regard to safety devices
- comprising of knowledge regarding the function and layout of hydraulic components.



Bosch Rexroth offers you measures supporting training in specific areas.

You can find an overview of the training contents on the Internet at:

www.boschrexroth.com/training.

2.5 General safety instructions

- Adhere to all applicable legal regulations, rules and directives regarding explosion protection.
- Observe the country-specific accident prevention and environmental protection regulations.
- Observe the safety regulations of the country in which the product is used/operated.
- Use Rexroth products only when they are in good working order.
- Observe all notices on the product.
- Do not assemble, operate, remove or maintain Rexroth products if under the influence of alcohol, drugs or medication that may affect your reaction time.
- Only use genuine Rexroth accessories and spare parts to ensure there is no hazard to persons from unsuitable spare parts.
- Observe the technical data and ambient conditions specified in the product documentation.
- If unsuitable products are installed or used in safety-relevant applications, unexpected operating conditions may occur in the application, which could result in personal injury or property damage. For this reason, only use the product in safety-relevant applications if this use is expressly indicated and approved in the product documentation, e. g. in explosion protection areas or in safety-related parts of a control system (functional safety).
- Only commission the product if it has been determined that the end product (e.g. machinery/system) in which the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards for the application.
- Use tools appropriate for the work being performed and wear appropriate protective clothing to prevent punctures and cuts (e.g. when removing protective covers, disassembly).
- There is a risk of entanglement when operating the axial piston unit with a bare shaft end. Check whether or not your machine requires additional safety measures for your application. If necessary, make sure these are appropriately implemented.
- A separate pressure relief valve is to be provided in the hydraulic system.

2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ Take care to remove dust in a timely manner in order to reduce the risk of ignition.
- ▶ The axial piston unit may only be operated if the hydraulic system is equipped with a leakage temperature monitoring system, which in the event of the maximum leakage temperature being exceeded (see data sheet Part II) deactivates so far that no further increase in temperature is possible.
- ▶ The system must be equipped with a monitoring device for the reservoir level and the temperature of the fluid in the reservoir. This device should shut off the machine when the values exceed the limits (see data sheet, Part II).
- ▶ Make sure parts (e.g., coupling components) that are able to move relative to each other do not touch, as this could create sparks and/or heat and explosion protection would no longer be guaranteed.
- ▶ Switch off the system if the axial piston unit can no longer deliver the specific torque (pressure).
- ▶ Switch off the system if there is a lack of dynamics during operation and if the load can no longer be held hydraulically.

Also observe the following for ATEX category II 2G Ex h IIB T4-T1 Gb X:

- ▶ The axial piston unit should only be operated if the hydraulic system is equipped with a leakage temperature monitor that, in the event the maximum leakage temperature is exceeded (see data sheet, Part II), deactivates the system so the temperature cannot continue to rise. This must be provided by the operator.

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface caused by overheating due to faults or defects, or actuation of the pressure relief valves!

Serious injury caused by blast pressure and fire may result.

- ▶ Secure the system against excess pressures.
- ▶ Make sure that the maximum permitted cracking pressure of the high-pressure relief valves of 400 bar is not exceeded.
- ▶ Make sure that oil is allowed to flow through the high-pressure relief valves for maximum 5 seconds in all operational states.

 DANGER**Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface caused by overheating due to excessive speed!**

Serious injury caused by blast pressure and fire may result.

- ▶ Make sure that the maximum permissible speed as specified in the data sheet (Part II) is not exceeded.
- ▶ If necessary, take measures to ensure rotational speed is limited.

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface caused by friction due to lack of lubricant!

Serious injury caused by blast pressure and fire may result.

- ▶ Ensure lubrication by leakage: Always use the highest case drain port to make sure the circulating leakage provides internal lubrication; see chapter 7.3 "Installation position" on page 33.
- ▶ With above-reservoir installation, prevent emptying of the housing area.
- ▶ Fill the axial piston unit with hydraulic fluid prior to commissioning.

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface caused by overloading and damage to shaft key or splines causing coupling to turn on shaft!

Serious injury caused by blast pressure and fire may result.

- ▶ Make sure the permissible shaft load indicated on the data sheet (Part II) is not exceeded under any operating conditions.
- ▶ Make sure the shaft and coupling are correctly aligned; see chapter 7.4.4 "Installation with a coupling" on page 37.

 DANGER**Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface caused by overheating!**

Serious injury caused by blast pressure and fire may result.

- ▶ Make sure that the maximum permissible case pressure stated in the data sheet (part II) is never exceeded as excessive case pressure or excessive pressure spikes can cause impermissible temperatures on the shaft seal and thus a risk of ignition.
- ▶ Bearing damage or damage to rotary groups within the axial piston unit result in an increase in the leakage temperature caused by heat set free through mechanical friction loss. A gradual increase in the leakage temperature can, therefore, indicate the onset of bearing damage. In such a case, check whether there is an increase in the mechanical loading when the difference between the input- and output power. Contact Bosch Rexroth Service for maintenance if you cannot trace the increase in temperature to an increase in the loading of the axial piston unit.
- ▶ A sudden increase in the leakage temperature indicates serious damage with extreme friction. If this occurs, shut down the axial piston unit immediately and contact Bosch Rexroth Service for maintenance.

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust caused by mechanically generated sparks!

Serious injury caused by blast pressure and fire may result.

To prevent mechanically generated sparks due to foreign particles made of aluminum with ferric oxide and/or particles of rust on the surface (see DIN EN ISO 80079-36, 6.4.2.1), the motor is given a corrosion-protection paint coating as standard.

- ▶ Make sure the paint is not damaged.
- ▶ Do not transport or store the axial piston unit in explosive areas.
- ▶ Do not load the axial piston unit in explosive areas.
- ▶ Do not unpack or pack the axial piston unit in explosive areas.

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust due to sparks caused by electrostatic discharge!

Serious injury caused by blast pressure and fire may result.

The axial piston unit has been painted as specified in Section 6.7 (Static Electricity) of DIN EN ISO 80079-36.

- ▶ Additional coats of paint should only be applied as specified in Section 6.7 of DIN EN ISO 80079-36, otherwise explosion protection cannot be no longer guaranteed. Do not paint solenoids, temperature sensors and ground terminals.
- ▶ Include the axial piston unit in the potential equalization connection.
- ▶ The axial piston unit is only approved for use in areas where no propagating brush discharge can occur.
- ▶ Do not transport or store the axial piston unit in explosive areas.
- ▶ Do not load the axial piston unit in explosive areas.
- ▶ Do not unpack or pack the axial piston unit in explosive areas.

WARNING

Danger due to excessive pressure!

Risk of death or injury, or property damage!

Improperly changing the factory pressure settings can result in a pressure increase beyond the permissible maximum pressure.

Operating the unit above the maximum permissible pressure can cause components to burst and hydraulic fluid to escape under high pressure.

- ▶ Changes to the factory settings may only be made by Bosch Rexroth specialists.
- ▶ In addition, a pressure relief valve is required in the hydraulic system as back-up. The pressure relief valves of the axial piston unit do not offer adequate protection against pressure overload.

Danger due to suspended loads!

Risk of death or injury, or property damage!

Improper transportation may cause the axial piston unit to fall down and lead to injury, e.g. crushing or fracture, or damage to the product.

- ▶ Make sure that the load bearing capacity of the lifting device is sufficient to safely bear the weight of the axial piston unit.
- ▶ Never step or grip under suspended loads.
- ▶ Ensure a stable transport position.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Use suitable lifting devices for transport.
- ▶ Observe the prescribed position of the lifting strap.
- ▶ Observe the national laws and regulations on occupational health and safety, and transportation.

 WARNING**System/machine under pressure!**

Risk of death or serious injury when working on unsecured machines/systems!
Property damage!

- ▶ Switch off the entire system and secure it against reactivation according to the parameters provided by the machine/system manufacturer.
- ▶ Ensure that all relevant components of the hydraulic system are depressurized. For this purpose, observe the parameters indicated by the machine/system manufacturer.
- ▶ Please note that the hydraulic system might still be pressurized even after separation from the actual pressure supply.
- ▶ Do not disconnect any line connections, ports or components as long as the hydraulic system is under pressure.

Escaping hydraulic fluid mist!

Risk of explosion and fire hazard, health hazard, risk of environmental pollution!

- ▶ Depressurize the relevant machine/system component and repair the leak.
- ▶ Only perform welding work when the machine/system is depressurized.
- ▶ Keep open flames and ignition sources away from the axial piston unit.
- ▶ Only use a hydraulic fluid that meets the requirements on the data sheet (Part II) (according to DIN EN ISO 80079-37, chapter 5.4).
- ▶ If axial piston units are located in the vicinity of ignition sources or powerful thermal radiators, a shield must be erected to ensure any escaping hydraulic fluid cannot be ignited, and to protect hose lines from premature aging.

Escaping hydraulic fluid due to leakage of machine/system components!

Risk of burning and risk of injury due to escaping hydraulic fluid jet!

In case of leakage at the axial piston unit, high-pressure fluid jets may escape.

- ▶ Depressurize the relevant machine/system component and repair the leak.
- ▶ Never attempt to block or seal the leak or hydraulic fluid jet with a cloth.
- ▶ Make sure that the fluid level in the tank is constantly monitored by an appropriate sensor in the system.

Hydraulic fluid will explode when making contact with water!

Explosion and fire hazard!

- ▶ Do not bring hot hydraulic fluids in contact with water.

Electrical voltage!

Danger to life or risk of injury due to electric shock or property damage!

- ▶ Always disconnect the voltage supply to the relevant machine/system part before installing the product and/or connecting or disconnecting the connector. Protect the machine/system against being re-energized.



WARNING

Limitation of load-holding function in lifting winches!

Risk of injury or property damage!

Moving parts in high-pressure relief valves may in certain circumstances become stuck in an undefined position due to contamination (e.g. impure hydraulic fluid). This can result in restriction or loss of load-holding functions in lifting winches.

- ▶ Check whether the application on your machine requires additional safety measures in order to keep the load in a safe position.
- ▶ If necessary, make sure these are appropriately implemented.



CAUTION

High noise development during operation!

Risk of hearing damage or hearing loss!

The noise emission of axial piston units depends on rotational speed, working pressure and installation conditions, among other factors. The sound pressure level may rise above 70 dB (A) under normal application conditions.

- ▶ Always wear hearing protection near a running axial piston unit.

Hot surfaces on axial piston unit!

Risk of getting burnt!

- ▶ Allow the axial piston unit to cool down sufficiently before touching it.
- ▶ Wear heat-resistant, protective clothing, e.g. gloves.

Improper cable and line routing!

Risk of stumbling and property damage! Due to incorrect routing of lines and cables, both a risk of stumbling as well as damage to parts and components can occur, e.g. due to lines and connectors being torn off.

- ▶ Always install cables and lines in a way that nobody can fall over them, that they are not bend or twisted, do not chafe on edges and are not guided through ducts with sharp edges without sufficient protection.

Contact with hydraulic fluid!

Risk of adverse health effects, e.g. eye injury, skin irritation, toxication from inhalation!

- ▶ Avoid any contact with hydraulic fluids.
- ▶ When handling hydraulic fluids, the safety instructions of the lubricant manufacturer need to be observed at all times.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Immediately seek medical attention, however, if hydraulic fluid gets into your eyes or blood circuit or if you swallow it accidentally.

Danger from improper handling!

Slip hazard! Risk of slipping on wet surfaces when climbing on the axial piston unit.

- ▶ Never grab or climb onto the axial piston unit.
- ▶ Check how to safely get on top of the machine/system.

2.7 Personal protective equipment

Personal protective equipment is the responsibility of the user of the axial piston unit. Observe the safety regulations in your country.

All pieces of personal protective equipment must be intact.

3 General instructions on property damage and product damage

The following instructions apply to chapters 6 to 14.

NOTICE

Danger from improper handling!

Product can be damaged!

- ▶ Do not subject the product to improper mechanical loads.
- ▶ Never use the product as handle or step.
- ▶ Do not put/place any objects on the product.
- ▶ Do not strike the drive shaft of the axial piston unit.
- ▶ Do not set/place the axial piston unit on the drive shaft or assembled parts.
- ▶ Do not strike assembled parts (e.g. sensors or valves).
- ▶ Do not hit sealing surfaces (e.g. on the working ports).
- ▶ Leave the protective covers on the axial piston unit until you connect the lines.

Risk of property damage due to inadequate lubrication!

Product can be damaged or destroyed!

- ▶ Never operate the axial piston unit without sufficient hydraulic fluid. Specifically, make sure that the rotary group has sufficient lubrication.
- ▶ When commissioning a machine/system, make sure that the housing area and the working lines of the axial piston unit are filled with hydraulic fluid and remain filled during operation.
- ▶ Check the hydraulic fluid level in the housing area regularly and recommission, if necessary. For above-reservoir installation, the housing area may drain out through the drain line after prolonged standstill periods (air enters through the shaft seal) or through the working line (gap leakage). This means the bearings are insufficiently lubricated when the system is turned on.

Mixing hydraulic fluids!

Product can be damaged!

- ▶ Before installation, remove all fluids from the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
- ▶ Never mix hydraulic fluids from different manufacturers or different types from the same manufacturer.

NOTICE

Contamination of the hydraulic fluid!

The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and service life of the hydraulic system. Contamination of the hydraulic fluid can cause premature wear and malfunctions!

- ▶ Always ensure a work environment in the assembly location that is free from dust and foreign particles to prevent foreign particles, e.g., welding beads or metal cuttings, from entering the hydraulic lines and leading to wear and malfunctions in the product. The axial piston unit should be clean when installed.
- ▶ Only use clean ports, hydraulic lines and assembled parts (e.g. measuring devices).
- ▶ When plugging the ports, no contamination must ingress.
- ▶ Before commissioning, make sure all hydraulic connections are tight, and all seals and plug-in connections are installed correctly to ensure they are leak-proof, and fluids and foreign particles cannot enter into the product.
- ▶ Use a suitable filter system to filter hydraulic fluid during filling to minimize solid particle contamination and water in the hydraulic system.
- ▶ Carry out the specified maintenance work at the intervals described in this manual in chapter 10.3 "Maintenance" on page 55.

Improper cleaning!

Product can be damaged!

- ▶ Plug all openings with appropriate protective covers in order to prevent cleaning agents from entering the hydraulic system.
- ▶ Never use solvents or aggressive cleaning agents. Use only water and, if necessary, a mild cleaning agent to clean the axial piston unit.
- ▶ Do not point a high-pressure cleaner at sensitive components, e.g. shaft seal, electrical connections and components.
- ▶ Use fiber-free cleaning cloths for cleaning.
- ▶ Please refer to chapter 10.1 "Cleaning and care" on page 53.

Environmental pollution due to incorrect disposal!

Careless disposal of the axial piston unit and its assembled parts, the hydraulic fluid and the packaging material can cause environmental pollution!

- ▶ Dispose of the axial piston unit, hydraulic fluid and packaging in accordance with the regulations in your country.
- ▶ Dispose of the hydraulic fluid in accordance with the applicable safety data sheet for the hydraulic fluid.

Danger from chemical or corrosive environmental conditions!

Product can be damaged! If the axial piston unit is exposed to chemical or corrosive environmental conditions, such as sea water, fertilizer or road salt, it can result in corrosion or, in extreme cases, malfunction. Leaks may lead to leakage of hydraulic fluid.

- ▶ Take appropriate measures to protect the axial piston unit from chemical or corrosive environmental conditions.

NOTICE

Leakage or spilling of hydraulic fluid!

Risk of environmental pollution and contamination of ground water!

- ▶ Always place a drip tray under the axial piston unit when filling and draining hydraulic fluid.
- ▶ Use oil binding agents if hydraulic fluid is spilled.
- ▶ Observe the safety data sheet for the hydraulic fluid and the specifications provided by the system manufacturer.

Danger from hot components!

Nearby products can be damaged! Due to a heat development in components (e.g. solenoids), adjacent products may be damaged during assembly if no sufficient safety distance is complied with.

- ▶ When installing the axial piston unit, check the safety distances to nearby products to ensure that they are not damaged.

The warranty exclusively applies to the delivered configuration.

The warranty will be voided if the product is incorrectly installed, commissioned or operated, or if it is used or handled improperly.

The warranty will also be voided if the product is serviced by anyone other than Bosch Rexroth Service or is not serviced within the specified intervals.

3.1 Operator's obligations

The operator has the obligation to check in the order confirmation that the axial piston unit supplied corresponds to the category needed and the related zone.

4 Scope of delivery

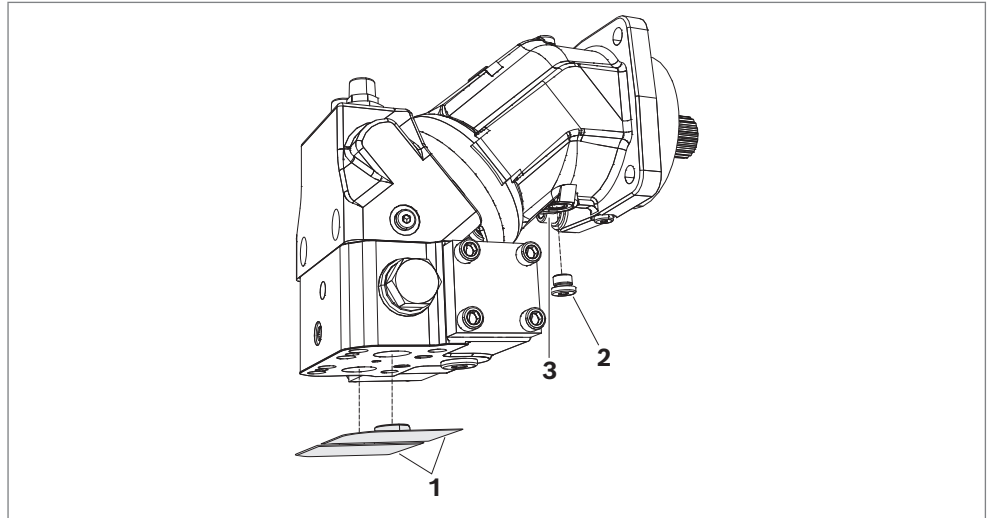


Fig. 1: Axial piston fixed motor with integrated pressure relief valve and mounted counterbalance valve (A2FM107/61W-A..188J-S)

The following is included in the scope of delivery:

- Axial piston unit as per order confirmation
- Instruction manual

The following parts come assembled on the unit:

- Protective covers **(1)**
- Protective plug/threaded plugs **(2)**
- Ground connection protection screw **(3)**

5 About this product

5.1 Performance description

The Axial piston fixed motor converts hydrostatic flow into mechanical rotation.

It is designed for mobile and stationary applications.

Refer to the data sheet (Part II) and the order confirmation for the technical data, operating conditions and operating limits of the axial piston unit.

5.2 Product description

The A2FM is an Axial piston fixed motor with axial tapered piston rotary group of bent-axis design for hydrostatic drives in open and closed circuits.

Due to the bent-axis design, the torque is developed directly at the drive shaft.

The pistons **(2)** load the cylinders **(3)**, but with only very little radial force.

This has a positive impact on wear, efficiency and starting torque.

For axial piston units with bent-axis design, the pistons **(2)** are arranged at an angle to the drive shaft **(1)**. The pistons perform a stroke movement which is converted into rotation by the piston joint on the flange of the drive shaft.

The cylinder **(3)** is moved by the pistons.

Open circuit In an open circuit, the hydraulic fluid flows from the reservoir to the hydraulic pump, where it is transported to the hydraulic motor. The hydraulic fluid flows from the hydraulic motor directly back to the reservoir. The output direction of rotation of the hydraulic motor can be changed with a directional valve.

Closed circuit In the closed circuit, the hydraulic fluid flows from the hydraulic pump to the hydraulic motor, then directly back to the hydraulic pump. The output direction of the hydraulic motor is changed, e.g., by reversing the flow direction in the hydraulic pump.

5.2.1 Axial piston unit layout

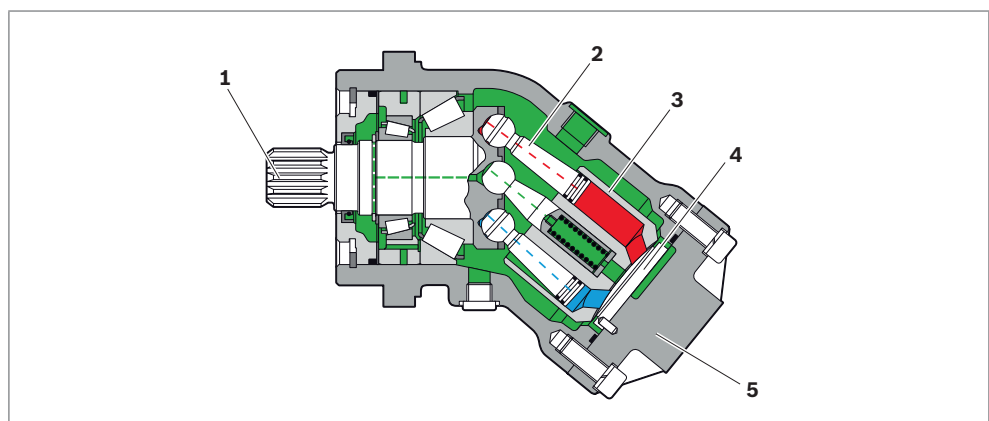


Fig. 2: Layout of the Axial piston fixed motor A2FM Series 61

1 Drive shaft

2 Piston

3 Cylinder

4 Control plate

5 Port plate

5.2.2 Functional description

Motor function

A Axial piston fixed motor converts hydrostatic energy into mechanical energy. Hydraulic fluid is directed via the port plate (5) and the control plate (4) to the cylinder bores. The pistons (2) in the cylinder bores perform a stroke movement which is converted into rotation by the piston joint on the flange of the drive shaft (1). During this process, the pistons move the cylinder (3) and generate an output torque at the drive shaft. The output torque is produced by the force resulting from the pressure and piston surface. The output speed is proportional to the inward flow and the displacement. This output torque increases with the pressure difference between the high-pressure and low-pressure sides.

Motor function in open circuit with pressure relief valve and counterbalance valve (BVD), winch application (if option selected)

Counterbalance valves in winch applications in an open circuit gain potential energy during the lowering process and convert it to heat. This is necessary since the load cannot be supported by the diesel engine or electric motor as in a closed circuit.

The counterbalance valve also prevents the hydraulic motor from overspeeding as the load is lowered. This protects the motor from cavitation. This occurs as soon as the speed induced by the load exceeds the speed that corresponds to the flow. If the system is correctly designed, the pressure relief valves must not trigger. They serve to protect the motor if the counterbalance valve piston drops too quickly and pressure spikes occur in the motor.

For the case of a load hanging from a crane, it is important that the mechanical brake closes automatically. If there was not a brake, the motor would slowly turn on account of leakage in the motor, resulting in an undesired lowering of the load. Without backfeeding via the S-port of the counterbalance valve, the turning motor would suck even the B line dry. This, in turn, would result in a free-falling load.

5.3 Product identification

5.3.1 Axial piston unit name plate

The axial piston unit can be identified by the name plate. The following example shows an A2FM ATEX name plate:

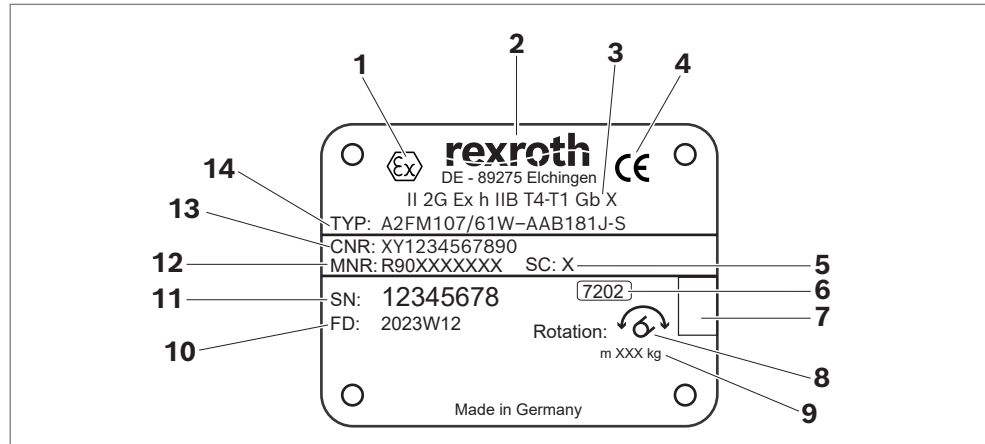


Fig. 3: Name plate for A2FM, ATEX version

- | | |
|---|---|
| 1 Explosion protection mark | 8 Direction of rotation (viewed on drive shaft) – here: bi-directional |
| 2 Manufacturer | 9 Weight (optional) |
| 3 Marking for protection class according to EC directive 2014/34/EU (explosion protection directive) and identifier for the ignition protection type of the mechanical part according to DIN EN ISO 80079-36 and -37 | 10 Manufacturing date |
| 4 CE mark | 11 Serial number/production number |
| 5 Sample category (optional) | 12 Material number of the axial piston unit |
| 6 Internal plant designation | 13 Customer material number |
| 7 Designated area for inspection stamp | 14 Type code |

5.3.2 Explosion protection mark

This chapter explains the codes for the protection class markings.

Comparison of equipment groups/categories and corresponding zones

In Table 6 you will find the equipment groups/categories as per 2014/34/EU, the related zones as per 1999/92/EC as well as the equipment protection level according to DIN EN ISO 80079-36.

Table 6: Comparison of equipment groups/categories and zones

Usable in zone per 1999/92/EC	Equipment group per Directive 2014/34/EU	Category per 2014/34/EU	Application/characteristics (excerpt from the directives)	Equipment group according to DIN EN ISO 80079-36	Equipment protection level (EPL) according to DIN EN ISO 80079-36
–	I	M1	Areas with firedamp atmospheres (Equipment Group I), i.e., underground mines and their surface installations. Continued operation is possible in the event of an explosive atmosphere. Very high level of safety	I	Ma
–		M2	Areas with firedamp atmospheres (Equipment Group I), i.e., underground mines and their surface installations. In the event of an explosive atmosphere, it must be possible to switch off the device. High level of safety	I	Mb
0, 1, 2	II	1G	Explosive areas in which explosive gases, mists or vapors (Equipment Group II) occur constantly or for long periods or frequently. Corresponds to Zone 0 per Directive 1999/92/EC. Very high level of safety	II	Ga
1, 2		2G	Explosive areas in which explosive gases, mists or vapors (Equipment Group II) occur occasionally. Corresponds to Zone 1 per Directive 1999/92/EC. High level of safety	II	Gb
2		3G	Explosive areas in which combustible gases, mists or vapors (Equipment Group II) do not normally occur or occur only infrequently or briefly. Corresponds to Zone 2 per Directive 1999/92/EC. Normal level of safety	II	Gc
20, 21, 22		1D	Explosive areas in which combustible dust/air mixtures (Equipment Group II) occur constantly or for long periods or frequently. Corresponds to Zone 20 per Directive 1999/92/EC. Very high level of safety	III	Da
21, 22		2D	Explosive areas in which combustible dust/air mixtures (Equipment Group II) occur occasionally. Corresponds to Zone 21 per Directive 1999/92/EC. High level of safety	III	Db
22		3D	Explosive areas in which an explosive atmosphere caused by dust in the air (Equipment Group II) does not normally occur or occurs only infrequently or briefly. Corresponds to Zone 22 per Directive 1999/92/EC. Normal level of safety	III	Dc

Categorization of gases, mists and vapors into explosion groups

Gases, mists and vapors are categorized into the explosion (sub)groups IIA, IIB and IIC according to their ignition resistance, i.e., their ability to conduct or prevent an explosion through a narrow gap. Ignition resistance is a measure of the risk of a gas exploding. Explosion Group IIA contains the less dangerous materials; Explosion Group IIC contains the most dangerous materials. Products in a given explosion group should also always be used in areas with lower risk.

Table 7: Categorization of gases, mists and vapors into explosion groups

Explosion group	Examples of gases, mists and vapors	Danger
IIA	Acetone, ammonia, gasoline, benzene, carbon monoxide, ethyl alcohol, methane, hydrogen sulfide, propane	moderate
IIB	Ethylene, coal gas, acetaldehyde	High
IIC	Hydrogen, carbon disulfide, acetylene	Very high

Refer to the technical literature for further material classifications as needed.

Temperature classes

In explosive areas at risk from explosive gases, mists or vapors (zones 0, 1, 2 designated for Equipment Group II, categories 1G, 2G and 3G), also note that the maximum surface temperature of the axial piston unit must be below the ignition temperature of the surrounding explosive gas, mist or steam. The categorization of an Equipment Group II operating resources into temperature classes T1 through T6 according to its maximum surface temperature indicates the suitability of the operating resources for use in explosive areas at risk from explosive gases, mists or vapors.

Table 8: Temperature classes

Temperature class per DIN EN ISO 80079-36	Maximum surface temperature	Permissible ignition temperature of the gas, mist or steam
T1	450 °C	> 450 °C
T2	300 °C	> 300 °C
T3	200 °C	> 200 °C
T4	135 °C	> 135 °C
T5	100 °C	> 100 °C
T6	85 °C	> 85 °C

Type of protection

The type of protection describes the type of measures taken to prevent the ignition of a surrounding explosive atmosphere.

Table 9: Type of protection

Type of protection	Meaning	Relevant for Non-electrical equipment	Electrical apparatus
Ex h	Control of ignition	X	–
Ex h	Constructional safety	X	–
Ex d	Flameproof encapsulation	X	X
Ex eb, ec	Increased safety	–	X
Ex fr	Vapor tightness	X	–
Ex h	Fluid encapsulation	X	–
Ex ob, oc	Oil encapsulation	–	X
Ex px, py, pz	Pressurized enclosure	X	X
Ex qb	Sand encapsulation	–	X
Ex ma, mb, mc	Encapsulation	–	X
Ex ia, ib, ic	Intrinsic safety	–	X

6 Transport and storage

DANGER

Risk of explosion by explosive atmosphere!

Static discharges and sparking resulting from material contact in an explosive atmosphere may cause explosions that can result in serious injury or even death.

- ▶ Do not transport or store the axial piston unit in explosive areas.
- ▶ Do not unpack or pack the axial piston unit in explosive areas.

- ▶ Always observe the required ambient conditions for transport and storage; see chapter 6.2 "Storing the axial piston unit" on page 29.



Information on unpacking can be found in chapter 7.1 "Unpacking" on page 31.

6.1 Transporting the axial piston unit

The following transportation options are available depending on the weight and duration of transport:

- Transport by hand
- Transporting with a lifting device (eye bolt or lifting strap)

Dimensions and weights

Table 10: Dimensions and weights

Size		10, 12, 16	23, 28, 32	45	56, 63	80, 90	107, 125	160, 180
Weight ¹⁾	kg	5.4	9.5	13.5	18	23	32	45
Weight ²⁾	kg	–	23.9	29.5	35	42	58.3	79
Width	mm	Dimensions vary by equipment. The values applicable for your axial piston unit can be found in the installation drawing (request if necessary).						
Height	mm							
Depth	mm							

¹⁾ Motor version without valves

²⁾ With integrated pressure relief valve and mounted counterbalance valve

Weight may vary by equipment.

6.1.1 Transport by hand

Up to a specific maximum weight, axial piston units can be transported by hand for a short distance. Observe the national regulations in your country.

To prevent health damage, we recommend renouncing any transport by hand.

CAUTION! Danger from heavy loads!

Health hazard from carrying axial piston units.

- ▶ Only manually transport the axial piston unit for a short period of time. Observe the national regulations in your country for manual transport.
- ▶ Always use appropriate lifting, lowering and moving techniques.
- ▶ Use your personal protective equipment (e.g. safety goggles, safety gloves, suitable working clothes, safety shoes).
- ▶ Do not transport the axial piston unit by sensitive assembled parts (e.g. sensors or valves).
- ▶ Carefully place the axial piston unit on the seating to prevent it from being damaged.

6.1.2 Transport with lifting devices

For transporting, the axial piston unit can be connected to a lifting device via an eye bolt or a lifting strap.

Transporting with eye bolt

The axial piston unit can be transported suspended from an eye bolt screwed into the drive shaft as long as only outward (pulling) axial forces are applied.

- ▶ For all female threads, use a stud end from the same system of units and of the correct size.
- ▶ To do this, screw an eye bolt completely into the female thread on the drive shaft. The thread size is indicated in the installation drawing.
- ▶ Make sure that the eye bolt can bear the total weight of the axial piston unit plus 20%.

You can lift the axial piston unit as shown in Fig. 4 with the eye bolt screwed into the drive shaft.

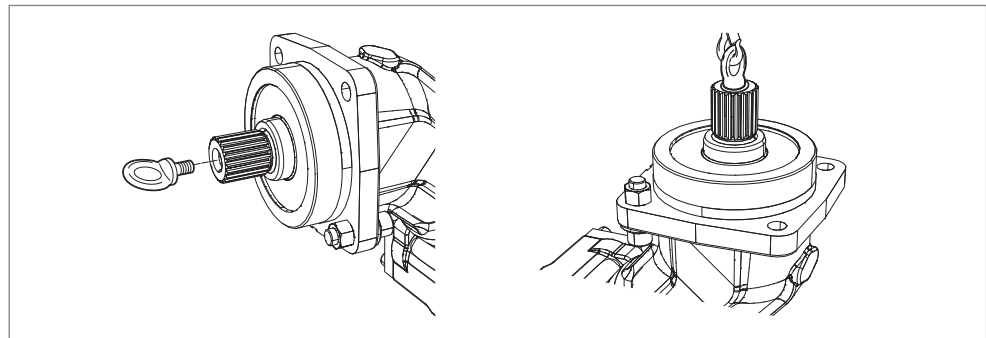


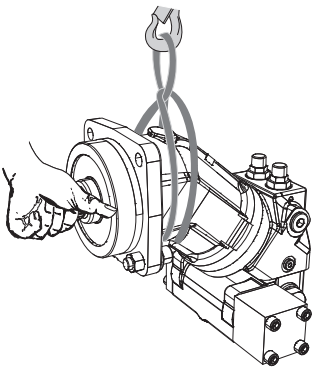
Fig. 4: Mounting the eye bolt in the drive shaft

Transport with lifting strap

WARNING! Danger due to suspended loads!

During transport with lifting strap, the axial piston unit can topple out of the lifting strap and cause injury.

- ▶ Use the widest possible lifting strap.
- ▶ Make sure that the axial piston unit is securely fixed with the lifting strap.
- ▶ Only guide the axial piston unit by hand for fine positioning and to avoid swinging.
- ▶ Never step or grip under suspended loads.
- ▶ Place the lifting strap around the axial piston unit in such a way that it neither passes over the assembled parts (e.g., valves, sensors) nor that the axial piston unit is hung from attachment parts.



6.2 Storing the axial piston unit

Requirement

- Storage areas should be free of corrosive materials and gases.
 - To prevent damage to the seals, do not operate ozone-forming equipment (e.g. mercury-vapor lamps, high-voltage equipment, electric motors, sources of electrical sparks or electrical discharge) in storage areas.
 - The storage locations must be dry. Recommendation: relative humidity $\leq 60\%$
 - Ideal bearing temperature: $+5\text{ }^{\circ}\text{C}$ to $+20\text{ }^{\circ}\text{C}$.
 - Minimum storage temperature: $-50\text{ }^{\circ}\text{C}$.
 - Maximum storage temperature: $+60\text{ }^{\circ}\text{C}$.
 - Keep out of direct sunlight.
 - Do not stack axial piston units and store them in a shock-proof manner.
 - Do not store the axial piston unit on the drive shaft or assembled parts, e.g. sensors or valves.
 - For further storage conditions, see Table 11.
- Check the axial piston unit monthly to ensure professional storage.

After delivery

The axial piston units come in corrosion protection packaging (corrosion protection film) provided at the factory. Table 11 lists the maximum permissible storage times for an unpackaged axial piston unit as per data sheet 91001-01-X-B2.

Table 11: Storage time with factory-supplied corrosion protection

Storage conditions	Standard corrosion protection	Long-term corrosion protection
Closed, dry room, uniform temperature between $+5\text{ }^{\circ}\text{C}$ and $+20\text{ }^{\circ}\text{C}$. Undamaged and closed corrosion protection film.	Maximum 12 months	Maximum 24 months



The warranty will be voided if the requirements and storage conditions are not observed or after expiration of the max. storage time (see Table 11).



After the maximum storage time has elapsed, have the axial piston unit inspected by Bosch Rexroth Service; for the address, see chapter 10.4 "Repair" on page 56.

After removal An uninstalled axial piston unit must be preserved with corrosion protection for the duration of storage.



The following instructions only refer to axial piston units operated with a mineral oil-based hydraulic fluid.

Other hydraulic fluids require other specific preservation measures.

In such a case, consult your local contact person; you can find their contact information at <https://addresses.boschrexroth.com>

Bosch Rexroth recommends the following procedure:

1. Clean the axial piston unit; see chapter 10.1 "Cleaning and care" on page 53.
2. Drain the axial piston unit.
3. For storage times up to 12 months: Moisten the inside of the axial piston unit with mineral oil and fill with approx. 100 ml mineral oil.
For storage times up to 24 months: Fill the axial piston unit with VCI corrosion protection oil (20 ml).
The filling is carried out via the reservoir port **T₁** or **T₂**, see chapter 7.4 "Installing the axial piston unit", Fig. 8 on page 42.
4. Plug all ports so they are airtight.
5. Coat unpainted areas of the axial piston unit with mineral oil or suitable, easily removable corrosion protection, e.g. acid-free grease.
6. Pack the axial piston unit with desiccant in an airtight manner in corrosion protection film.
7. Store the axial piston unit in a non-explosive area and in such a manner that it is protected against shocks; see "Requirement" on page 29 in this chapter.

7 Installation

DANGER

Risk of explosion and/or fire due to ignition of an explosive gas-air atmosphere or of combustible dust

Serious injury caused by blast pressure and fire may result.

- ▶ Only install in a non-explosive atmosphere.
- ▶ The system operator is responsible for ensuring the appropriate ambient conditions. The operator is also responsible for installation.

Prior to installation, the following documents should be to hand:

- Data sheet (Part II) of the axial piston unit (contains the permissible technical data, main dimensions and circuit diagrams of standard versions)
- Installation drawing for the axial piston unit (can be obtained from your contact person at Bosch Rexroth)
- Hydraulic circuit diagram for the axial piston unit (in the data sheet and on the installation drawing)
- Hydraulic circuit diagram for the machine/system (available from the machine/system manufacturer)
- Order confirmation (contains the order-related technical data for your axial piston unit)

7.1 Unpacking

The axial piston unit comes in a polyethylene material (PE) corrosion protection film.

DANGER! Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Static discharges and sparking resulting from material contact in an explosive atmosphere may cause explosions that can result in serious injury or even death.

- ▶ Do not unpack the axial piston unit in explosive areas.

CAUTION! Danger due to falling parts!

If the packaging is not opened correctly, parts may fall out and damage the parts or even result in injury.

- ▶ Place the packaging on a level underground with sufficient load-bearing capacity.
- ▶ Only open the packaging from the top.
- ▶ Remove the packaging from the axial piston unit.
- ▶ Check the axial piston unit for transport damage and completeness; see chapter 4 "Scope of delivery" on page 21.
- ▶ Verify that the instruction manual is complete by cross-checking with the table of contents. Please contact us if the instruction manual is incomplete.
- ▶ Dispose of the packaging in accordance with the regulations in your country.

7.2 Installation conditions

The installation position and location of the axial piston unit essentially determine how it is installed and commissioned (such as when filling and air bleeding the axial piston unit).

- ▶ Fasten the axial piston unit so that the expected forces and torque can be transferred without any danger. The machine/system manufacturer is responsible for sizing the fastening elements.
- ▶ Observe the permissible radial forces in accordance with page 7 of the data sheet (Part II) on the drive shaft when transferring output drive with radial loading. Do not use belt drives; see chapter 7.3 "General instructions" on page 36.
- ▶ Make sure the axial piston unit is always filled with hydraulic fluid during commissioning and operation. Also do this also after relatively long standstill periods, since the axial piston unit may drain out through the hydraulic lines.
- ▶ Perform assembly carefully and properly with respect to the risk of explosion to prevent damage to the bearings, case and drive shaft.
- ▶ Direct the leakage in the housing area to the reservoir through the highest drain port. Use a line size that matches the port.
- ▶ Avoid using a check valve in the drain line.
A check valve in the drain line (cracking pressure 0.5 bar) can prevent the system from draining through the drain line. Please note the correct flow direction.
- ▶ To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts).
- ▶ Make sure that the reservoir and return lines lead into the reservoir below the minimum fluid level in all operating conditions. This will prevent air from being drawn in and foam from forming.
- ▶ Make sure that the reservoir level is monitored. If the level drops below the minimum level, the machine/system must be switched off immediately. Make sure that the motor is switched off no later than 5 seconds after the monitoring function responds. Do not restart the machine/system until the hydraulic fluid level is once more above the minimum level.
- ▶ For Equipment Category II 2G Ex h IIB T4-T1 Gb X, the reservoir level must be monitored continuously and the system must be switched off immediately if the minimum level falls below a value.
- ▶ Make sure that the working environment at the installation site is completely free of dust and foreign substances. The axial piston unit should be clean when installed. Contamination of the hydraulic fluid can considerably affect the function and service life of the axial piston unit, as well as its suitability for use in explosive areas.
- ▶ Use fiber-free cleaning cloths for cleaning.
- ▶ Use suitable mild cleaning agents to remove lubricants and other difficult-to-remove contamination. Do not allow cleaning agents to enter into the hydraulic system.
- ▶ Only clean the axial piston unit with a damp cloth; cleaning with a dry cloth could cause static electricity to build.

7.3 Installation position

! DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface!

An improper installation position of the axial piston unit may result in risk of explosion due to excessive case temperature during operation. Serious injury caused by blast pressure and fire may result.

- Drain the leakage fluid at the highest port.
- For drain ports and pipeline routing conditions, see the data sheet (Part II).

The following installation positions are permissible. The pipeline routing shown illustrates the basic layout.



Recommended installation position: 1 and 2.



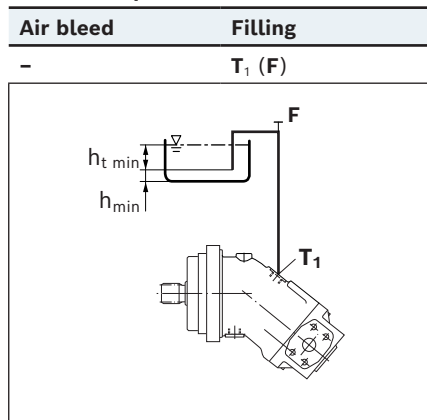
Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Key	
F	Filling/air bleeding
T₁, T₂	Drain port
U	Bearing flushing / air bleed port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

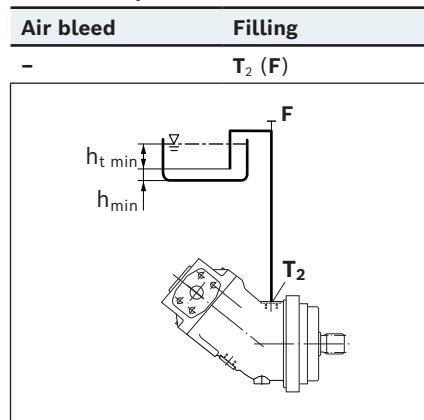
7.3.1 Below-reservoir installation (standard)

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

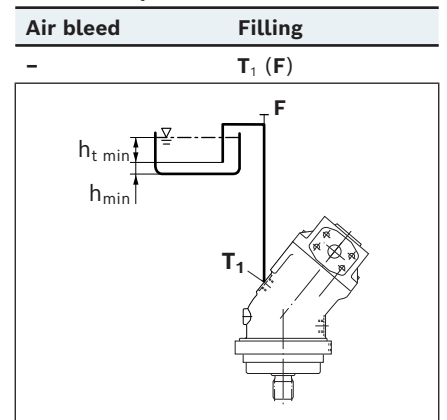
Installation position 1



Installation position 2



Installation position 3



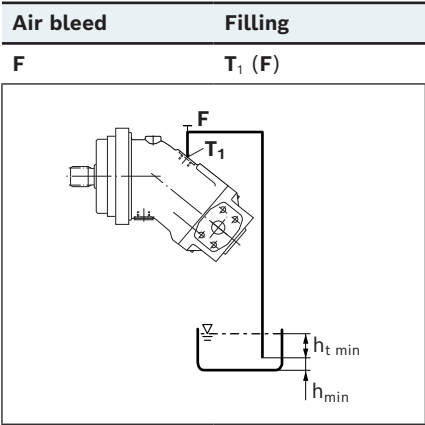
7.3.2
Above-reservoir installation

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

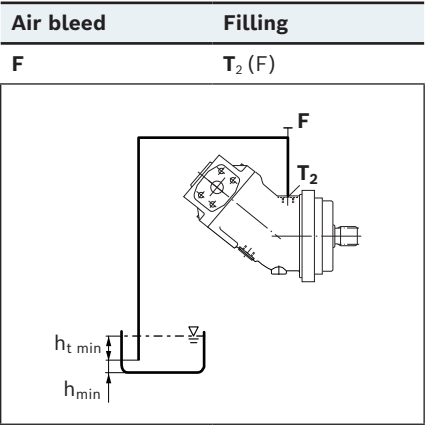


Recommendation for installation position 6 (drive shaft downward):
use of a swan neck that is higher than the highest case contour.

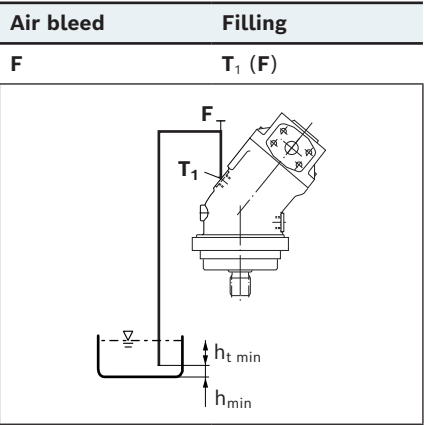
Installation position 4



Installation position 5



Installation position 6



7.4 Installing the axial piston unit

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust due to sparks caused by electrostatic discharge!

Installing the axial piston unit on an electrically non-conductive base plate or port plate may cause explosions due to electrostatic discharge that may result in serious injury or even death.

- ▶ Install the axial piston unit on an electrically conductive base plate or port plate.
- ▶ Include the base plate and port plate in the potential equalization connection.
- ▶ Ground hydraulic hoses separately.
- ▶ The A2FM features one ground connection port. This generally have to be included in the potential equalization to prevent a buildup of electrostatic charge.
- ▶ Also take care to remove dust in a timely manner in order to reduce the risk of ignition.

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust due to sparks caused by electrostatic discharge!

The use of components with different material characteristics (material pairing) and different ignition properties may cause to explosions due to electrostatic discharge that may result in serious injury or even death.

- ▶ Check whether the explosion protection mark on the name plate of the axial piston unit matches the details in this instruction manual.
- ▶ Check whether the explosion protection class and temperature class correspond to the zone classification in the explosion protection document of the system.
- ▶ Also take care to remove dust in a timely manner in order to reduce the risk of ignition.

7.4.1 Preparation

1. Check the specifications on the name plate of the axial piston unit to see if the correct type of fixed motor is present.
2. Compare the material number and designation (type code), required category and related zone with the details in the order confirmation.



If the material number for the axial piston unit does not match the one in the order confirmation, contact your local contact person for clarification.

You can find their contact information at

<https://addresses.boschrexroth.com>

3. Before installing, completely drain the axial piston unit to prevent mixing with the hydraulic fluid used in the machine/system.
4. Check the direction of rotation of the axial piston unit (on the name plate) and make sure that this corresponds to the direction of rotation of the intended motor function.

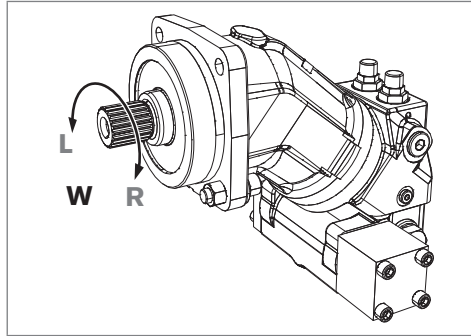


Fig. 5: Direction of rotation

- W** Bi-directional (can rotate counter-clockwise and clockwise)
L Counter-clockwise
R Clockwise



The direction of rotation as indicated on the name plate determines the direction of rotation of the axial piston unit as viewed on the drive shaft; see chapter 5.3 "Product identification" on page 24.

7.4.2 Dimensions

For standard versions, the data sheet (Part II) contains all required installation dimensions as well as the position and dimensions of the ports. If necessary, an installation drawing can be requested. Also observe the manuals provided by the manufacturers of the other hydraulic components when selecting the required tools.

7.4.3 General instructions

Follow these general notices when installing the axial piston unit:

- If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
- Excessive case pressure or excessive pressure peaks can cause wear, leaks and excessive temperatures in the shaft seal, creating a risk of sparks (see also chapter 2.6 "Product-specific safety instructions" on page 11).

The version of installation for the axial piston unit depends on the connecting elements to the output side. The following descriptions explain the installation of the axial piston unit:

- With a coupling
- On a gearbox

7.4.4 Installation with a coupling

The following describes how to assemble the axial piston unit with a coupling:

NOTICE! Danger from improper handling!

Product can be damaged!

- Do not install the coupling hub on the drive shaft of the axial piston unit by striking it.

1. Install the specified coupling half on the drive shaft of the axial piston unit according to the instructions of the coupling manufacturer.



The drive shaft of the axial piston unit is equipped with a female thread. Use this female thread to pull the coupling element onto the drive shaft. The size of the female thread can be seen in the installation drawing.

2. Make sure that the installation location is clean and free from dirt and foreign particles.
3. Clamp the coupling hub onto the drive shaft or ensure permanent lubrication of the drive shaft. This prevents the formation of frictional corrosion and the associated wear. Moreover, this prevents relative movement which could cause heat or sparks to form.
4. Transport the axial piston unit to the installation location.
5. Install the coupling on the drive shaft of the machine/system in accordance with the specifications provided by the coupling manufacturer.



Do not fasten down the axial piston unit until the coupling has been correctly installed.

6. Fasten the axial piston unit at the installation location.
7. Align the drive shaft of the axial piston unit and the drive shaft of the machine/system so that there is no angular deviation.
Make sure no excessive axial and radial forces are acting on the drive shaft.
8. Details on the required tools and tightening torques for the mounting bolts are available from the machine/system manufacturer.
9. Use the shaft collar as a stop for the coupling. The coupling should not grind on stationary parts. When using elastic couplings, maintain an air gap to the case so that no sparking can occur through material contact. When using elastic couplings, make certain that a sufficiently large air gap to the case is present, even during operation.

7.4.5 Installation on a gearbox

The following describes how to assemble the axial piston unit on a gearbox.

After installing on a gearbox, the axial piston unit is covered and is difficult to access:

- Before installing, make sure that the spigot diameter centers the axial piston unit (observe tolerances) and that no excessive axial or radial forces are acting on the drive shaft of the axial piston unit (installation length).
- Protect the drive shaft against frictional corrosion by ensuring permanent lubrication.

- Maintain a sufficiently large air gap between the coupling and the case so no sparking or heat buildup can occur through material contact.
- Fasten the axial piston unit at the installation location.

For attachment via gear wheel or helical gear shaft

No spline forces higher than the permissible axial and radial forces should act on the shaft; if necessary, support the gear wheel at the gearbox output separately.

7.4.6 Completion of installation

1. Remove any installed transport screws.

CAUTION! Operation with protective plugs!

Operating the axial piston unit with protective plugs may result in injury or damage to the axial piston unit.

- Before commissioning, remove all protective plugs and replace them with suitable, pressure-proof connecting fixtures and specified sensors.

2. Remove the transport protection.

The axial piston unit is delivered with protective covers **(1)**, protective plugs/ threaded plugs **(2)** and ground connection protection screw **(3)**. The protective covers **(1)** and protective plugs **(2)** are not pressure-resistant and have to be removed prior to connection. Remove the ground connection protection screw **(3)** before installing. Use a suitable tool for this to prevent damage to the sealing and functional surfaces. If sealing or functional surfaces are damaged, contact your Bosch Rexroth service partner or the service department of the manufacturer's plant of the axial piston unit.

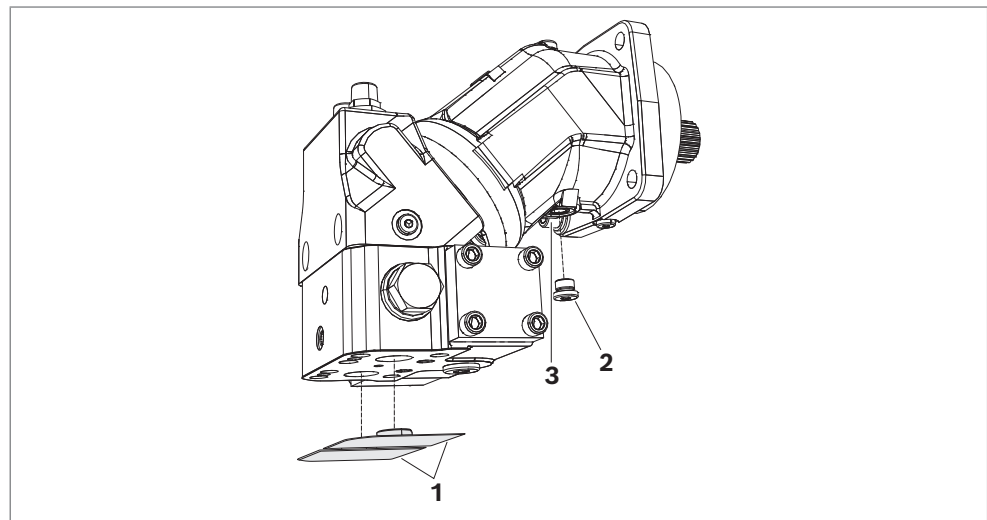


Fig. 6: Removing transport protection

- 1 Protective covers
- 2 Protective plugs/threaded plugs
- 3 Ground connection protection screw



Ports intended for connecting lines and sensors are covered by protective plugs or threaded plugs, which serve as transport protection. Make sure all ports required for functional operation are connected (see Table 14 "Ports A2FM Series 61" on page 42). Non-compliance could lead to malfunctions or damage. If a port is not being used, plug it with a threaded plug since the protective plugs are not pressure-resistant.

The following information only applies to fixed motors with pressure relief valves.



Setting screws are protected against unauthorized adjustment by tamper-proof caps. Removal of the tamper-proof caps will void the warranty. If you need to change the settings, please contact your local contact person; you can find their contact information at <https://addresses.boschrexroth.com>

7.4.7 Hydraulically connecting the axial piston unit

The machine/system manufacturer is responsible for dimensioning of the lines. Connect the axial piston unit to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine/system manufacturer.

The ports and fastening threads are designed for the $p_{\max}$ permissible pressures of the respective ports, see Table 14 "Ports A2FM Series 61" on page 43.

The machine/system manufacturer is required to ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.



Connect only hydraulic lines that match the axial piston unit port (pressure level, size, system of units).

Information on routing of lines

Observe the following information when routing the pressure and drain lines.

- Lines and hoses must be installed without pretension, so that no further mechanical forces are applied during operation that will reduce the service life of the axial piston unit and, if applicable, the entire machine/system.
- Use suitable seals as sealing material.
- Pressure line
 - For the pressure lines, use only pipes, hoses and connecting elements rated for the working pressure range specified in the data sheet (Part II) (see Table 15).

- Drain line
 - Always route the drain lines so that the housing is constantly filled with hydraulic fluid and to ensure no air gets through the shaft seal, even during extended standstill periods.
 - Under no operating circumstances may the case pressure exceed the maximum values specified for the axial piston unit in the data sheet (Part II).
 - The drain line inflow in the reservoir should always be below the minimum fluid level (see chapter 7.3 "Installation position" on page 33).
- If the axial piston unit is equipped with assembled screw fittings, do not remove them. Screw the stud end of the fitting directly into the installed fitting.

Risk of confusion with threaded connections

Axial piston units are employed in regions using the metric measuring system, in regions using the Anglo-American (imperial) measuring system and in regions using the Japanese measuring system (JIS – Japan Industrial Standard). Various kinds of seals are also used. The system of units, the kind of seal and the size of female thread and stud ends (e.g. threaded plug) must all match. There is a risk of confusion due to the limited ways of visually telling them apart.

WARNING! Leaky and bursting stud ends!

If a stud end with a measurement system, seal type and size that are different from the female thread is pressurized, the threaded plug may loosen itself or even be propelled out of the hole. This can result in serious injury and property damage. Hydraulic fluid can escape from this leakage point.

- ▶ Use the drawings (installation drawing) to determine the required stud end for each fitting.
- ▶ Make sure the right fittings, mounting bolts and threaded plugs are installed.
- ▶ For all female threads, use a stud end from the same system of units and of the correct size.

Mounting the counterbalance valve

Observe the following notes concerning the version with counterbalance valve (port plate 178, 188).

When delivered, the counterbalance valve is fastened to the motor with two tacking screws (transport lock). The tacking screws may not be removed while mounting the working lines! If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be fastened to the motor port plate using the provided tacking screws. The counterbalance valve is finally mounted on the motor by fitting the SAE flange with the following screws:

6 screws (**1, 2, 3, 4, 5, 8**) Length B1+B2+B3

2 screws (**6, 7**) Length B3+B4

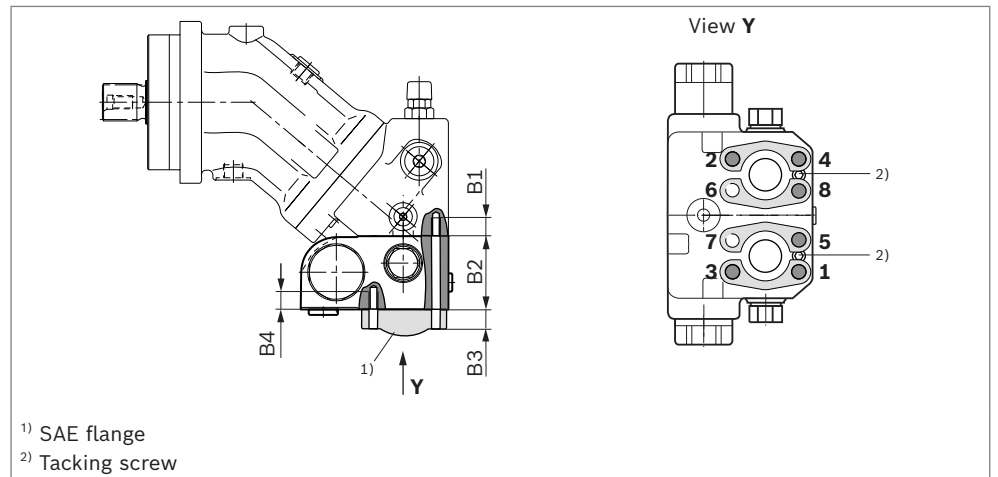
Tighten the screws in two steps in the specified sequence from **1** to **8** (see following diagram)!

- First, tighten the screws to half the tightening torque, then tighten to the max. tightening torque (see table Table 12).

Table 12: Mounting bolt tightening torques

Thread	Property class	Tightening torque ¹⁾
M6 × 1 (tacking screw)	10.9	15.5 Nm
M10 × 1.5	10.9	75 Nm
M12 × 1.75	10.9	130 Nm
M14 × 2	10.9	205 Nm

¹⁾ The tightening torques for mounting bolts apply for the "slightly oiled" state as received on delivery. (friction coefficient $\mu = 0.10$).


Fig. 7: Mounting the counterbalance valve


The SAE flange and corresponding mounting bolts are not included in the scope of delivery.

Table 13: Thread sizes and dimensions

Size	28, 32, 45	56, 63	80, 90	107, 125, 160, 180
Dimension B1 ¹⁾	M10 × 1.5; 17 deep	M10 × 1.5; 17 deep	M12 × 1.75; 18 deep	M14 × 2; 19 deep
Dimension B2	78 mm ²⁾	68 mm	68 mm	85 mm
Dimension B3	customer-specific (flange-dependent)			
Dimension B4	M10 × 1.5; 15 deep	M10 × 1.5; 15 deep	M12 × 1.75; 16 deep	M14 × 2; 19 deep

Fastening thread according to DIN 13. For mounting bolts with metric ISO threads according to DIN 13, we recommend checking the tightening torque individually in accordance with VDI 2230.

¹⁾ Minimum required thread reach $1 \times \text{Ø-thread}$

²⁾ Including sandwich plate

Port overview

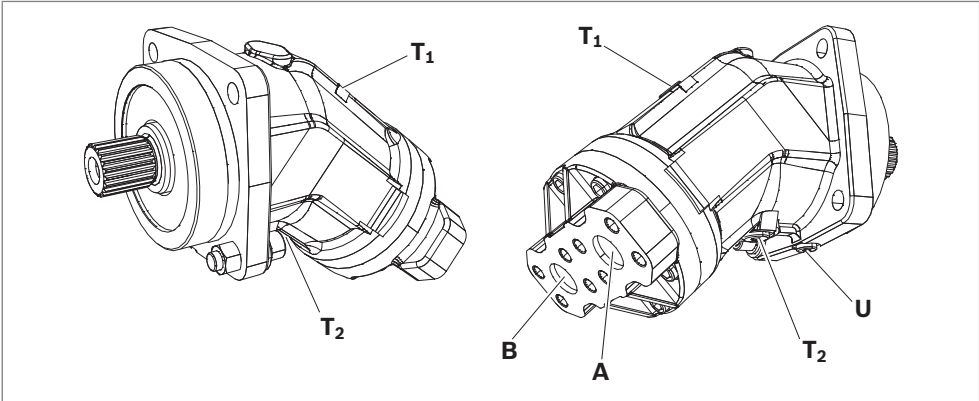


Fig. 8: Port overview A2FM, working ports at rear (port plate 010)

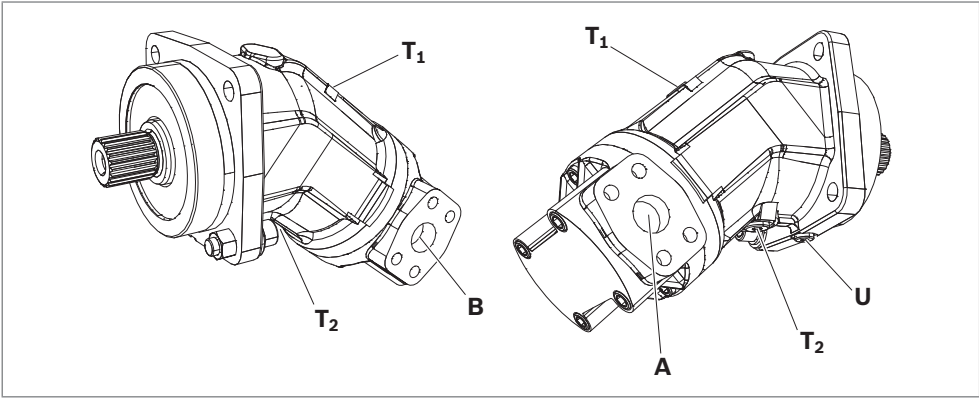


Fig. 9: Port overview A2FM, working ports on side (port plate 020)

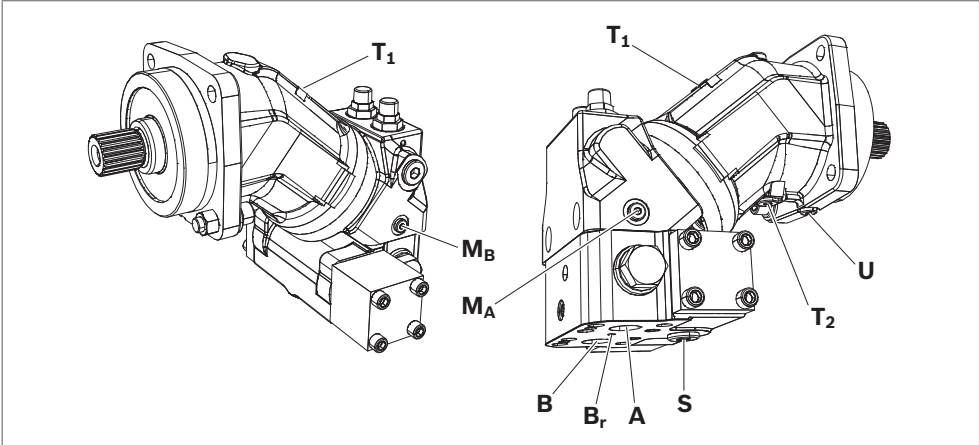


Fig. 10: Port overview A2FM with integrated pressure relief valve and mounted counterbalance valve (port plate 181)

Table 14: Ports A2FM Series 61

Ports ¹⁾		$p_{\max}$ [bar] ²⁾	State
A, B	Working port	450	O
T₁	Drain port	3	X ³⁾
T₂	Drain port	3	O ³⁾
M_A, M_B	Pressure measurement A and B	420	X
S	Infeed at counterbalance valve	30	X
Br	Brake release, reduced high pressure (version L)	30	O
G_{ext}	Brake release, high pressure (version S)	420	X

¹⁾ The measuring system and thread size can be found in the installation drawing. Sizes may vary.

²⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

³⁾ Depending on the installation position, T₁ or T₂ must be connected (see also chapter 7.3 "Installation position" on page 33)

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Tightening torques

The following tightening torques apply:

- Fittings:

Observe the manufacturer's specifications regarding the tightening torques of the fittings used.

- Female threads in the axial piston unit:

The max. permissible tightening torques $M_{G \max}$ are the maximum values for the female threads and should not be exceeded. For values, see Table 15.

- 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 Table 15.

- Mounting bolts:

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

Table 15: Tightening torques for female threads and threaded plugs

Ports Standard	Thread size	Maximum permissible tightening torque of female threads $M_{G\ max}$	Required tightening torque of threaded plugs M_v	WAF hexagon socket of the threaded plug
DIN 3852	M8 × 1	10 Nm	7 Nm ¹⁾	3 mm
	M10 × 1	30 Nm	15 Nm ²⁾	5 mm
	M12 × 1.5	50 Nm	25 Nm ²⁾	6 mm
	M14 × 1.5	80 Nm	35 Nm ¹⁾	6 mm
	M16 × 1.5	100 Nm	50 Nm ¹⁾	8 mm
	M18 × 1.5	140 Nm	60 Nm ¹⁾	8 mm
	M22 × 1.5	210 Nm	80 Nm ¹⁾	10 mm
	M26 × 1.5	230 Nm	120 Nm ¹⁾	12 mm
	M27 × 2	330 Nm	135 Nm ¹⁾	12 mm
	M33 × 2	540 Nm	225 Nm ¹⁾	17 mm
	M42 × 2	720 Nm	360 Nm ¹⁾	22 mm
	M48 × 2	900 Nm	400 Nm ¹⁾	24 mm

¹⁾ The tightening torques for the threaded plugs are valid for the condition "dry" and "lightly oiled".

²⁾ The tightening torques for the threaded plugs are valid for the condition "dry" – in the condition "lightly oiled", the tightening torques for M10 × 1 are reduced to 10 Nm and for M12 × 1.5 to 17 Nm.

Procedure

To connect the axial piston unit to the hydraulic system:

1. Remove the protective plugs and/or threaded plugs from the ports where the connections should be made according to the hydraulic circuit diagram.
2. Make sure the sealing surfaces of the hydraulic ports and functional surfaces are not damaged.
3. Use only clean hydraulic lines or flush them before installation.
(Observe chapter 7.5 "Performing flushing cycle" on page 46 when you flush out the entire system.)
4. Connect the lines in accordance with the installation drawing and the machine or system circuit diagram. Check that all ports are connected or plugged with threaded plugs.
5. Properly tighten the fittings (observe tightening torques!).
Mark all properly tightened fittings, e.g. with a permanent marker.
6. Check all pipes and hose lines and every combination of connecting pieces, couplings or connecting points with hoses or pipes to ensure they are in safe working condition.



Relationship between direction of rotation and flow direction:

Clockwise rotation: **A to B**

Counter-clockwise rotation: **B to A**

7.4.8 Electrically connecting the axial piston unit for the equipment category II 2G Ex h IIB T4-T1 Gb X

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ The electrical connections should only be made by a suitably qualified electrician.
- ▶ De-energize the current circuits before working on them or opening a terminal box. In explosive areas, only use tools and measuring equipment approved for these areas.
- ▶ In the event of a malfunction, check the wire connections and power supply in the non-explosive atmosphere for proper function.
- ▶ If this is not possible, make sure there is no risk of explosion while working and monitor for such a risk.
- ▶ The electrical connection can be established via the connection line outside the explosive area or with an explosion-protected terminal box inside the explosive area.

For Equipment Category II 2G Ex h IIB T4-T1 Gb X Requirements on control units for temperature monitoring

- The leakage temperature of the axial piston unit should be monitored by a sensor with integrated shut-off feature installed in the drain line (maximum 30 cm from drain port). The operator is responsible for selecting and installing this temperature sensor.
- As soon as the specified maximum leakage temperature (see data sheet Part II) is exceeded in a sensor installed in the axial piston unit or as soon as a malfunction is detected in the temperature monitor, the axial piston motor must be shut down immediately. Make sure that the axial piston motor is switched off no later than 5 seconds after the monitoring function responds.
- The control units should include a monitoring circuit for sensor faults and cable breaks, and a self-monitoring circuit for faults in the control unit. In case of such faults, the axial piston motor must be stopped.

7.4.9 Connecting to the potential equalization

! DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust due to sparks caused by electrostatic discharge!

Axial piston units fastened with elastic elements and the use of hydraulic hoses can constitute a risk of sparks due to electrostatic discharge if they come into contact with assembled parts, tools and personnel with a different potential. Serious injury caused by blast pressure and fire may result.

- ▶ To prevent the buildup of static electricity, include all ground connections of the axial piston unit in the potential equalization connection.
- ▶ Ground hydraulic hoses separately.
- ▶ Make sure assembled parts, tools and personnel have the same potential as the axial piston unit before they come into contact with them.

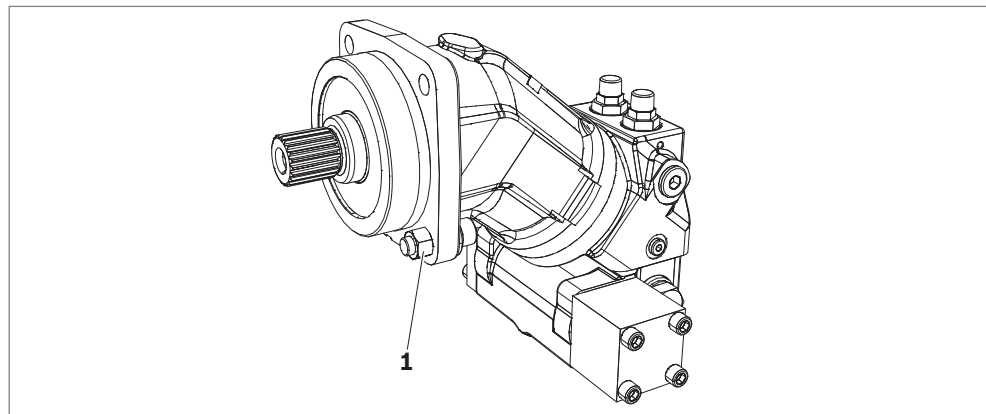


Fig. 11: Ground connection

1. Remove the ground connection protection screw (1).
2. At the same point, fix a suitable grounding strap which is grounded with a earthing line with a minimum conductor cross section of 2.5 mm², with the mounting bolt of the flange (not included in the delivery contents).

7.5 Performing flushing cycle

In order to remove foreign particles from the system, Bosch Rexroth recommends a flushing cycle for the entire system prior to initial commissioning. To avoid internal contamination, do not include the axial piston unit in the flushing cycle.



Use an additional flushing unit to perform the flushing cycle. Follow the instructions of the flushing unit's manufacturer for the exact procedure during the flushing cycle.

8 Commissioning

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ Only commission the unit in a non-explosive atmosphere.
- ▶ The system operator is responsible for ensuring the appropriate ambient conditions.

WARNING

Danger while working in the danger zone of a machine/system!

Danger to life, risk of injury or serious injury!

- ▶ Pay attention to and eliminate potential danger sources before commissioning the axial piston unit.
- ▶ Make sure no one is in the danger zone of the machine/system.
- ▶ The emergency stop button for the machine/system should be within the operator's reach.
- ▶ Always follow the instructions of the machine/system manufacturer during commissioning.

CAUTION

Commissioning an incorrectly installed product!

Risk of injury and property damage!

- ▶ Make sure all electrical and hydraulic ports are connected or plugged.
- ▶ Commission only a fully installed, fully functioning product with original accessories from Bosch Rexroth.

8.1 Initial commissioning



During all work on commissioning the axial piston unit, observe the general safety instructions and intended use in chapter 2 "Safety instructions" on page 8.

- ▶ Connect the pressure gauge for the working pressure and case pressure to the specified measuring points on the axial piston unit or in the hydraulic system, to check the technical data at first operation.
- ▶ During commissioning, monitor the temperature of the hydraulic fluid in the reservoir to make sure it remains within the permissible temperature and viscosity limits.

8.1.1 Observing inlet/leakage temperature limit values

- ▶ When commissioning, a test is required to make sure the leakage temperature of the axial piston unit does not exceed the limit value indicated on the data sheet (Part II) when at max. power during operation.
- ▶ During operation, the leakage temperature should be inspected as regularly as necessary and action taken if it exceeds the specified limit. The recommended maintenance interval is one day.
- ▶ For Equipment Category II 2G Ex h IIB T4-T1 Gb X, leakage temperature is continuously monitored by a temperature sensor selected by the operator and integrated into the shut-off chain (see chapter 7.4.8 "Electrically connecting the axial piston unit for the equipment category II 2G Ex h IIB T4-T1 Gb X" on page 45).

8.1.2 Function check of shut-off chain

(only for equipment category II 2G Ex h IIB T4-T1 Gb X)

- ▶ Make sure that the shut-off chain of the machine/system is compliant with the specified ignition protection system type b1 according to DIN EN ISO 80079-37 and check its function in accordance with the switch-off temperatures and limit values specified in the data sheet (Part II).

8.1.3 Filling the axial piston unit

! DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot surface!

Operating the axial piston unit without or with insufficient hydraulic fluid may lead to a risk of ignition due to overheating caused by dry running on the shaft seal ring. Serious injury caused by blast pressure and fire may result.

- ▶ Fill the case, and the suction and working lines with hydraulic fluid prior to commissioning.
- ▶ Drain the leakage fluid at the highest port.
- ▶ Observe the specified case pressure and leakage temperature.
- ▶ Observe the operating data; see the data sheet (Part II).
- ▶ Also take care to remove dust in a timely manner in order to reduce the risk of ignition.

Professional filling and air bleeding is required to prevent damage to the axial piston unit and to maintain proper function.



Usually, the cleanliness level of commercial hydraulic fluids is insufficient for our components. These hydraulic fluids must be filtered during filling using an appropriate filter system to minimize solid particle contamination and water in the system.

Use only a hydraulic fluid that corresponds to the following requirements:
Information about the minimum requirements on hydraulic fluids can be found in the Rexroth data sheet 90220 "Hydraulic fluids based on mineral oils and related hydrocarbons". You can find the parameters regarding the permissible and optimal viscosity in data sheet 91001-01-X-B2 (Part II).



Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to data sheet 90235. For hydraulic fluids which have been positively evaluated in the Fluid Rating, please refer to data sheet 90245 "Bosch Rexroth fluid rating list for Rexroth hydraulic components (pumps and motors)". Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} ; see selection diagram in the data sheet Part II).

To ensure the functional reliability of the axial piston unit, cleanliness level 20/18/15 according to at least ISO 4406 is required for the hydraulic fluid. At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required. You can find parameters on the permissible and optimal viscosities and admissible temperatures in data sheet Part II.

Only use hydraulic fluid in compliance with the data sheet (Part II):
The machine/system manufacturer can send you precise information about the hydraulic fluid. Use a hydraulic fluid that corresponds to the data sheet (Part II).
At no point of the axial piston unit may the temperature of the hydraulic fluid be higher than the temperature specified in the data sheet (Part II).

Procedure Proceed as follows to fill the axial piston unit:

1. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may leak.

NOTICE! Contaminated hydraulic fluid!

The cleanliness levels of commercial hydraulic fluids are usually insufficient for the requirements of our components.

- Use a suitable filter system to filter hydraulic fluids during filling to minimize solid particle contamination and water in the hydraulic system.
 - Note that contaminated hydraulic fluid can constitute a risk of sparking due to overheating.
2. Fill and air bleed the axial piston unit via the appropriate ports; see chapter 7.3 "Installation position" on page 33. Also fill the hydraulic lines of the system.

8.1.4 Testing the hydraulic fluid supply

The axial piston unit should always have a sufficient supply of hydraulic fluid. For this reason, the supply of hydraulic fluid must be ensured at the start of the commissioning process.

When you test the hydraulic fluid supply, constantly monitor noise development and check the hydraulic fluid level in the reservoir. If the axial piston unit becomes louder (cavitation) or the leakage fluid is discharged with bubbles, this is an indication that the axial piston unit is not being sufficiently supplied with hydraulic fluid.

For information on troubleshooting, see chapter 14 "Troubleshooting" on page 60.

To test the hydraulic fluid supply:

1. Test the axial piston unit in a non-explosive atmosphere.
2. Allow the axial piston unit to run at low rotational speed and without load. Pay attention to leaks and noises.
3. Check the axial piston unit's drain line during the test. The leakage should be without bubbles.
4. Increase the load and check whether the working pressure rises as expected.
5. Perform a leak test to ensure the hydraulic system is sealed and can withstand the max. pressure.
6. At max. working pressure, check the case pressure at port **T₁** or **T₂**. Refer to the data sheet (Part II) for the permissible value.

8.1.5 Performing a functional test



WARNING

Improperly connected axial piston unit!

Mixing up the ports will cause malfunctions (e.g. lift instead of lower) and could endanger personnel and equipment!

- Before the functional test, check whether the piping specified in the hydraulic circuit diagram has been installed.

Once you have tested the hydraulic fluid supply, perform a functional test of the machine/system. The functional test should be performed according to the instructions of the machine/system manufacturer.

The axial piston unit is tested for functional capability and performance before delivery according to the technical data. During commissioning, make sure the axial piston unit was installed in the machine/system as intended.

- After starting the system, check in particular the specified pressures, e.g., working pressure and case pressure.
- Prior to normal operation, measure the heat development with an approved measuring device without load and with the customer-specific operating data. A temperature development of up to the shut-off temperature specified in the data sheet (Part II) is permissible.
- Prior to normal operation, perform a leak test and heat development test without and with load in a non-explosive atmosphere.
- If necessary, remove the pressure gauge and plug the ports with the specified threaded plugs.

8.2 Running-in phase

NOTICE

Property damage due to insufficient viscosity!

Elevated hydraulic fluid temperature may excessively reduce viscosity and damage the product!

- ▶ Monitor the operating temperature during the running-in phase, e.g. by measuring the leakage temperature.
- ▶ Reduce the loading (pressure, rotational speed) of the axial piston unit if unacceptable operating temperatures and/or viscosities occur.
- ▶ Excessively high operating temperatures indicate faults that have to be analyzed and eliminated.

The bearings and sliding surfaces are subject to a running-in phase.

The increased friction at the start of the running-in phase results in increased heat development which decreases with increasing operating hours. Volumetric and mechanical-hydraulic efficiency is also greater until the running-in phase of about 10 operating hours is concluded.

To ensure that contamination in the hydraulic system does not damage the axial piston unit, Bosch Rexroth recommends the following procedure after the running-in phase:

- ▶ After the running-in phase, have a hydraulic fluid sample analyzed for the required cleanliness level.
- ▶ Change the hydraulic fluid if the required cleanliness level is not reached.
If a laboratory test is not carried out after the running-in phase, Bosch Rexroth recommends changing the hydraulic fluid.

8.3 Recommissioning after standstill

Depending on the installation conditions and ambient conditions, changes may occur in the hydraulic system which make recommissioning necessary.

The following criteria may make recommissioning necessary:

- After a period of standstill longer than 1 hour (to ensure fluid immersion especially with above-reservoir installation)
 - Air and/or water in the hydraulic system
 - Old hydraulic fluid
 - Other contamination
-
- ▶ Before recommissioning, proceed as described in chapter 8.1 "Initial commissioning" on page 47.

9 Operation

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust on a hot case surface!

Insufficient monitoring during operation may result in excessively high case temperature. Serious injury caused by blast pressure and fire may result.

- ▶ During operation, monitor the fluid level and temperature in the reservoir.
- ▶ Please observe the prescribed case pressure.
- ▶ **For equipment category II 2G Ex h IIB T4-T1 Gb X:** Monitor the leakage temperature in accordance with the specifications in this manual.
- ▶ Observe the operating data; see the data sheet (Part II).

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust resulting from damage to a bearing or the rotary group!

Early bearing damage will cause the interior of the axial piston unit to heat up. Overheating can pose an ignition risk.

- ▶ Perform both an inspection for unusual noise development and a visual inspection of external integrity daily.
- ▶ Check the leakage temperature (or inlet temperature) daily.
(Realized automatically for Equipment Category II 2G Ex h IIB T4-T1 Gb X by integrated temperature monitoring).
- ▶ Observe the maintenance interval for the axial piston unit
(see Table 17 "Maintenance interval" on page 55).

This product is a component which requires no settings or changes during operation. For this reason, this chapter of the manual does not contain any information on adjustment options. Use the product only within the performance range specified in the technical data. The machine/system manufacturer is responsible for proper project planning of the hydraulic system and its control.

- ▶ If the axial piston unit can no longer achieve the specified torque (pressure), shut the system down.

10 Maintenance and repair

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ Maintenance and repairs should only be performed in a non-explosive atmosphere.
- ▶ The system operator is responsible for ensuring the appropriate ambient conditions.

NOTICE

Overdue inspection and maintenance work!

Property damage!

- ▶ Perform the specified inspection and maintenance work at the intervals described in this manual.

10.1 Cleaning and care

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ The axial piston unit must not be cleaned with compressed air, solvents, aggressive cleaning agents or high-pressure cleaners since these can result in changes that could result in the loss of the explosion protection.
- ▶ Only clean the axial piston unit with a moist cloth. Cleaning with a dry, lint-free cloth could cause a buildup of electrostatic charge.

NOTICE

Damage to seals and electrical system due to mechanical effects!

The jet of a high-pressure cleaner may damage the seals and electrical system of the axial piston unit!

- ▶ Do not point a high-pressure cleaner at sensitive components, e.g. shaft seal, electrical connections and components.

For cleaning and care of the axial piston unit, observe the following:

- ▶ Check whether all seals and plug-in connections are securely seated to ensure no moisture can penetrate into the axial piston unit during cleaning.
- ▶ Use only water and, if necessary, a mild cleaning agent to clean the axial piston unit. Never use solvents or aggressive cleaning agents.
- ▶ Only clean the axial piston unit with a damp cloth; cleaning with a dry cloth could cause static electricity to build.
- ▶ Remove major external contamination and keep clean sensitive and important components, such as solenoids, valves, indicators and sensors.

10.2 Inspection

In order for the axial piston unit to be reliable and long-lasting, Bosch Rexroth recommends inspecting the hydraulic system and axial piston unit on a regular basis, and documenting and archiving the following operating conditions:

Table 16: Inspection schedule

Tasks to be performed		Interval
Hydraulic system	Check hydraulic fluid level in the reservoir.	Daily
	Check the operating temperature at a comparable load condition at drain port and in the reservoir.	Weekly
	Perform hydraulic fluid analysis: Viscosity, aging and contamination	Yearly or every 2000 operating hours (whichever occurs first)
	Check filter. The replacement interval may vary depending on the degree of contamination of the hydraulic fluid. We recommend using a contamination indicator.	Yearly or every 1000 operating hours (whichever occurs first)
Axial piston unit	Check that the leakage temperature or inlet temperature of the axial piston unit is within limit values. Exceeding these limits means explosion protection is no longer guaranteed.	Daily
	Check axial piston unit for leakage. Early detection of hydraulic fluid loss can help to find faults on the machine/system and rectify them. This is why Bosch Rexroth recommends always keeping the axial piston unit and system clean.	Daily
	Check axial piston unit for unusual noise development.	Daily
	Visual inspection for external integrity, case damage.	Daily
	Visual inspection of paint for damage. Initiate repairs as necessary in accordance with DIN EN ISO 80079-36 section 6.7. Otherwise, explosion protection is no longer guaranteed.	Monthly
	Check mounting elements for tight seating. Check all fastening elements only when the hydraulic system is switched off, depressurized and cooled down.	Monthly
	Check ground connection lines for tight seating.	Monthly
	Remove dust deposits from between the shaft and the sealing flange	Depending on ambient condition

10.3 Maintenance

The axial piston unit is low-maintenance when used as intended. You may change the hydraulic fluid only; all other maintenance work must be performed by Bosch Rexroth Service. Observe the specifications in the chapter titled "Hydraulic fluid" on the data sheet (Part II).

Changing hydraulic fluid

The service life of the axial piston unit is heavily dependent on the quality of the hydraulic fluid. This is why we recommend changing the hydraulic fluid at least once per year or every 2000 operating hours (whichever occurs first), or having it analyzed by the hydraulic fluid manufacturer or a laboratory to determine its suitability for further use.

Maintenance interval

The service life of the axial piston unit is limited to the service life of the bearings and the shaft seal used if the permissible operating parameters are observed. Observe the maintenance interval for replacing the bearings and shaft seal. Have Bosch Rexroth Service perform maintenance on the unit upon reaching the operating hours listed in the following table or every four years, whichever comes first; for the address, see chapter 10.4 "Repair" on page 56.

If your application data differs from that shown here, request an individual calculation from your local contact person. The address can be found under <https://addresses.boschrexroth.com>

Table 17: Maintenance interval

Size of motor	Working pressure [bar]	Rotational speed n [rpm]	Operating hours [h]
10, 12, 16	350	8000	700
	190	8000	5600
	350	4000	1050
	190	4000	8600
23, 28, 32	350	6300	350
	190	6300	2850
	350	3150	500
	190	3150	4300
45	350	5600	700
	190	5600	5750
	350	2800	1050
	190	2800	8650
56, 63	350	5000	700
	190	5000	5600
	350	2500	1050
	190	2500	8450
80, 90	350	4500	550
	190	4500	4700
	350	2250	850
	190	2250	7100

Size of motor	Working pressure [bar]	Rotational speed n [rpm]	Operating hours [h]
107, 125	350	4000	500
	190	4000	4100
	350	2000	750
	190	2000	6150
160, 180	350	3600	450
	190	3600	4050
	350	1800	750
	190	1800	6000

The following requirements apply:

- Viscosity $\nu = 25 \text{ mm}^2/\text{s}$
- Cleanliness level 20/18/15 to ISO 4406 (19/17/14 at viscosities of less than $10 \text{ mm}^2/\text{s}$)
- Constant load condition



Maintenance work on the axial piston unit should only be performed by Bosch Rexroth Service; for the address, see chapter 10.4 "Repair" on page 56.

10.4 Repair

Bosch Rexroth offers a comprehensive range of services for the repair of Rexroth axial piston units.

Repairs on the axial piston unit and its assembled parts should only be performed by Bosch Rexroth Service.

Bosch Rexroth AG
 Glockeraustraße 2
 89275 Elchingen, Germany
 Hotline +49 9352 405060

For general inquiries, please contact your local contact person.

You can find their contact information at
<https://addresses.boschrexroth.com>

11 Removal and replacement

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Serious injury caused by blast pressure and fire may result.

- ▶ Only remove or replace the unit in a non-explosive atmosphere.
- ▶ The system operator is responsible for ensuring the appropriate ambient conditions.

11.1 Required tools

Removal can be performed using standard tools. No special tools are necessary.

11.2 Preparing for removal

1. Decommission the entire system as described in the instruction manual for the machine or system.
 - Relieve pressure in the hydraulic system according to the instructions of the machine or system manufacturer.
 - Make sure the relevant system components are depressurized and de-energized.
2. Secure the entire system against being re-energized.

11.3 Performing the removal

Proceed as follows to remove the axial piston unit:

1. Make sure you have the appropriate tools and wear personal protective equipment.
2. Allow the axial piston unit to cool down until it can be removed without danger.
3. For below-reservoir installation, seal the connection to the reservoir or drain the reservoir before removing the axial piston unit from the overall system.
4. Place a drip tray under the axial piston unit to collect any hydraulic fluid that may leak.
5. Disconnect the lines and collect the escaping hydraulic fluid in the drip tray.
6. Remove the axial piston unit. Use a suitable lifting device.
7. Completely drain the axial piston unit.
8. Plug all openings.

11.4 Preparing the components for storage or further use

DANGER

Risk of explosion and/or fire due to ignition of an explosive atmosphere or of combustible dust!

Reusing used units in an explosive atmosphere may cause explosions that can result in serious injury or even death.

- ▶ Make sure used units are not reused in an ATEX environment.
 - ▶ Make sure used units are inspected by Bosch Rexroth Service before reusing them in an ATEX environment; for the address, see chapter 10.4 "Repair" on page 56.
-
- ▶ Proceed as described in chapter 6.2 "Storing the axial piston unit" on page 29.

12 Disposal

Careless disposal of the axial piston unit, the hydraulic fluid and the packaging material can result in environmental pollution.

Observe the following when disposing of the axial piston unit:

- 1.** Completely drain the axial piston unit.
- 2.** Dispose of the axial piston unit and packaging material in accordance with the regulations in your country.
- 3.** Dispose of the hydraulic fluid in accordance with the regulations of your country. Also observe the applicable safety data sheet for the hydraulic fluid.
- 4.** Disassemble the axial piston unit into its constituent parts for proper recycling.
- 5.** For example, separate the parts into:
 - Castings
 - Steel
 - Aluminum
 - Non-ferrous metal
 - Electronic waste
 - Plastic
 - Seals

13 Extension and conversion

Do not modify the axial piston unit and/or its assembled parts.

This also includes adjusting the setting screws.



The warranty from Bosch Rexroth only applies to the configuration as delivered. The warranty will be voided if the unit is modified or extended.



Setting screws are protected against unauthorized adjustment by tamper-proof caps. Removal of the tamper-proof caps will void the warranty. If you need to change the settings, please contact your local contact person; you can find their contact information at

<https://addresses.boschrexroth.com>.

14 Troubleshooting

The Table 18 is intended to support troubleshooting. This table is not exhaustive. Issues may occur in practice that are not listed here.

Only authorized personnel may perform troubleshooting inside a safety area designated by the machine manufacturer.

14.1 How to proceed for troubleshooting

- ▶ Work systematically and in a targeted manner, even when pressed for time. Random, indiscriminate removal and changing of settings could make it impossible to determine the original cause of the fault.
- ▶ First get a general idea of how your product functions in conjunction with the entire system.
- ▶ Try to find out whether or not the product was working properly in conjunction with the entire system before the fault occurred.
- ▶ Try to determine any changes to the entire system in which the product is installed:
 - Have there been any changes to the application conditions or operating range of the product?
 - Has maintenance work recently been carried out? Is there an inspection or maintenance log?
 - Have any changes (e.g. upgrades) or repairs been made to the overall system (machine/system, electrics, control) or to the product? If yes: What changes?
 - Has the hydraulic fluid been changed?
 - Has the product or machine been used as intended?
 - How does the malfunction appear?
- ▶ Try to get a clear idea of the cause of the fault. Directly ask the (machine) operator.
- ▶ Document the work carried out.
- ▶ If the fault cannot be corrected, please refer to one of the contract addresses at: <https://addresses.boschrexroth.com>.

14.2 Malfunction table

Table 18: Axial piston unit malfunction table

Malfunction	Possible cause	Remedy
Unusual noises	Insufficient air bleeding of the hydraulic system	Axial piston unit, suction line for the hydraulic pump and filling the reservoir Completely air bleed the axial piston unit and hydraulic system Check correct installation position
	Output speed too high	Machine/system manufacturer: Reduce output speed
	Improper mounting of the axial piston unit	Check the mounting of the axial piston unit according to the specifications of the machine/system manufacturer – observe tightening torques
	Improper mounting of assembled parts, hydraulic lines or improper installation of the coupling	Fasten assembled parts according to the parameters provided by the coupling fitting manufacturer
	Resonances due to a defective or unsuitable elastic coupling	Check the specification of the elastic coupling and/or exchange defective or worn coupling
	Mechanical damage to the axial piston unit (e.g. bearing damage)	Replace axial piston unit Contact Bosch Rexroth Service
Increased, unusual vibration	Bearings worn	Contact Bosch Rexroth Service
No or insufficient pressure	Insufficient air bleeding of the hydraulic system	Axial piston unit, suction line for the hydraulic pump and filling the reservoir Check correct installation position
	Faulty mechanical output drive (e.g., defective coupling)	Contact machine/system manufacturer
	Drive power too low	Contact machine/system manufacturer
	Wear or mechanical damage to the axial piston unit	Replace axial piston unit Contact Bosch Rexroth Service
	Drive unit defective (e.g. hydraulic pump)	Contact machine/system manufacturer
Pressure/flow fluctuations/ instabilities	Insufficient air bleeding of the hydraulic system	Axial piston unit, suction line for the hydraulic pump and filling the reservoir Completely air bleed the axial piston unit and hydraulic system Check correct installation position
Rotational speed or torque cannot be reached	Insufficient flow at hydraulic pump.	Check function of the hydraulic pump.
	Hydraulic fluid not in optimal viscosity range	Machine/system manufacturer: Check temperature range and use suitable hydraulic fluid
	Wear or mechanical damage to the axial piston motor	Replace axial piston unit Contact Bosch Rexroth Service
	Wear or mechanical damage to the hydraulic pump.	Replace hydraulic pump Contact Bosch Rexroth Service
	Wrong direction of rotation	Check function of the hydraulic pump. Machine/system manufacturer: Check correct direction of rotation, see chapter 7.4.1 "Preparation" on page 35

Table 18: Axial piston unit malfunction table

Malfunction	Possible cause	Remedy
Excessively high temperature of hydraulic fluid and housing	Excessively high inlet temperature at the axial piston unit	Machine/system manufacturer: Inspect system, e.g. malfunction in the cooler, insufficient hydraulic fluid in the reservoir
	Output speed too high	Contact machine/system manufacturer
	Flushing flow of the flushing valve too low	Contact Bosch Rexroth Service
	Axial piston unit worn	Replace axial piston unit; contact Bosch Rexroth Service

15 Technical data

The permissible values of the technical data of your axial piston unit can be found in the data sheet (Part II).

Order-related technical data for your axial piston unit can be found in the order confirmation.

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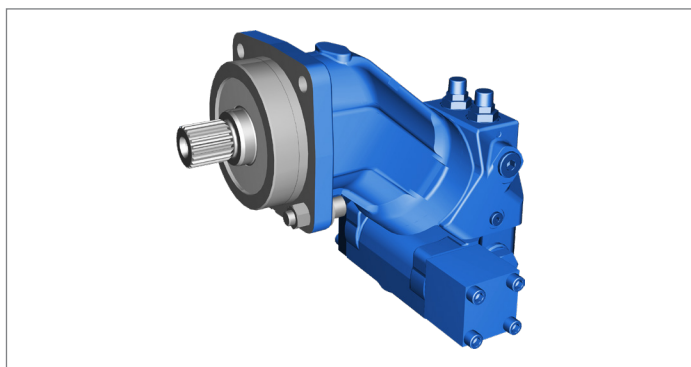
Your local contact person can be found at:

<https://addresses.boschrexroth.com>

Axial piston fixed motor A2FM Series 61 for explosive areas II 2G Ex h IIB T4-T1 Gb X and II 3G Ex h IIB T4-T1 Gc X



Part II of instruction
manual in accordance with
ATEX Directive 2014/34/EU
(data sheet)



- ▶ All-purpose high pressure motor
- ▶ Sizes 10 to 180
- ▶ Nominal pressure 400 bar
- ▶ Maximum pressure 450 bar
- ▶ Open and closed circuits

Information on explosion protection

- ▶ Application per Directive 2014/34/EU (ATEX)
- ▶ Gas: II 2G Ex h IIB T4-T1 Gb X according to
DIN EN ISO 80079-36 :2016,
DIN EN ISO 80079-37:2016
- ▶ Gas: II 3G Ex h IIB T4-T1 Gc X according to
DIN EN ISO 80079-36 :2016,
DIN EN ISO 80079-37:2016

Features

- ▶ Fixed motor with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits.
- ▶ For use in mobile and stationary applications
- ▶ The output speed depends on the flow of the pump and the displacement of the motor
- ▶ The output torque increases with the pressure differential between the high-pressure side and the low-pressure side.
- ▶ Finely graduated sizes permit far-reaching adaptation to the drive concerned
- ▶ High power density
- ▶ Small dimensions
- ▶ High total efficiency
- ▶ Good starting efficiency
- ▶ One-piece tapered piston with piston rings for sealing

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Type code

01	02	03		04	05		06	07	08	09	10		11
A2F	M		/	61	W	-			B		J	-	

Axial piston unit

01	Bent-axis design, fixed	A2F
----	-------------------------	-----

Operating mode

02	Motor	M
----	-------	---

Size (NG)

03	Geometric displacement, see technical data on page 7																
		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	

Series

04	Series 6, index 1	61
----	-------------------	----

Direction of rotation

05	Viewed on drive shaft, bidirectional	W
----	--------------------------------------	---

Sealing material ATEX version

06	ATEX device category 3G (normal level of safety), shaft seal ring made of FKM (fluorocarbon rubber)	A
	ATEX device category 2G (normal level of safety), shaft seal ring made of FKM (fluorocarbon rubber)	R

Drive shaft

		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	
07	Splined shaft DIN 5480	●	●	●	●	●	●	-	●	●	●	●	●	●	●	●	A
		●	●	-	●	●	-	●	●	-	●	-	●	-	●	-	Z
	Parallel keyed shaft, DIN 6885	●	●	●	●	●	●	-	●	●	●	●	●	●	●	●	B
		●	●	-	●	●	-	●	●	-	●	-	●	-	●	-	P

Mounting flange

08	ISO 3019-2; 4-hole	B
----	--------------------	---

Port plate for working lines¹⁾

		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	
09	SAE flange ports A and B at rear	-	-	-	●	●	●	●	●	●	●	●	●	●	●	●	010
	SAE flange ports A and B at side, opposite	-	-	-	●	●	●	●	●	●	●	●	●	●	●	●	020
	Threaded ports A and B, at side, opposite	●	●	●	●	●	●	-	-	-	-	-	-	-	-	-	030
	Threaded ports A and B at side and rear ²⁾	●	●	●	●	●	●	●	●	●	-	-	-	-	-	-	040
	SAE flange ports A and B at bottom (same side)	-	-	-	-	●	●	●	●	●	●	●	●	●	●	●	100
	Port plate with 1-stage pressure relief valves for mounting a counterbalance valve ³⁾	BVD20	-	-	-	-	-	-	-	-	-	-	●	●	-	-	178
		BVD20/25	-	-	-	●	●	●	●	●	●	●	●	●	●	●	188

Rotary group

10	Version J	J
----	-----------	---

Special version

11	Special version	S
----	-----------------	---

● = Available – = Not available

Notice

Note the project planning notes on page 29.

1) Fastening thread or threaded ports, metric

2) Threaded ports at the sides sealed with threaded plugs

3) Indicate type code for counterbalance valve BVD separately as per data sheet 95522.
Note the restrictions described on page 24.

Features of the ATEX version

With the ATEX version of the A2FM axial piston fixed motor, a restriction of the technical data must be taken into account.

External distinguishing feature from the standard motor:

- The unpainted part of the mounting flange, which is marked by a socket-head screw,
- The ex-mark and the CE-mark on the name plate.

Observe the instruction manual.

Temperature classes per DIN EN ISO 80079-36

Depending on the two temperature classes T3 and T4, the maximum permissible speed and temperature restrictions must be taken into account (see table "Viscosity and temperature of the hydraulic fluid" and "Technical data").

Notice

ATEX classification: When ordering, please state which equipment group, category, explosion group, temperature class and ignition protection type are required for your planned ATEX application.

Technical data: Compared to the standard motor, there are restrictions regarding temperature, case pressure and bearing flushing / installation position.

Painting/color selection: In order to avoid mechanically generated sparks from foreign particles made of aluminum with iron oxide and/or particles of rust of the surface¹⁾, the axial piston unit is painted as standard with corrosion protecting. For the available colors, please contact your Rexroth contact person.

Maintenance interval: The bearing service life of the axial piston unit is limited. Therefore, the maintenance intervals in accordance with instruction manual (Part I) must be observed; if necessary, the individual service life must be calculated. Please contact us.

Potential equalization: The axial piston unit must be grounded. For grounding points, please refer to the drawings starting on page 10.

Hydraulic fluids

The fixed motor A2FM is designed for operation with HLP mineral oil according to DIN 51524.

See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons

The fixed motor A2FM for explosive areas is only approved for mineral oils.

Information on the selection of hydraulic fluid

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} ; see selection diagram).

The ignition temperature of the hydraulic fluid must be greater than 250 °C.

Please note

The temperature must not exceed 90 °C at any point in the component. The temperature difference shown in the table must be taken into account for determining the viscosity in the bearing.

If it is not possible to maintain the conditions above due to extreme operating parameters, we recommend flushing the case at port **T₁/T₂**.

Project planning note

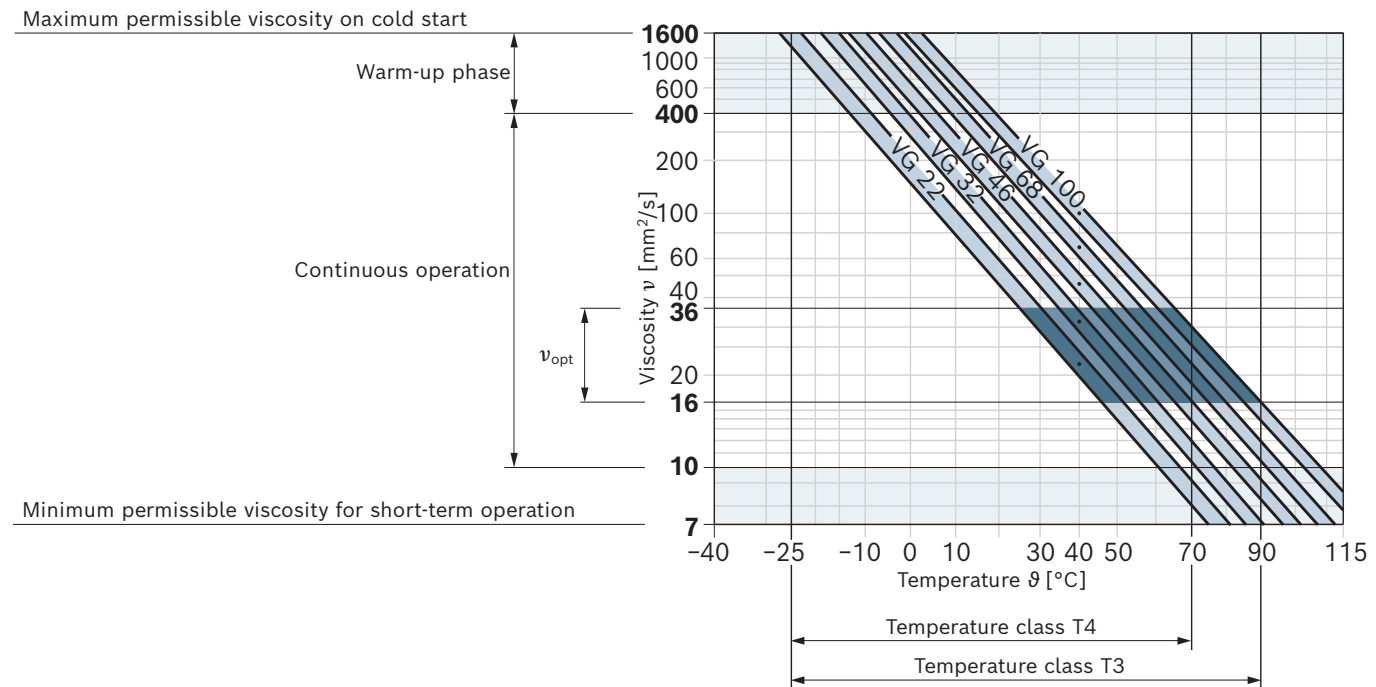
The maximum leakage temperature and case pressure must not be exceeded. Observe the safety instructions on page 5 "Operating data monitoring – X parameters".

¹⁾ See DIN EN ISO 80079-36, 6.4.2.1

Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Remarks
Cold start	$\nu_{\max} \leq 1600 \text{ mm}^2/\text{s}$	$\vartheta_{\text{St}} \geq -25 \text{ }^\circ\text{C}$	$t \leq 3 \text{ min}$, $n \leq 1000 \text{ rpm}$, without load $p \leq 50 \text{ bar}$
Permissible temperature difference		$\Delta T \leq 25 \text{ K}$	Between axial piston unit and hydraulic fluid in the system
Warm-up phase	$\nu < 1600 \text{ to } 400 \text{ mm}^2/\text{s}$		At $p \leq 0.7 \times p_{\text{nom}}$, $n \leq 0.5 \times n_{\text{nom}}$ and $t \leq 15 \text{ min}$
Continuous operation	$\nu = 400 \text{ to } 10 \text{ mm}^2/\text{s}$		This corresponds, for VG 46 for example, to a temperature range of $+5^\circ\text{C}$ to $+85^\circ\text{C}$ (see selection diagram)
Temperature class T3		$\vartheta = -25 \text{ }^\circ\text{C}$ to $+90 \text{ }^\circ\text{C}$	Measured at port T
Temperature class T4		$\vartheta = -25 \text{ }^\circ\text{C}$ to $+70 \text{ }^\circ\text{C}$	Observe permissible temperature range of the shaft seal ring ($\Delta T = \text{approx. } 12 \text{ K}$ between bearing/shaft seal and port T)
	$\nu_{\text{opt}} = 36 \text{ to } 16 \text{ mm}^2/\text{s}$		Optimal operating viscosity and efficiency range
Short-term operation	$\nu_{\min} = 10 \text{ ... } 7 \text{ mm}^2/\text{s}$		$t < 3 \text{ min}$, $p < 0.3 \times p_{\text{nom}}$

▼ Selection diagram



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.

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

At a hydraulic fluid viscosity of less than 10 mm^2/s (e.g. due to high temperatures during short-term operation), a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

For example, the viscosity 10 mm^2/s at:

- HLP 32 a temperature of 73 $^\circ\text{C}$
- HLP 46 a temperature of 85 $^\circ\text{C}$

Operating data monitoring – X parameters

- Ambient temperature T_a : -20 °C to +40 °C

Safety instructions: Temperature class T4–T1

ATEX category II 3G Ex h IIB T4-T1 Gc X

To observe the **maximum leakage temperature of 90 °C**, at least one of the following measures must be taken and checked regularly:

- Check the leakage temperature at port **T** (maximum distance 30 cm)
- Check a maximum inlet temperature that must be determined for the following operating points when commissioning:
 - Maximum working pressure and maximum possible flow
 - Maximum working pressure and minimum flow

Also monitor the reservoir level. Take appropriate action if the temperature exceeds limits.

ATEX category II 2G Ex h IIB T4-T1 Gb X

To observe the **maximum leakage temperature of 70 °C**, the following measures must be taken:

- Continuously monitor leakage temperature at each axial piston unit with a temperature sensor on port **T** (maximum distance to port 30 cm).
- Connect the temperature sensor with a switching-off for the system at the limit temperature of 70 °C.
- This shut-off function should be tested during commissioning; see chapter 8.1.2 of the instruction manual.

Reservoir level monitoring is also required.

Installation instructions can be found in the instruction manual 91001-01-X-B1 as of chapter "7.3 Installation position"

Flow direction

Direction of rotation, viewed on drive shaft	
Clockwise	Counter-clockwise
A to B	B to A

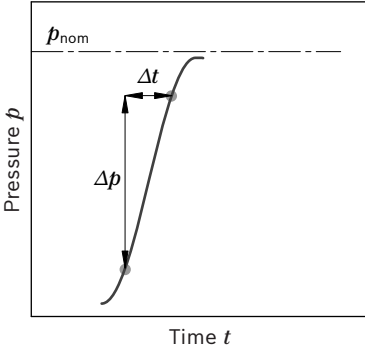
Speed range

No limit to minimum speed $n_{\min}$. If uniformity of motion is required, rotational speed $n_{\min}$ must not be less than 50 rpm. For the maximum speed, see Technical data on page 7.

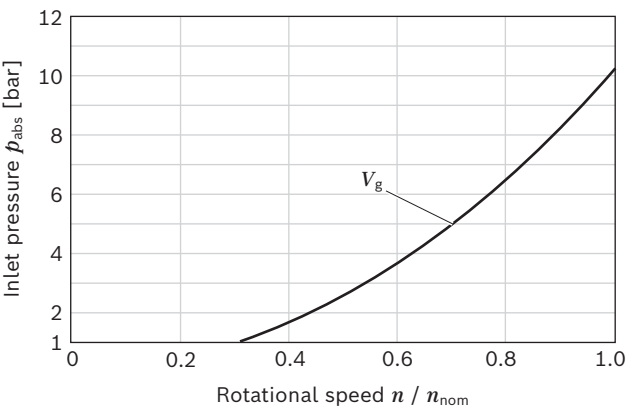
Working pressure range

Pressure at working port A or B		Definition
Nominal pressure p_{nom}	400 bar	The nominal pressure corresponds to the maximum design pressure. The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
Maximum pressure p_{max}	450 bar	
Single operating period	10 s	
Total operating period	300 h	
Minimum pressure (high-pressure side)	25 bar	Minimum pressure at the high-pressure side (A or B) which is required to prevent damage to the axial piston unit.
Minimum pressure – operation as a pump (inlet)	See characteristic curve	To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{Su} (pressure A + pressure B)	700 bar	The summation pressure is the sum of the pressures at the ports for the working lines (A and B).
Rate of pressure change $R_{A\ max}$		Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
with integrated pressure relief valve	9000 bar/s	
without pressure relief valve	16000 bar/s	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T\ cont}$	2 bar	Maximum, averaged differential pressure at the shaft seal (housing pressure to ambient pressure)
Pressure peaks $p_{T\ peak}$	10 bar	$t < 0.1\ s$

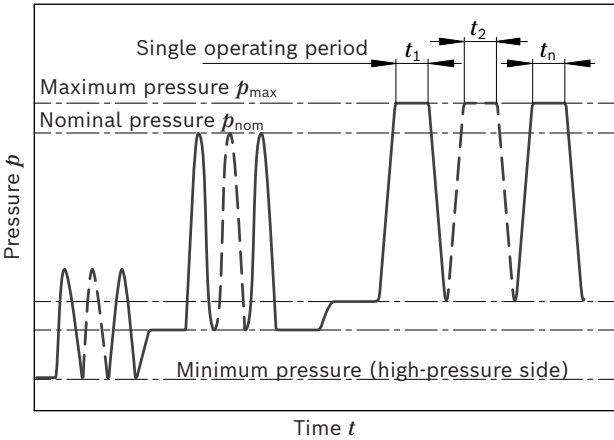
▼ Rate of pressure change $R_{A\ max}$



▼ Minimum pressure – operation as a pump (inlet)



▼ Pressure definition



Total operating period = $t_1 + t_2 + \dots + t_n$

This diagram is only valid for the optimum viscosity range of $\nu_{opt} = 36$ bis $16\text{ mm}^2/\text{s}$.
If the above-mentioned conditions cannot be ensured, please contact us.

Notice

- ▶ In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.
- ▶ The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
- ▶ The case pressure must be greater than the external pressure (ambient pressure) at the shaft seal.

Technical data

Size	NG		10	12	16	23	28	32	45	56
Displacement geometric, per revolution	V_g	cm ³	10.3	12	16	22.9	28.1	32	45.6	56.1
Maximum rotational speed ¹⁾	Temperature class T3	n_{max}	rpm	8000	8000	8000	6300	6300	6300	5000
	Temperature class T4	n_{max}	rpm	4000	4000	4000	3150	3150	3150	2800
Inlet flow ²⁾	at n_{nom}	$q_{v\ max}$	l/min	82	96	128	144	177	202	281
Torque ³⁾	at $\Delta p = 350$ bar	M	Nm	57	67	89	128	157	178	254
	at $\Delta p = 400$ bar	M	Nm	66	76	102	146	179	204	290
Rotary stiffness		c_{min}	kNm/rad	0.92	1.25	1.59	2.56	2.93	3.12	4.18
Moment of inertia of the rotary group		J_{TW}	kgm ²	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024
Case volume		V	l	0.17	0.17	0.17	0.20	0.20	0.20	0.33
Weight approx.		m	kg	5.4	5.4	5.4	9.5	9.5	9.5	13.5

Size	NG		63	80	90	107	125	160	180
Displacement geometric, per revolution	V_g	cm ³	63	80.4	90	106.7	125	160.4	180
Maximum rotational speed ¹⁾	Temperature class T3	n_{max}	rpm	5000	4500	4500	4000	4000	3600
	Temperature class T4	n_{max}	rpm	2500	2250	2250	2000	2000	1800
Inlet flow ²⁾	at n_{nom}	$q_{v\ max}$	l/min	315	362	405	427	500	577
Torque ³⁾	at $\Delta p = 350$ bar	M	Nm	351	448	501	594	696	893
	at $\Delta p = 400$ bar	M	Nm	401	512	573	679	796	1021
Rotary stiffness		c_{min}	kNm/rad	6.25	8.73	9.14	11.2	11.9	17.4
Moment of inertia of the rotary group		J_{TW}	kgm ²	0.0042	0.0072	0.0072	0.0116	0.0116	0.0220
Case volume		V	l	0.45	0.55	0.55	0.8	0.8	1.1
Weight approx.		m	kg	18	23	23	32	32	45

Determination of the operating characteristics			
Inlet flow	q_v	$= \frac{V_g \times n}{1000 \times \eta_v}$	[l/min]
Rotational speed	n	$= \frac{q_v \times 1000 \times \eta_v}{V_g}$	[rpm]
Torque	M	$= \frac{V_g \times \Delta p \times \eta_{hm}}{20 \times \pi}$	[Nm]
Power	P	$= \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p \times \eta_t}{600}$	[kW]

Key

V_g	Displacement per revolution [cm ³]
Δp	Differential pressure [bar]
n	Rotational speed [rpm]
η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

Notice

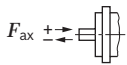
- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.

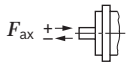
1) The valid values (observing the maximum permissible inlet flow):
– for the optimum viscosity range from $\nu_{opt} = 36$ to 16 mm²/s
– with hydraulic fluid based on mineral oils

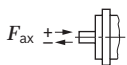
2) Observe limitation of inlet flow due to counterbalance valve (see page 24).

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

Permissible radial and axial loading on the drive shafts

Size	NG		10	10	12	12	16	23	23	28	28
Drive shaft	Ø	mm	20	25	20	25	25	25	30	25	30
Maximum radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	kN	3.0	3.2	3.0	3.2	3.2	5.7	5.4	5.4
		a	mm	16	16	16	16	16	16	16	16
Maximum torque at $F_{q \max}$	$M_{\max}$	Nm	66	66	76	76	102	146	146	179	179
Maximum differential pressure at $F_{q \max}$	$\Delta p_{\max}$	bar	400	400	400	400	400	400	400	400	400
Maximum axial force at standstill or depressurized operation		$+ F_{ax \max}$	N	0	0	0	0	0	0	0	0
		$- F_{ax \max}$	N	320	320	320	320	320	500	500	500
Permissible axial force per bar working pressure	$+ F_{ax \text{ perm}}/\text{bar}$	N/bar	3.0	3.0	3.0	3.0	3.0	5.2	5.2	5.2	5.2

Size	NG		32	45	56	56 ²⁾	56	63	80	80 ²⁾	80
Drive shaft	Ø	mm	30	30	30	30	35	35	35	35	40
Maximum radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	N	5.4	7.6	9.5	7.8	9.1	9.1	11.6	11.1
		a	mm	16	18	18	18	18	18	20	20
Maximum torque at $F_{q \max}$	$M_{\max}$	Nm	204	290	357	294	357	401	512	488	512
Maximum differential pressure at $F_{q \max}$	$\Delta p_{\max}$	bar	400	400	400	330	400	400	400	380	400
Maximum axial force at standstill or depressurized operation		$+ F_{ax \max}$	N	0	0	0	0	0	0	0	0
		$- F_{ax \max}$	N	500	630	800	800	800	800	1000	1000
Permissible axial force per bar working pressure	$+ F_{ax \text{ perm}}/\text{bar}$	N/bar	5.2	7.0	8.7	8.7	8.7	8.7	10.6	10.6	10.6

Size	NG		90	107	107	125	160	160	180
Drive shaft	Ø	mm	40	40	45	45	45	50	50
Maximum radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	kN	11.4	13.6	14.1	14.1	18.1	18.3
		a	mm	20	20	20	20	25	25
Maximum torque at $F_{q \max}$	$M_{\max}$	Nm	573	679	679	796	1021	1021	1146
Maximum differential pressure at $F_{q \max}$	$p_{\text{nom perm.}}$	bar	400	400	400	400	400	400	400
Maximum axial force at standstill or depressurized operation		$+ F_{ax \max}$	N	0	0	0	0	0	0
		$- F_{ax \max}$	N	1000	1250	1250	1250	1600	1600
Permissible axial force per bar working pressure	$+ F_{ax \text{ perm}}/\text{bar}$	N/bar	10.6	12.9	12.9	12.9	16.7	16.7	16.7

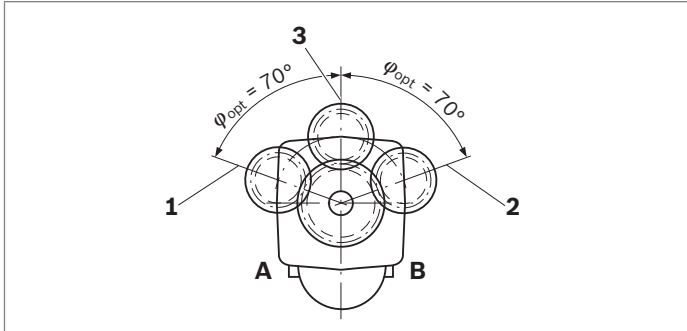
1) With intermittent operation

2) Restricted technical data only for splined shaft

Effect of radial force F_q on bearing service life

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 bearing service life. Recommended position of mating gear is dependent on the direction of rotation. Examples:

▼ Gear output drive



- 1 “Counter-clockwise” rotation, pressure at port **B**
- 2 “Clockwise” rotation, pressure at port **A**
- 3 “Bidirectional” direction of rotation

Notice

- The values given are maximum values and do not apply to continuous operation.
- The permissible axial force in direction $-F_{ax}$ is to be avoided as the service life of the bearing is reduced.
- Special requirements apply in the case of belt drives. Please contact us.

Technical drawing of the 1000 series motor, showing side and front views with dimensions.

Side View Dimensions:

- Flange diameter: $\varnothing 80_{-0.019}$
- Flange thickness: 20¹⁾
- Flange to mounting bracket distance: 95
- Mounting bracket thickness: 6
- Mounting bracket to motor body distance: 18.2
- Motor body width: 12
- Motor body to base distance: 60
- Base width: 54
- Base to motor body distance: 54
- Motor body to base distance: 29
- Motor body to base distance: 40°
- Motor body to base distance: T₁
- Motor body to base distance: T₂
- Motor body to base distance: $\varnothing 85$

Front View Dimensions:

- Motor body width: 95
- Motor body to base distance: 9
- Motor body to base distance: 45°
- Motor body to base distance: 45°
- Motor body to base distance: 100
- Motor body to base distance: A
- Motor body to base distance: B

Flange similar to
ISO 3019-2

A – W25x1.25x18x9g

Technical drawing of a bolt and nut assembly. The bolt is labeled **A – W25x1.25x18x9g**. The drawing shows a side view of the bolt and a top view of the nut. The bolt has a head diameter of 22mm and a length of 18mm. The nut has an outer diameter of 28mm and a height of 9mm. The bolt is threaded with M10 x 1.5(3) threads. The drawing includes dimension lines and arrows indicating the various measurements.

Z - W20x1.25x14x9g

Technical drawing of a bolt and nut assembly. The bolt is labeled **Z - W20x1.25x14x9g**. The drawing shows a side view of the bolt and nut. The bolt has a hexagonal head with a diameter of 16 mm and a height of 5 mm. The threaded part of the bolt has a length of 22 mm. The total length of the bolt is 34 mm. The nut has an outer diameter of 28 mm. The thread is M6 x 1 1/2 (3).

B – AS8×7×32

Technical drawing of a shaft key (B) with dimensions: 28, 22, 7.5, 40, 28, 1.5(3), 0.015, 0.002, M10, Shaft key width 8, Ø25, Ø28.

P – AS6×6×32

Technical drawing of a shaft-hub assembly. The shaft has a diameter of $\varnothing 20^{+0.015}_{-0.002}$ and a length of 22.5. The hub has an outer diameter of $\varnothing 28$ and a total length of 40. The shaft is secured with a shaft key of width 6. The hub bore has a diameter of $M6 \times 1^{(2/3)}$. The keyway in the hub has a depth of 5. The distance from the end of the shaft to the start of the keyway is 16.

Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 11)			450	
T₁	Drain port	DIN 3852 ⁶⁾	M12 × 1.5; 12 deep	3	X ⁵⁾
T₂	Drain port	DIN 3852 ⁶⁾	M12 × 1.5; 12 deep	3	O ⁵⁾

X = Plugged (in normal operation)

▼ Location of working line ports on port plates

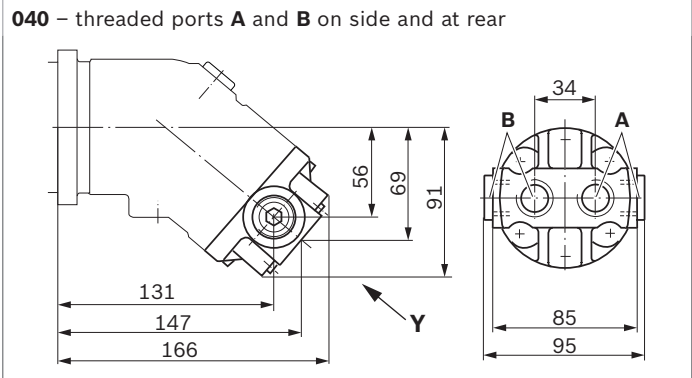
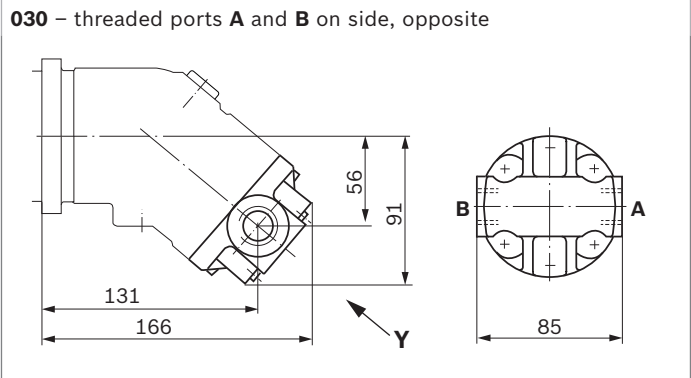
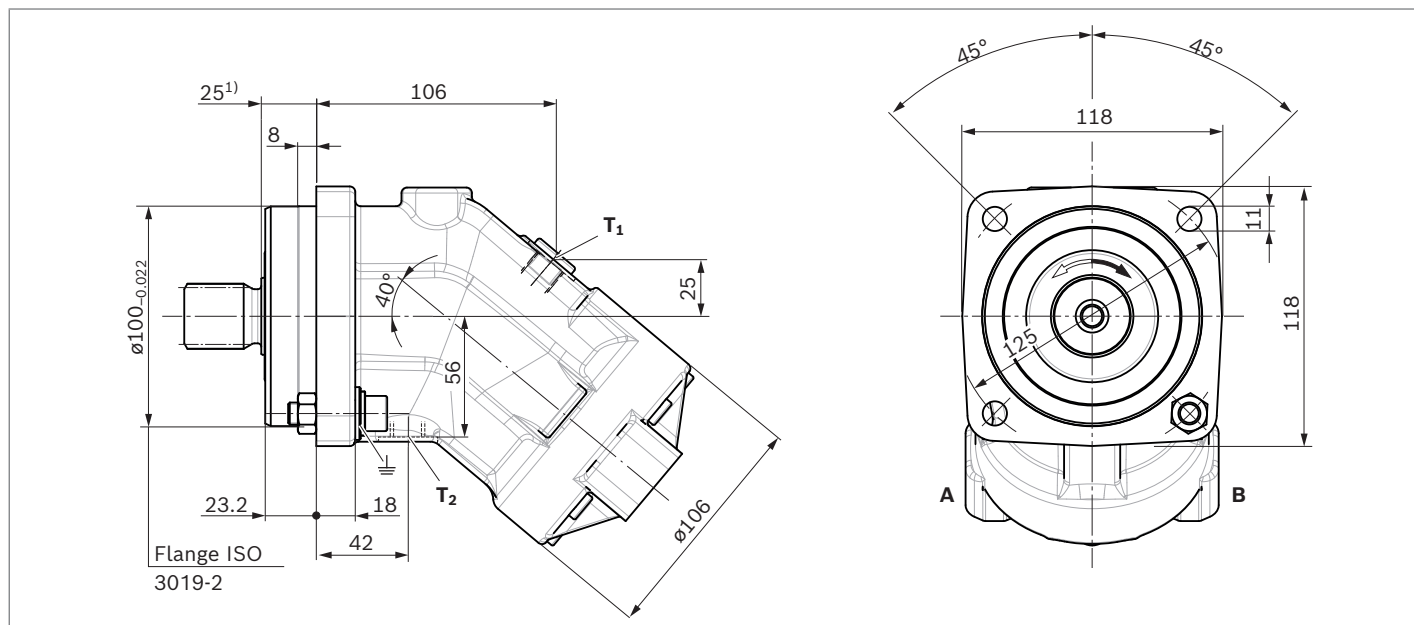


Plate	Ports		Standard ³⁾	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁴⁾
030	A, B	Working port	DIN 3852	M22 × 1.5; 14 deep	450	O
040	A, B	Working port	DIN 3852	M22 × 1.5; 14 deep	450	Each 1 × O

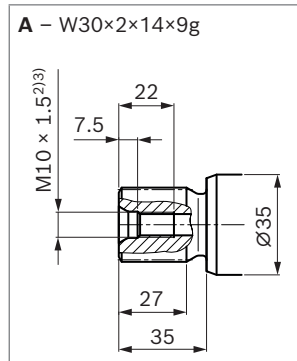
1) For maximum tightening torques, see instruction manual.
2) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.

3) The countersink may be deeper than specified in the standard.
4) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

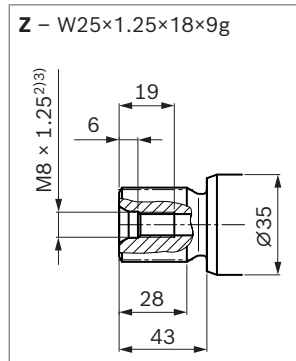
Dimensions, sizes 23, 28, 32



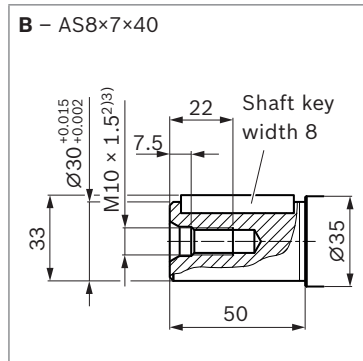
▼ Splined shaft DIN 5480, NG23, 28, 32



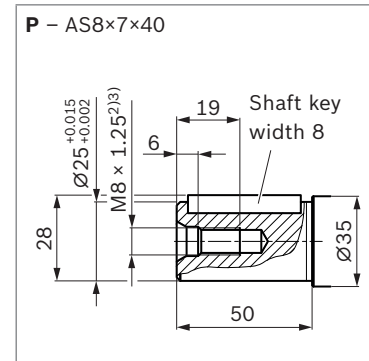
▼ Splined shaft DIN 5480, NG23, 28



▼ Parallel keyed shaft, DIN 6885, NG23, 28, 32



▼ Parallel keyed shaft, DIN 6885, NG23, 28



Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 13)			450	
T ₁	Drain port	DIN 3852 ⁶⁾	M16 × 1.5; 12 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M16 × 1.5; 12 deep	3	O ⁵⁾

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) For maximum tightening torques, see instruction manual.

4) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T₁ or T₂ must be connected
(see also installation instructions on page 27).

6) The countersink may be deeper than specified in the standard.

7) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

▼ Location of working line ports on port plates

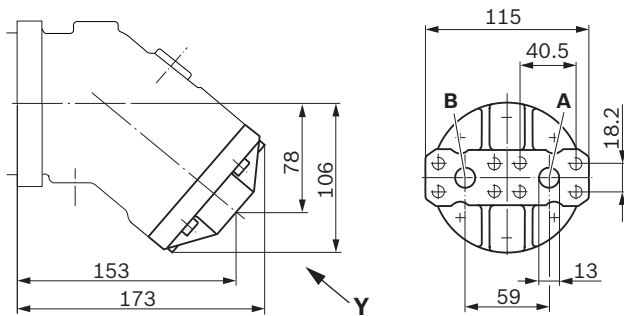
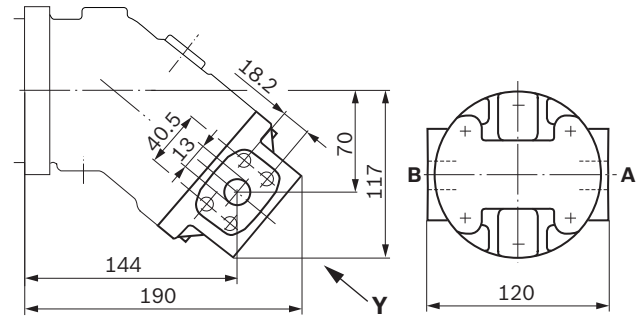
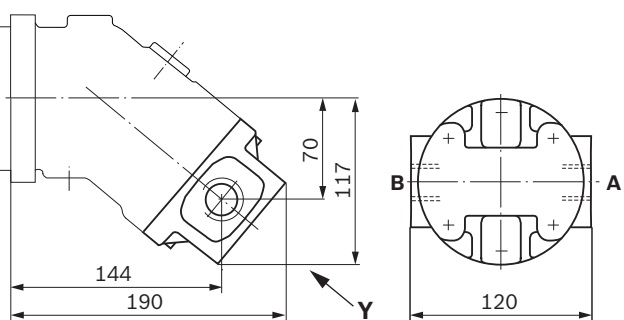
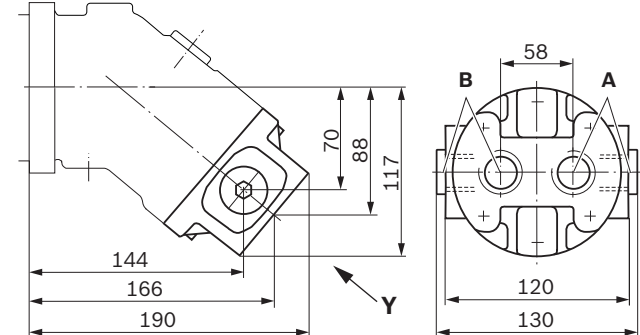
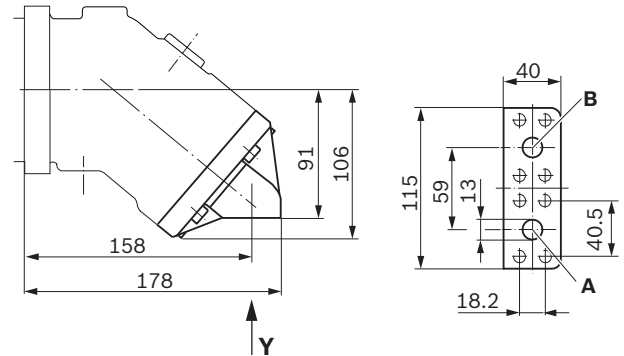
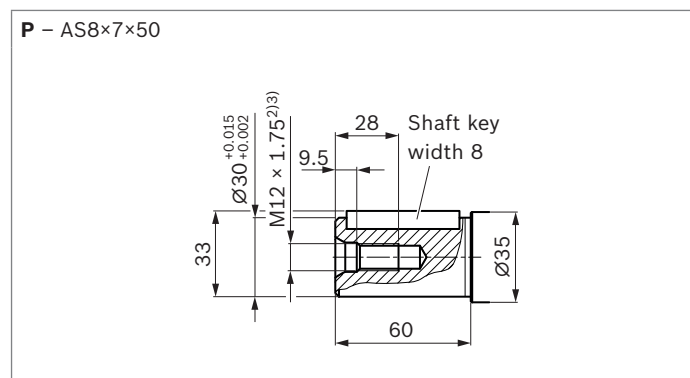
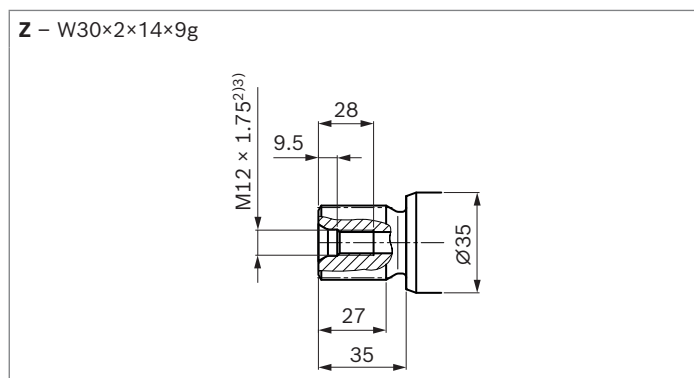
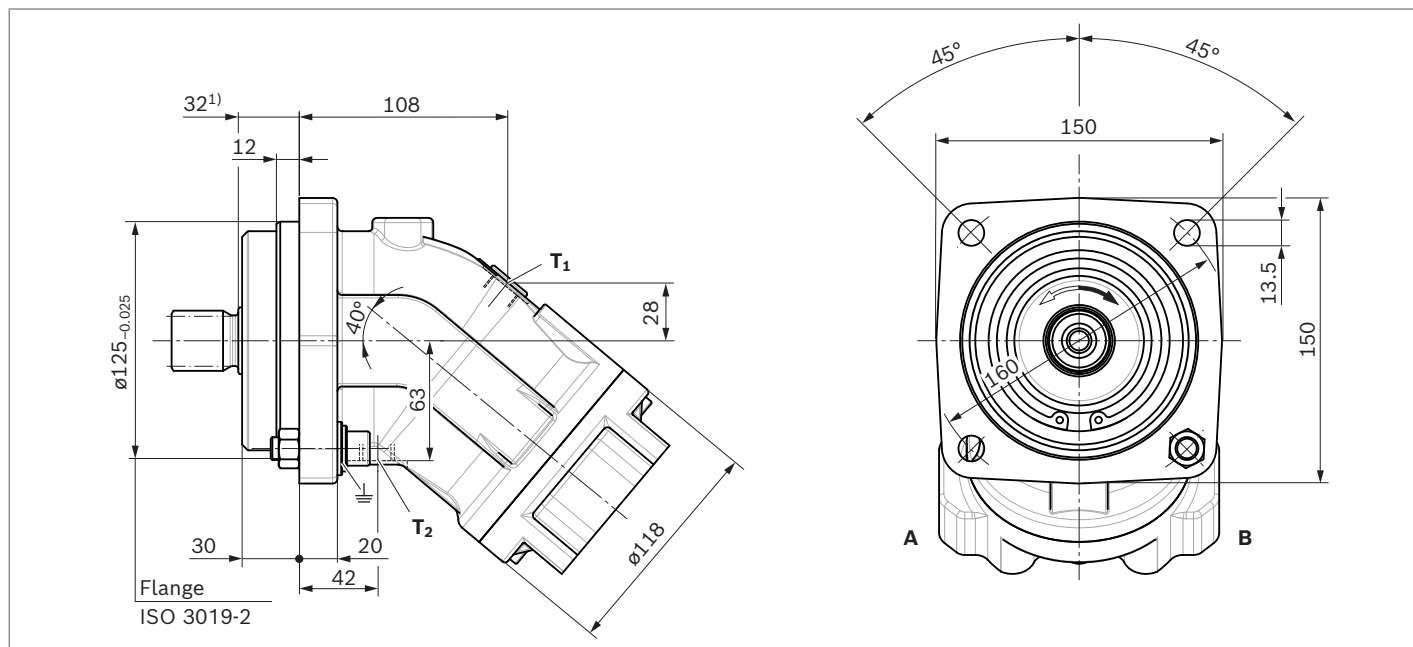
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite**030** – threaded ports **A** and **B** on side, opposite**040** – threaded ports **A** and **B** on side and at rear**100** – SAE flange connections **A** and **B** below (same side)⁴⁾

Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁶⁾
010, 020, 100	A, B	Working port	SAE J518 ³⁾	1/2 in	450	O
		Fastening thread A/B	DIN 13	M8 × 1.25; 15 deep		
030	A, B	Working port	DIN 3852 ⁵⁾	M27 × 2; 16 deep	450	O
040	A, B	Working port	DIN 3852 ⁵⁾	M27 × 2; 16 deep	450	Each 1 × O

Port plate **188** see page 26.

- 1) For maximum tightening torques, see instruction manual.
- 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
- 3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

- 4) Only sizes 28 and 32
- 5) The countersink may be deeper than specified in the standard.
- 6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)



Ports	Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾	
A, B	Working port (see port plates, page 15)		450		
T ₁	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	O ⁵⁾

X = Plugged (in normal operation)

▼ Location of working line ports on port plates

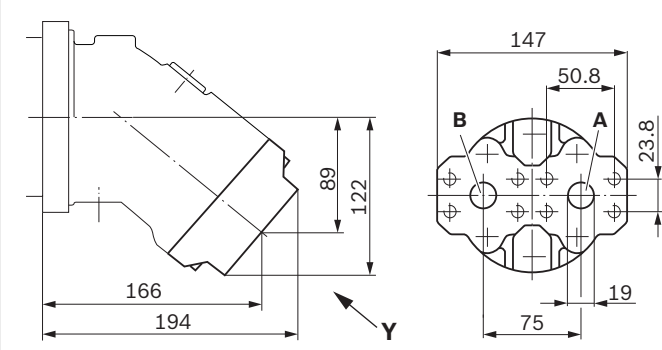
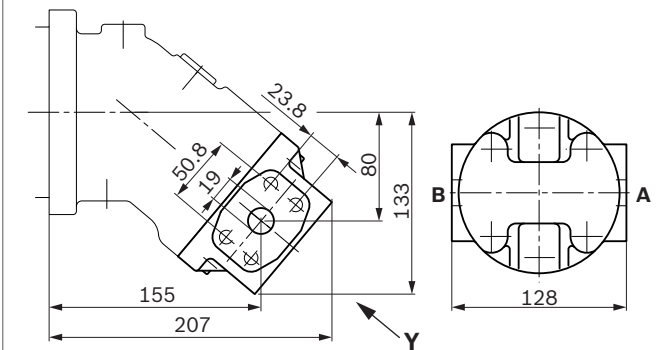
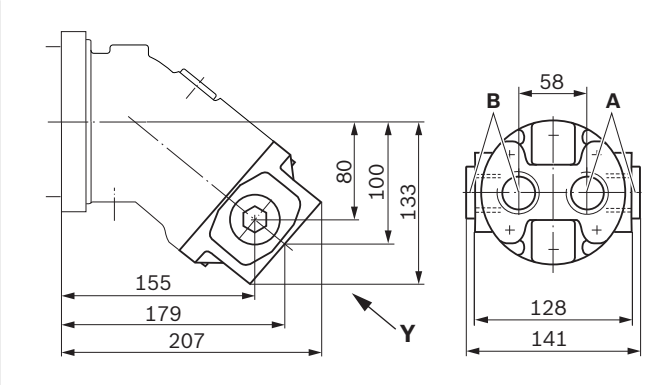
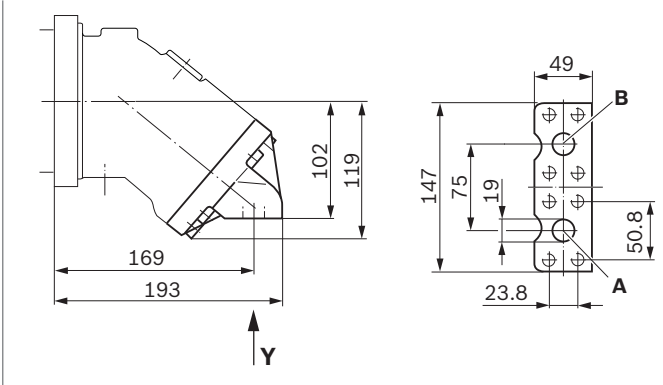
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite**040** – threaded ports **A** and **B** on side and at rear**100** – SAE flange connections **A** and **B** below (same side)

Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁶⁾
010, 020, 100	A, B	Working port	SAE J518 ³⁾	3/4 in	450	O
		Fastening thread A/B	DIN 13	M10 × 1.5; 17 deep		
040	A, B	Working port	DIN 3852 ⁴⁾	M33 × 2; 18 deep	450	Each 1 × O

Port plate **188** see page 26.

1) For maximum tightening torques, see instruction manual.

2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

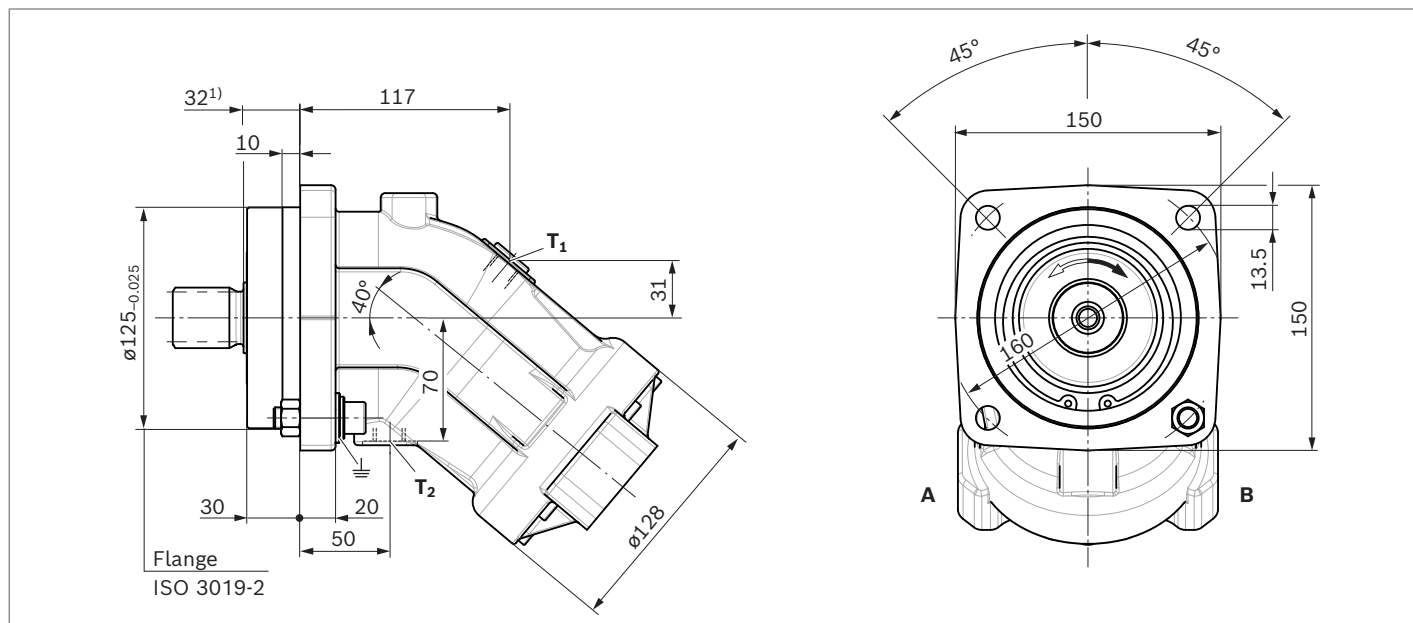
3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) The countersink may be deeper than specified in the standard.

5) O = Must be connected (plugged on delivery)

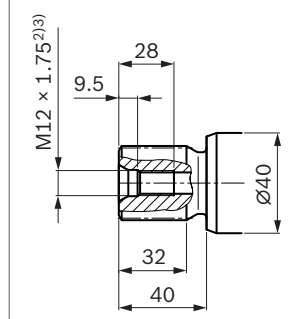
X = Plugged (in normal operation)

Dimensions, sizes 56, 63



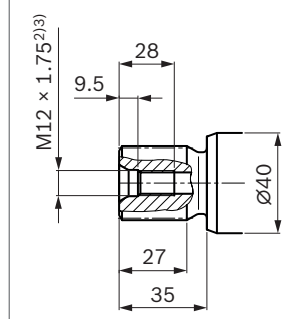
▼ Splined shaft DIN 5480, NG56, 63

A – W35×2×16×9g



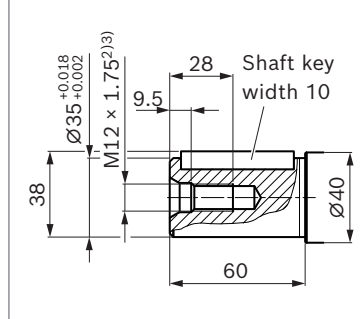
▼ Splined shaft DIN 5480, NG56

Z – W30×2×14×9g



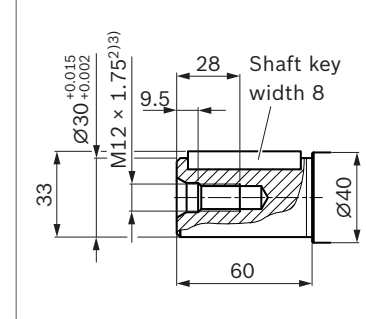
▼ Parallel keyed shaft, DIN 6885, NG56, 63

B – AS10×8×50



▼ Parallel keyed shaft, DIN 6885, NG56

P – AS8×7×50



Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 17)			450	
T ₁	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	O ⁵⁾

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) For maximum tightening torques, see instruction manual.

4) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T₁ or T₂ must be connected
(see also installation instructions on page 27).

6) The countersink may be deeper than specified in the standard.

7) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

▼ Location of working line ports on port plates

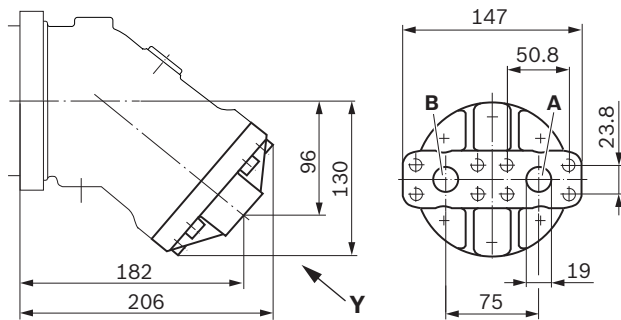
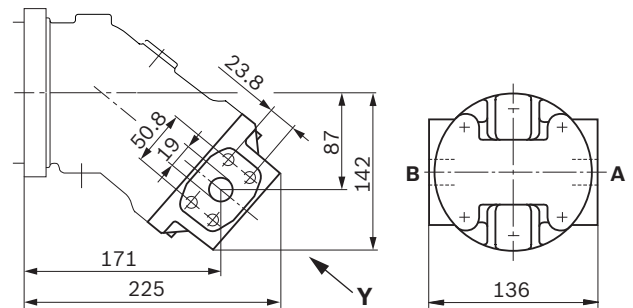
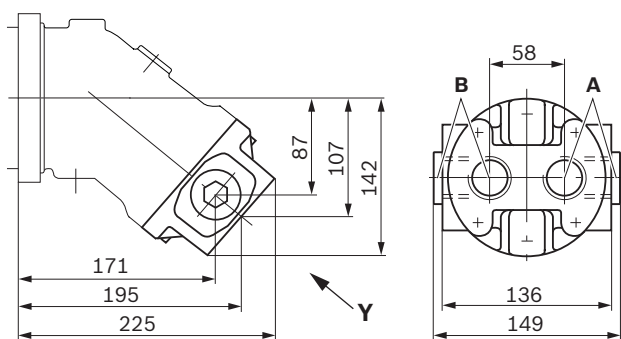
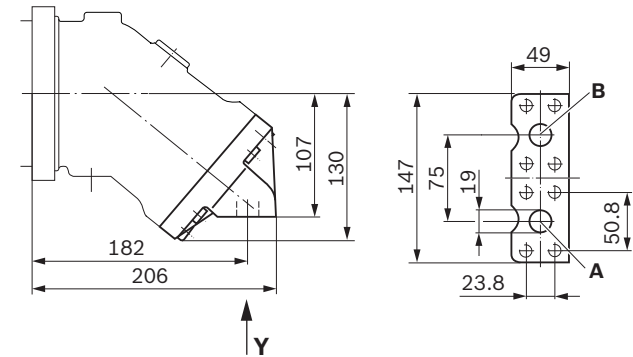
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite**040** – threaded ports **A** and **B** on side and at rear**100** – SAE flange connections **A** and **B** below (same side)

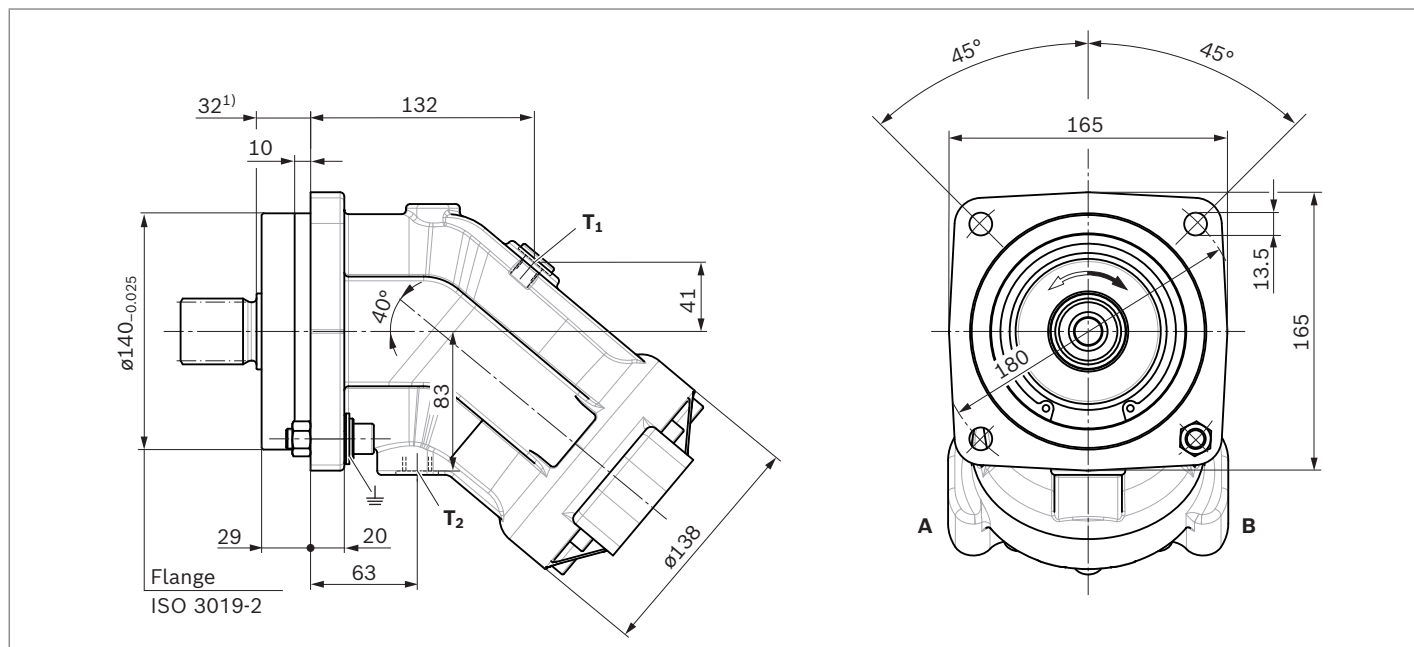
Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁶⁾
010, 020, 100	A, B	Working port	SAE J518 ³⁾	3/4 in	450	O
		Fastening thread A/B	DIN 13	M10 × 1.5; 17 deep		
040	A, B	Working port	DIN 3852 ⁴⁾	M33 × 2; 18 deep	450	Each 1 × O

Port plate **188** see page 26.

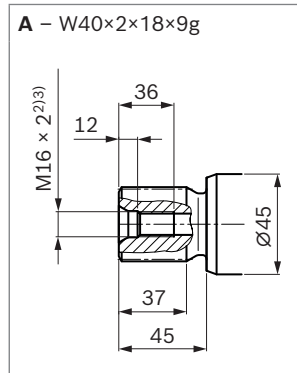
1) For maximum tightening torques, see instruction manual.
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) The countersink may be deeper than specified in the standard.
 5) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

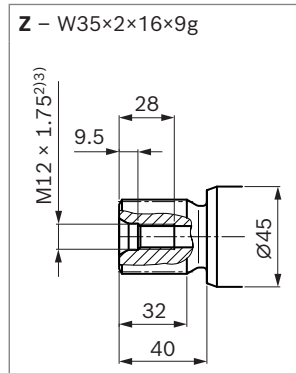
Dimensions, sizes 80, 90



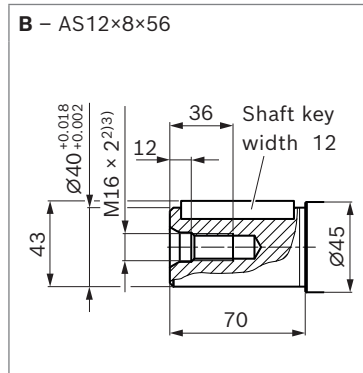
▼ Splined shaft DIN 5480, NG80, 90



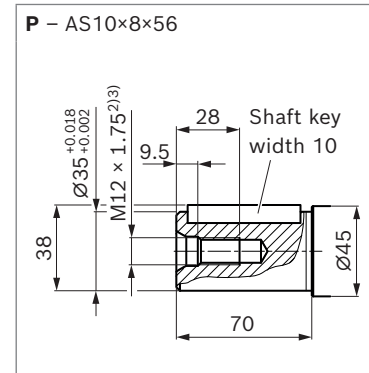
▼ Splined shaft DIN 5480, NG80



▼ Parallel keyed shaft, DIN 6885, NG80, 90



▼ Parallel keyed shaft, DIN 6885, NG80



Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 19)			450	
T ₁	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	O ⁵⁾

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) For maximum tightening torques, see instruction manual.

4) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T₁ or T₂ must be connected
(see also installation instructions on page 27).

6) The countersink may be deeper than specified in the standard.

7) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

▼ Location of working line ports on port plates

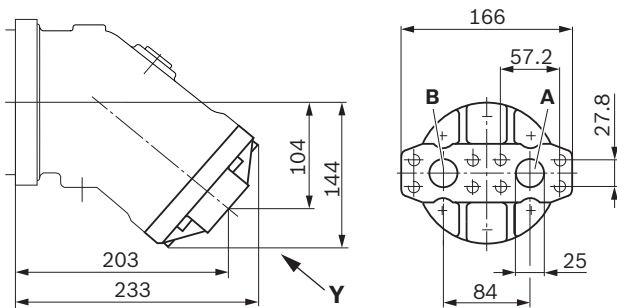
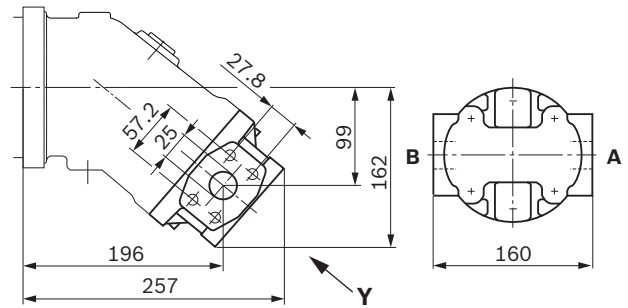
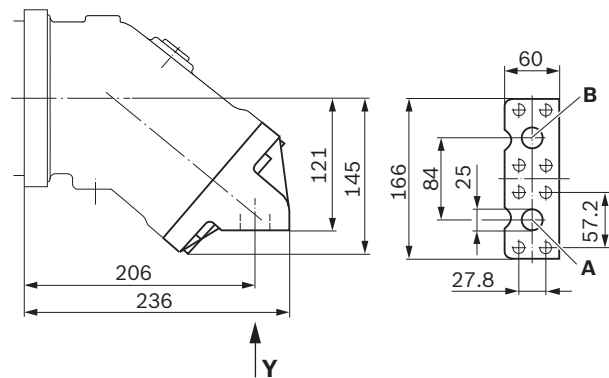
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite**100** – SAE flange connections **A** and **B** below (same side)

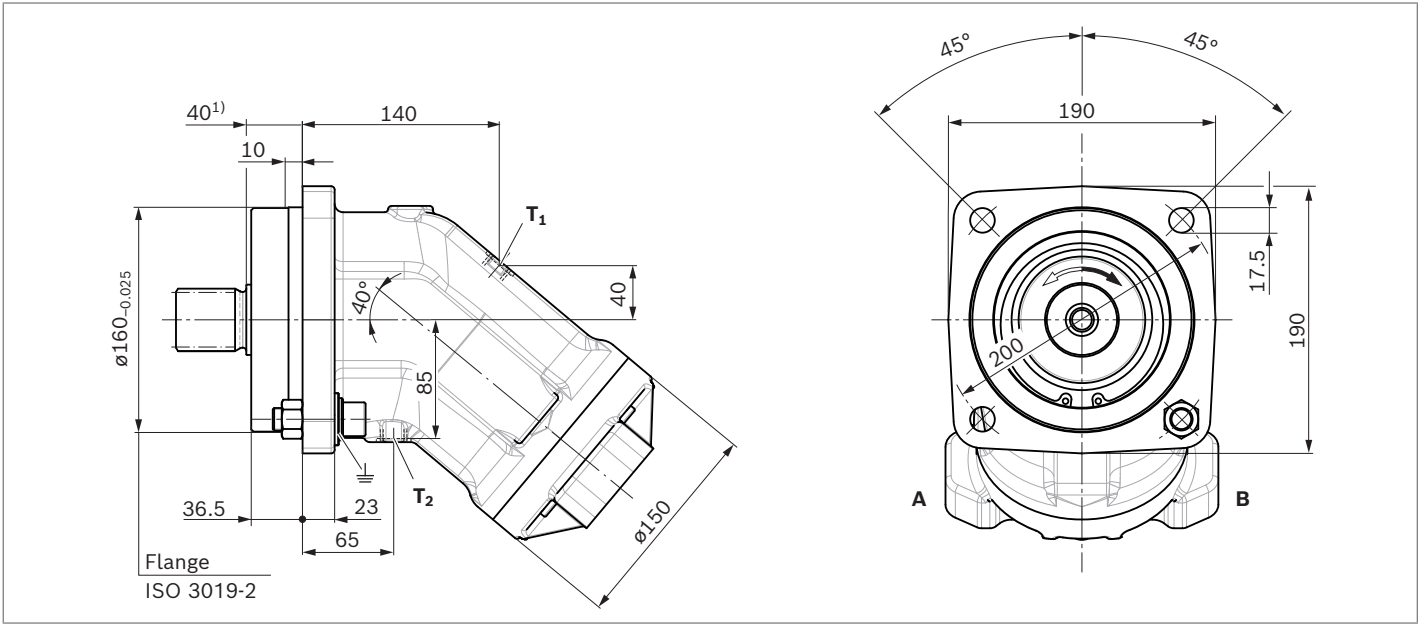
Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁶⁾
010, 020, 100	A, B	Working port	SAE J518 ³⁾	1 in	450	O
		Fastening thread A/B	DIN 13	M12 × 1.75; 17 deep		

Port plate **188** see page 26.

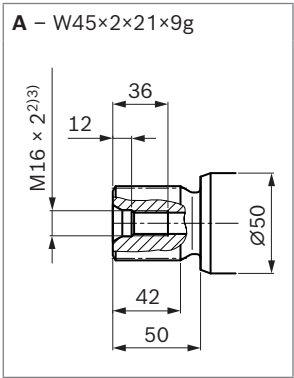
1) For maximum tightening torques, see instruction manual.
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

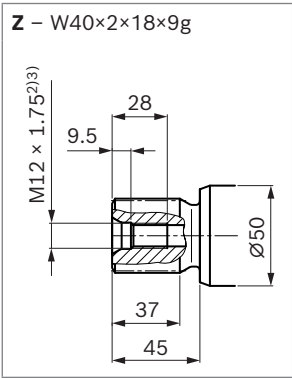
Dimensions, sizes 107, 125



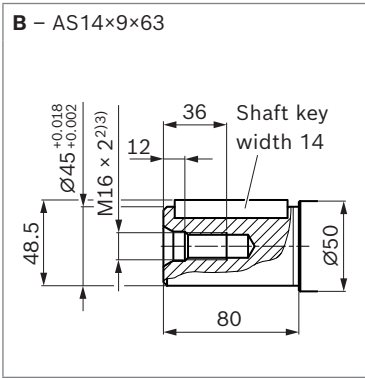
▼ Splined shaft
DIN 5480, NG107, 125



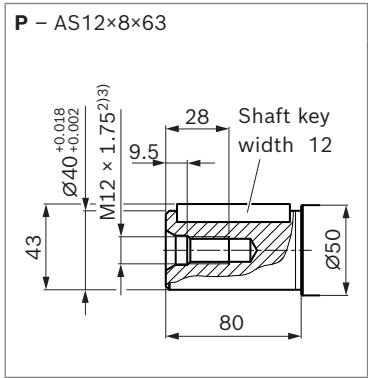
▼ Splined shaft
DIN 5480, NG107



▼ Parallel keyed shaft,
DIN 6885, NG107, 125



▼ Parallel keyed shaft,
DIN 6885, NG107



Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 21)			450	
T ₁	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M18 × 1.5; 12 deep	3	O ⁵⁾

1) To shaft collar
2) Center bore according to DIN 332 (thread according to DIN 13)
3) For maximum tightening torques, see instruction manual.
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 27).
6) The countersink may be deeper than specified in the standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ Location of working line ports on port plates

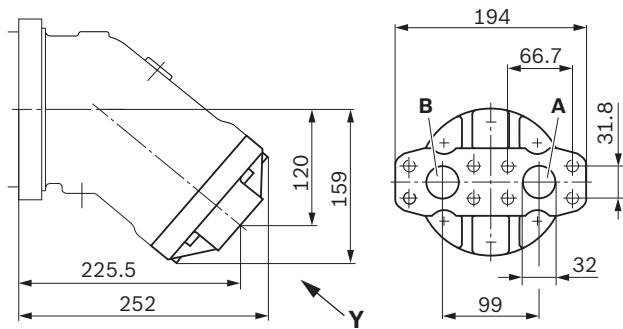
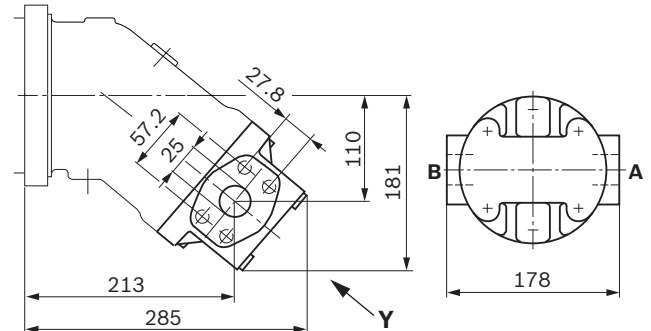
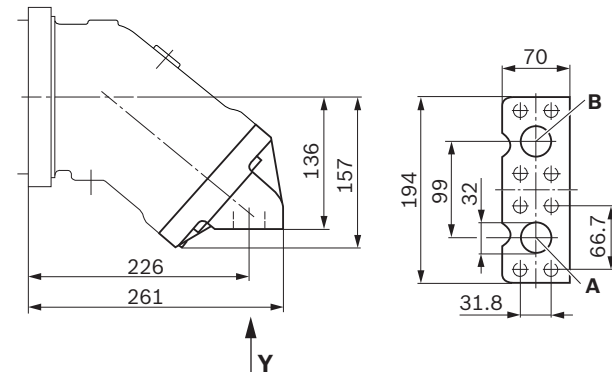
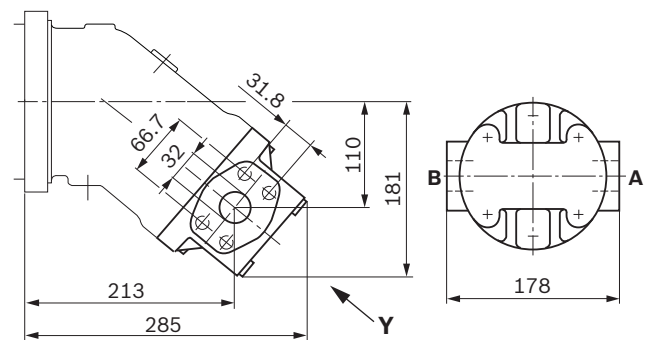
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite (NG107)**100** – SAE flange connections **A** and **B** below (same side)**020** – SAE flange connections **A** and **B** on side, opposite (NG125)

Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁴⁾
010, 100	A, B	Working port	SAE J518 ³⁾	1 1/4 in	450	O
		Fastening thread A/B	DIN 13	M14 × 2; 19 deep		
020 (NG107)	A, B	Working port	SAE J518 ³⁾	1 in	450	O
		Fastening thread A/B	DIN 13	M12 × 1.75; 17 deep		
020 (NG125)	A, B	Working port	SAE J518 ³⁾	1 1/4 in	450	O
		Fastening thread A/B	DIN 13	M14 × 2; 19 deep		

Port plate **178** and **188** see page 26.

¹⁾ For maximum tightening torques, see instruction manual.

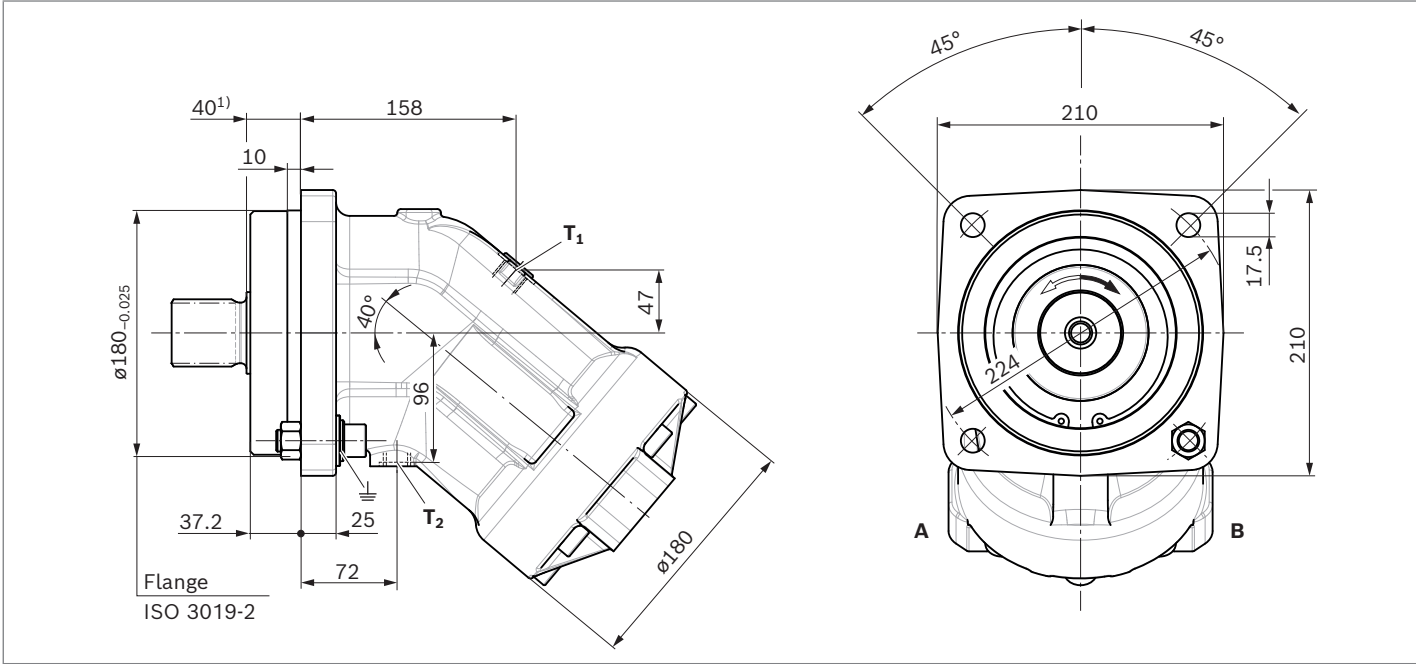
²⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

³⁾ Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

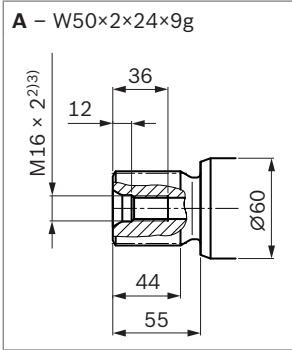
⁴⁾ O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

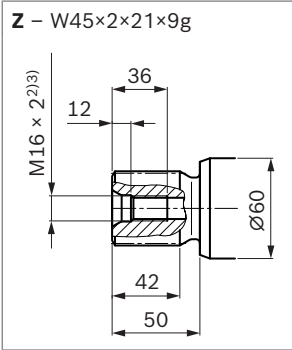
Dimensions, sizes 160, 180



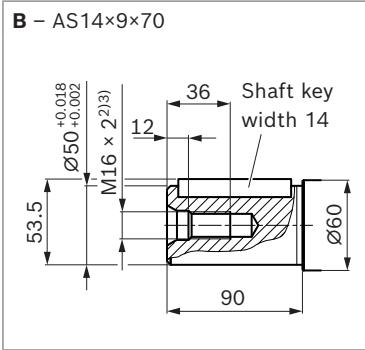
Splined shaft
DIN 5480, NG160, 180



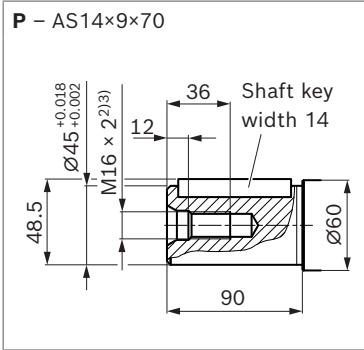
Splined shaft
DIN 5480, NG160



Parallel keyed shaft,
DIN 6885, NG160, 180



Parallel keyed shaft,
DIN 6885, NG160



Ports		Standard	Size ³⁾	$p_{\max}$ [bar] ⁴⁾	State ⁷⁾
A, B	Working port (see port plates, page 23)			450	
T ₁	Drain port	DIN 3852 ⁶⁾	M22 × 1.5; 14 deep	3	X ⁵⁾
T ₂	Drain port	DIN 3852 ⁶⁾	M22 × 1.5; 14 deep	3	O ⁵⁾

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) For maximum tightening torques, see instruction manual.

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 27).

6) The countersink may be deeper than specified in the standard.

7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ Location of working line ports on port plates

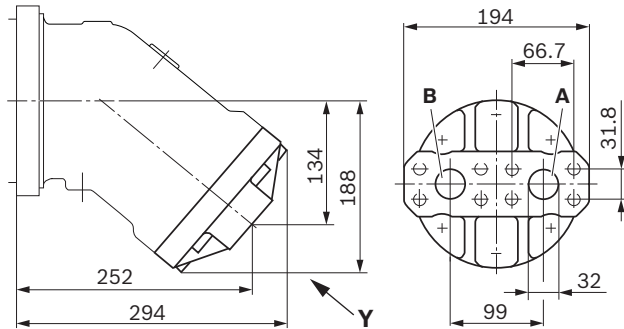
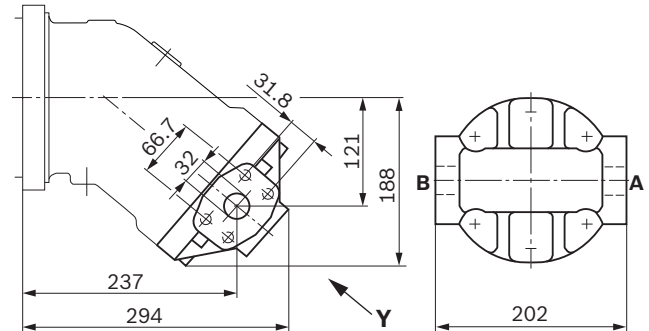
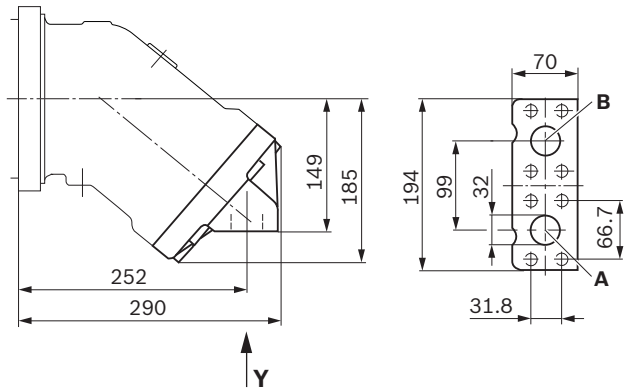
010 – SAE flange connections **A** and **B** at rear**020** – SAE flange connections **A** and **B** on side, opposite**100** – SAE flange connections **A** and **B** below (same side)

Plate	Ports		Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁶⁾
010, 020, 100	A, B	Working port	SAE J518 ³⁾	1 1/4 in	450	O
		Fastening thread A/B	DIN 13	M14 × 2; 19 deep		

Port plate **188** see page 26.

1) For maximum tightening torques, see instruction manual.

2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

4) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Counterbalance valve BVD

Function

Counterbalance valves for travel drives and winches should reduce the danger of overspeed and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking, when going downhill or during the load-lowering process, the motor speed is greater than it should be for the given inlet flow and thus the supply pressure falls sharply.

If the supply pressure falls below the value specified for the relevant counterbalance valve, the counterbalance spool moves into the closed position. The cross section of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor is again as it should be for the given inlet flow.

Notice

- ▶ BVD available in sizes 28 to 180,
- ▶ The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
Order example: A2FM90/61W-AAB188J-S + BVD20W27L/41B-V01K00D0800S00
- ▶ The counterbalance valve does not replace the mechanical service brake and holding brake.
- ▶ Counterbalance valves must be optimized during prototype commissioning to prevent unacceptable operating conditions, and compliance with the specification must be verified.
- ▶ Observe the detailed notes on the BVD counterbalance valve contained in data sheet 95522
- ▶ For the design of the brake release valve, we must know the following data for the mechanical holding brake:
 - the cracking pressure
 - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
 - the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

Permissible inlet flow or pressure when using pressure relief valves and BVD

Motor NG	Without valve		Limited values when using pressure relief valves and BVD								
	p_{nom}/p_{max} [bar]	q_V [l/min]	PRV ¹⁾			BVD ²⁾					
			NG	p_{nom}/p_{max} [bar]	q_V [l/min]	NG	p_{nom}/p_{max} [bar]	q_V [l/min]	Code		
28	400/450	176	16	350/420	100	20	350/420	100	188		
32		201									
45		255									
56		280	22		240			220			
63		315									
80		360									
90		405									
107		427									178
125		500									
107		427	32		400	25		320	188		
125		500									
160		577									
180		648									

1) Pressure relief valve

2) Counterbalance valve, double-acting

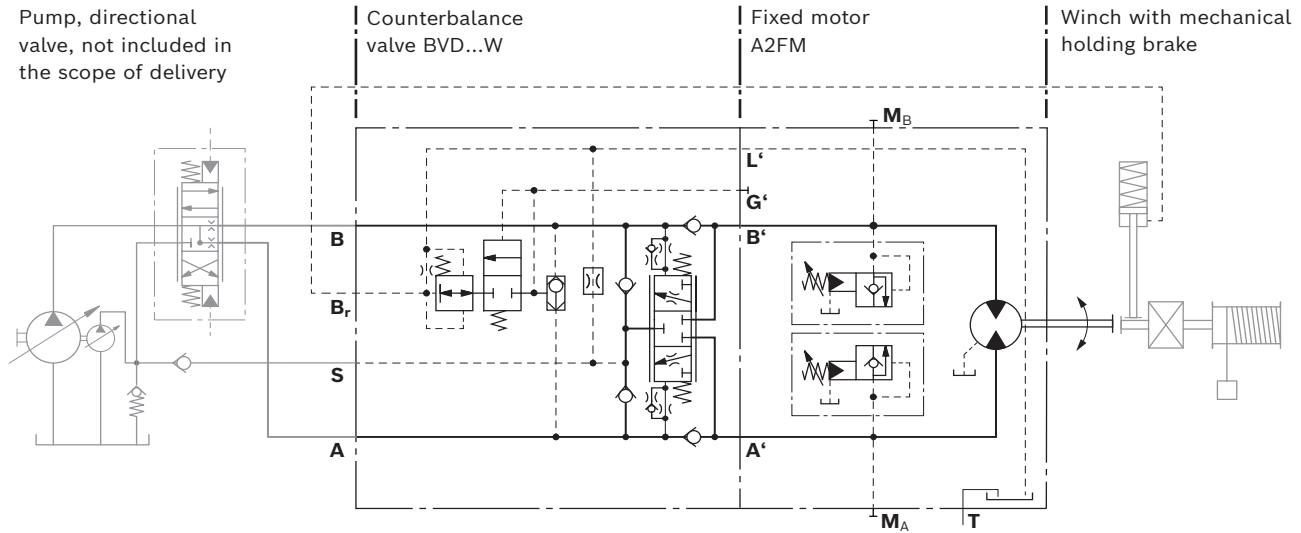
Counterbalance valve for winches and track drive BVD...W

Application option

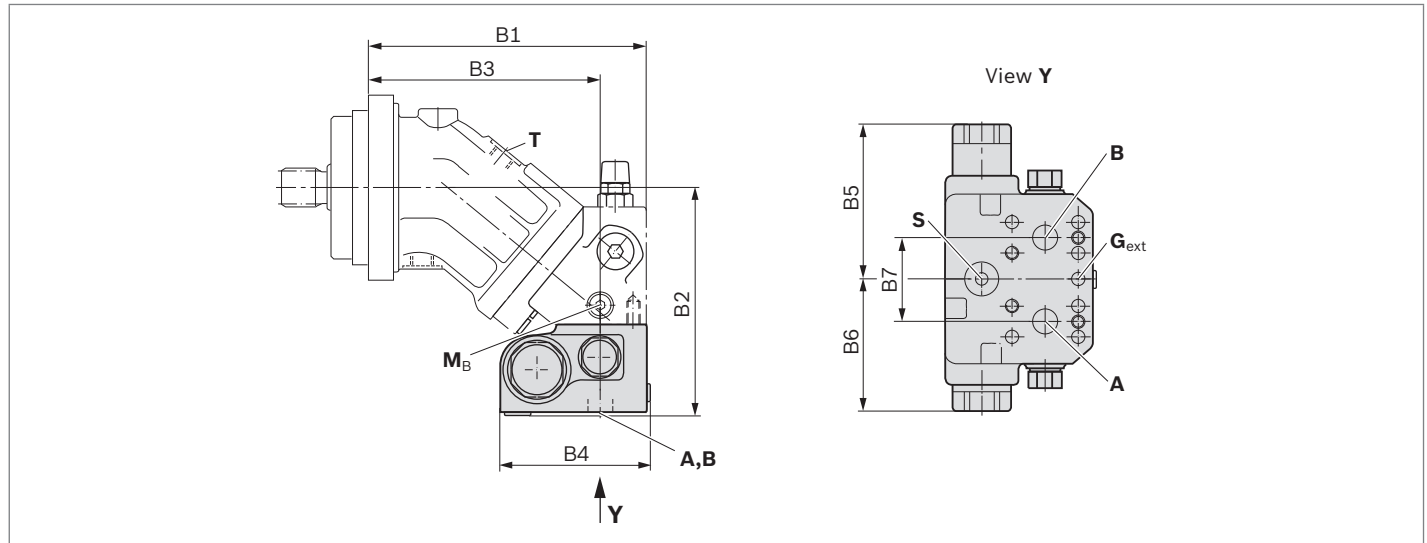
- Winch drives in cranes
- Track drive in excavators

▼ Application example for winch counterbalance valve BVD...W in cranes

Pump, directional valve, not included in the scope of delivery



Dimensions



A2FM NG	Counterbalance valve		Dimensions							
	Type	Ports A, B	B1	B2	B3	B4 (S)	B4 (L)	B5	B6	B7
28, 32	BVD20..16	3/4 in	209	175	174	142	147	139	98	66
45	BVD20..16	3/4 in	222	196	187	142	147	139	98	66
56, 63	BVD20..17	3/4 in	250	197	208	142	147	139	98	75
80, 90	BVD20..27	1 in	271	207	229	142	147	139	98	75
107, 125	BVD20..28	1 in	298	238	251	142	147	139	98	84
107, 125	BVD25..38	1 1/4 in	298	239	251	158	163	175	120.5	84
160, 180	BVD25..38	1 1/4 in	332	260	285	158	163	175	120.5	84

Ports	Version	Standard	Size ¹⁾	$p_{\max}$ [bar] ²⁾	State ⁴⁾
A, B	Working line	SAE J518	See table above	420	O
S	Boost pressure supply	BVD20	DIN 3852 ³⁾	M22 × 1.5; 14 deep	30
		BVD25	DIN 3852 ³⁾	M27 × 2; 16 deep	30
Br	Brake release, reduced high pressure	L	DIN 3852 ³⁾	M12 × 1.5; 12.5 deep	30
G _{ext}	Brake release, high pressure	S	DIN 3852 ³⁾	M12 × 1.5; 12.5 deep	420
M _A , M _B	Pressure measurement A and B		ISO 6149 ³⁾	M12 × 1.5; 12 deep	420

Mounting the counterbalance valve

When delivered, the counterbalance valve is fastened to the motor with two tacking screws (transport lock). The tacking screws may not be removed while mounting the working lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be fastened to the motor port plate using the provided tacking screws.

The counterbalance valve is finally mounted to the motor by fitting the SAE flange.

The screws to be used and the instructions for mounting can be found in the instruction manual.

¹⁾ For notices on tightening torques, see the instruction manual.

²⁾ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

³⁾ The countersink may be deeper than specified in the standard.

⁴⁾ O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

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 may empty via the hydraulic lines. The leakage in the housing area must be directed to the reservoir via the highest drain port (T₁, T₂). If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain lines must be laid if necessary. To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts). Under all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Notice
Port **F** is part of the external piping and must be provided on the customer side to simplify the filling and air bleeding.

Key	
F	Filling / air bleeding
R	Air bleed (special version)
U	Bearing flushing / air bleed port
T₁, T₂	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

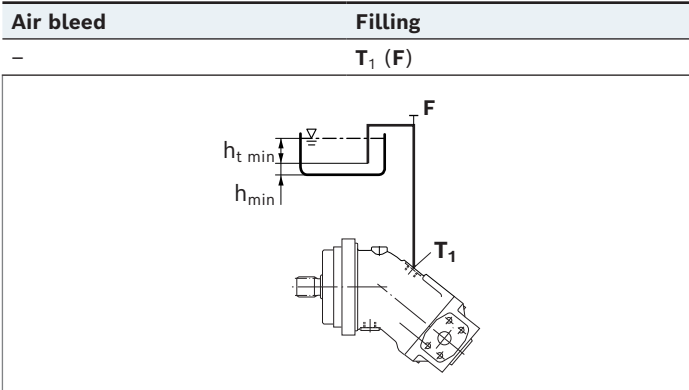
Installation position

See the following examples 1 to 6.
Further installation positions are available upon request.
Recommended installation position: 1 and 2

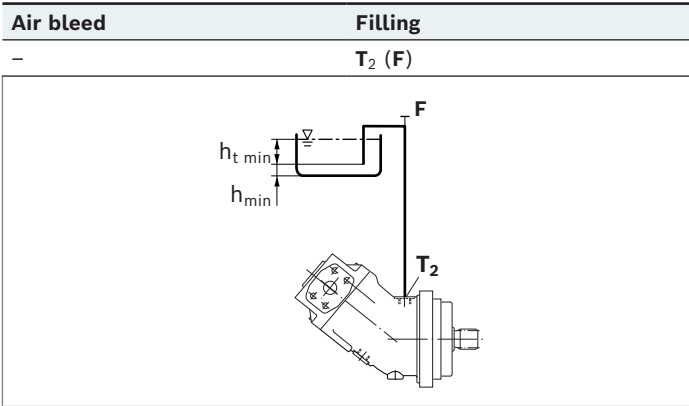
Below-reservoir installation (standard)

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

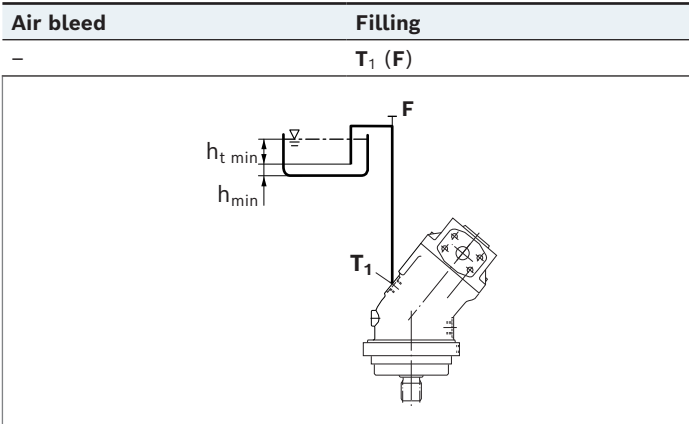
▼ Installation position 1



▼ Installation position2



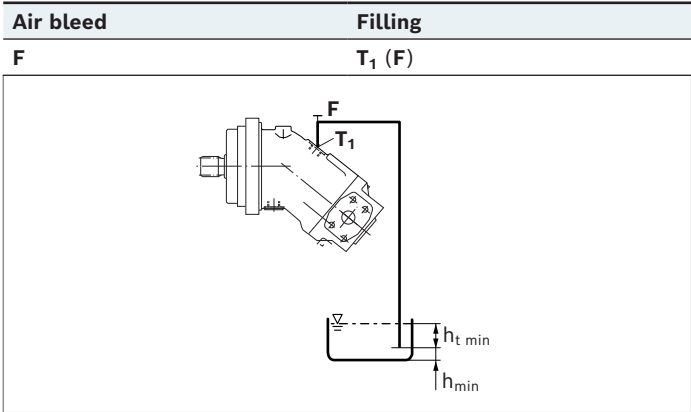
▼ Installation position3



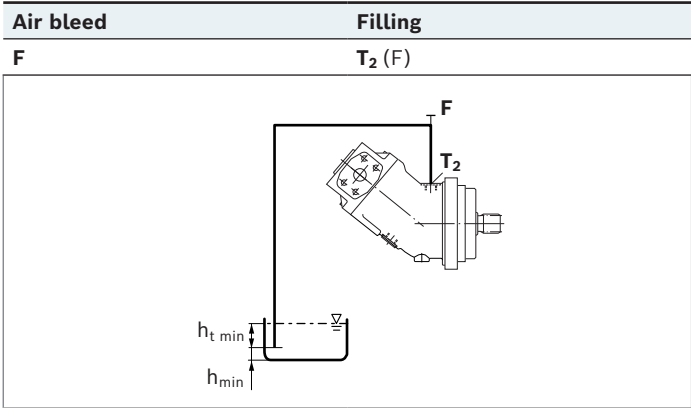
Above-reservoir installation

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

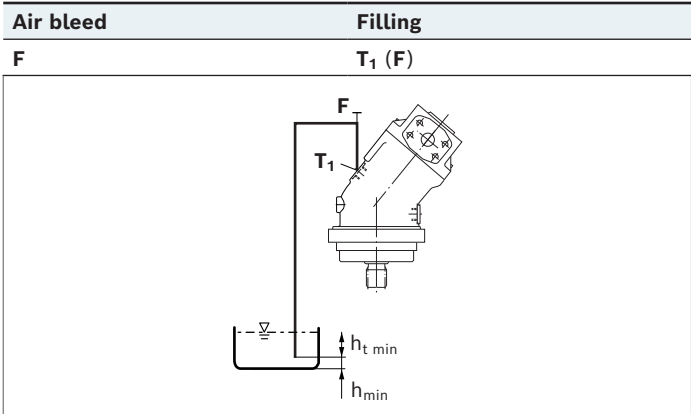
▼ **Installation position 4**



▼ **Installation position 5**



▼ **Installation position 6**



Project planning notes

- ▶ The motor A2FM is designed to be used in open and closed circuits.
- ▶ The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ Before finalizing your design, please request a binding installation drawing.
- ▶ The specified data and notes contained herein must be observed.
- ▶ Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply for optimal storage conditions, which can be found in data sheet 90312 or in the instruction manual.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- ▶ Be sure to add a pressure relief valve to the hydraulic system.
- ▶ Please note that a hydraulic system is an oscillating system. This can lead, for example, to the excitation of the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- ▶ Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- ▶ The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. 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 ports and function ports are only intended to accommodate hydraulic lines.

- ▶ Please note that the series control of motors and the operation under summation pressure affect the efficiency of the units.

Safety instructions

- ▶ During and shortly after operation, there is a risk of getting burnt on the axial piston unit. Take the appropriate safety measures (e.g. by wearing protective clothing).
- ▶ Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g., safe stop) and ensure any measures are properly implemented.
- ▶ Moving parts in high-pressure relief valves may in certain circumstances become stuck in an undefined position due to contamination (e.g. impure hydraulic fluid). This can result in restriction or loss of load-holding functions in lifting winches. The machine/system manufacturer must check whether additional measures are required on the machine for the relevant application in order to keep the load in a safe position and ensure they are properly implemented.

Bosch Rexroth AG

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www.boschrexroth.com

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EU-Konformitätserklärung - Original

EC declaration of conformity

Dok.-Nr. / Doc. No.: RB00840233

Datum / Date: 16.02.2023

- ☐ nach Maschinenrichtlinie 2006/42/EG / in accordance with Machinery Directive 2006/42/EC
- ☐ nach Niederspannungsrichtlinie 2014/35/EU / in accordance with Low Voltage Directive 2014/35/EU
- ☐ nach EMV-Richtlinie 2014/30/EU / in accordance with EMC Directive 2014/30/EU
- ☐ nach Druckgeräte-Richtlinie 2014/68/EU / in accordance with Pressure Equipment Directive 2014/68/EU
- ☒ nach ATEX-Richtlinie 2014/34/EU / in accordance with ATEX Directive 2014/34/EU
- ☐ nach RoHS-Richtlinie 2011/65/EU / in accordance with RoHS Directive 2011/65/EU

Hiermit erklärt der Hersteller, / The manufacturer

Bosch Rexroth AG, Glockeraustraße 2, 89275, Elchingen,

dass das nachstehende Produkt / hereby declares that the product below

Bezeichnung / Name: **Axialkolben-Konstantmotor für explosionsgefährdete Bereiche**
 Typ / Type: **A2FM.../61...** Kennzeichnung / Identification: **II 2G Ex h IIB T4-T1 Gb X**
 Typ / Type: **A2FM.../61...** Kennzeichnung / Identification: **II 3G Ex h IIB T4-T1 Gc X**

in Übereinstimmung mit oben genannte(n) Richtlinie(n) entwickelt, konstruiert und gefertigt wurde. / was developed, designed and manufactured in compliance with the above-mentioned directive(s).

Die alleinige Verantwortung für die Ausstellung dieser EU-Konformitätserklärung trägt der Hersteller. / This EC declaration of conformity is issued under the sole responsibility of the manufacturer.

Angewandte harmonisierte Normen / Harmonized Standards applied:

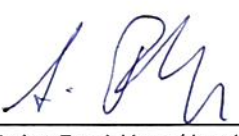
Norm / Standard	Titel / Name	Ausgabe / Issue
DIN EN ISO 80079-36	Explosionsfähige Atmosphären - Teil 36: Nicht-elektrische Geräte für den Einsatz in explosionsfähigen Atmosphären - Grundlagen und Anforderungen (ISO 80079-36:2016) Deutsche Fassung EN ISO 80079-36:2016	2016-12
DIN EN ISO 80079-37	Explosionsfähige Atmosphären - Teil 37: Nicht-elektrische Geräte für den Einsatz in explosionsfähigen Atmosphären - Schutz durch konstruktive Sicherheit "c", Zündquellenüberwachung "b", Flüssigkeitskapselung "k" (ISO 80079-37:2016): Deutsche Fassung EN ISO 80079-37:2016	2016-12

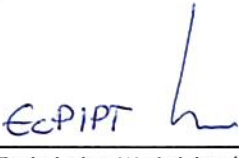
Weitere Erläuterungen / Further explanations:

Die Montage- und Installationshinweise gemäß Produktdokumentation RD 91001-01-X-B0 sind zu beachten. / The assembling and installation instructions according to the manual RD 91001-01-X-B0 have to be followed.

Elchingen
Ort / Place

16.02.2023
Datum / Date


Leiter Entwicklung / head of development
Flaig Alexander (DC-MH/NE)


Technischer Werksleiter / Technical head of plant
Übelhör Peter (EcP/PT)

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Your local contact can be found at:

<https://addresses.boschrexroth.com>