USER MANUAL

AXP
AXIAL PISTON PUMP

Rev. A, October 2025

PERFECT BALANCE. ZERO COMPROMISE.

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Foreword

This manual has been prepared in accordance with DIN EN 82079-1, "Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements".

The manual was written and checked at the best experience of Moog.

Moog has written this technical documentation in compliance with the requirements of the Machinery Directive 2006/42/EC.

About Moog

Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including test, simulation, plastics, metal forming, and power generation.

Moog customers include leading automotive manufacturers, aerospace manufacturers, testing labs, and global automotive racing teams.

We help performance-driven companies design and develop their next-generation machines.

Moog's Industrial Group is part of Moog Inc.

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Document Version

The following table shows the version of this document and all other possible versions:

ES	DA	DE	EL	EN	FR	IT	NL	PT	FL	SV	CS	ET	LV	HU	MT	PL	SK	SL	BG	RO	GA
				X																	

The language of documents and drawings are subject to contractual negotiations with the customer.

In case of "Translation of the Original Instructions", the manufacturer of the machinery supplies also the "Original Instructions".

Revision Record

The following table shows the revision record:

Revision	Description	Prepared	Checked	Approved	Date
–	Initial version				June 2025

Reader Instructions

The following tables show the symbols adopted in Moog documents:

⚠ DANGER

DANGER warns about an imminent danger to health and life.
Failure to observe this warning can result in severe injuries or even death.

⚠ WARNING

WARNING warns about a possible situation dangerous to health. Failure to observe this warning can result in severe injuries or even death.

⚠ CAUTION

CAUTION warns about a possible situation dangerous to health. Failure to observe this warning can cause slight injuries.

NOTICE

NOTICE indicates possible property damage.

The following table shows the structure of a warning:

① ⚠ DANGER ②
Moving machine parts! ③ Entrapment hazard! ④ ▶ Do not enter danger zone! ⑤

Legend

1 Warning symbol
2 Signal word
3 Type and source of hazard
4 Possible consequences of not avoiding the potential hazard
5 How to avoid the hazardous situation

The following table shows other typographic elements:

Symbol	Explanation
	Notes about important operations and other useful information
▶	This is an action to be carried out
•	This is a bullet list
Blue text	Identifies a hyperlink within the PDF file or to an external URL

1 General Information

1.1 Information on the user manual

This User Manual refers solely to the Axial Piston Pumps in the AXP series and is an integral part of the product. It describes the intended use and safe application of the product in all phases of operation.

1.1.1 Target Groups

1.1.1.1 Operator

Among other things, the operator must ensure that the trained staff working with the Axial Piston Pump has read the User Manual and its supplemental documentation, and that it is observed accordingly, especially the relative safety and warning instructions.
➪ Chap. "1.4 Responsibilities", Page 6

1.1.1.2 Trained Staff

The trained staff must read the User Manual and its important supplemental documentation and must observe and follow the instructions, especially the respective safety and warning instructions.

1.1.2 Subject to Change and Validity

The information in this User Manual is valid as of the date this version of the User Manual is released. Version number and release date of this User Manual are noted in the footer.
This User Manual is subject to change at any time and such changes may be made without justification.

1.1.3 Completeness

The User Manual is only complete along with the supplemental documentation relevant for each particular application.
➪ Chap. "1.2 Supplemental Documentation", Page 4

1.1.4 Storage Location

This User Manual and any and all relevant supplemental documentation for each respective application must always be kept safely in an easily accessible location and be available at all times in the vicinity of the Axial Piston Pump or close to the higher-level machinery with which the pump is associated.

1.2 Supplemental Documentation

	The supplemental documentation listed here is an integral part of the scope of delivery.

Table 1: Supplemental Documentation

Supplemental documentation	Description
AXP catalog	Provides ordering information, technical data and additional information relating to the AXP Axial Piston Pump
Mounting and start up instructions for RKP and AXP, CA57130	Quick reference guide for the AXP Axial Piston Pump, technical data (included in the scope of delivery)

1.3 Environmental Protection

1.3.1 Emissions

If operated properly according to instructions, no dangerous emissions will normally emanate from the Axial Piston Pump.

1.3.2 Disposal

When disposing of the Axial Piston Pump, its spare parts or accessories, superfluous packaging material, hydraulic fluid or additives and substances needed for cleaning purposes, the respective country-specific waste disposal regulations as amended must be observed!

In some cases, the items to be disposed of must be disassembled professionally and be separated according to their materials and then be disposed of in the respective waste stream or recycling location accordingly.

Incorporated in the Axial Piston Pump are, among other things, the following substances or materials:

- Adhesive
- Parts with galvanized surfaces
- Hydraulic fluid
- Various metals and plastics

1.4 Responsibilities

The manufacturer and the operator of the machinery are both responsible for ensuring that the planning and execution of the work performed with and to the Axial Piston Pump as well as all interactions with the Axial Piston Pump are carried out in accordance with the instructions given in this User Manual and in the relevant supplemental documentation for each respective application.

The manufacturer and the operator of the machinery are responsible in particular for the following:

- Staff selection and training
  ➪ Chap. "2.2.2 Staff Selection and Qualification", Page 10
- Intended use
  ➪ Chap. "2.1 Intended Use", Page 9
- Safe operation
  ➪ Chap. "2.2.1 Safe Operation", Page 10
- Taking the required work safety measures for the respective application and monitoring their implementation
  ➪ Chap. "2.2.4 Work Safety", Page 11
- Observing the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Observing the relevant national and international regulations as well as the applicable standards and directives (e. g. EU Machinery Directive and the regulations by the Employer's Liability Association, TÜV or VDE) as amended in their current version when designing, assembling, and operating the machinery with all the installed components
- Installing an suitable safety system for limiting the pressure in the hydraulic connections
  ➪ Chap. "2.3.2.1 Safety Devices for Limiting Pressure", Page 12
- Using only an Axial Piston Pump that is in a technically flawless condition and safe for operation
- Preventing unauthorized or unprofessional structural modifications, repairs, and maintenance work to be carried out
  ➪ Chap. "2.2.3 Structural Modifications", Page 11
  ➪ Chap. "10 Spare Parts, Accessories, Repairs", Page 47
- Defining and adhering to application specific inspection and servicing instructions
- Adhering to all technical data during storage, transport, assembly, disassembly, connecting, start-up, configuring, operating, cleaning, repairing or performing any troubleshooting, especially the ambient conditions as well as to the data of the hydraulic fluid in use
- Proper storage, transport, assembly, disassembly, connection, start-up, configuration, operation, cleaning, repairing, performing any troubleshooting or disposal
- Providing ready access to this Manual and its storage location as well as the relevant supplemental documentation for each respective application.
  ➪ Chap. "1.1.4 Storage Location", Page 4
- This User Manual and the relevant supplemental documentation for each respective application are to be added to the User Manual of the machinery.

1.5 Warranty and Liability

In principle, our general terms and conditions for delivery and payment apply. These shall be made available to the buyer no later than the time at which the sales contract is concluded.

Among other things, warranty and liability claims for personal injury and damage to property are excluded if they are caused by one or more of the following:

- Work performed with and to the Axial Piston Pump or handling the Axial Piston Pump by users not qualified for the job
  ➪ Chap. "2.2.2 Staff Selection and Qualification", Page 10
- Improper use
  ➪ Chap. "2.1 Intended Use", Page 9
- Unsafe operation
  ➪ Chap. "2.2.1 Safe Operation", Page 10
- Failing to take the required work safety measures for the respective application
  ➪ Chap. "2.2.4 Work Safety", Page 11
- Not adhering to the instructions in this User Manual or to the relevant supplemental documentation relevant for the respective application
- Non-observance of the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Non-observance of the relevant national and international regulations as well as the applicable standards and directives (e. g. EU Machinery Directive and the regulations by the Employer's Liability Association, TÜV or VDE) as amended in their current version when designing, assembling, and operating the machinery with all the installed components
- Lack of a suitable safety device for pressure limitation in the hydraulic connections
  ➪ Chap. "2.3.2.1 Safety Devices for Limiting Pressure", Page 12
- Using the Axial Piston Pump that is not in a technically flawless condition or are not safe for operation
- Unauthorized or unprofessional design modifications, repairs, or maintenance work
  ➪ Chap. "2.2.3 Structural Modifications", Page 11
  ➪ Chap. "8 Maintenance and Repairs", Page 42
- Not adhering to the inspection and maintenance instructions from the manufacturer and the operator of the machinery
- Not adhering to all technical data during storage, transport, assembly, disassembly, connecting, start-up, configuring, operating, cleaning, repairing or troubleshooting, especially to the ambient conditions as well as to the data of the hydraulic fluid in use
  ➪ Chap. "4 Technical Data", Page 19
- Improper storage, transport, assembly, disassembly, connection, start-up, configuration, operation, cleaning, repairing, troubleshooting or disposal
- Use of unsuitable or defective accessories or rather unsuitable or defective spare parts
  ➪ Chap. "10 Spare Parts, Accessories, Repairs", Page 47
- Catastrophes caused by foreign objects or force majeure

1.6 Trademarks

Moog™ and Moog Authentic Repair Service™ are registered trademarks of Moog Inc. and its subsidiaries.

	All product and company names listed in the User Manual may be protected trademarks of their respective manufacturer, the use of which by third parties for their own purposes may be in violation of the manufacturer's rights. A missing ® or ™ symbol must not be interpreted to mean that the name is a brand name that can be used without restriction.

2 Safety

2.1 Intended Use

The AXP Axial Piston Pump is a work machine used to produce hydraulic displacement.

Usage Environment:
The Axial Piston Pump is designed to control and regulate pressures and displacements in commercial applications.

Obvious Misuse:
Operating the unit outside the specified application and environmental conditions in respect of:

- Operating pressure
- Temperature
- Speed and direction of rotation
- Operating ambient pressure
- Shock/vibration
- Resistance to electromagnetic interference
- Operating fluids (viscosity, cleanliness class, chemical ingredients)
- Protection class
- Operation in explosion hazardous areas, if not permitted for such use

The following applies in respect of higher-level machinery/equipment:

- The Axial Piston Pump must only be operated as a component of a complete superordinate system, e.g. in a machine.
- The Axial Piston Pump is designed to be used with the specified operating fluids. Use with any other operating fluids requires our express approval.
- The efficient, reliable, and safe operation of the Axial Piston Pump demands high-quality project planning as well as appropriate application, transport, storage, mounting, demounting, electrical, and hydraulic connections, start-up, configuration, operation, cleaning and servicing.

The Axial Piston Pump must not be put into operation until the following has been assured:

- The higher-level machine/equipment and all its installed components adhere to the relevant national and international regulations as well as the applicable standards and directives (e.g. the EU Machinery Directive and the applicable regulations of the Employer's Liability Insurance Association, TÜV or VDE) as amended in their current version.
- The Axial Piston Pump and all other installed components are in a technically and operationally safe condition.

The following also applies in respect of "Intended Use":

- Observance of this User Manual
- Safe handling of the Axial Piston Pump
  ⇨ Chap. "2.2.1 Safe Operation", Page 10
- Adhering to the inspection and maintenance instructions from the manufacturer and the operator of the machinery
- Following all the supplemental documentation relating to the application
- Observing the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Observing the relevant national and international regulations, as well as the applicable standards and directives (e.g. the EU Machinery Directive and the applicable regulations of the Employer's Liability Insurance Association, TÜV or VDE) as amended

2.2 Organizational Measures

2.2.1 Safe Operation

⚠ CAUTION

Danger of personal injury and damage to property due to unexpected operation!
As in any control system, the failure of certain components in Axial Piston Pumps as well might lead to an uncontrolled and/or unpredictable operational sequence.

- If automatic control technology is to be used, the user should, in addition to all the potentially available standards or guidelines on safety-engineering installations, consult the manufacturers of the components used in great depth.

	It is the responsibility of the manufacturer and the operator of the machine/equipment to ensure the safe operation of the Axial Piston Pump.

The basic requirement for safe handling and trouble free operation of the Axial Piston Pump involves observing the following:

- All safety instructions and user manuals
- All safety instructions contained in the supplemental documentation relating to the application in question
- All safety instructions pertaining to the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- All relevant national and international safety and accident prevention regulations, standards, and directives, such as the safety instructions of the Employer's Liability Insurance Association, TÜV or VDE, in particular the following standards for the safe operation of machinery:
  - EN ISO 12100
  - EN ISO 4413

Following the safety instructions and the safety and accident prevention regulations, standards, and directives helps to prevent accidents, machine failure and property damage!

2.2.2 Staff Selection and Qualification

⚠ WARNING

Incorrect handling of the Axial Piston Pump!
May result in severe personal injury and property damage.

- Any and all work on the Axial Piston Pump may only be performed by qualified and authorized users.

Qualified users are skilled professionals who have been trained to carry out these tasks and who have the required knowledge and experience. In particular, such skilled professionals must be licensed to operate, ground and label machines, systems and electric circuits in accordance with applicable safety standards. Project planners must be familiar with the safety concepts associated with automation technology.

2.2.3 Structural Modifications

To prevent damage to the Axial Piston Pump or any of its accessories, structural modifications to the equipment may only be performed by us or by an authorized service center.
➪ Chap. "8.3 Moog Service Addresses", Page 44

Warranty and liability claims for personal injury or property damage are excluded if they are the result of unauthorized or improperly carried out structural modifications or tampering with the equipment in any way.
➪ Chap. "1.5 Warranty and Liability", Page 7

2.2.4 Work Safety

⚠ WARNING

Risk of poisoning and injury!
Contact with hydraulic fluids can damage your health (e.g. eye injuries, skin and tissue damage, poisoning in case of inhaling).
- Always wear safety gloves and safety glasses.
- Consult immediately a relevant medical professional if hydraulic fluid splashes in the eyes or if it penetrates the skin.
- Always observe the safety instructions of the manufacturer when handling hydraulic fluids.

⚠ CAUTION

Danger of injury due to falling objects!
Falling tools or accessories can cause personal injury.
- Wear suitable safety equipment, e.g. safety shoes.

⚠ CAUTION

Risk of burns!
The Axial Piston Pump and the hydraulic connection lines can get very hot during operation and may burn your skin if you touch them.
- Wear suitable safety equipment such as work gloves.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

⚠ CAUTION

Damage to hearing!
Operating the machinery may expose its operators to loud noise, which can lead to hearing damage.
- The operator/manufacturer must take suitable measures to protect against noise, e.g. stipulating that ear protection is worn.

⚠ CAUTION

Hazardous operating fluids!
When working with hazardous operating fluids, any skin contact or inhalation may cause personal injury.
▶ Wear suitable safety equipment such as work gloves.

2.3 General Safety Instructions

- Any and all work on the Axial Piston Pump may only be performed by qualified and authorized users.
  ⇨ Chap. "2.2.2 Staff Selection and Qualification", Page 10
- The technical data and especially the information shown on the nameplate of the Axial Piston Pump must be observed and adhered to at all times.
  ⇨ Chap. "4 Technical Data", Page 19

2.3.1 Specific Phases of Operation

2.3.1.1 Mounting

- During mounting, ensure that all connections, plugs and sockets are tightly sealed to prevent the ingress of substances into the Axial Piston Pump.
- The Axial Piston Pump must be completely filled with operating fluid.
- Before mounting, the Axial Piston Pump must have adapted to room temperature and must not contain any condensation.

2.3.1.2 Start Up

- All hydraulic and electric connections must be in use or closed off.
- Never start up the Axial Piston Pump until all installation steps have been completed.

2.3.1.3 Maintenance and Repair

- Maintenance and repair work as well as servicing work is to be carried out according to schedule and regularly at the specified times.
- Secure the machine/equipment to prevent it from being started up during maintenance and repair.
- Ensure that the machine/equipment is depressurized before commencing any maintenance work.

2.3.2 Operating Hydraulic Equipment

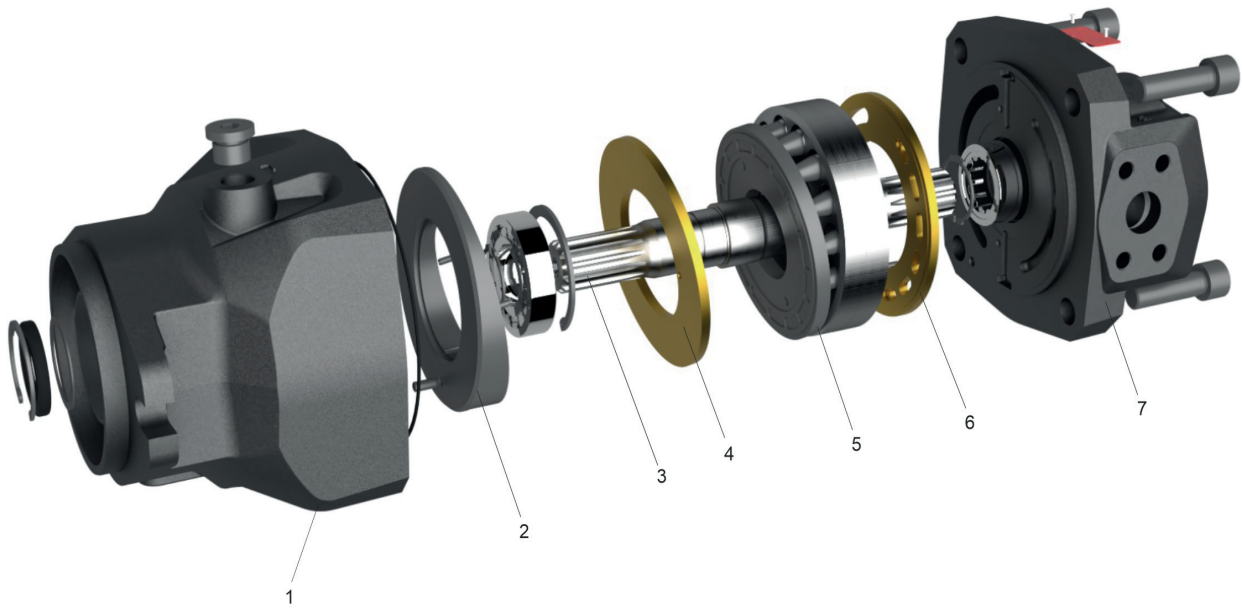
2.3.2.1 Safety Devices for Limiting Pressure

⚠ DANGER

Excess pressure may cause personal injury and property damage!
Excess pressure in the machine/equipment may damage parts of the machine/system and as a result cause severe personal injury.
▶ To limit the machine/system to the maximum permissible operating pressure, a pressure limitation valve or a comparable safety device must be installed directly at the pump output.

3 Product Description

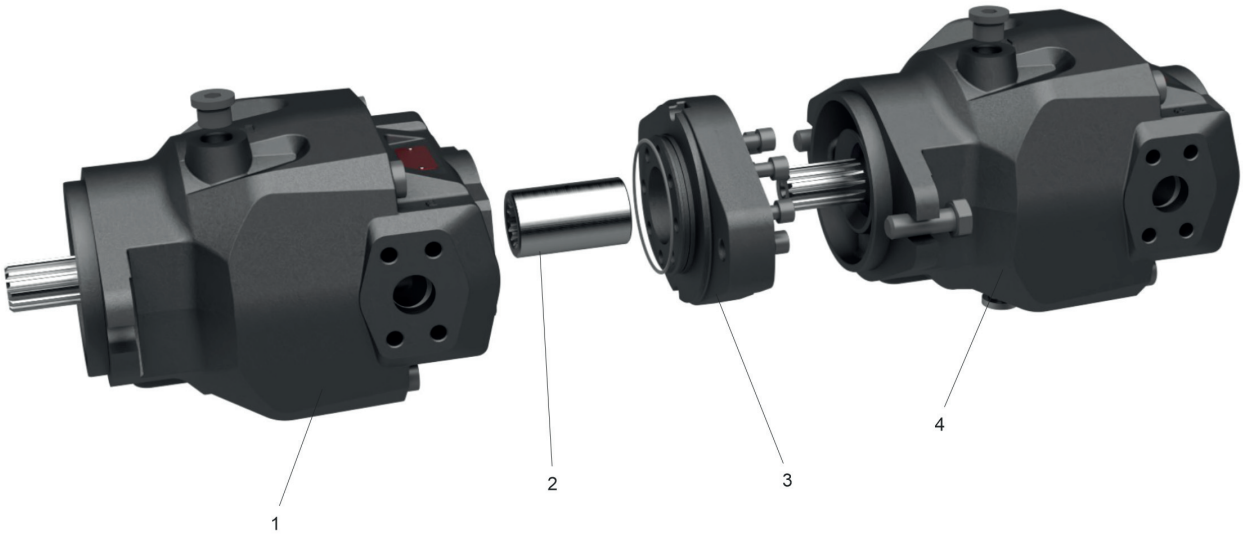
3.1 Single Pump Design



Item	Description
1	Pump housing
2	Swash plate
3	Drive shaft
4	Bearing plate
5	Rotary group
6	Valve plate
7	Rear flange

Fig. 1: Single pump design

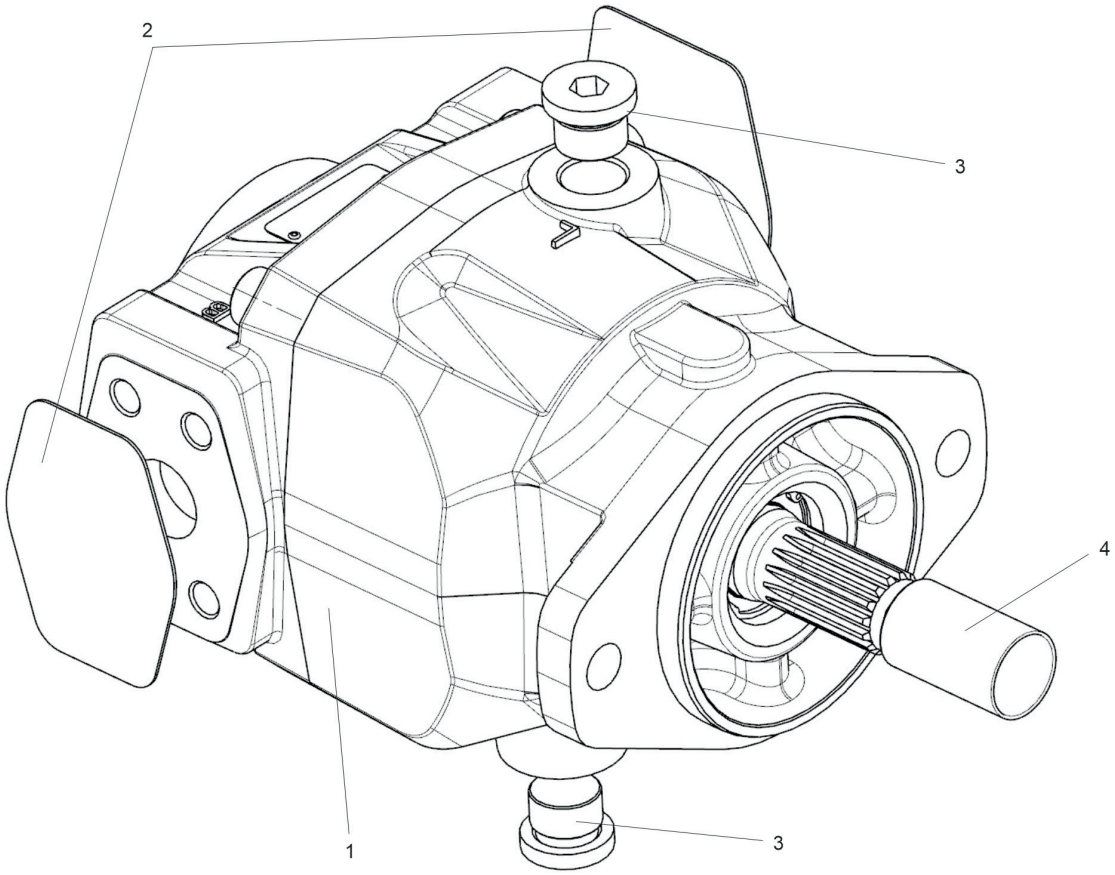
3.2 Double Pump Design



Item	Description
1	Pump stage 1
2	Through drive hub
3	Adapter flange
4	Pump stage 2

Fig. 2: Double pump design

3.3 Single Pump Scope of Delivery



Item	Description
1	Axial Piston Pump AXP
2	Flange covers
3	Cap or sealing plug
4	Transport protection for shaft ends

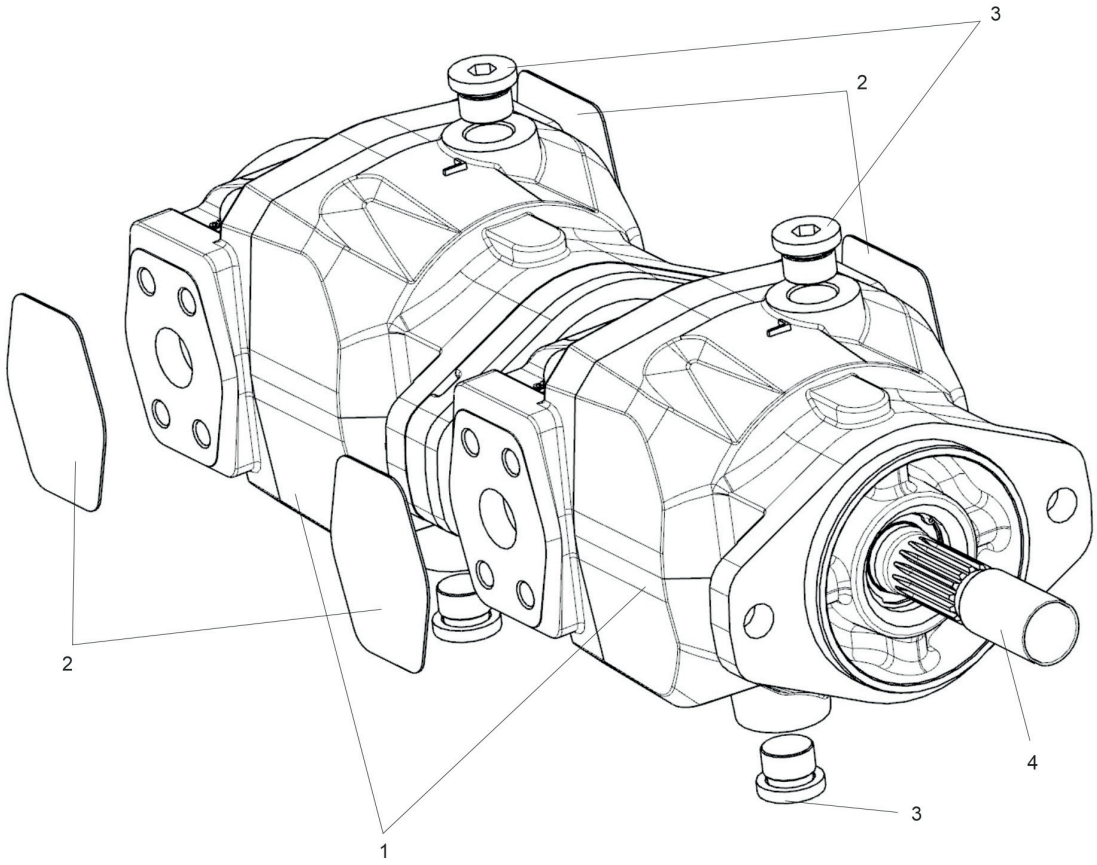
Fig. 3: Single pump scope of delivery

	When pump stages are delivered, the through drive is closed with a sealing cap. The sealing caps are not suitable for operational purposes.

Included in the scope of delivery:

- Axial Piston Pump AXP with flange covers, sealing cap, sealing plug, and transport protection for the shaft ends, preserved
- Mounting and Installation Notes

3.4 Double Pump Scope of Delivery



Item	Description
1	Axial Piston Pump AXP
2	Flange covers
3	Cap or sealing plug
4	Transport protection for shaft ends

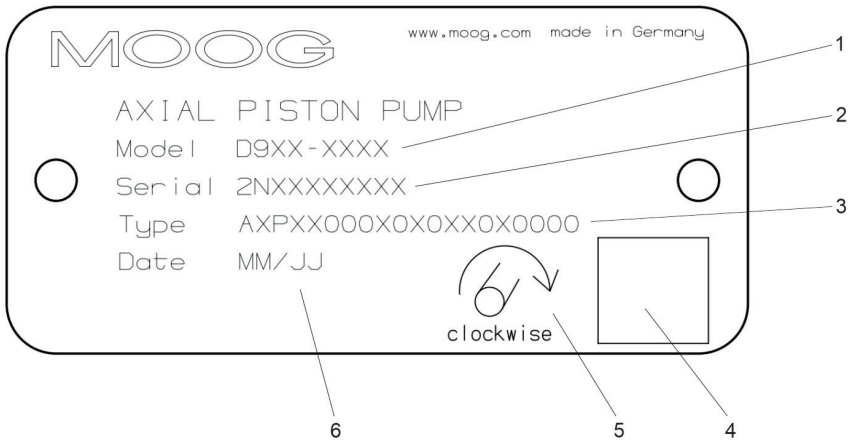
Fig. 4: Double pump scope of delivery

	When pump stages are delivered, the through drive is closed with a sealing cap. The sealing caps are not suitable for operational purposes.

Included in the scope of delivery:

- Axial Piston Pump AXP with flange covers, sealing cap, sealing plug and transport protection for the shaft ends, preserved
- Mounting and Installation Notes

3.5 Nameplate



Item	Marking	Additional information
1	Model number incl. revision status	
2	Serial number	
3	Type code	⇨ Axial Piston Pump AXP Catalog
4	QR code	⇨ AXP landing page with additional information
5	Rotational direction	
6	Date of manufacture in the format MM/YY	

Fig. 5: Nameplate for Axial Piston Pump AXP

	In the case of multiple pumps, each individual pump has its own nameplate.

Further information such as type code explanation, maximum operating pressure, maximum speed, etc. can be found in the valid AXP catalog.

3.6 Functional Description

The Moog AXP is an axial piston pump. It converts mechanical power (speed and torque) into hydraulic power (hydrostatic displacement and pressure). It is designed for variable speed operation with synchronous and asynchronous motors.

Technical data, operating conditions and operating limits of the axial piston unit are described in the catalog and in the order confirmation.

The Moog AXP is intended for the use in open-circuit systems. It contains an axial piston turbine in swash plate design. In axial piston units in swash plate design, the pump pistons are aligned axially to the **drive shaft**. **Rotary group** and **drive shaft** are connected to each other by a spline.

Drive torque and speed of a drive motor are transmitted from the **drive shaft** of the AXP to the **rotary group** via a spline, which causes the rotary group to rotate. With each rotation the pistons in its bores perform a stroke, which is determined by the angle of inclination of the **swash plate**. The pivoting part of the **rotary group** is held against a **bearing plate** by spring force. During one pump revolution, each piston moves through a lower and an upper reversal point. The hydraulic fluid is supplied and discharged through appropriately arranged suction and pressure kidneys in the **valve plate**. On the suction side, hydraulic fluid flows into the increasing piston chamber; on the opposite high-pressure side, the hydraulic fluid is pressed out of the decreasing cylinder chamber into the hydraulic system.

Open circuit
In an open circuit, the hydraulic fluid is fed from the tank of the axial piston unit and from there to hydraulic consumers such as hydraulic motors and cylinders. From there, the hydraulic fluid flows back to the tank. The direction of movement of the hydraulic cylinder can be controlled, for example, by using a directional control valve.

4 Technical Data

4.1 General Technical Data/Operating Conditions

The general technical data and operating conditions can be found in the AXP catalog.

5 Transport and Storage

	Always wear appropriate personal protective equipment when working on the pump. ⇨ Chap. "2.2.4 Work Safety", Page 11

5.1 Unpacking the Pump

⚠ CAUTION

Individual parts may fall out!
If the original packaging is opened improperly, individual parts may fall out and be damaged or lead to injuries of the staff.
- Place the pump in its original packaging on a stable surface.
- Only open the original packaging from the top.
- Dispose of the packaging material in accordance with locally applicable regulations.

Procedure:

1. Remove original packaging.
2. Inspect product and contents according to the purchase order.
3. Check that the packing slip and delivered product match.
4. In the event of transport damage or defects, inform the manufacturer or the supplier.
5. Store original packaging for later use or dispose of it in accordance with locally applicable regulations.

5.2 Transporting the Pump

⚠ WARNING

Danger of crushing!
The pump may topple over during transport and lead to crushing injuries.
- Select lifting tackle to correspond with the overall weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
- Do not stand under a suspended load.

NOTICE

Damage to the drive shaft!
During transport, impact and blows to the drive shaft may damage the pump.
- Do not bang objects against the drive shaft.
- Do not place or set the pump onto the drive shaft.
- Do not exceed permissible axial and radial forces to the drive shaft.

NOTICE

Damage to the attached parts!
Any heavy weight on the attached parts during transport may result in damage to such.
- Do not attach lifting tackle to the attached parts during transport.
- Make sure that the attached parts do not collide with other objects during transport.

	For multiple pumps, add up the weights of the individual pumps.

Procedure:

1. Determine the weight and dimensions of the pump.
   ⇨ Axial Piston Pump AXP Catalog
   ⇨ Chap. "4 Technical Data", Page 19
2. Attach suitable lifting tackle to the pump:
   - Mount the ring bolts into the attachment flange of the pressure side.
3. Lift the pump carefully and transport it with supervision.

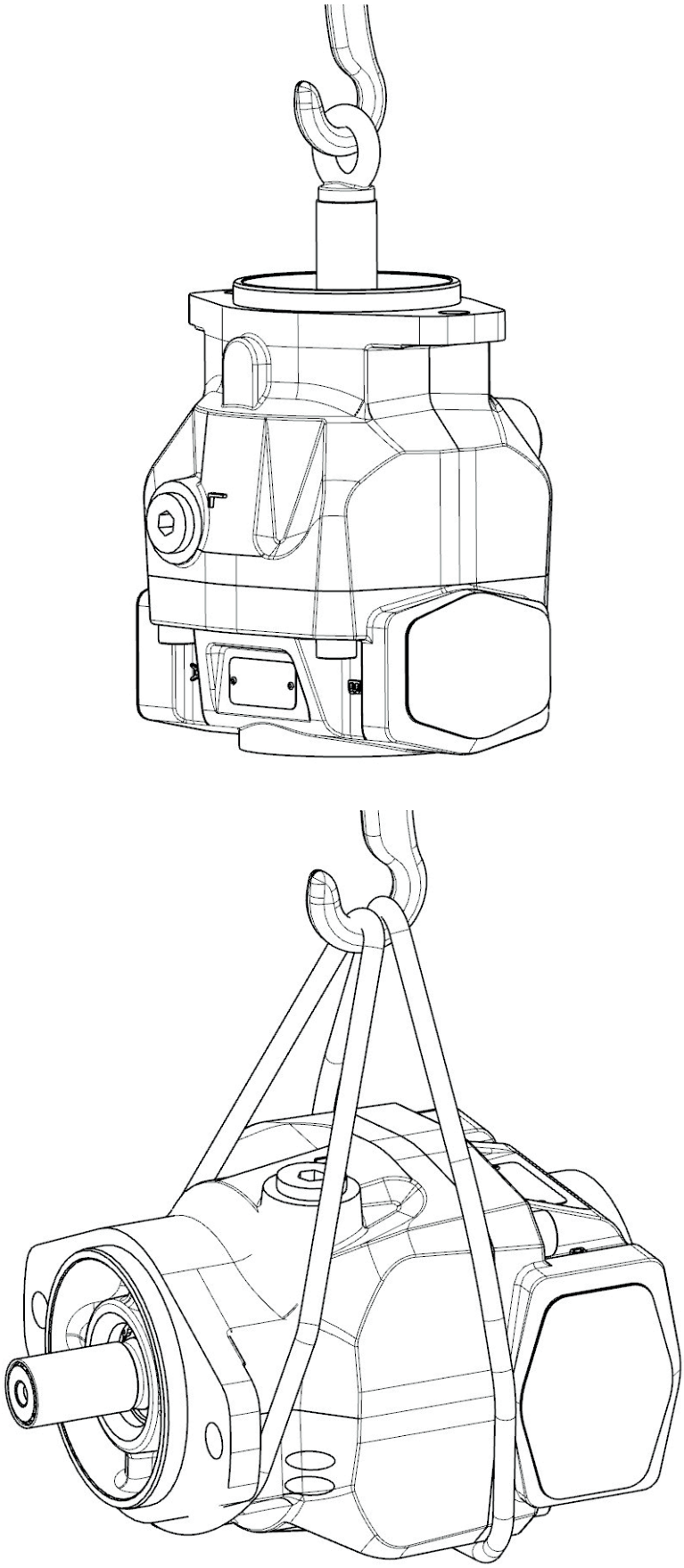


Fig. 6: Transporting Single Pump with Lifting Tackle

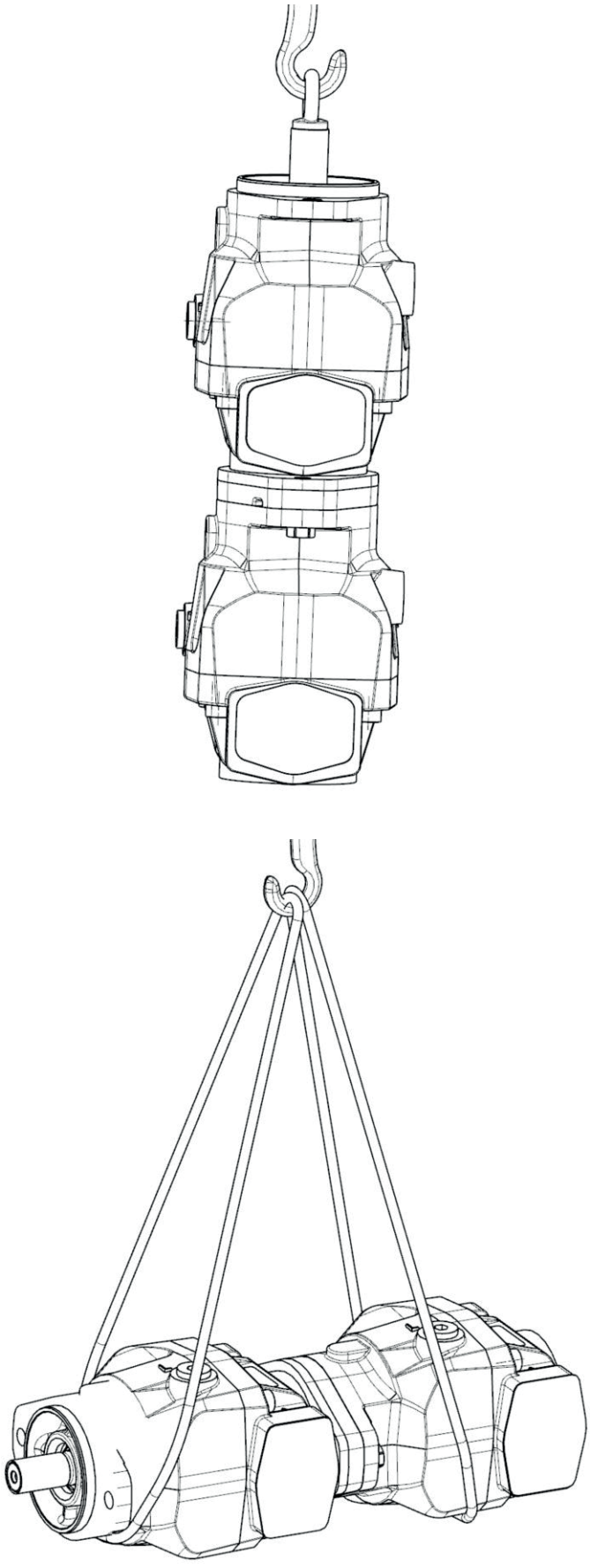


Fig. 7: Transporting Multiple Pump with Lifting Tackle

5.3 Storing the Pump

⚠ CAUTION

Property damage and personal injury due to improper storage!
If stored improperly, the pump may topple over and be damaged or lead to injuries of the staff.
- Place the pump in its original packaging whenever possible on a stable surface.
- Secure the pump against slippage and toppling over.

NOTICE

Warning of possible property and environmental damage!
Storing the pump improperly may lead to property damage.
- Store the pump as instructed and if necessary, preserve it.

Preservation Conditions
Table 2: Preservation Conditions

Storage Duration	Preservation
up to 12 months	not required
> 1 year	required ➪ Chap. "5.4 Preserving the Pump", Page 25

Storage Conditions
Table 3: Storage Conditions

Storage Duration	Measures
> 1 year	Visual inspection

Preconditions:
- Pump has been demounted. ➪ Chap. "9.1 Demounting the Pump", Page 45

Procedure:
1. Inspect to assure that all openings have been closed using flange covers or transportation caps and covers.
2. Check to assure that transportation protection means are attached to the pump's drive shaft.
3. Make certain that the storage space
   - is clean, dry, frost-protected and free of corrosives and vapors
   - has a consistent temperature (temperature difference < 10 °C).
4. Depending on the storage duration: Preserve the pump.
   - ➪ Table 2, Page 24
5. Check the storage conditions.
   - ➪ Table 3, Page 24
6. After delivery: No steps need to be taken.
7. After demounting: Pour a small amount of mineral oil into the pump's interior.

5.4 Preserving the Pump

	The pump should only be preserved on the exterior.

NOTICE

Damage to property!

Improper preservation or no preservation at all may cause corrosion to the pump.

- If required, properly preserve the pump. ➪ Chap. "5.4 Preserving the Pump", Page 25

Preconditions:

- Pump has been demounted. ➪ Chap. "9.1 Demounting the Pump", Page 45
- Pump is clean and dry.
- All openings are closed using flange covers or transportation caps and covers.

Procedure:

1. Store in INTERCEPT® corrosion intercept bag or apply corrosion preventative (e.g. Castrol SafeCoat DW 18X) evenly to the pump's exterior surface.
2. Allow the pump to dry.

	The pump does not need to be de-preserved before initial set-up.

6 Mounting

Always wear appropriate personal protective equipment when working on the pump.
⇨ Chap. "2.2.4 Work Safety", Page 11

⚠ DANGER

Risk of injury and property damage as a result of leaking operating fluid or high pressure fluid ejection hazard!
Any ejection of operating fluid under high pressure because of improper mounting may lead to serious injury or property damage.

- Only trained personnel should be allowed to mount the pump.
- Check the cleanliness of the mounting surface.
- Observe the tightening torques for the fasteners.
  ⇨ Chap. "12.2 Tightening Torques", Page 52
- Use only specified fasteners (quantity/type).
- Ensure the proper flange and screws are being used as per standard (e.g. SAE).
- Check for the existence and correct position of the O-rings.
- Use the correct sealant based on the operating fluid.
- Mount all connections to be hydraulically sealed.
- Do not exceed the maximum operating pressure in the system.
- Do not exceed the maximum case / drain line pressure.

⚠ DANGER

Serious personal injury!
Starting-up the machine/equipment during the mounting process may lead to serious injuries or death.

- Ensure that the machine/equipment cannot be switched on.

6.1 Preparing for Mounting

The pump is pre-assembled in the factory.

Procedure:

- Pump has been unpacked.
  ⇨ Chap. "5.1 Unpacking the Pump", Page 20
- The required supplementary documentation is at hand.
- The hydraulic schematics from the machine/system manufacturer are available.
- The required standard tools and mounting material are at hand.

6.2 Installing the Pump

⚠ DANGER

Risk of death from electric shock!
Touching any live parts can result in serious injury or death.
- Ensure that the machine/system is in dead-voltage state and is impossible to turn on again accidentally.

⚠ WARNING

Danger of crushing!
The pump can drop down as it is being mounted and crush body parts.
- Select lifting tackle appropriate for the total weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
  ➪ Chap. "5.2 Transporting the Pump", Page 20
- Do not stand under a suspended load.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Any hazardous operating fluids that escape or leak can cause serious injuries.
- Check whether the operating fluids being used pose a risk.
- Ensure that the machine/system is depressurized and de-energized.
- Wear safety equipment such as work gloves. ➪ Chap. "2.2.4 Work Safety", Page 11

⚠ WARNING

Risk of injury and property damage as a result of vibration!
Vibrations from machine/system parts may result in personal injury or property damage.
- Decouple the pump using suitable anti-vibration elements.

NOTICE

Material damage as a result of contamination!
Removing the transportation caps and covers on the pump connections can result in contamination and hence material damage.
- Do not remove the transportation caps and covers until just before the pipes and hoses are connected.

Preconditions:

- The mounting area is freely accessible.
- The machine/system has been depressurized and de-energized.
- The operating fluid matches the information on the order data sheet.
- Standard tools and mounting material are at hand.
- Supplementary documentation is available.
- The specified direction of rotation of the pump corresponds to that of the drive motor.

The pump can be mounted in any position.

Procedure:

- Mount the specified half of the coupling to the pump drive shaft in accordance with the instructions provided by the coupling manufacturer.

The threaded bore on the pump drive shaft can be used to mount the coupling.

- Ensure that the connection and mounting surfaces are clean.
  - If not, clean the connection and mounting surfaces using suitable cleaning agents.
  - Use suitable cleaning rags.
  - Do not allow the cleaning agent to enter the hydraulic circuit.
- Ensure that the coupling hub is tightened to the drive shaft or that the drive shaft is lubricated continuously to prevent abrasion by vibration.
- Transport the pump to the mounting location.
- Mount the coupling to the drive according to the information provided by the coupling manufacturer.

Only bolt the pump down after the coupling has been mounted correctly.

- Fasten the pump with the coupling at the mounting location. Tighten the mounting screws crosswise to the appropriate tightening torque. ➪ Chap. "12.2 Tightening Torques", Page 52
- For bell housing mounting: check the axial clearance of the coupling as per the information provided by the coupling manufacturer.
- For flange mounting: align the pump supports with the drive.
- For elastic couplings: after completing the mounting, check the drive to ensure it does not vibrate.

6.3 Planning Lines

To minimize the noise output resulting from the transmission of structure-bore noise, observe the following:

- Use hoses instead of pipes.
- Secure pipes with elastic clamps.

Suction Line

NOTICE

Damage to property from cavitation!

Lack of pressure in the suction line may lead to the formation of air bubbles in the operating fluid, which may result in severe damage to the pump.

- ▶ Configure the layout of the suction lines so that the inlet pressure cannot be any lower than the minimum of 0.8 bar absolute at the suction port.
- ▶ Ensure that the operating fluid is of the correct viscosity.

- Short suction lines with wide inside diameters are needed to ensure that the noise output is low.
- Fluid velocity in suction line < 1 m/sec.
- Avoid sharp angles and screwed pipe joints (danger of air intake and bubble formation, high flow resistance). Use curved pipes or hoses instead.
- Maintain the minimum inlet pressure.
- Reduce of cross section of the suction line right before the pump entry.
- If a suction filter (min. 0.15 mm mesh aperture) or a shut-off valve is used, install the devices below the fluid level.

Pressure Line

- Ensure sufficient pressure strength.
- Check the tightening torques of the screws.

Drain Line

- Install the drain line in a manner that the pump housing is always completely filled with hydraulic fluid (use the upper connection).
- Route directly into the tank, separate from the other return lines.
- The end of the line must be below the fluid level in the tank, even at the lowest fluid level.
- Position the leakage oil return in the tank as far away as possible from the suction line so that direct suction of the leakage oil is avoided as far as possible. Do not place a filter, cooler or non-return valve in the drain line. Max. length 3 m.
- Pressure at the drain line max. 2 bar absolute (1 bar above atmosphere).
- Use the outside pipe diameters (lightweight version) as recommended in the catalog.

6.4 Connecting the Lines

For the pump, the connections do not depend on the direction of rotation.

Procedure:

The appropriate screw connections must be used for fastening the control and leak oil port and the suction and pressure flange.

- Remove the transportation caps and covers from each connection.
- Clean the sealing surfaces and the lines.
- Connect the lines in accordance with the block diagram (suction line A, pressure line B).
  ⇨ Chap. "12.2 Tightening Torques", Page 52

6.5 Multiple Pumps

Certain versions of the axial piston pumps are available with an open through drive interface. These pumps contain a through drive hub for adapting the second pump stage and an O-ring for sealing the adapter flange.

When selecting the additional pump stages, the relevant interface dimensions of the adapter flange and the maximum transmittable drive torque must be observed (see AXP catalog).

Exceeding the maximum permissible drive torque due to excessive pressure and/or excessive displacement in the additional pump stages can lead to pump failure.

Also to be considered:
⇨ Chap. "3.2 Double Pump Design", Page 14
⇨ Chap. "3.4 Double Pump Scope of Delivery", Page 16
⇨ Chap. "5 Transport and Storage", Page 20

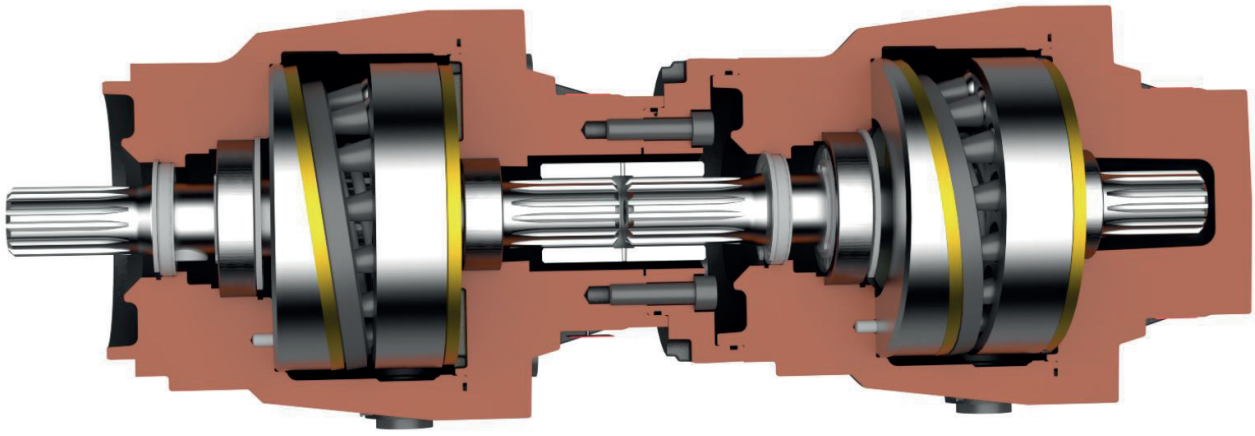


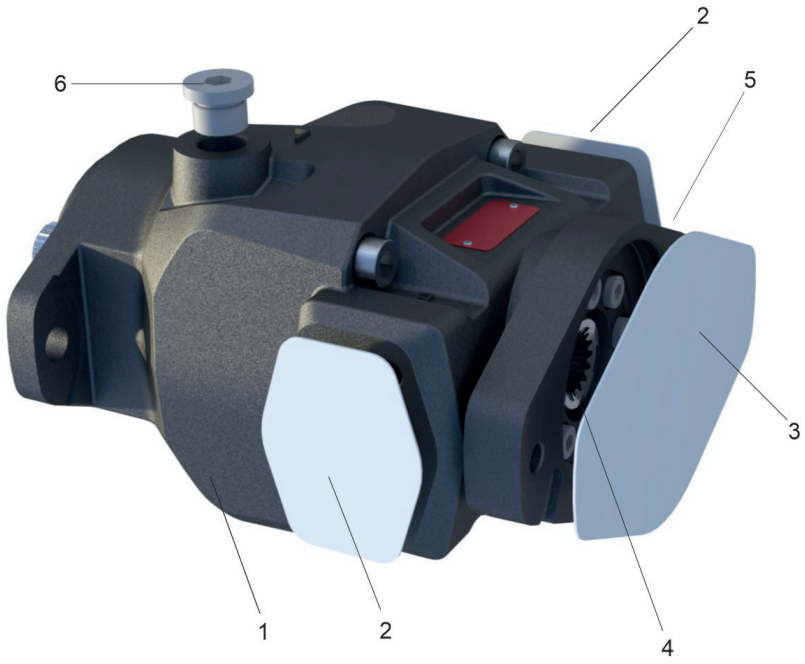
Fig. 8: Section Diagram for Double Pump

It is not permitted to operate an Axial Piston Pump with an open through drive interface. An additional pump stage or a pressure-resistant cover including suitable mounting screws and sealings must be used.

6.5.1 Mounting Multiple Pumps

All attached transport covers must be removed before installing the multiple pumps. Then check whether the supplied through drive hub is correctly mounted on the through drive shaft of the first pump stage. In addition, the O-ring must be inserted into the groove on the adapter flange or checked for correct installation. Then the 2nd pump stage can be installed.

The correct mounting screws and tightening torques must be used and applied.



Item	Description
1	Axial Piston Pump AXP
2	Flange covers
3	Transport cover adapter flange (not pressure-resistant)
4	Through drive hub
5	Adapter flange incl. O-ring
6	Sealing plug

Fig. 9: Mounting Multiple Pumps

7 Operation

Always wear appropriate personal protective equipment when working on the pump.
⇨ Chap. "2.2.4 Work Safety", Page 11

7.1 Initial Pump Set-Up

⚠ DANGER

Risk of injury and property damage as a result of hydraulic fluid squirting out!
Risk of severe injury or death due to hydraulic fluid squirting out under high pressure.
- Only trained personnel should be allowed to initially set up the pump.
- Check that the pump is mounted correctly before start-up.
- Make sure that all hydraulic ports are connected correctly.
- The maximum permissible operating pressure in the hydraulic system must not be exceeded.

⚠ DANGER

Unexpected and uncontrolled movement of the machine/system may lead to severe injury or property damage!
Unexpected or uncontrolled movements of the machine/equipment can cause serious personal injury or property damage.
- Only trained personnel should be allowed to initially set up the pump.
- Check with the equipment manufacturer or operator that no uncontrolled signals will be sent to the pump.
- The system manufacturer or operator has to assure that a pump malfunction (e. g. piston jam caused by swarf) is recognized in a manner that a malfunction of the axis/machine/system is avoided.
- Make sure that all plug connections are wired and allocated correctly.
- Make sure that all hydraulic ports are connected correctly.
- Make sure that the rotational direction of the drive motor is correct.
- Check for correct drive shaft connection to the drive motor.
- The system manufacturer or operator has to assure that customer specific parameters were loaded correctly.

⚠ WARNING

Unexpected or uncontrolled movements of the machine or system may lead to severe personal injury and property damage!
Unexpected or uncontrolled movements of the machine or system may occur during the parameterization of drives.
- Only trained and qualified personnel may enter settings e.g. sensor calibration, changes of control parameters or changes of characteristics.

⚠ WARNING

Risk of poisoning and injury!
Contact with operating fluid can cause health problems such as injury to eyes, damage to the skin or inhalation poisoning.
- Before initial set-up, check the lines and connection ports for any damage.
- Adhere to the operating fluid manufacturer's instructions.

⚠ WARNING

Risk of injury and property damage as a result of fire!
Easily flammable operating fluid may cause fire.
- Keep the pump away from any open flames.

⚠ WARNING

Risk of injury and property damage as a result of grasping or winding up!
Freely accessible rotating machine/system parts may lead to severe injuries or property damage as a result of grasping or winding up.
- Use suitable protective devices to ensure that access to the drive shaft is prevented.

⚠ CAUTION

Risk of burns!
Pump components become hot during operation.
- Do not touch the pump while it is in operation.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

NOTICE

Damage to the pump!
Setting up the pump for initial operation without the required basic mechanical and hydraulic knowledge may result in damage to the pump.
- The pump may only be set up initially by qualified personnel.

7.1.1 Filling the Pump

The pump must be completely filled with operating fluid before initial operation.

Procedure:

1. Fill the pump through the leakage port with operating fluid completely.

   In the case of multiple pumps, all pump stages must be completely filled with hydraulic fluid via the respective leakage oil connection of the pump stage before initial operation.

7.2 Performing Functional Tests

The functional tests are performed to ensure that the pump has been installed into the machine/system properly.

Preconditions:

- Initial set-up of the pump is complete: ⇨ Chap. "7.1 Initial Pump Set-Up", Page 33
- The transportation caps and covers on the through drive of the pump stages have been removed.
- It has been assured that the pump is being supplied with operating fluid.
- The pump has been visually inspected, with particular attention given to the lines and port connections.

Procedure:

1. Carry out the functional tests in accordance with the instructions provided by the machine/system manufacturer.
2. In doing so, watch especially for:
   - Noise development
   - Any exterior leaks

⚠ WARNING

Unexpected or uncontrolled movements of the machine or system may lead to severe personal injury and property damage!

Unexpected or uncontrolled movements of the machine or system may occur during the electrical signals measurement on drives.

- Only trained and qualified personnel may enter settings e.g. sensor calibration, changes of control parameters or changes of characteristics.

7.3 Operating the Pump

⚠ DANGER

Personal injury and property damage!
Incorrectly setting the pump in operation may lead to unexpected and uncontrolled movements of the machine/system and as a result may lead to bodily injuries or property damage.

- Only trained personnel should be allowed to operate the pump.
- Check with the equipment manufacturer or operator that no uncontrolled signals will be sent to the pump.
- The system manufacturer or operator has to assure that a pump malfunction (e. g. piston jam caused by swarf) is recognized in a manner that a malfunction of the axis/machine/system is avoided.

⚠ WARNING

Unexpected or uncontrolled movements of the machine or system may lead to severe personal injury and property damage!
Unexpected or uncontrolled movements of the machine or system may occur during the parameterization of drives.

- Only trained and qualified personnel may enter settings e.g. sensor calibration, changes of control parameters or changes of characteristics.

⚠ WARNING

Risk of injury and property damage as a result of grasping or winding up!
Freely accessible rotating machine/system parts may lead to severe injuries or property damage as a result of grasping or winding up.

- Use suitable protective devices to ensure that access to the drive shaft is prevented.

⚠ WARNING

Risk of injury and property damage as a result of vibration!
Vibrations from machine/system parts may result in personal injury or property damage.

- Decouple the pump using suitable anti-vibration elements.

⚠ CAUTION

Risk of personal injury and property damage!
Altering the configuration of the pumps may change the functionality of the pump in such way, that it leads to damage, malfunction or failure of the pump or machine.

- Modifying the pump configuration while the pump is in operation is only permitted if such an action does not set the machine and its environment in a hazardous condition.

⚠ CAUTION

Risk of burns!
Pump components become hot during operation.
- Do not touch the pump while it is in operation.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

⚠ CAUTION

Unexpected or uncontrolled movements of the machine or system may lead to severe personal injury and property damage!
Unexpected or uncontrolled movements of the machine or system may occur during the electrical signals measurement on drives.
- Only trained and qualified personnel may enter settings e.g. sensor calibration, changes of control parameters or changes of characteristics.

⚠ CAUTION

Risk of burns!
The Axial Piston Pump and the hydraulic connection lines can get very hot during operation and may burn your skin if you touch them.
- Wear suitable safety equipment such as work gloves.
- Allow the pump and the connection cable to cool off before contact.

⚠ CAUTION

Damage to hearing!
Operating the machinery may expose its operators to loud noise, which can lead to hearing damage.
- The operator/manufacturer must take suitable measures to protect against noise, e.g. stipulating that ear protection is worn.

NOTICE

Damage to property!
Operating the pump without operating fluid will cause the pump to run dry and to damage.
- Only activate the pump when the pump housing is completely filled with operating fluid.
- Ensure that the pump housing remains filled with operating fluid at all times while the pump is running.

7.3.1 Start up

Preconditions:

- Pump has been filled: ➪ Chap. "7.1.1 Filling the Pump", Page 35
- The temperature of the operating fluid in the tank must not exceed the pump temperature by more than 25 °C.

Procedure:

If the temperature of the operating fluid in the tank exceeds the pump temperature by more than 25 °C, the pump should only be switched on in short intervals of 1 to 2 seconds until it warms up.

1. Start up the drive motor.
2. Check the rotational direction of the drive motor.
3. Operate the pump at low pressure until the hydraulic system has been fully de-aerated.
4. For pumps with HF fluids: Run the pump for approx. one hour at low pressure (30 to 50 bar).

7.4 Setting the Pump out of Operation

⚠ DANGER

Risk of personal injury and property damage as the result of uncontrolled movements!
Unexpected or uncontrolled movements of the machine/equipment can cause serious personal injury or property damage.

- Only trained personnel should be allowed to demount the pump.
- Check with the equipment manufacturer or operator that no uncontrolled signals will be sent to the pump.
- Ensure that the drive motor cannot start up.

⚠ DANGER

Risk of death from electric shock!
Touching any live parts can result in serious injury or death.

- Ensure that the machine/system is de-energized.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Escaping operating fluid may lead to severe personal injury and property damage.

- Only trained personnel should be allowed to set the pump out of operation.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Any hazardous operating fluids that escape or leak can cause serious injuries.
- Check whether the operating fluids being used pose a risk.
- Ensure that the machine/system is depressurized and de-energized.
- Wear safety equipment such as work gloves.
  ➪ Chap. "2.2.4 Work Safety", Page 11

⚠ WARNING

Danger of crushing!
The pump can drop down as it is being mounted and crush body parts.
- Select lifting tackle appropriate for the total weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
  ➪ Chap. "5.2 Transporting the Pump", Page 20
- Do not stand under a suspended load.

⚠ WARNING

Risk of burns!
Pump components become hot during operation.
- Do not touch the pump while it is in operation.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

Preconditions:
- The drive motor has been switched off and is secured from being switched back on.
- Machine/system is at zero pressure and in dead-voltage state.
- Pump has cooled down.

Procedure:
1. Close the fittings on the suction and pressure side.
2. Completely drain the pump through the leakage oil port.
3. Depending on what is required:
   - Remove the pump:
     ➪ Chap. "9.1 Demounting the Pump", Page 45
   - Store the pump:
     ➪ Chap. "5.3 Storing the Pump", Page 24

7.5 Reconnecting the Pump

⚠ DANGER

Risk of personal injury and property damage as the result of uncontrolled movements!
Unexpected or uncontrolled movements of the machine/equipment can cause serious personal injury or property damage.
- Only trained personnel should be allowed to demount the pump.
- Check with the equipment manufacturer or operator that no uncontrolled signals will be sent to the pump.
- Ensure that the drive motor cannot start up.

⚠ DANGER

Risk of death from electric shock!
Touching any live parts can result in serious injury or death.
- Ensure that the machine/system is de-energized.

⚠ WARNING

Risk of burns!
Pump components become hot during operation.
- Do not touch the pump while it is in operation.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

⚠ WARNING

Danger of crushing!
The pump can drop down as it is being mounted and crush body parts.
- Select lifting tackle appropriate for the total weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
  ➪ Chap. "5.2 Transporting the Pump", Page 20
- Do not stand under a suspended load.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Any hazardous operating fluids that escape or leak can cause serious injuries.
- Check whether the operating fluids being used pose a risk.
- Ensure that the machine/system is depressurized and de-energized.
- Wear safety equipment such as work gloves.
  ➪ Chap. "2.2.4 Work Safety", Page 11

Preconditions:

- If the pump was stored: Measures were carried out that were necessary because of the duration of storage. ➪ Table 2, Page 24
- Pump is installed. ➪ Chap. "6 Mounting", Page 26

Procedure:

1. Carry out all the steps applicable for the initial set-up of the pump.
   ➪ Chap. "7.1 Initial Pump Set-Up", Page 33

8 Maintenance and Repairs

⚠ DANGER

Risk of personal injury and property damage as the result of uncontrolled movements!
Unexpected or uncontrolled movements of the machine/equipment can cause serious personal injury or property damage.

- Only trained personnel should be allowed to demount the pump.
- Check with the equipment manufacturer or operator that no uncontrolled signals will be sent to the pump.
- Ensure that the drive motor cannot start up.
- Ensure that the operation of the pump will not be impaired by maintenance and repairs.

⚠ DANGER

Risk of death from electric shock!
Touching any live parts can result in serious injury or death.

- Ensure that the machine/system is de-energized.

⚠ WARNING

Danger of crushing!
The pump can drop down as it is being mounted and crush body parts.

- Select lifting tackle appropriate for the total weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
  ⇨ Chap. "5.2 Transporting the Pump", Page 20
- Do not stand under a suspended load.

⚠ WARNING

Risk of burns!
Pump components become hot during operation.

- Do not touch the pump while it is in operation.
- Wear suitable safety equipment if you have to touch the pump while it is in operation or shortly afterwards.

⚠ WARNING

Unexpected or uncontrolled movements of the machine or system may lead to severe personal injury and property damage!
Unexpected or uncontrolled movements of the machine or system may occur during the parameterization of drives.

- Only trained and qualified personnel may enter settings e.g. sensor calibration, changes of control parameters or changes of characteristics.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Any hazardous operating fluids that escape or leak can cause serious injuries.
- Check whether the operating fluids being used pose a risk.
- Ensure that the machine/system is depressurized and de-energized.
- Wear safety equipment such as work gloves.
  ⇨ Chap. "2.2.4 Work Safety", Page 11

⚠ CAUTION

Risk of personal injury and property damage!
Altering the configuration of the pumps may change the functionality of the pump in such way, that it leads to damage, malfunction or failure of the pump or machine.
- Modifying the pump configuration while the pump is in operation is only permitted if such an action does not set the machine and its environment in a hazardous condition.

Always wear appropriate personal protective equipment when working on the pump.
⇨ Chap. "2.2.4 Work Safety", Page 11

Purging with compressed air or spraying/rinsing with pressurized fluids in the area around the rotary shaft seal is prohibited.

8.1 Monitoring

Table 4: Monitoring

Tasks	Intervals
Check pump for leaks	Daily
Check pump for noises	Daily
Check that fastening screws are tightened	Monthly
Check the operating temperature of the machine under constant operating conditions	Weekly
Check the level of operating fluid in the machine	Daily
Check the quality of the operating fluid	Annually or every 2000 operating hours

8.2 Troubleshooting

If any pump repair is needed, it should only be carried out by one of our service technicians or by an authorized service center.

➪ Chap. "2.2.3 Structural Modifications", Page 11
➪ Chap. "8.3 Moog Service Addresses", Page 44

Table 5: Troubleshooting

Fault	Cause	Repair
Axial Piston Pump		
Peculiar noises	Cavitation, pump sucking air, speed to high, mechanical damage	Configure the inlet suction in a manner that the pressure in the suction line is not below its specified minimum level. Limit the speed. Contact Moog service and have damaged parts replaced.
Volume flow too low or non-existent	Leak in the pump, performance of drive motor and pump do not match, wear caused by dirt, rotary group damage	Check displacement, check for wear. Contact Moog service and have damaged parts replaced.
Pressure too low or non-existent	Leak in the pump, performance of drive motor and pump do not match, wear caused by dirt, rotary group damage	Seal leaky lines, check control of pump drive. Contact Moog service and have damaged parts replaced.
Fluctuations in the pressure or volume flow	Pump sucking air, leak in the pump, wear caused by dirt, rotary group damage, unstable behavior of the controller	Seal leaking areas, check control of pump drive. Contact Moog service and have damaged parts replaced.
Increased, unusual vibration	Bearing wear	Contact Moog service and have damaged parts replaced.

8.3 Moog Service Addresses

Visit www.moog.com/worldwide to find your nearest location for application engineering, repairs and service.

9 Demounting

Always wear appropriate personal protective equipment when working on the pump.
➪ Chap. "2.2.4 Work Safety", Page 11

9.1 Demounting the Pump

This section describes how to remove the pump for sending it to us or an authorized service workshop for repair; it does not describe how to dismantle the pump.

Purging with compressed air or spraying/rinsing with pressurized fluids in the area around the rotary shaft seal is prohibited.

⚠ DANGER

Risk of death from electric shock!
Touching any live parts can result in serious injury or death.
- Ensure that the machine/system is in dead-voltage state and is impossible to turn on again accidentally.

⚠ WARNING

Danger of crushing!
The pump can drop down as it is being demounted and crush body parts.
- Select lifting tackle appropriate for the total weight of the pump.
- Attach the lifting tackle to the pump in the approved manner.
  ➪ Chap. "5.2 Transporting the Pump", Page 20
- Do not stand under a suspended load.

⚠ WARNING

Risk of injury and poisoning from hazardous operating fluids!
Any hazardous operating fluids that escape or leak can cause serious injuries.
- Check whether the operating fluids being used pose a risk.
- Ensure that the machine/system is depressurized and de-energized.
- Wear safety equipment such as work gloves. ➪ Chap. "2.2.4 Work Safety", Page 11

⚠ WARNING

Risk of burns!
Pump components become hot during operation.
- Allow the pump to cool down before demounting it.
- Wear suitable safety equipment if you have to touch the pump as it is being demounted.

NOTICE

Material damage as a result of contamination!
Removing the transportation caps and covers on the pump connections can result in contamination and hence material damage.
▶ Do not remove the caps and covers until just before the pipes and hoses are connected.

Preconditions:

- Pump has been taken out of operation: ➪ Chap. "7.4 Setting the Pump out of Operation", Page 38
- The demounting area is freely accessible.
- The machine/system has been depressurized and in dead-voltage state.
- Operating fluids have been checked for possible risks and any necessary safety precautions have been implemented.
- Standard tools are available.
- Supplementary documentation is available.

Procedure:

1. Place a tray underneath the pump to collect the emerging operating fluid.
2. Disconnect the pipes from the pump.
3. Drain the pump completely.
4. Attach caps and flange covers to the pump.
5. Attach suitable lifting tackle to the pump. ➪ Chap. "5.2 Transporting the Pump", Page 20
6. Detach the pump and coupling from the drive motor.
7. Place the pump on a stable, load-bearing surface.
8. Detach the lifting tackle from the pump.
9. Detach the coupling from the pump drive shaft in accordance with the instructions provided by the coupling manufacturer.
10. Attach transport protection to the end of the pump drive shaft.

10 Spare Parts, Accessories, Repairs

The operator is not authorized to install spare parts and accessories. Repairs or other structural modifications to the pump may only be carried out by us or by an authorized service repair center.
➪ Chap. "2.2.3 Structural Modifications", Page 11

For all tasks described in this User Manual, available standard tools may be used.

⚠ CAUTION

Risk of personal injury and property damage!
Like new pumps, spare pumps are also delivered with the relevant factory settings. In the event of a repair job for defective pumps, neither we nor our authorized service centers shall accept any liability for software, data, and settings installed by the customer.
- Check the pumps for correct mechanical design and correct configuration before start-up.

⚠ CAUTION

Risk of personal injury and property damage!
Altering the configuration of the pumps may change the functionality of the pump in such way, that it leads to damage, malfunction, or failure of the pump or machine.
- Modifying the pump configuration while the pump is in operation is only permitted if such an action does not set the machine and its environment in a hazardous condition.

⚠ CAUTION

Property damage to the pump or system!
Unsuitable or defective accessories or spare parts may lead to pump or machine/system failure as a result of damage.
- We recommend: Only use original accessories or original spare parts.
- All warranties and liability claims shall be void for injuries or property damage as a result of using unsuitable or defective accessories or spare parts. ➪ Chap. "1.6 Warranty and Liability", Page 7

Steps to be taken when carrying out repair work:

1. For repairs to the pump:
   ➪ Chap. "9.1 Demounting the Pump", Page 45
2. Package the pump for transport to our facility or to an authorized service repair shop, preferably in its original packaging material.
   ➪ Chap. "8.3 Moog Service Addresses", Page 44

Moog Global Support

Moog Global Support™ provides professional repair and corrective maintenance services of the highest level thanks to our experienced technicians. Our customer service and our professional expertise ensure that your systems will always remain in an optimal state. We offer the reliability that you can only expect from a leading manufacturer with branch offices around the globe.

Your advantages:

- Shorter downtimes, critical systems can be continuously operated at a high performance level
- Investment security thanks to the reliability, adaptability, and guaranteed life span of our products
- Optimized corrective maintenance planning and system set-up
- Use of our flexible corrective maintenance program according to your service requirements

Our range of services:

- Repair with original parts by trained technicians according to the latest Moog specifications
- Provision of original spare parts and products in order to avoid unplanned downtimes
- Flexible programs according to your needs for preventative corrective maintenance and set-up thanks to annual or multi-year contracts
- On-site service for start-up, set-up, and fault diagnosis
- Reliable service with the same high quality anywhere in the world

For more information about Moog Global Support™, visit http://www.moog.com/industrial.

In the event of a repair job for defective pumps, we and our authorized service centers reserve the right to perform a repair, or alternatively, to supply replacement pumps with an identical or compatible equipment specification upon consultation with the customer.

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12 Appendix

12.1 Abbreviations, Symbols and Code Letters

Table 6: Abbreviations, Symbols and Code Letters (Part 1 of 2)

Abbr.	Explanation
$ß_x$	Symbol for filter fineness
Δp	Symbol for pressure drop
Δp_N	Symbol for nominal pressure drop
ν	Symbol for viscosity
A	Connection port (suction port)
ANSI	American National Standards Institute (http://www.ansi.org)
B	Connection port (suction port)
D	Orifice
D1, D2	Orifice diameter
DIN	Deutsches Institut für Normung e. V. (German Institute for Standardization) (http://www.din.de)
EN	Europa-Norm (European standard)
EU	European Union
HNBR	Hydrogenated Nitrile Butadiene Rubber (sealing compound, such as O-rings)
ISO	International Organization for Standardization (http://www.iso.org)
M	Symbol for through drive torque
M_A	Tightening torque
n	Revolution speed
$n_{max.}$	Maximum revolution speed
NW	Nominal width
η_{hm}	Symbol for hydraulic-mechanical efficiency
p	Symbol for pressure
$p_{min.}$	Symbol for minimum pressure
$p_{max.}$	Symbol for maximum pressure
p_N	Symbol for nominal pressure
p_n	Symbol for maximum operating pressure
P	Connection port (pressure connection)
Q	Symbol for flow
Q	Symbol for pump displacement
SAE	American series of standards (parallel to DIN-EN standards)
WS	Width Across Flats for wrenches

Table 6: Abbreviations, Symbols and Code Letters (Part 2 of 2)

Abbr.	Explanation
t	Symbol for time
T	Symbol for temperature
T	Connection port (tank connection)
TÜV	Technischer Überwachungsverein (German Technical Inspection Agency)
U	Revolution
V	Symbol for volume (such as tank capacity)
V	Symbol for displacement
$V_{max.}$	Symbol for maximum displacement
$V_{min.}$	Symbol for minimum displacement
ΔV	Change in pump displacement
VDI	Verein Deutscher Ingenieure e. V. (Association of German Engineers) (http://www.vdi.de)
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e. V. (German Association of Electrical Engineering, Electronics and Information Technology) (http://www.vde.de)
X	Control port
L	Leakage port

12.2 Tightening Torques

The data on the tightening torques in this segment is considered as reference values only. Preference should be given to the data provided by each manufacturer of the particular machine part!

Flange for Suction and Pressure Connection

Flanges with corresponding screws and sealing elements are to be used in accordance with the information provided by the flange manufacturer.

Respective tightening torques should be gathered from the information provided by the flange manufacturer or as per standard ISO 6162.

Mounting screws

For mounting screws with metric ISO threads as per DIN 13 or ISO 68, in individual cases, tightening torques should be checked in accordance with VDI 2230. Mounting screws for connecting multiple pumps to AXP rear flanges or adapter flanges:

Table 7: Tightening Torques for mounting screws (strength category 10.9)

Thread size	Max. permissible tightening torque
M 8	30 ... 36 Nm
M 10	55 ... 65 Nm
M 12	80 ... 100 Nm
M 16	225 ... 275 Nm

Sealing Plugs Form E with ED Seal (Reference Values)

Table 8: Tightening Torques for sealing plugs

Thread size	Max. permissible tightening torque
G 1/4"	30 Nm (+10 %)
G 3/8"	60 Nm (+10 %)
G 1/2"	80 Nm (+10 %)
G 3/4"	140 Nm (+10 %)
G 1"	200 Nm (+10 %)

Straight Screw-In Sockets Form E with ED Seal (Reference Values)

Table 9: Tightening Torques for straight screw-in fittings

Thread size	Max. permissible tightening torque
G 1/4"	35 Nm (+10 %)
G 3/8"	70 Nm (+10 %)
G 1/2"	90 Nm (+10 %)
G 3/4"	180 Nm (+10 %)
G 1"	310 Nm (+10 %)

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