

Mounting- and operating instruction

 ATEX

PIV DRIVES

Helical and bevel-helical gear reducers Series **POSIRED**

The mounting- and operating instructions must be read before carrying out any work on the gear unit.

PIV Drives GmbH
Justus-von-Liebig-Straße 3
61352 Bad Homburg
Telephone: +49 6172 102-0
Fax: +49 6172 102-380
email: sales-gm@piv-drives.com
Internet: www.piv-drives.com

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1 General information

1.1 About this manual

An indispensable part of this manual is the gearbox-specific technical specification, TS for short, in the appendix.

This manual allows safe and efficient handling of the gearbox. This manual is considered a component of the gearbox and must be kept in the immediate vicinity of the gearbox and must be accessible to the personnel at any time.

Prior to any work, the personnel must have carefully read and understood the entire manual. For safe work, it is imperative that all safety notes and instructions in this manual be observed.

In addition, all local work health and safety regulations and the general safety provisions for the gearbox's site of operation apply.

Illustrations in this manual are intended to assist in general comprehension and may differ from the actual version.

This manual is for the following gearbox types:

- POSIRED 2
 - Helical gear reducers PB, PC, PD, PE
 - Bevel helical gear reducers PLB, PLC, PLD
 - Compact gear units PWC, PWD
- POSIRED N
- POSIRED D
- POSIRED TS

1.2 Explanation of symbols

Safety notes

Safety notes in this manual are indicated by symbols. The safety notes are introduced using signal words that express the hazard's degree of danger.



DANGER!

This combination of symbol and signal word indicates an immediate hazard that can cause fatalities or serious injury if not avoided.



WARNING!

This combination of symbol and signal word indicates an immediate hazard that can cause fatalities or serious injury if not avoided.



CAUTION!

This combination of symbol and signal word indicates a potential hazard that can cause slight or minor injury if not avoided.



NOTICE!

This combination of symbol and signal word indicates a potential hazard that can cause property damage if not avoided.



NOTICE!

This combination of symbol and signal word indicates a potential pollution hazard.

Tips and recommendations



This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:



DANGER!

This combination of symbol and signal word indicates an immediately-dangerous situation due to electric shock. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.








WARNING!

This combination of symbol and signal word indicates information and instructions regarding the proper use of the gearbox in potentially explosive areas.

Failure to observe such a note increases the risk of explosion and may cause serious or fatal injury.

Additional symbols

This manual uses the following symbols to indicate instructions, effects, lists, references and other elements:

Additional symbols	Explanation
	Step-by-step instructions
	Effects of actions
	References to sections within this manual and to other applicable documents
	Lists without specific order
	Overview of alternative procedures



1.3 Customer service

In case of technical queries, please contact our customer service:

Address	PIV Drives GmbH Justus-von-Liebig-Straße 3 61352 Bad Homburg
Phone	+49 6172 102-500
Fax	+49 6172 102-556
e-mail	service@piv-drives.com
Internet	www.piv-drives.com

We are also always interested in hearing about information and experiences obtained through use and which may be of value in improving our products.

2 Safety

This section provides an overview of all safety aspects important for the protection of people and for safe and fault-free operation. Additional, task-related safety notes are included in the following sections.

2.1 Proper use

The POSIRED gearbox is designed to convert speed and torque after connection to the target system and is intended for use in explosive areas in accordance with the ATEX indication.

Proper use also includes observance of all specifications within this manual.

Any use other or beyond proper use shall be deemed improper use.



WARNING!

Danger through improper use!

Improper use of the POSIRED gearbox may result in danger.

- Operate the gearbox only within the specified limits (↪ *Chapter 3 'Technical data' on page 29*) and in accordance with the gearbox-specific order confirmation.
- Never exceed the speed and torque specifications listed on the type plate.
- Never thermally overload the gearbox by applying excessive power.
- Never allow the roller bearings to slip through application of insufficient load.
- Never change the oil viscosity or oil type without prior consultation with PIV Drives GmbH.
- Never change the direction of rotation specified as permissible in the technical specifications or drawing.

2.2 General hazards

2.2.1 Danger through explosive atmospheres

Incorrect site of operation



WARNING!

Risk of explosion through operation at incorrect sites!

The standard version of the gearbox is not designed for operation in explosive areas.

Use of a standard gearbox in explosive areas may result in danger.

- If you plan to use a standard gearbox in an explosive area, always consult PIV Drives GmbH first.
- Never work on, in or in the vicinity of the gearbox in an explosive atmosphere. Observe the ATEX specifications listed on the type plate. Observe the maximum permissible surface temperatures.

Explosion protection



WARNING!

Risk of explosion!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Obtain a written work permit before beginning work in the explosive area.
- Never perform work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Electrostatic charge generation through belt drives, fans, siphoning of synthetic oils



WARNING!

Risk of injury and explosion through static charge of moving materials!

Belt drives, running fans and siphoning or decanting synthetic oils can produce an electrostatic charge. Electrostatic charge may cause serious injury. In explosive areas, there is a risk of explosion.

- Establish an electrically conductive connection between all parts of the casing and ensure equipotential bonding.
- Operate the gearbox in explosive areas only in accordance with the ATEX certification.
- Never work on, in or in the vicinity of the gearbox in an explosive atmosphere.

2.2.2 Danger through high temperatures

Hot surfaces



WARNING!

Risk of burning through hot surfaces!

The gearbox's surface can reach high temperatures during operation. Skin contact with hot surfaces can cause severe skin burns.

- Always wear thermally resistant safety clothing and protective gloves when working in the vicinity of hot surfaces.
- Always ensure that all surfaces have cooled to ambient temperature prior to performing any work.
- If the gearbox reaches a temperature of more than 90°C, contact PIV Drives GmbH immediately. Gearbox cooling may be necessary.

Hot gear oil

**WARNING!****Risk of burning through hot gear oil!**

The gear oil can become very hot during operation. Skin contact can result in burns. Inhaling oil vapours can cause lung damage.

- Always allow the gearbox and gear oil to cool before performing any work.
- Never open covers while hot.
- Wear thermally resistant safety clothing and protective gloves.
- Wear breathing protection if there are oil vapours.

2.2.3 Dangers through electrical energy

Connecting electrical components

**WARNING!****Risk of injury when connecting electrical components!**

Incorrect connection of electrical components may result in danger.

- When connecting electrical components (e.g. motor or hydraulic unit), observe the gearbox design and the intended site of operation.
- Observe the components' electrical connection values.

Faults due to short circuit

**WARNING!****Danger of injury due to faults!**

Through short circuit in the electrical equipment faults in the entire system can occur. Faults can cause serious injuries.

- Connect all housing parts coupled to the local equipotential bonding busbar.
- Install an earth leakage circuit breaker to prevent ignition sparks and touch voltages if there is a fault.

2.2.4 Danger through moving parts

Rotating parts on the shafts



WARNING!

Risk of injury through rotating parts!

Input and output shafts or flanges may rotate. Contact with them can cause injury.

- A corresponding protective barrier must be installed over freely rotating gearbox parts.
- Perform work on the gearbox only when it is at a standstill and the drive unit is switched off.
- When working on the gearbox, the switched-off drive unit must be secured against switching on inadvertently.

Belt drive



WARNING!

Risk of catching through belt drive!

There is a risk of injury through being caught and trapped by the belt drive.

- Perform work on the gearbox only when it is at a standstill and the drive unit is switched off.
- When working on the gearbox, the switched-off drive unit must be secured against switching on inadvertently.
- Observe the separate instructions issued by the belt's manufacturer.

Pretensioned springs on thrust plate and brake



WARNING!

Risk of injury through springs under tension!

Pretensioned springs on the thrust plate and brake can cause serious injury.

- Relieve all spring tension before performing any work on the thrust plate or brake.

Vibrations**WARNING!**
Risk of injury through heavy vibration!

Heavy vibrations can lead to serious injury and chronic impairments to health over the long term. The source of vibrations must be mechanically isolated from its environs by means of vibration dampers.

- Never disable the vibration dampers.
- Keep out of the vibrating area during operation.

High weight**WARNING!**
Risk of crushing through high weight!

Due to its high weight, moving the gearbox can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See *Chapter 5 'Transport, packaging and storage'* on page 46.
- Always secure the gearbox before releasing any connections.

Torsional moment**WARNING!**
Risk of injury through torsional momenta!

Tension within the system can produce torsional momenta in the shaft connections. When disconnecting the shafts, the torsional momenta can cause injury and damage.

- Before beginning any work, relieve the system tension at suitable points.

Sharp edges and pointed corners



CAUTION!

Danger of injury posed by sharp edges and pointed corners!

Sharp edges and pointed corners may cause skin grazes and cuts.

- Proceed with caution when working in the vicinity of sharp edges and pointed corners.
- If in doubt, wear safety gloves.

Risk of slipping on slippery surfaces



CAUTION!

Risk of slipping on slippery surfaces!

Soiling can make smooth surfaces slippery.

- Always remove any soiling immediately.
- Collect any oil that may have been spilled during this process immediately and dispose of it in an environmentally sound manner.
- Wear non-slip safety shoes.
- Set up warning signs if necessary.

2.2.5 Danger through noise

Noise generated by gearboxes or fans



WARNING!

Risk of injury through noise!

The noise level produced at the site of operation can cause serious damage to your hearing.

- Always wear hearing protection when working with loud gearboxes and systems.
- Only remain on the gearbox's site of operation for as long as necessary.
- The standard DIN EN ISO 11690 "Acoustics - Recommended practice for the design of low-noise workplaces containing machinery" must be observed.

2.2.6 Danger through operating fluids

Lubricants, gear oils, preservatives



WARNING!
Danger to health through lubricants!

Contact with operating fluids can cause allergic reactions and skin irritation.

- Always wear protective gloves and safety goggles when handling operating fluids.
- Do not swallow, do not inhale vapours.
- In the event of inadvertent eye contact, rinse out the operating fluid with copious amounts of water and seek medical attention if necessary.
- In the event of skin contact, rinse off with copious amounts of water and soap.
- Observe the safety data sheets issued by the operating fluid's manufacturer.

Pressurised gases and liquids in the lubricant system



WARNING!
Lethal danger through hydraulic energies!

The lubricant system contains gases and liquids under pressure. This may cause serious injury.

- Before beginning any work on the lubricant system, relieve the system pressure completely. Fully depressurise the pressure reservoir.

Bacteria in the coolant



WARNING!

Danger to health through bacteria in the coolant!

Bacteria can propagate in the coolant that may be detrimental to health in the event of skin contact, swallowing or inhaling.

- Replace coolant regularly.
- If there is a risk of skin contact, swallowing or inhaling, wear personal protective equipment:
 - Protective work clothing
 - Protective gloves
 - Light breathing protection
 - Safety goggles

2.2.7 Risks for the gearbox

Improper handling



NOTICE!

Risk of damage through improper handling of the gearbox!

Improper handling can cause the gearbox to overheat. The gearbox's leak tightness cannot be guaranteed if it is overloaded.

- Avoid improper handling.
- Observe the specifications and information listed on the type plate.
- Only run a connected drive motor with a frequency converter if the specifications on the gearbox's type plate and the technical specifications in the order confirmation are observed.
- Do not perform any welding work on the gearbox.
- Do not use the gearbox as an earth point for welding work. Tothing and bearings may suffer irreversible damage through fusing.

Loss of oil



NOTICE!

Gearbox damage due to lack of oil!

Insufficient oil supply can result in the gearbox overheating, thus causing damage.

- Check the oil supply regularly. See ↗ *Chapter 8.4 'Oil change schedule' on page 131.*
- If you notice a loss of oil, immediately stop the gearbox. Further operation is permissible only after examination of the fault cause.

Consult PIV Drives GmbH immediately. For contact details, see ↗ *Chapter 1.3 'Customer service' on page 8.*

2.3 Operator's responsibility

Operator

The operator is that entity who runs the gearbox for commercial purposes or entrusts the gearbox to third parties for use and who is legally responsible for the product during operation, including responsibility for the protection of the user, personnel and third parties.

Operator's duties

The gearbox is used commercially. The operator is therefore subject to the legal provisions governing work health and safety.

In addition to the safety notes in this manual, the safety, work health and safety and environmental protection regulations applicable for the site of operation must be observed.

The following applies in particular:

- The operator is under obligation to obtain information on the applicable work health and safety regulations and to draft a hazard assessment determining any additional risks resulting from the specific work conditions at the gearbox's site of operation. The operator is obliged to implement this in the form of operating instructions for the operation of the gearbox.
- The operator needs to check constantly throughout the period of operation of the gearbox whether the operating instructions drafted correspond to the latest version of the regulations and, if necessary, must amend the instructions.
- The operator must clearly define and specify responsibilities regarding installation, operation, fault remedy, maintenance and cleaning.
- The operator must ensure that all persons handling the gearbox have read and understood this manual. In addition, the operator must regularly train the personnel (see appendix for instruction protocol) and inform them of the risks.
- The operator must supply the personnel with the required protective equipment and obligate the personnel to wear it.

The operator is further responsible for ensuring that the gearbox is always in technically flawless condition. The following therefore applies:

- The operator must ensure that the maintenance intervals specified in this manual are observed.
- The operator must regularly check all safety equipment for correct operation and completeness.

2.4 Personnel requirements

2.4.1 Qualifications

The various tasks described in this manual demand a varying degree of qualification of the persons appointed to perform the tasks.



WARNING!

Danger through insufficiently qualified personnel!

Insufficiently qualified personnel are unable to correctly assess the risks of handling the gearbox and risk causing serious or fatal injury to themselves or other persons.

- Only allow specifically qualified persons to perform any work.
- Keep insufficiently qualified persons out of the work area.
- Cease all work while unauthorised persons remain in the danger zone and work area.

Only such persons are permitted to perform any work that can be expected to perform the respective work reliably. Persons with impaired reactions, e.g. due to intoxication by drugs, alcohol or medication, are not permitted.

This manual lists the following qualifications for the persons appointed to perform the various tasks:

Electrically skilled person with additional explosion protection qualifications

Electrically skilled persons with additional explosion protection qualification are specifically trained for the tasks they are to perform and knows the relevant standards and regulations.

Due to their technical training and their experience, electrically skilled persons with additional explosion protection qualification can perform work on electrical systems and can identify and avoid potential risks.

Specialist for explosive areas

Specialists for explosive areas, due to their technical training, skills and experience as well as their knowledge of the applicable standards and regulations, are able to perform work on systems or components in explosive areas. Specialists for explosive areas are able to identify and avoid potential risks.

In addition, specialists for explosive areas are qualified to perform typical work on gearboxes such as aligning the shaft.

Service personnel

The following work may be performed by the customer's qualified personnel:

- Oil change (caution: risk of scalding – observe the separate chapter in this manual!)
- Temperature measurements
- Visual inspection through oil sight glass
- Filter change on external oil-coolant-lubricant system (observe the operating manual issued by the oil-coolant-lubricant system's manufacturer)
- Replacement of the elastic segments if a corresponding coupling is used (observe the operating manual issued by the coupling's manufacturer)
- Regreasing the couplings if a corresponding coupling is used (observe the operating manual issued by the coupling's manufacturer)
- Vibration measurements
- Frequency analyses
- Regreasing of taconite labyrinth shaft seals
- Replacement of brake shoes (observe operating manual issued by brake shoes' manufacturer)

PIV service personnel

Other work may be performed only by PIV Drive GmbH's specialist personnel. Other personnel is not permitted to perform such work. To have the necessary work performed, contact PIV Drives GmbH customer service, see [Chapter 1.3 'Customer service' on page 8](#).

2.4.2 Unauthorised persons



WARNING!

Risk to life for unauthorised persons due to hazards in the danger and working zone!

Unauthorised persons who do not meet the requirements described here will not be familiar with the dangers in the working zone. Therefore, unauthorised persons face the risk of serious injury or death.

- Unauthorised persons must be kept away from the danger and working zone.
- If in doubt, address the persons in question and ask them to leave the danger and working zone.
- Cease work while unauthorised persons are in the danger and working zone.

2.4.3 Instruction

The operator must instruct the personnel regularly. For ease of verification, the instruction protocol (see appendix) must be filled in completely and kept on record.

2.5 Personal protective equipment

Personal protective equipment is designed to keep people safe and protect them from health hazards during work.

When working with or on the gearbox, the personnel must wear the personal protective equipment indicated in the individual sections of this manual.

Description of the personal protective equipment

The personal protective equipment is explained below:



Protective work clothing

Protective work clothing is tight-fitting work clothing with low resistance to tearing, with tight sleeves, and without projecting parts.



Breathing protection

Breathing protection protects from hazardous dusts and oil mists.

**Hearing protection**

Hearing protection protects your hearing from damage through noise.

**Industrial hard hat**

Industrial hard hats protect the head from falling objects, swinging loads and impacts on stationary objects.

**Light breathing protection**

Light breathing protection protects from dust and oil mists.

**Protective suit**

Protective suits protect against dusts during cleaning operations.

**Safety goggles**

Safety goggles protect your eyes from flying debris and fluid sprays.

**Protective gloves**

Protective gloves protect hands from friction, abrasion, puncture wounds, or deeper injuries, aggressive chemicals, as well as from contact with hot surfaces.

**Safety footwear**

Safety footwear protects the feet from crushing injuries, falling parts and slipping on a slippery substrate.

2.6 Safety equipment



WARNING!

Danger to life from nonfunctional safety devices!

If safety devices are not functioning or are disabled, there is a danger of serious injury or death.

- Check that all safety devices are fully functional and correctly installed before starting work.
- Never disable or bypass safety devices.
- Ensure that all safety devices are always accessible.



Observe the operating manuals of additionally purchased parts.

2.6.1 Safety barriers

Protective covers for rotating shaft ends and fans Safety barriers prevent moving parts from being touched.

2.6.2 Additional safety equipment for use in explosive areas

Thermometer-resistor	Monitors the gear oil's temperature.
Earth connection points	Establish potential equalisation.
Thermosensor	Monitors the gear oil's temperature.
Float-switch oil level monitor	Monitors the gearbox's oil level and switches off the drive unit in the event of an impermissible oil level drop in the gearbox.
Flow monitor	Monitors the oil flow.

Pressure switch	Monitors the oil pressure.
Filter contamination indicator	Indicates the oil filter's contamination level.
Vibration sensors	Transmits generation of vibration to a monitor point.

2.6.3 Operator's safety equipment

If required, the operator must retrofit the following safety equipment:

- Emergency-off facility for the entire system in which the gearbox is installed
- Potential equalisation and fault-interrupt switch
- Safety equipment for moving parts such as the input and output shaft
- Safety equipment for shutting down the electrical power supply, protecting against inadvertent reactivation and prevention of uncontrolled/unintended operating states

2.7 Additional symbols

The following symbols and instruction signs are affixed in the work area. These symbols and instruction signs refer to the immediate vicinity in which they are affixed.



WARNING!
Danger due to illegible signage!

Over time, stickers and signs can get dirty or in some other manner become illegible, so that dangers cannot be recognized and necessary operating instructions cannot be followed. Thus an injury hazard occurs.

- Keep all safety, warning, and operating instructions that are affixed to the device in legible condition.
- Replace damaged signs or stickers immediately.



The correct direction of rotation is indicated by an arrow.



The earth connection points are marked.

2.8 Environmental protection



NOTICE!

Danger of pollution through incorrect handling of environmentally hazardous substances!

Incorrectly handled environmentally hazardous substances may seriously damage the environment, particularly if disposed of incorrectly.

- Always observe the notes below on handling environmentally hazardous substances and their disposal.
- If environmentally hazardous substances enter the environment by accident, immediately take appropriate measures. If in doubt, notify the local authorities responsible of the damage and enquire as to suitable measures.

The following environmentally hazardous substances are employed:

Gear oil

Gear oil may contain toxic substances. These must not enter the environment. Disposal must be handled by a disposal specialist.

Cooling lubricant and filters

Cooling lubricant and the filters used in cooling lubricant systems may contain toxic substances. These must not enter the environment. Disposal must be handled by a disposal specialist.

Corrosion protection

Corrosion protection can contain toxic substances. These substances should not get into the environment. Disposal must be carried out by a specialised disposal company.

Paper on the shaft ends

The paper protecting the shaft ends and the blank function surface contains corrosion protection. Corrosion protection may contain toxic substances. These must not enter the environment. Disposal must be handled by a disposal specialist.

Electrical and electronic components

Electrical and electronic components can be installed in attachment parts.

Electrical and electronic components can contain toxic materials. These components must be collected separately and taken to municipal collection points or disposed of by a specialised company.

These components include light bulbs, capacitors that contain PCB, components that contain mercury, printed circuit boards, fluid crystal displays, batteries, external electrical lines and electrolytic capacitors.

3 Technical data



The data on the type plate and in the technical specification in PIV Drives GmbH's order confirmation's applies.

3.1 EX marking

Overview

The EX marking contains the following information:

Group I	
Mining	
Category	
M1	M2
for safe operation in explosive atmosphere	Shutdown if explosive atmosphere occurs

Group II					
all other explosive areas					
Category 1		Category 2		Category 3	
G	D	G	D	G	D
Gas	Dust	Gas	Dust	Gas	Dust
Zone 0	Zone 20	Zone 1	Zone 21	Zone 2	Zone 22
for safe operation in explosive atmosphere		highly safe in occasional explosive atmosphere		suitable for rarely occurring explosive atmosphere	
constant to frequent > 100 h per year		occasional 10 to 100 h per year		rare and only briefly < 10 h per year	

Technical data

Temperature class	Maximum permissible surface temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C

Non-electrical equipment designed for operation in explosive areas	Ignition protection types
Protection through fume-restricting enclosure	fr
Protection through pressure-proof enclosure	d
Protection through inherent safety	g
Protection through constructive safety	c
Protection through ignition source monitoring	b
Protection through overpressure enclosure	p
Protection through liquid enclosure	k

Example

Example of an EX marking:

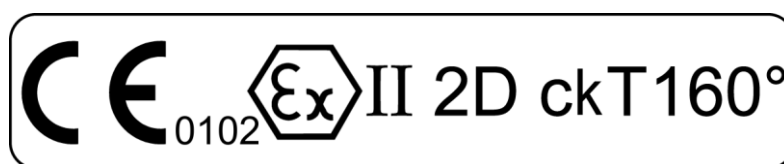


Fig. 1: Example of an EX marking

Symbols	Designation	Meaning
CE	CE symbol	Conformity mark in accordance with Appendix X to Directive 94/9/EC. Applied by the manufacturer prior circulating.
II	Device group	The gearbox is approved for use in explosive areas other than mining.
2D	Device category	For device category 2D, an atmosphere rendered explosive through dust (D) may occur occasionally. The device guarantees a high degree of safety and may be used in zone 21 and zone 22.
c	Ignition protection type	Constructive safety for non-electrical devices in explosive areas according to DIN EN 13463-5.
k	Ignition protection type	Liquid enclosure for non-electrical devices in explosive areas according to DIN EN 13463-8.
T160°C	Temperature class	Surface temperature does not exceed 160 °C
X	Additional marking	Indicates the requirement of observing special environmental conditions, in this case ambient temperature (see section on “Technical data”).
0102	Notified body	Body with which the technical documentation has been filed in accordance with 94/9/EC

3.2 Type plate

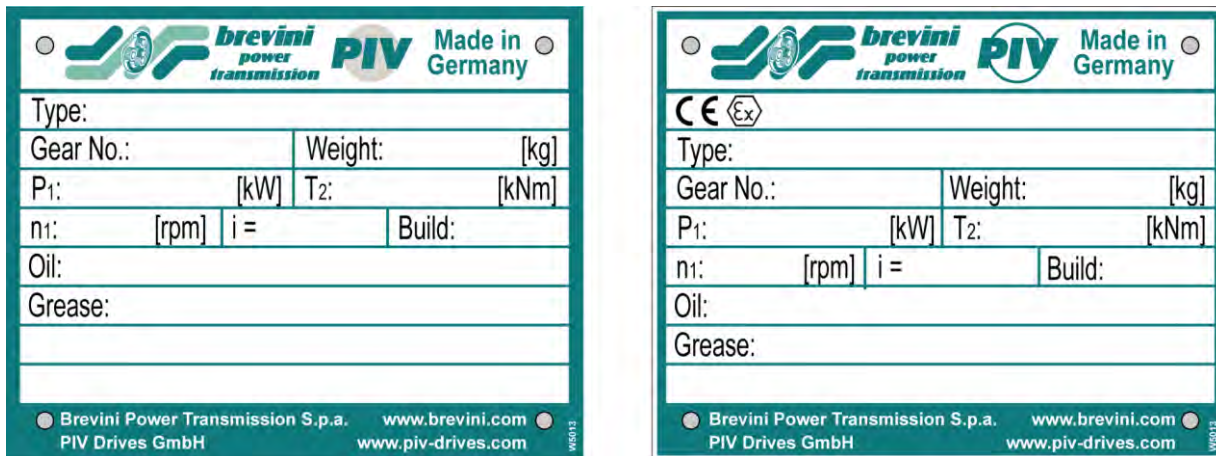


Fig. 2: Type plates, standard (left) and ATEX (right)

The type plate is affixed to the gearbox casing and lists the following data:

- ATEX version: ATEX marking
- Type
- Serial number
- Gearbox weight
- Drive power P_1 [kW]
- Output torque T_2 [Nm]
- Input speed n_1 [min^{-1}]
- Transmission ratio i
- Date of gearbox production
- Oil type, viscosity grade VG and oil quantity [l]
- Grease type, regreasing quantity and number of greasing points
- Customer-specific data
- Manufacturer

4 Design and function

4.1 Order designation



Fig. 3: Example of order designation

K	Connection to motor
	K - Motor bell housing
	M - Motor plate
	J1 - Motor bracket
	J2 - Motor console
PD	Design
	PB, PC, PD, PE - Parallel gearbox
	PLB, PLC, PLD - Right-angle gearbox
	PWC, PWD - Compact gearbox
22	Gearbox size: 10 to 84
R	Gearbox position and bottom casing surface
	R1, R2 - Horizontal, output shaft horizontal
1	S5 - Vertical, output shaft at bottom
	T6 - Vertical, output shaft at top
	U3, U4 - Horizontal, output shaft vertical
1	Attachment variants
	0 - Shaft-mounted gearbox with torque bracket
	1 - To casing surface 1
	2 - To casing surface 2
	3 - To casing surface 3
	4 - To casing surface 4
	5 - To casing surface 5
	6 - To casing surface 6
	7 - To output flange

- V** Output shaft
 - V - Solid shaft with keyway
 - H - Hollow shaft with keyway
 - G - Hollow shaft with shrink disc
 - F - Flanged shaft
- 11** Shaft layout and direction of rotation
Position of pawl
- 25** Nominal transmission ratio
- Z1** Addition
 - 1 - Fan cooling
 - 2 - Two fans
 - 3 - Cooling coil
 - 4 - Fan and cooling coil
 - 8 - Two cooling coils
 - 9 - Two cooling coils and one fan

4.2 Brief description

General information	The gearbox converts a drive unit's speed and torque. Drive is provided solely through torque. The drive power is transferred from the input shaft to the output shaft via a reduction gearing.
Design	See separate technical specifications and spare parts drawing.
Lubrication	See separate technical specifications.
Cooling	See separate technical specifications.
Monitoring and control devices	See separate technical specifications.

4.3 Gearbox position

Parallel gearboxes PB, PC, PD, PE

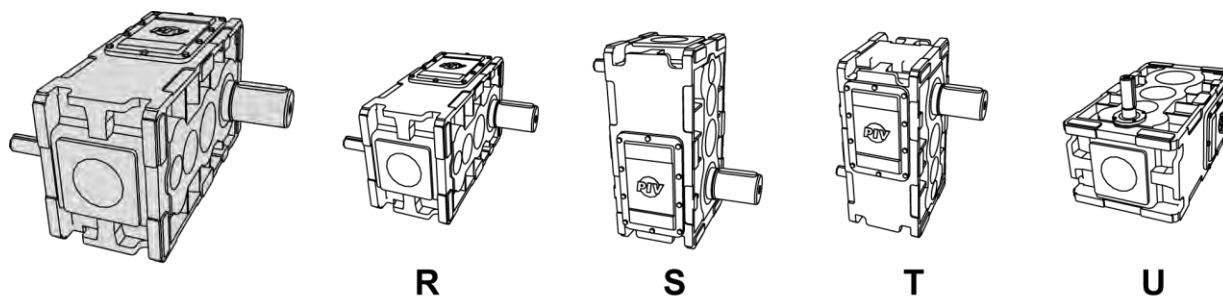


Fig. 4: Parallel gearbox

Right-angle gearboxes PLB, PLC, PLD

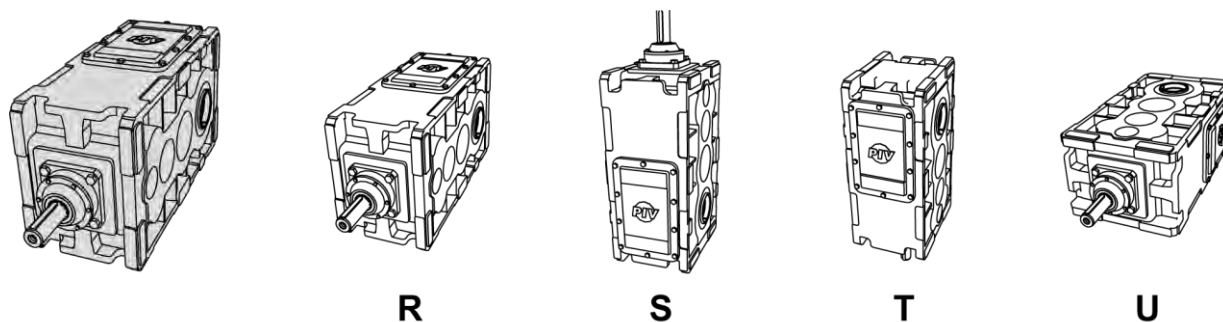


Fig. 5: Right-angle gearbox

Compact gearboxes PWC, PWD

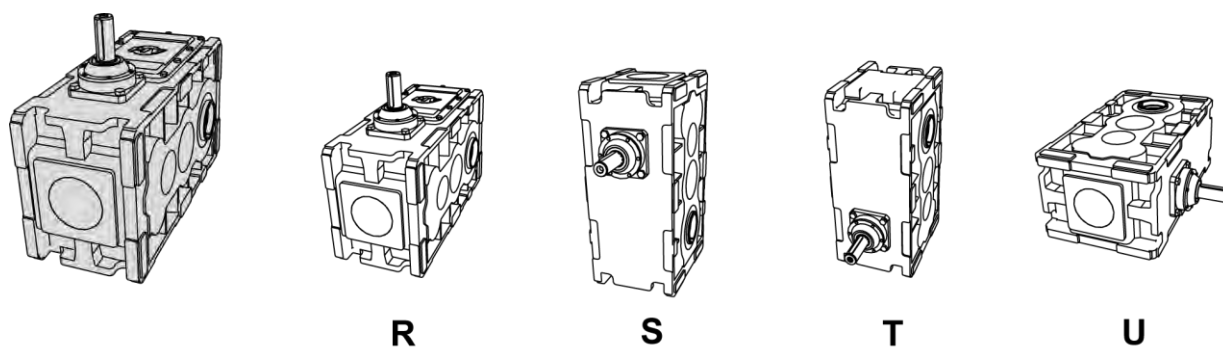
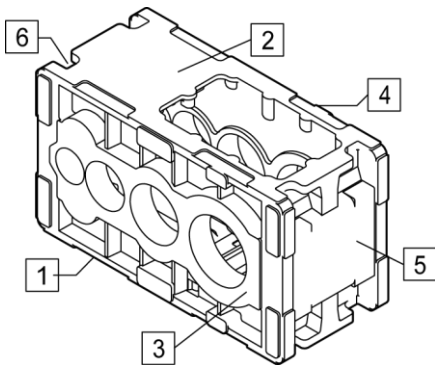


Fig. 6: Compact gearbox

Design and function

4.4 Casing surfaces



The casing surfaces are numbered 1 to 6 for ease of identification (Fig. 7).

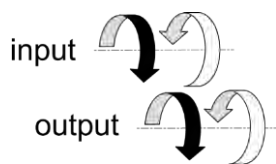
Refer to the gearbox's dimensions sheet for the permissible setup.

Fig. 7: Casing surfaces

Example

R1 R – gearbox horizontal
1 – surface 1 below

4.5 Shaft layouts and directions of rotation



Indication of directions of rotation



Indication of bottom surface

③

Additional shaft end or continuous shaft

④

Position of pawl

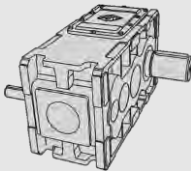
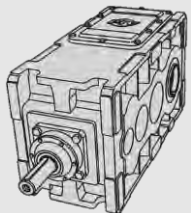
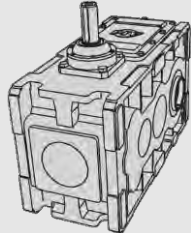
⑤

Hollow shaft with shrink disc only as of size 31

Overview



Overview of designs and gearbox positions:

Design		Gearbox positions and casing surfaces		Figure
	Parallel gearbox	PB	R1	Fig. 8
		PC	R1, S5, T6	Fig. 9
		PD	R1, S5, T6	
		PE	R1, S5, T6	
	Right-angle gearbox	PLB	R1, S5, T6	Fig. 10
		PLC	R1, S5, T6, U3	Fig. 11
		PLD	R1, S5, T6, U3	
	Compact gearbox	PWC	R1, S5, T6, U4	Fig. 12
		PWD	R1, S5, T6, U4	Fig. 13

Design and function



Parallel gearboxes PB, PC, PD, PE

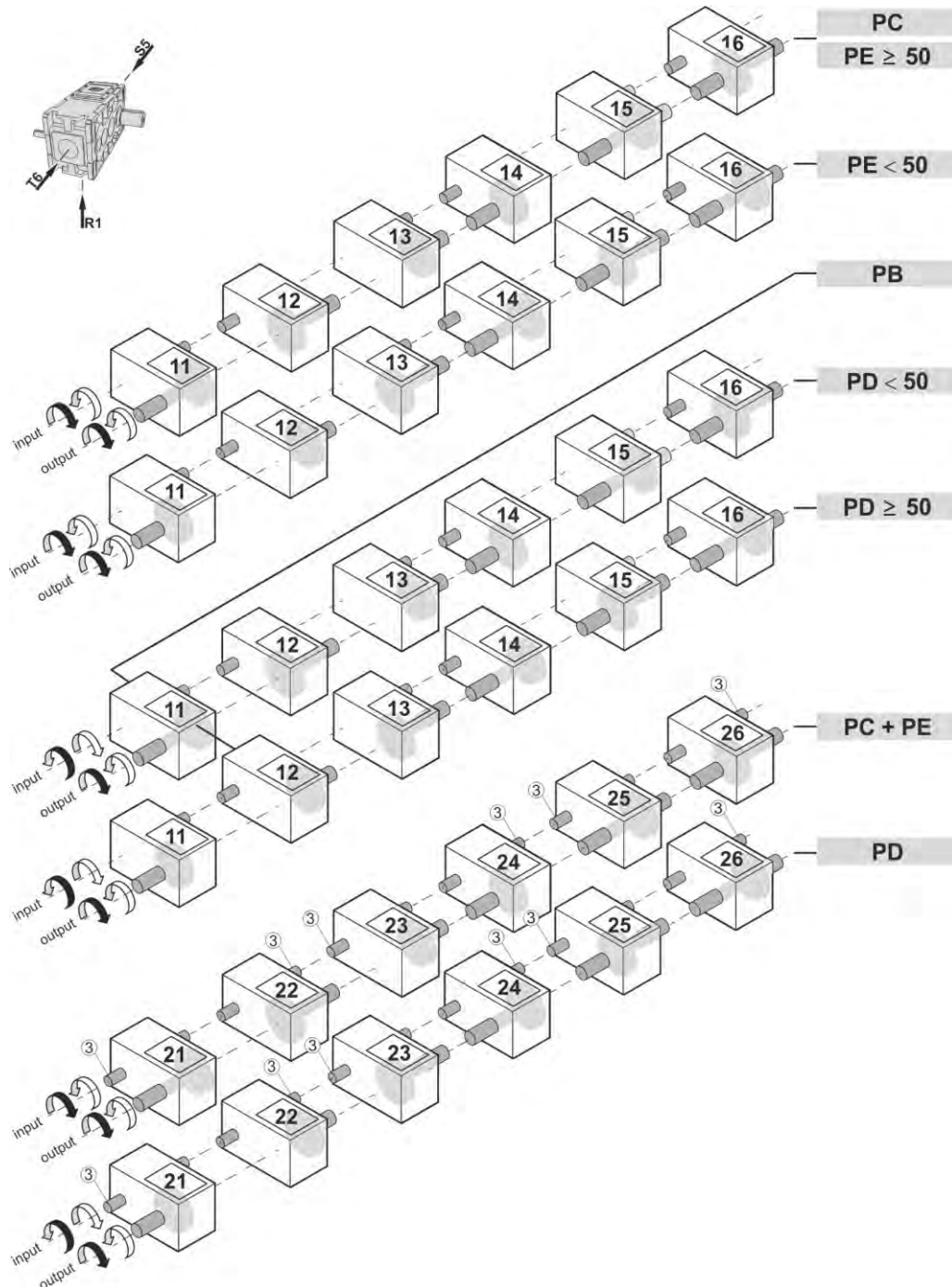


Fig. 8: Shaft layouts and directions of rotation for parallel gearboxes

R1, Gearbox position and bottom casing surface
 T6 and S5

③ Additional shaft end or continuous shaft

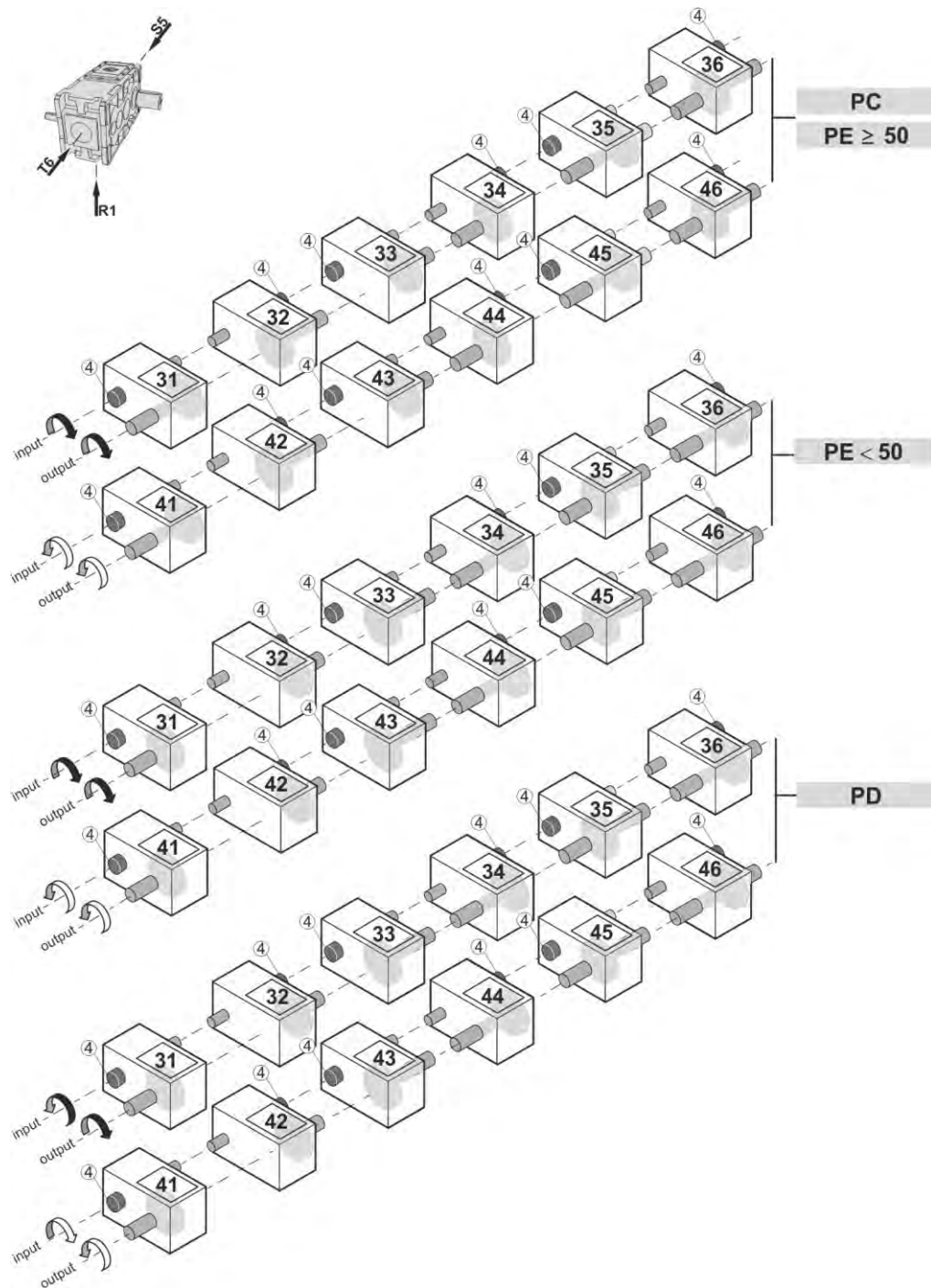


Fig. 9: Shaft layouts and directions of rotation for parallel gearboxes

R1, Gearbox position and bottom casing surface
 T6
 and
 S5

④ Position of pawl

Right-angle gearboxes PLB, PLC, PLD

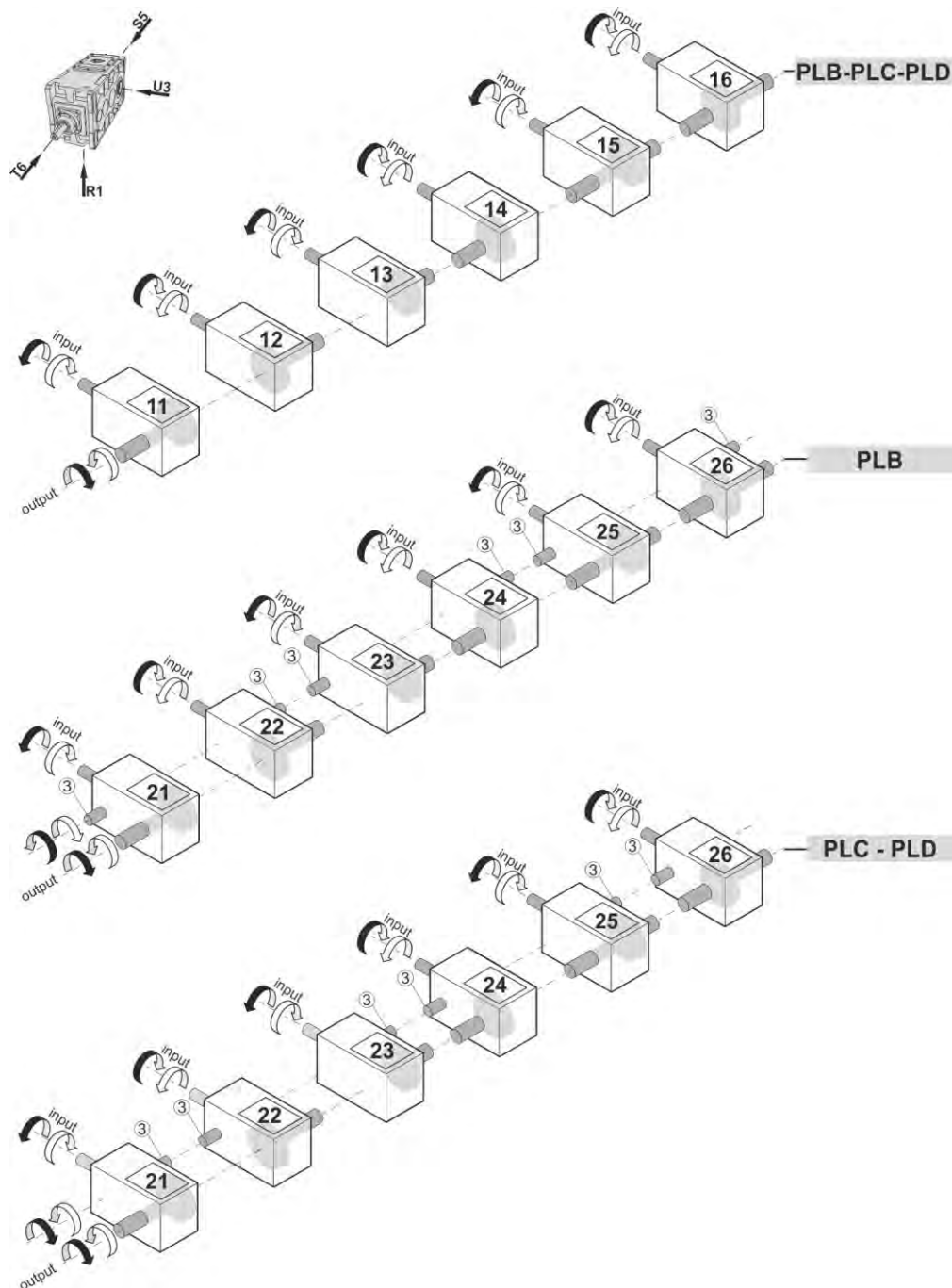


Fig. 10: Shaft layouts and directions of rotation for right-angle gearboxes

R1, Gearbox position and bottom casing surface ③ Additional shaft end or continuous shaft
 T6
 and
 S5

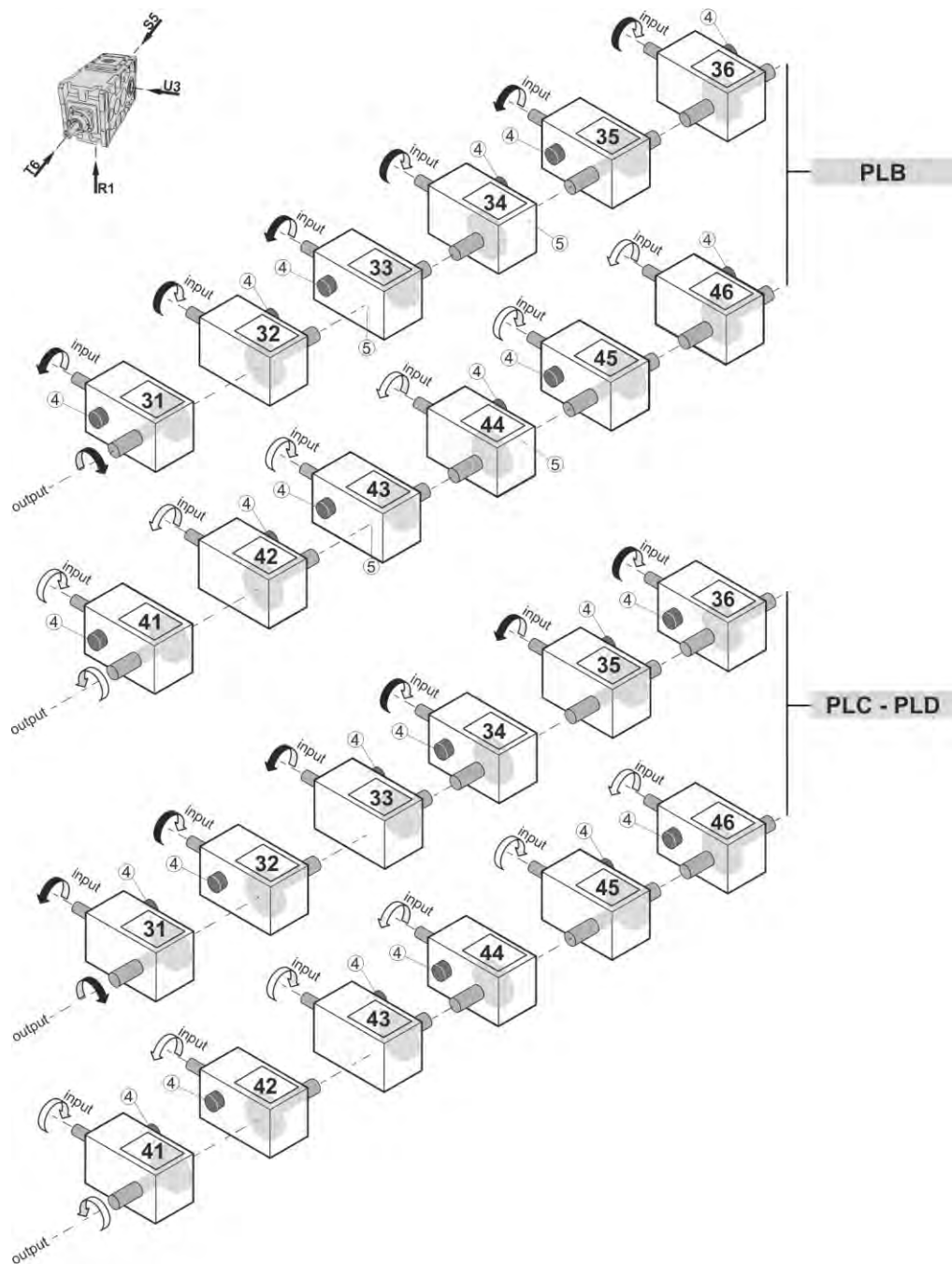


Fig. 11: Shaft layouts and directions of rotation for right-angle gearboxes

R1, Gearbox position and bottom casing surface
 T6
 and
 S5

④ Position of pawl
 ⑤ Hollow shaft with shrink disc only as of size ≥ 31

Design and function

Compact gearboxes PWC, PWD

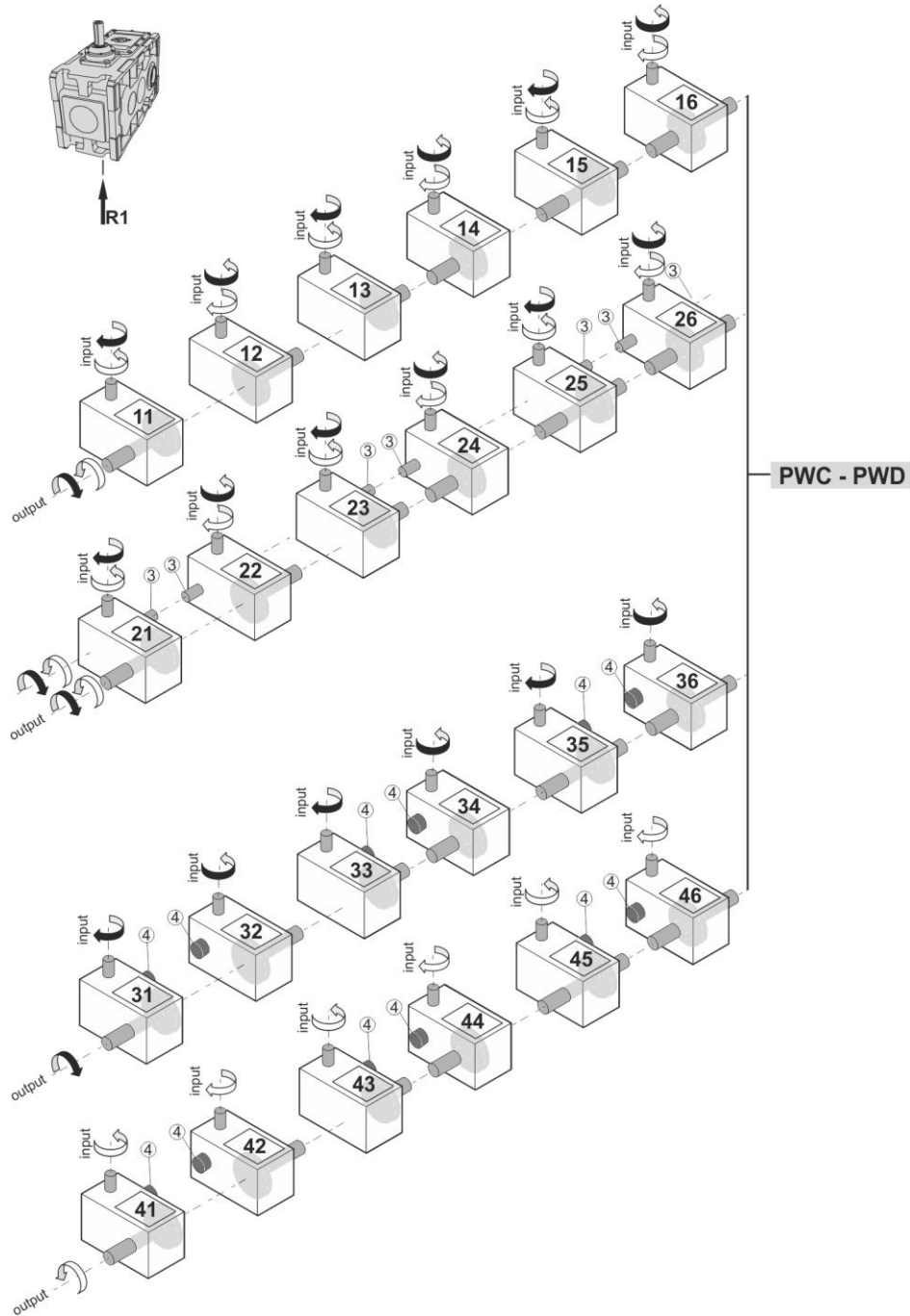


Fig. 12: Shaft layouts and directions of rotation for compact gearboxes

- | | |
|--|--|
| R1, Gearbox position and bottom casing surface | ③ Additional shaft end or continuous shaft |
| T6 and S5 | ④ Position of pawl |

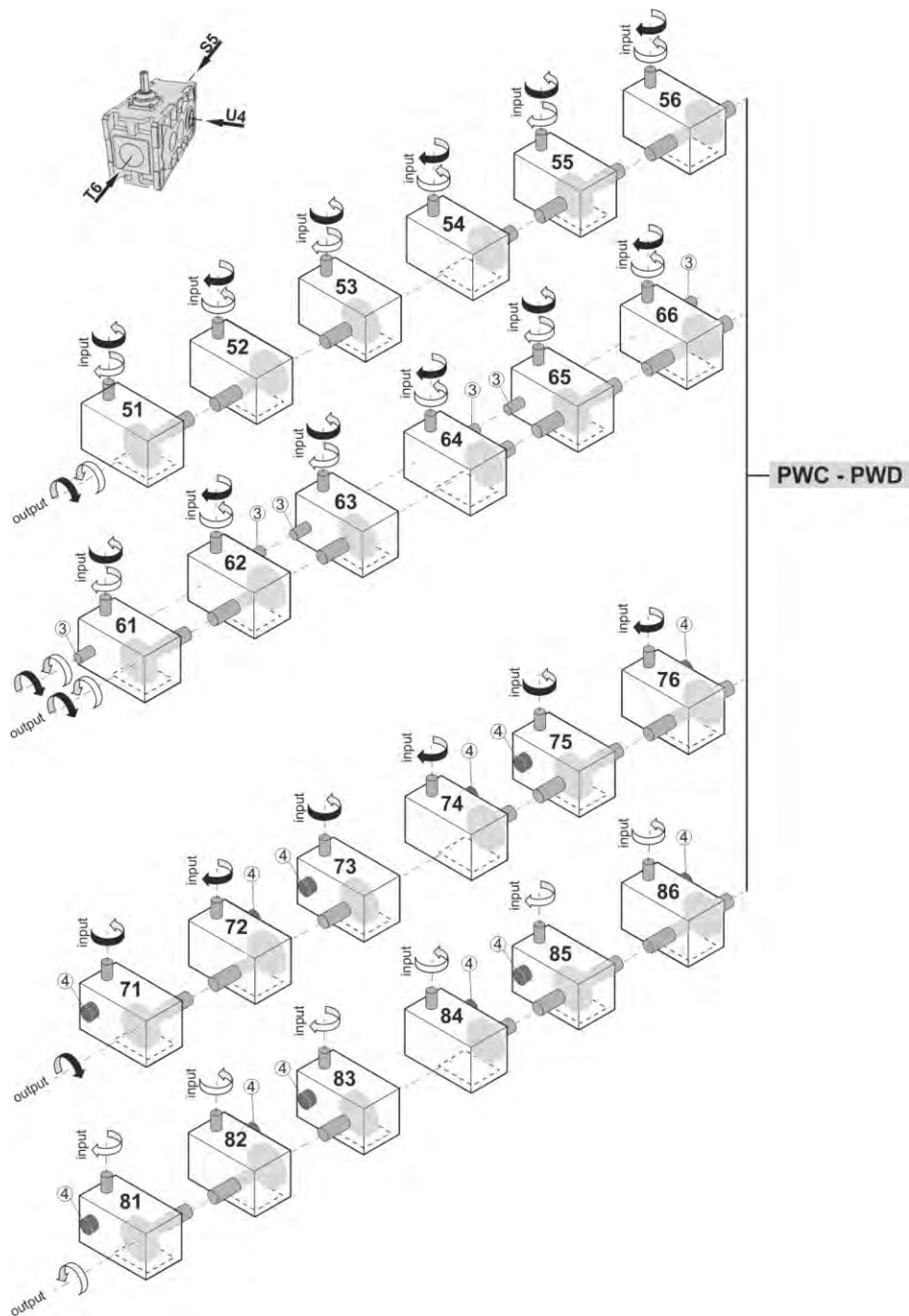


Fig. 13: Shaft layouts and directions of rotation for compact gearboxes

- | | |
|--|--|
| R1, Gearbox position and bottom casing surface | ③ Additional shaft end or continuous shaft |
| T6 | ④ Position of pawl |
| and | |
| S5 | |

4.6 Displays and controls

The following displays may be featured:

- Oil dipstick standard
- Oil gauge
- Oil sight glass
- Oil thermometer
- Pressure gauge
- Filter contamination indicator

4.7 Tools and utilities designed to be used in areas exposed to explosive hazards

Zones 0 and 20

In zones 0 and 20, use only tools that cannot generate sparks.

Zones 1 and 2

In zones 1 and 2, use only steel tools that can generate no more than a single spark when used. Tools that generate spark showers are only permissible if it is ensured that there is no explosive atmosphere at the workplace.

IIc

If there is a risk of explosion through group-IIc explosive substances, no kind of steel tool may be used in zone 1 at all.

Tools and utilities

The following tools and utilities designed for use in explosive areas are required:

- Spanner set
- Torque wrench set
- Screwdriver set
- Hexagon-socket spanner set
- Retractor
- possibly Compensator elements (washers, spacer rings)
- Fastening materials for drive/power take-off elements
- Lubricant (Molycote®)
- Screw locking materials, e.g. Loctite 243

4.8 Accessories

- Electric gearbox
- Additionally purchased parts, see included operating manuals
- Additional accessories, see catalogue

5 Transport, packaging and storage

The various versions of the gearbox can differ substantially in terms of size and weight.

The transport utilities are not included by PIV Drives GmbH.

5.1 Safety notes for transport

Suspended loads



WARNING!

Danger to life through suspended loads

Loads may swing and drop during transport. This can cause serious or even fatal injury.

- Always secure the transport path.
- Never enter the swing range or area beneath suspended loads.
- Only trained personnel are permitted to carry out transport. See the instruction protocol in the appendix.
- Only move loads under supervision.
- Only use approved lifting equipment and fastening gear with sufficient load capacity.
Observe the operating manuals of the lifting equipment.
- Never use damaged lifting equipment, ropes and belts.
- Use a suitable cross bar.
- Lower the load when leaving the workplace.

Risk of slipping



WARNING!

Risk of injury through slipping!

Oil may leak from damaged seals. Slipping on this oil can cause serious injuries.

- Collect any oil that may have been spilled during this process immediately and dispose of it.
- Clean the floor area.

Improper transport



NOTICE!

Damage to property due to improper transport!

Transport units may fall or tip over as a result of improper transport. This can cause a significant level of property damage.

- Proceed carefully when unloading transport units at delivery and during in-house transport; observe the symbols and instructions on the packaging.
- Only use the attachment points provided.
- Only remove the packaging shortly before assembly.

5.2 Transport inspection

On receipt, immediately inspect the delivery for completeness and transport damage.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Issue a complaint in respect of each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

5.3 Packaging

About packaging

The individual packing items are packaged in accordance with the expected transport conditions.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage until assembly. Therefore, do not destroy the packaging and remove it only immediately prior to assembly.

Tensioning straps

The gearbox is lashed to the pallet using tensioning straps.



CAUTION!
Risk of injury through sharp edges and corners on the tensioning straps!

The tensioning straps used to lash the gearbox to the pallet have sharp edges. The tensioning straps spring back when cut and have sharp ends. Contact with sharp-edged tensioning straps can cause injury.

- Wear protective gloves.
- When cutting the tensioning straps, position yourself in such a way that the straps pose no danger when they spring back.
- Dispose of tensioning straps correctly.

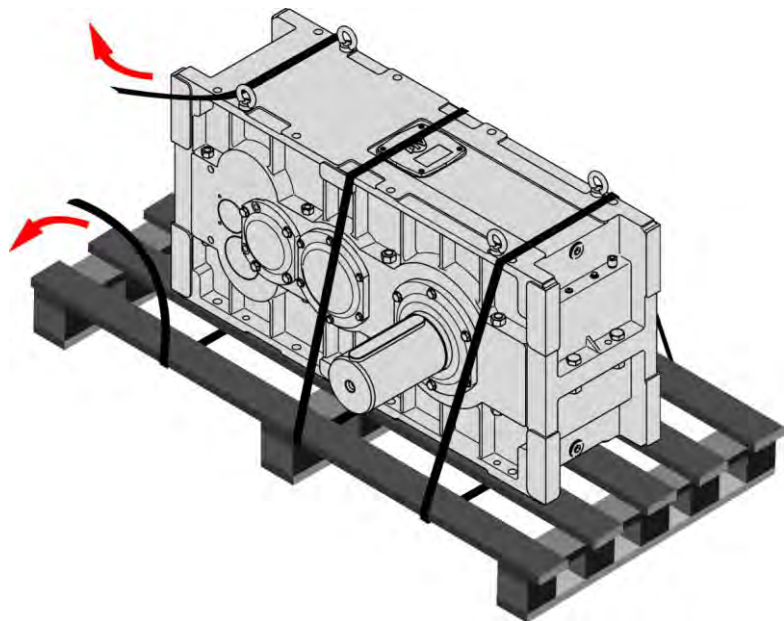


Fig. 14: Tensioning straps

Protective equipment: ■ Protective gloves

Undoing tensioning straps

1.



CAUTION!
Risk of injury when tensioning straps spring back!

Cut the tensioning straps using tin snips.

2. Dispose of tensioning straps correctly.

Handling packaging materials

Dispose of packaging material in accordance with the respectively applicable legal provisions and local regulations.



NOTICE!

Danger of pollution through incorrect disposal!

Packaging materials are valuable resources and can in many cases be reused or reconditioned and recycled. Incorrect disposal of packaging materials may cause pollution.

- Dispose of packaging materials in an environmentally sound manner.
- Observe the locally applicable disposal regulations. If necessary, have disposal handled by a specialist.

Packaging materials

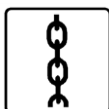
The packaging is adapted to the transport route and to the expected climatic conditions. The following packaging materials may be used:

- Wood
- Film
- Poly-nets
- BRANOrost corrosion-protection paper
- Protective varnish
- Desiccant sachets
- Tensioning straps
- Cardboard
- UCI paper/UCI bags

5.4 Symbols on the packaging

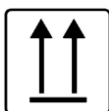
The packaging features the following symbols. Always observe the symbols for the purposes of transport.

Sling here



Attach lifting equipment only to the points indicated by this symbol.

This way up



The tips of the arrows indicate the top of the package. They must always point upwards or the contents may be damaged.

Centre of gravity



Indicates a package's centre of gravity.
Observe the centre of gravity when lifting and during transport.

Keep dry



Protect package from damp and keep it dry.

Fragile



Indicates packages with fragile or sensitive contents.
Handle the package with care, do not drop it and protect it from impacts.

Forklift



The package can be transported using lifter trucks.
Lift the package with the lifter truck at this point.

Keep away from heat



Use a cover to protect the gearbox from heat and direct sunlight.

Keep away from cold



Use a cover to protect the gearbox from cold.

Do not open



Read the instructions before opening the packaging.

Do not use hooks



Hooks are prohibited to prevent damage to the gearbox and attached parts.

Do not unpack



Do not unpack.

The contents of this package is protected by BRANORost corrosion-protection paper. This paper works by constantly evaporating an active substance.

Only open the packaging prior to use of the gearbox.

Reseal BRANORost packaging as quickly as possible after inspections. Damaged BRANORost packaging must be replaced.

Do not step here



Never step onto gearboxes, even if they are still packaged.

5.5 Transport

5.5.1 Sling points on the gearbox

The individual gearboxes can be lifted using shackles or ring bolts in accordance with DIN 580 (not included by PIV Drives GmbH).

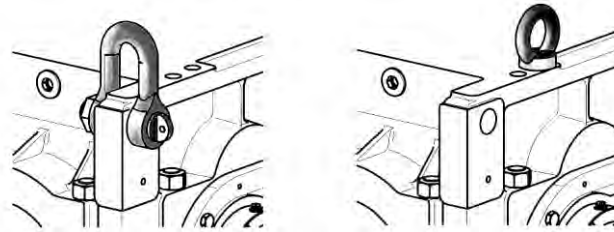


Fig. 15: Shackles and ring bolts

Transport together with motor

Protective equipment:

- Protective work clothing
- Safety footwear
- Industrial hard hat
- Protective gloves

Special tool:

- Cross bar

Belt

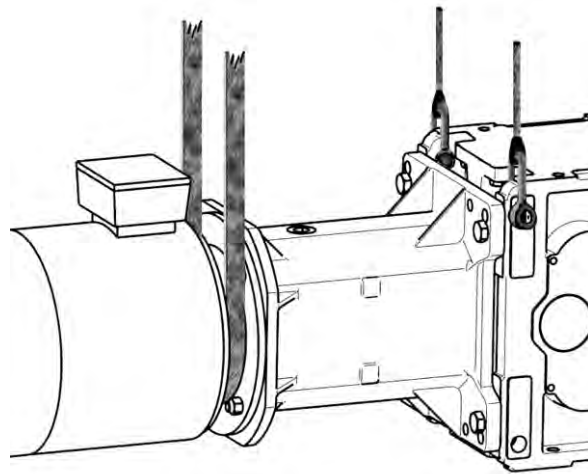


Fig. 16: Transport together with motor

1.



WARNING!

Risk of crushing through incorrect attachment of gearbox

If attached incorrectly, the package may drop. This can cause serious injury and major damage.

Use a belt to stabilise motors bolted to the gearbox via a bell housing.

Gearbox suspension points

2. Suspend the main weight of gearbox and motor from the gearbox's suspension points.



*The belt is for additional support only.
Any lifting eyelets on the motor must not be used
when transporting the gearbox-motor combination.*

3. Always pull the belt upwards perpendicular to the central axis. Use a transport cross bar when doing so.

Cross bar

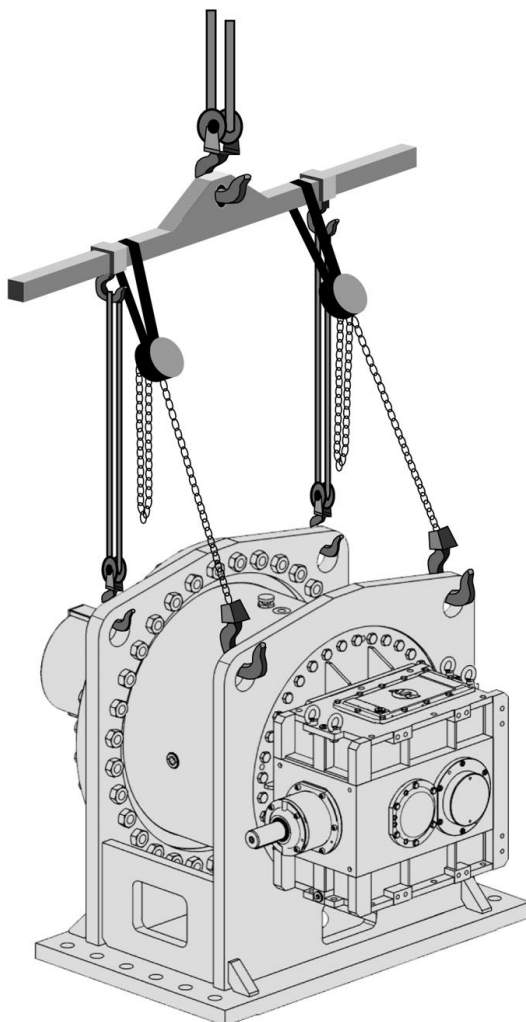


Fig. 17: Suspension for only stabilisation

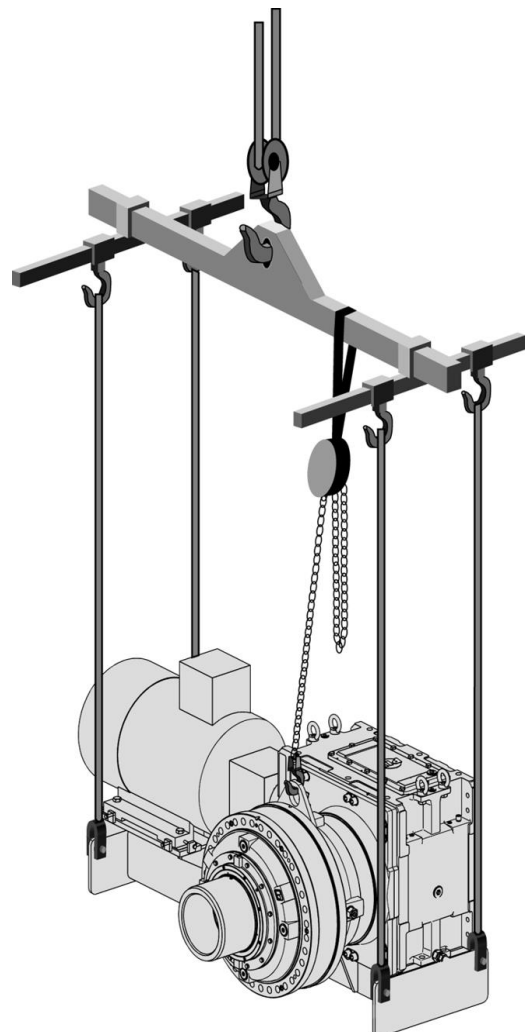


Fig. 18: Suspension for only stabilisation

Attaching the gearbox



WARNING!

Risk of crushing through incorrect attachment of gearbox!

Transporting a gearbox without a cross bar can cause serious injury and major damage.

- Never transport without a cross bar.
- If additional suspension is required for stabilisation, a chain and chain winch can be used to align the gearbox combination.



In the examples shown in Fig. 17 and Fig. 18, the ropes are bearing the load.

The chains may be used only to align and stabilise the gearbox combination.

5.5.2 Notes on transporting gearboxes

The following notes must be observed for every gearbox transport:

- The casings of the POSIRED models are dimensioned so that the forces resulting from operation are safely transmitted. The attachment points on the casings can only support the gearbox's weight.

The attachment points are not dimensioned for transport of an entire machine, only for transport of the gearbox. For drive units consisting of a gearbox and motor on a frame, the attachment points are located on the frame. See [Chapter 5.5.3 'Example of gearbox transport'](#) on page 57.

- Incorrect transport can damage the gearbox or the entire machine.
- For the total weight of the gearbox and connected parts, see the delivery note.
- The gearboxes may be lifted only by the corresponding suspension points. These are indicated by stickers on the gearbox.
- No lateral forces may be applied to the attachment points. Ropes and chains must always be positioned perpendicularly to the attachment surface. This means the gearbox with and without frame or the gearbox-motor unit must always be transported using a cross bar (see application example illustrations).
- Never use the front threads on the shaft ends to affix ring bolts for transport.
- Never use the shaft ends as attachment points for transport.
- Lifting gear must be designed to handle the weight of the gearbox with sufficient safety.
- The gearbox must be transported in such a way that nobody gets injured and damage to the gearbox is avoided. Impacts on the free shaft ends, for example, can damage the gearbox.
- The gearboxes may be transported only using suitable transport equipment. Cranes and hoists must be designed for the transport packages' weights. Protect transport ropes from damage through sharp edges.
- The operator must be authorised to operate cranes.
- Transport the gearbox drained of oil. If transporting the gearbox while filled with oil cannot be avoided, transport the gearbox with extra care. Oil sloshing back and forth can set the gearbox swinging.
- If possible, keep the gearbox or entire machine on its transport packaging (pallet) and transport it using a forklift.
- Make sure that any oil lines or attached parts on the gearbox are not damaged, crushed or bent.
- Do not tilt the gearbox during transport.
- Gearboxes may not be stacked even when packaged.

Transport, packaging and storage



- Do not store the gearbox in pathways or escape routes.
- Do not store the gearbox in front of fire alarms or fire extinguishing equipment.

5.5.3 Example of gearbox transport

Overview of examples



- POSIRED 2 gearboxes ↪ *page 57*
- POSIRED D gearboxes with bell housing ↪ *page 58*
- POSIRED 2 gearboxes with bell housing and motor ↪ *page 58*
- POSIRED N gearboxes ↪ *page 58*
- POSIRED 2 gearboxes with motor and clutch/brake on frame ↪ *page 59*
- POSIRED gearboxes with motor and belt drive ↪ *page 59*
- POSIREX gearboxes ↪ *page 60*
- POSITWIN gearboxes ↪ *page 60*
- High-power gearbox combination ↪ *page 60*
- High-power gearbox combination with motor on frame ↪ *page 61*
- High-power gearbox combination with motor and torque bracket ↪ *page 61*

POSIRED 2

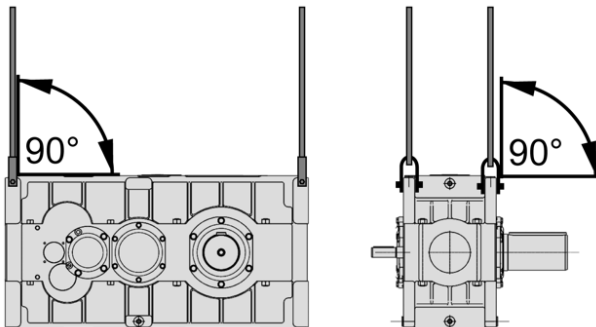


Fig. 19: POSIRED 2

Transport using ropes or chains and cross bar.
Suspension as far as possible using shackles or load blocks.



Any ropes, belts or chains must be used at right angles to the suspension point.

POSIRED D with bell housing

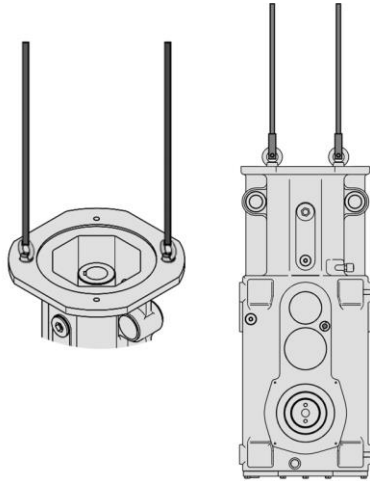


Fig. 20: POSIRED D with bell housing

Transport using ropes or chains.



The ring bolts are screwed into the threaded bores for motor assembly. The gearbox does not feature any further suspension points. Transport with a motor connected is not permitted.

POSIRED 2 with bell housing and motor

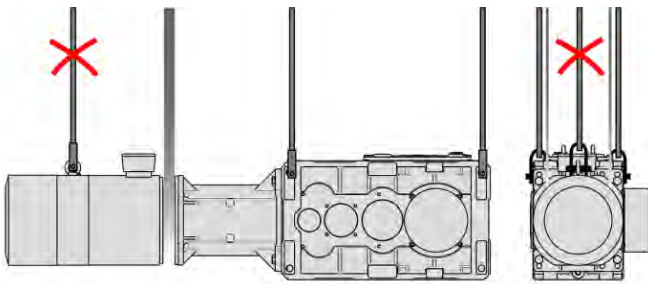


Fig. 21: POSIRED 2 with bell housing and motor

Transport with cross bar.



The motor must be stabilised using additional suspension. Suspend the main weight of gearbox and motor from the gearbox's suspension points. The additional suspension is for support and alignment only. Do not use the lifting eyelets on the motor (marked X in Fig. 21) for this purpose.

POSIRED N

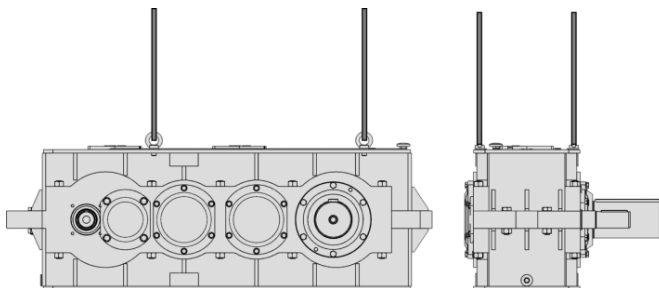


Fig. 22: POSIRED N

Transport using ropes or chains and cross bar.



If using shackles is not possible, transport the gearbox using ring bolts.

POSIRED 2 with motor and clutch/brake on frame

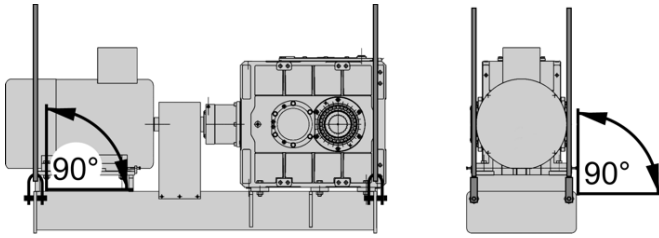


Fig. 23: POSIRED 2 with motor and clutch/brake on frame

Transport with cross bar.



The ropes or chains may be attached only vertically and only to the suspension points indicated on the frame.

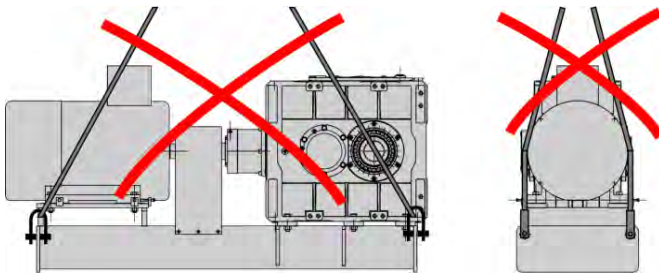


Fig. 24: Incorrect transport



Never pull the ropes/chains at an oblique angle to the suspension.

POSIRED with motor and belt drive

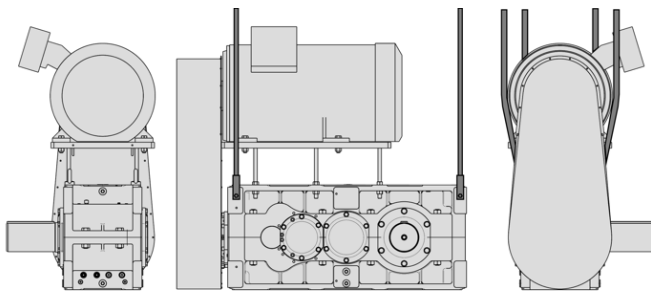


Fig. 25: POSIRED with motor and belt drive

Transport with cross bar.



Never use the motor mount or any suspension points on the motor for lifting.

Transport, packaging and storage



POSIREX

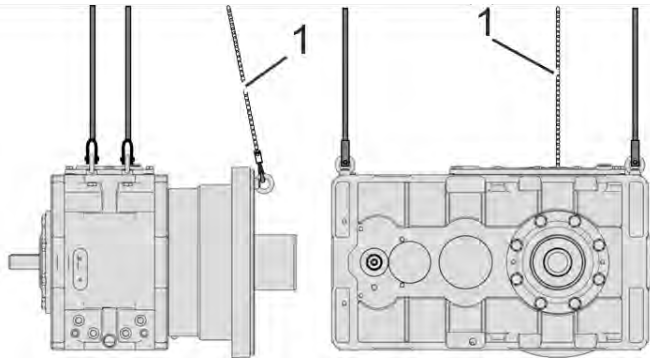


Fig. 26: POSIREX

Transport with cross bar.

The thrust bearing cup needs to be stabilised against tipping using a chain (Fig. 26/1) (suspend from ring bolt).



None of the pipes may be damaged. Suspend the main weight from the gearbox's suspension points. The additional suspension is for support and alignment only.

POSITWIN

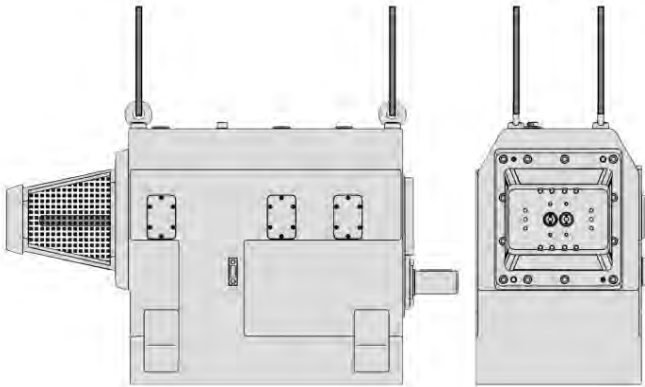


Fig. 27: POSITWIN

Transport with cross bar.



Take particular care that the bell housing around the output shafts (Fig. 27/1) is not damaged during transport. If necessary, fit protective elements around the bell housing. Never use the bell housing to lift the gearbox.

High-power gearbox combination

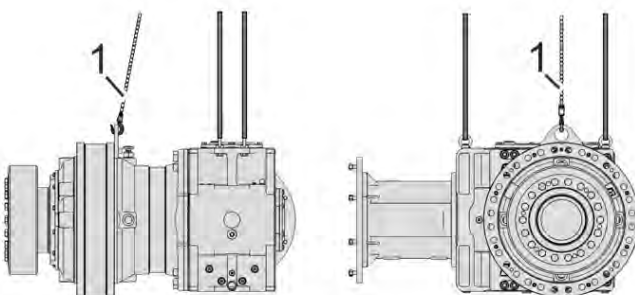


Fig. 28: High-power gearbox combination

Transport with cross bar.



Suspend the main weight of the gearbox combination from the gearbox's suspension points. The planetary gear's suspension (Fig. 28/1) is for alignment and support.

High-power gearbox combination with motor on frame

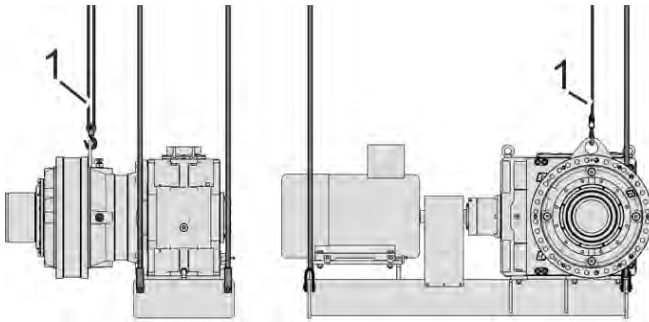


Fig. 29: High-power gearbox combination with motor on frame

Transport with cross bar.



Suspend the main weight of the gearbox combination from the gearbox frame. The planetary gear's suspension (Fig. 29/1) is for alignment and support.

Never attach ropes/chains at an oblique angle to the frame.

High-power gearbox combination with motor and torque bracket

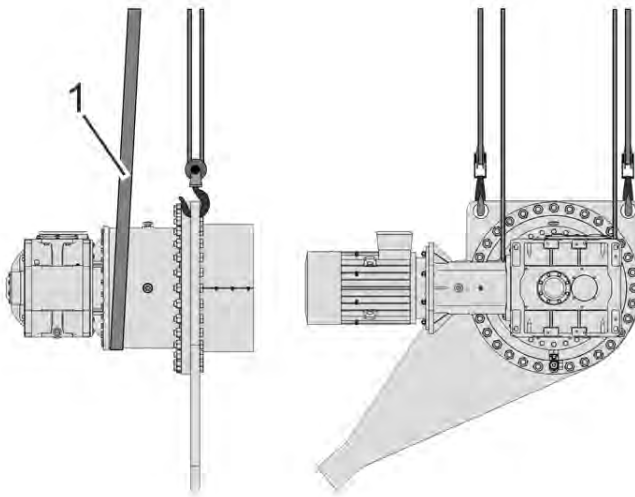


Fig. 30: High-power gearbox combination with motor and torque bracket

Transport with cross bar.



Suspend the main weight of the gearbox combination from the gearbox's suspension points. The additional tension belt (Fig. 30/1) is for alignment and support only.

Never use the torque bracket's arm as an attachment point. Protect it against impacts during transport.

5.5.4 Lifting

- Protective equipment:
- Protective work clothing
 - Safety footwear
 - Industrial hard hat
 - Protective gloves

- Special tool:
- Cross bar



WARNING!

Risk of crushing through falling packages!

If attached incorrectly, the gearbox may drop. This can cause serious injury.


1. Always tension ropes or chains at a right angle to the foundation frame.
See ↪ *Chapter 5.5.1 'Sling points on the gearbox' on page 52,*
↪ *Chapter 5.5.2 'Notes on transporting gearboxes' on page 55*
and
↪ *Chapter 5.5.3 'Example of gearbox transport' on page 57.*
2. Make sure that the transport package is suspended straight. Observe any eccentric centre of gravity if applicable.
3. Begin transport.

5.6 Storage



Note that there may be storage instructions included on the packages that go beyond the requirements listed here. Observe these accordingly.

The following notes must be observed:

- Irrespective of the later assembly position, the gearbox should preferably be stored in R position. See  *Chapter 4.3 'Gearbox position' on page 35.*
Stacking gearboxes on one another is not permitted.
Gearboxes must not be stacked on top of one another even if packed in boxes.
- The gearbox must be stored in a dry place and be protected from the weather.
The permissible temperature range for the storage location is +5 °C to +35 °C .
If stored outdoors, the gearbox must be covered with extra care so that neither dampness nor foreign matter (dirt, dust) can accumulate on the gearbox.
Water must be prevented from accumulating under all circumstances. The permissible relative humidity is max. 60%.
- The gearbox must not be subjected to rapid temperature fluctuation.
- The gearbox must not be exposed to aggressive chemical products or similar adverse effects.
- The gearbox's coating must not be damaged. Any damage can lead to failure of the external corrosion protection.
- If storing the gearbox for more than 3 months, regularly check the general condition of all parts and the packaging.
- To avoid damage, the gearbox must be protected from vibrations throughout the entire storage period, for example by setting it on rubber mounts.
- If the gearbox was stored for longer than 6 months, we recommend replacing the shaft seal rings before commissioning the gearbox.
- Transport and store the gearbox in its original packaging.
- The BRANORost paper shaft protection must not be damaged.
If the shaft protection is damaged, it must be renewed. While undamaged, the BRANORost paper will provide sufficient corrosion protection for up to 3 years.

5.7 Preservation



The following preservation instructions applies only to gearboxes by PIV Drives GmbH.

The operating manuals and preservation instructions issued by the respective manufacturers apply to all attached parts.

The gearbox is supplied without oil as standard.

At the PIV Drives GmbH plant, basic preservation as per [Chapter 5.7.2 'Basic gearbox preservation'](#) on page 68 was performed.

If the gearbox was supplied with oil, please consult PIV Drives GmbH for details on preservation (see [Chapter 1.3 'Customer service'](#) on page 8 for contact details).



Polyglycols are not covered in this manual and are only permissible as lubricants for the gearboxes after consulting PIV Drives GmbH.

Preservation instructions



Overview of preservation instructions:

- State of preservation of gearbox upon delivery [page 65](#)
- Basic gearbox preservation [page 68](#)
 - Basic gearbox preservation by PIV Drives GmbH using mineral, synthetic (poly-alpha-olefin) and biodegradable lubricant [page 68](#)
 - Basic gearbox preservation by PIV Drives GmbH using physiologically harmless lubricants [page 69](#)
- Subsequent preservation by customer [page 71](#)
 - Gearbox preservation with anti-corrosion mineral oil or physiologically harmless lubricant [page 72](#)
 - Gearbox preservation through completely filling gearbox with lubricant [page 75](#)
- Machine trial with subsequent preservation [page 78](#)
 - Machine trial using anti-corrosion mineral oil [page 78](#)
 - Machine trial with a gearbox filled completely with lubricant for corrosion protection [page 79](#)

5.7.1 State of preservation of gearbox upon delivery

The casing's inner and outer sides are painted with a base coat.

The outer surfaces are painted with an additional coat.

The input and output shafts are preserved using BRANORost paper. This preservation must not be damaged and must remain on the shafts until the gearbox is finally connected to the machine.

If damaged, the BRANORost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

All other blank surfaces are greased.

Food industry

If the order states application in the food industry, ex-works preservation takes the form of physiologically harmless oil.

Otherwise, an oil is used that guarantees corrosion protection for 18 months, provided the gearbox remains hermetically sealed.

Basic preservation

This basic preservation guarantees preservation of the gearbox for 18 months (mineral, synthetic poly-alpha-olefin and biodegradable oil) or 6 months (physiologically harmless oil), provided the gearbox remains hermetically sealed.

After this period, the gearbox's preservation must be checked.

The preservation period is indicated by a sticker on the gearbox.

Transport, packaging and storage



Basic preservation by PIV Drives GmbH

Basic preservation by PIV Drives GmbH using	Mineral oil with special corrosion protection for 18 months			Physiologically harmless oil with special corrosion protection for 6 months
	Mineral oil	Synthetic oil (poly-alpha-olefin)	Biodegradable oil	
Lubricant used during later operation	Mineral oil	Synthetic oil (poly-alpha-olefin)	Biodegradable oil	Physiologically harmless oil
Basic preservation	Mineral oil	Mineral oil	Mineral oil	Physiologically harmless oil
Possible preservation period of basic preservation	18 months	18 months	18 months	6 months
Flushing required before filling the operation lubricant	No	No	Yes, in accordance with oil manufacturer's specifications and VDMA 24569	No
Service life of BRANOrost paper shaft preservation	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months



Transport, packaging and storage

Subsequent preservation by customer

Subsequent preservation by customer using	Mineral oil with special corrosion protection for 18 months			Physiologically harmless oil with special corrosion protection for 6 months
	Mineral oil	Synthetic oil (poly-alpha-olefin)	Biodegradable oil	Physiologically harmless oil
Lubricant used during later operation	Mineral oil	Synthetic oil (poly-alpha-olefin)	Biodegradable oil	Physiologically harmless oil
Possible preservation period of the respective subsequent preservation	18 months	18 months	18 months	6 months
Number of subsequent preservations by customer	1	1	1	2
Maximum possible total preservation period including basic preservation by PIV Drives	maximum 36 months	maximum 36 months	maximum 36 months	maximum 18 months
	Further preservation possible only after consultation with PIV Drives GmbH.			
Service life of BRANOrost paper shaft preservation	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months	Undamaged maximum 36 months

5.7.2 Basic gearbox preservation

5.7.2.1 Basic gearbox preservation by PIV Drives GmbH using mineral, synthetic (poly-alpha-olefin) and biodegradable lubricant

Irrespective of the oil used during later application by the customer, the gearbox is preserved using a special mineral oil for corrosion protection.

The special mineral oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 18 months, provided the gearbox remains hermetically sealed. To hermetically seal the gearbox, the bleeder screw is replaced by a dummy plug.

PIV Drives GmbH securely stows the bleeder screw on the gearbox.

The input and output shafts are preserved using BRANORost paper. This preservation must not be damaged. If damaged, the BRANORost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

These measures preserve the gearbox for 18 months.

Prior to commissioning

1.



DANGER!

Risk of explosion through flammable gases!

When removing the plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.

Before commissioning, replace the dummy plug with the original bleeder screw.

2. Fill fresh oil of the type and viscosity intended for operation up to the specified oil level using a filling filter (filter unit 25 µm).

Sticker

The gearbox features a sticker noting:

“Gearbox was preserved by the manufacturer using mineral oil. If the customer is using a different lubricant type, the oil manufacturer’s specifications must be observed.”

Flushing the gearbox

1.



Always observe any additional legal provisions.

If the gearbox has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegradable oil, flush the gearbox particularly thoroughly.

5.7.2.2 Basic gearbox preservation by PIV Drives GmbH using physiologically harmless lubricants

If PIV Drives GmbH has been informed that the gearbox will be employed in the food industry, the gearbox will be preserved using a physiologically harmless lubricant approved in accordance with NSF-H1.

The special mineral oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 6 months, provided the gearbox remains hermetically sealed. To hermetically seal the gearbox, the bleeder screw is replaced by a dummy plug.

PIV Drives GmbH securely stows the bleeder screw on the gearbox.

The input and output shafts are preserved using BRANORost paper. This preservation must not be damaged. If damaged, the BRANORost paper must be replaced.

While undamaged, it will provide sufficient corrosion protection for up to 3 years.

This measure preserves the gearbox for 6 months.

Prior to commissioning

1.



DANGER!
Risk of explosion through flammable gases!

When removing the plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.

Before commissioning, replace the dummy plug with the original bleeder screw.

2. Fill fresh oil of the type and viscosity intended for operation up to the specified oil level using a filling filter (filter unit 25 µm).

Sticker

The gearbox features a sticker noting:

“Gearbox was preserved by the manufacturer using physiologically harmless lubricant (according to specification NSF-H1).”

Flushing the gearbox

1.



Always observe any additional legal provisions.

If the gearbox is to be operated using a lubricant other than the physiologically harmless oil, flush the gearbox particularly thoroughly.

5.7.3 Subsequent preservation by customer

After the 18- or 6-month period of the PIV Drives GmbH basic preservation has elapsed, the gearbox can be preserved for further planned storage as follows:

Flammable gases



DANGER!

Risk of explosion through flammable gases!

Oil mist can cause explosions.

- Open flames, sparks and hot objects are prohibited.

Working with oil



WARNING!

Danger to health through oil!

Inhaling oil mist and skin contact with oil can be hazardous to health.

- Wear a breathing mask, protective clothing and protective gloves when working with oil.

Working on the gearbox



NOTICE!

Risk of damage to gearbox through improper work on gearbox!

Work performed improperly on the gearbox can result in major damage to the gearbox.

- Never allow foreign bodies to enter the gearbox.
- Never mix lubricants based on different oils. Always observe the oil manufacturers' specifications.
- Do not damage pipelines or gearbox attachments.
- Do not damage the BRANORost paper shaft protection. If the shaft protection is damaged, it must be renewed.
- Observe all safety provisions.



NOTICE!

Risk of pollution through oil!

Escaped oil can pollute the environment.

- Collect escaping oil and dispose of it in accordance with the applicable regulations or store it appropriately.

5.7.3.1 Gearbox preservation with anti-corrosion mineral oil or physiologically harmless lubricant

The gearbox can be preserved with anti-corrosion mineral oil or physiologically harmless lubricant as follows:

1.



DANGER!
Risk of explosion through flammable gases!

Remove the maintenance cover.

Corrosion

2. Check the gearbox interior for corrosion.
3. If there is any corrosion, contact PIV Drives GmbH.
4. If there is no corrosion, apply preservation to the gearbox through suitable measures.

The lubricant used must, in a hermetically sealed gearbox, guarantee at least 18 months of corrosion protection, or at least 6 months if a physiologically harmless lubricant is used.

Filling oil

5. Fill oil up to the specified oil level. Use a filling filter to fill the oil (filter unit 25 µm).
6. Rotate the input shaft by hand a number of times until the output shaft has completed at least one full turn.

⇒ The oil is now fully distributed throughout the gearbox.

Draining oil

7. Drain the oil.
 - ⇒ The oil still clinging to the toothing after the oil has been drained guarantees corrosion protection for 18 or 6 months, provided the gearbox remains hermetically sealed.
8. To hermetically seal the gearbox, replace the bleeder screw by a dummy plug.

Securely stow the bleeder screw on the gearbox.

Non-contact seals

9.



Refer to the documentation or technical specification to find out whether the gearbox features non-contact seals.

If the gearbox features non-contact seals and grease chambers, relubricate the grease chambers. See [Chapter 8.7.10 'Relubricating taconite seals and non-contact labyrinth-type seals with lubricating grease'](#) on page 140.

10. If there are no grease chambers, tape off the gap around the shaft outlet hermetically.

⇒ This prevents air from escaping through the non-contact seals and seals the gearbox hermetically.

BRANOrost paper

11.



The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged.

If damaged, replace the BRANOrost paper.

⇒ While undamaged, it will provide sufficient corrosion protection for up to 3 years.

This measure preserves the gearbox for 18 months or, if using physiologically harmless oil, for 6 months.

Maximum storage period

The preservation procedure described above may be performed by the customer once if using a mineral oil with special corrosion protection or at most twice when using a physiologically harmless lubricant with special corrosion protection.

Thus, including the basic preservation by PIV Drives GmbH, the gearbox can be stored for a maximum period of 36 months.

Gearboxes with physiologically harmless lubricant can be preserved for a maximum of 18 months.

If you wish to store the gearbox for a longer period of time, contact PIV Drives GmbH.

For such cases, PIV Drives GmbH offers a maintenance contract and corresponding staff. For contact details, see [Chapter 1.3 'Customer service'](#) on page 8.

Prior to commissioning

1.



DANGER!
Risk of explosion through flammable gases!

When removing the plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.

Before commissioning, replace the dummy plug with the original bleeder screw.

2. Fill fresh lubricant of the oil type and viscosity intended for operation up to the specified oil level using a filling filter (filter unit 25 µm).

Flushing the gearbox

1.



Always observe any additional legal provisions.

If the gearbox is to be operated using a lubricant other than the physiologically harmless oil, flush the gearbox particularly thoroughly.

Preservation record



Document application of long-term preservation in the preservation record (see appendix).

5.7.3.2 Gearbox preservation through completely filling gearbox with lubricant



Gearbox preservation through completely filling the gearbox with lubricant is not possible if the gearbox features non-contact seals.

Use the variant using special anti-corrosion oil described above (☞ Chapter 5.7.3.1 'Gearbox preservation with anti-corrosion mineral oil or physiologically harmless lubricant' on page 72).

Refer to the documentation or technical specification to find out whether the gearbox features non-contact seals.

The gearbox can be preserved through completely filling it with lubricant as follows:

1.



DANGER!
Risk of explosion through flammable gases!

Completely drain off the lubricant in the gearbox. To do so, open the oil drain screw, all filler openings and all bleeder screws.

Corrosion

2. Check the gearbox interior for corrosion.

3. If there is any corrosion, contact PIV Drives GmbH.

Dryer cartridge

4. If there is no corrosion, replace the bleeder screw with a dryer cartridge including an intermediate oil expansion tank.

5. Regularly check the dryer cartridge in accordance with the manufacturer's specifications and replace it if necessary.


Securely stow the bleeder screw on the gearbox as it needs to be reinstalled on the gearbox before commissioning.

6. Irrespective of the later assembly position, the gearbox should preferably be stored in R position (☞ Chapter 4.3 'Gearbox position' on page 35).

Filling lubricant

7. Fill fresh lubricant of the oil type and viscosity intended for operation into the maintenance cover opening up to the lower edge of the maintenance opening using a filling filter (filter unit 25 µm).
8. Close the maintenance cover.
9. For gearboxes of the “S”, “T” and “U” versions, which cannot be stored in R-position due to attached parts, fill the gearbox entirely up to the top edge of the gearbox through the oil filler neck.

BRANOrost paper

10.  *The input and output shafts are preserved using BRANOrost paper. This preservation must not be damaged.*

If damaged, replace the BRANOrost paper.

⇒ While undamaged, it will provide sufficient corrosion protection for up to 3 years.

The lubricant used must, in a hermetically sealed gearbox, guarantee at least 18 months of corrosion protection, or at least 6 months if a physiologically harmless lubricant is used.


Maximum storage period

The preservation procedure described above may be performed by the customer once if using a mineral oil with special corrosion protection or at most twice when using a physiologically harmless lubricant with special corrosion protection.

Thus, including the basic preservation by PIV Drives GmbH, the gearbox can be stored for a maximum period of 36 months.

Gearboxes with physiologically harmless lubricant can be preserved for a maximum of 18 months.

If you wish to store the gearbox for a longer period of time, contact PIV Drives GmbH.

For such cases, PIV Drives GmbH offers a maintenance contract and corresponding staff. For contact details, see  *Chapter 1.3 ‘Customer service’ on page 8.*

Prior to commissioning

1. Check the lubricant for compliance with the permissible water content and permissible lubricant ageing.
The limit values as specified by the respective lubricant's manufacturer apply.

- 2.



DANGER!

Risk of explosion through flammable gases!

When removing the plug on the oil filler neck, flammable gases may escape.

- Open flames, sparks and hot objects are prohibited.

Before commissioning, drain the lubricant down to the specified oil level and replace the dryer cartridge with intermediate oil expansion tank with the original bleeder screw.

Flushing the gearbox

- 1.



Always observe any additional legal provisions.

If the gearbox has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegradable lubricant, flush the gearbox particularly thoroughly.

Preservation record



Document application of long-term preservation in the preservation record (see appendix).

5.7.4 Machine trial with subsequent preservation

5.7.4.1 Machine trial using anti-corrosion mineral oil

Filling lubricant

1. If the gearbox is installed in a machine and the machine is to be commissioned for trial-run purposes, fill fresh lubricant of the lubricant type and viscosity intended for operation up to the specified oil level using a filling filter (filter unit 25 µm).

⇒



Filling with lubricant rinses off the corrosion protection.


Flushing the gearbox

2.



Always observe any additional legal provisions.

If the gearbox has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegradable lubricant, flush the gearbox particularly thoroughly.

3. If corrosion protection is required once more after the trial run, proceed as per  Chapter 5.7.3 'Subsequent preservation by customer' on page 71.
4. Preserve free input and output shafts using BRANOrrost paper.
5. Lightly grease all other blank surfaces.

BRANOrrost paper

5.7.4.2 Machine trial with a gearbox filled completely with lubricant for corrosion protection

Draining lubricant

1. If the gearbox is installed in a machine and the machine is to be commissioned for trial-run purposes, drain the lubricant filled for preservation down to the oil level specified for operation.

Dryer cartridge

2. Replace the dryer cartridge with intermediate oil expansion tank with the bleeder screw.



Draining the oil level eliminates the corrosion protection.

Flushing the gearbox


- 3.



Always observe any additional legal provisions.

If the gearbox has been preserved using a mineral oil and is later to be operated using a physiologically harmless or a biodegradable lubricant, flush the gearbox particularly thoroughly.

Corrosion protection

4. If corrosion protection is required once more after the trial run, proceed as per  *Chapter 5.7.3 'Subsequent preservation by customer' on page 71.*

Check the lubricant for compliance with the permissible water content and permissible lubricant ageing.

The limit values as specified by the respective lubricant's manufacturer apply.

BRANORost paper

5. Preserve free input and output shafts using BRANORost paper.
6. Lightly grease all other blank surfaces.

6 Installation and commissioning



Installation and commissioning may be performed only by qualified persons or by PIV Drives GmbH's service personnel.

Incorrect installation and commissioning



WARNING! **Danger to life through incorrect installation and commissioning!**

Errors during installation or commissioning can lead to life-threatening situations and cause substantial damage.

- Observe all specifications issued by PIV Drives GmbH in the following chapters and perform all checks.
- Never perform unauthorised modifications. Failure to observe these notes will eliminate the explosion protection.
- In any case of doubt, always consult PIV Drives GmbH.

Qualification

The following applies to all installation and commissioning work:

Personnel: ■ Specialist for explosive areas
■ PIV service personnel

Special tool: ■ Tools approved for the existing explosive area

6.1 Safety notes for installation and commissioning

Explosion protection



WARNING!

Risk of explosion during assembly!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning assembly, obtain written work permission and keep it outside the danger zone.
- Never perform assembly work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.
- Only use drive and power take-off elements with ATEX approval.
- Only use belts with sufficient shunt resistance $< 10^9 \Omega$.

Failure to observe these notes will eliminate the explosion protection.

Motor start-up



WARNING!

Risk of crushing through inadvertent starting!

Inadvertent starting can cause serious injury or death.

- Secure the drive against inadvertent starting. To do so, disconnect the motor from its power source and prevent it from being switched on inadvertently.
- Affix a note saying "Do not switch on!" to the motor switch.

Hot oil and hot surfaces



WARNING!
Danger of burning through hot oil and hot gearbox surfaces!

During operation, the oil and the gearbox become hot. Skin contact can result in serious burns.

- Before beginning work, allow the gearbox and the gear oil to cool.

Falling parts



WARNING!
Risk of crushing through falling heavy parts!

Falling or toppling components (motor, clutch, gearbox, attached parts) can cause serious injury or death.

- Secure all components against inadvertent motion.
- Never stand under suspended loads.
- Restrict access for unauthorised persons.

Shaft torsional moment



WARNING!
Risk of crushing through shaft torsional moment!

The shafts' torsional momenta can cause crushing at the shaft connections.

- Before releasing shaft connections, prevent shaft torsional momenta.


Incorrect gear oil



NOTICE!

Gearbox damage through incorrect gear oil!

If incorrect gear oil is used, the required lubricant properties are no longer guaranteed and there is a risk of serious gearbox damage.

- Only fill with the gear oil specified on the gearbox's type plate.
- Use a filling filter (25 µm).
- Make sure that no foreign bodies enter the gearbox.
- For more information, see  *Chapter 8.7.4 'Oil change' on page 135.*


Incorrect assembly



WARNING!

Gearbox damage through incorrect assembly!

Incorrect assembly can lead to serious gearbox damage.

- Observe the instruction manuals for the parts attached to the gearbox.
- Tighten the fastening bolts on the gearbox in accordance with  *Chapter 6.6 'Tightening torque' on page 89.*
- After performing any work on the gearbox, always perform a function test and a safety check.
- Never use a high-pressure jet for cleaning.
Hosing down the gearbox with detergent and water is prohibited.
This may damage seals and attached parts.
- Observe the assembly and safety notes in the respective sections of this operating manual and in the operating instructions for the attached parts.

6.2 Preparations

Installation site

The installation site must meet the following requirements:

- The floor must be capable of supporting sufficient weight, must be free of vibrations and resistant to buckling
- There must be sufficient space for assembly.
- Ensure that the ambient conditions listed in the technical specification upon conclusion of the contract are matched.
- Protect from direct sunlight.
- Prevent substantial temperature fluctuation.
- In damp locations and when installing outdoors, use only gearboxes with paint coat.
- The oil filler necks, oil level inspection ports, oil drain locations and all maintenance covers must be freely accessible.
- All attached transmission elements must be balanced. They may not produce impermissible radial or axial forces.

6.3 Additional ATEX requirements

The drive may be assembled under the following conditions only:

- The specifications on the gearbox's type plate match the permissible explosive area on site.
 - Device group
 - EX category
 - EX zone
 - Temperature class
 - Maximum surface temperature
- The drive must be free of damage (no transport or storage damage).
- The following requirements must be met during assembly:
 - No explosive atmospheres
 - No oils
 - No acids
 - No gases
 - No radiation

Electrochemical corrosion

If there is a risk of electrochemical corrosion between gearbox and working unit (connection of different metals such as cast iron/stainless steel, for example):

- Use plastic inserts (2 to 3 mm thick).
- Use plastic washers for screws and bolts.
- Shunt resistance of plastic used $< 10^9 \Omega$.
- Earth the gearbox.

6.4 Installing the gearbox in category II2G and II2D

The following requirements must be met for category II2G and II2D gearboxes:

Ambient temperature

Only use category II2G and II2D in ambient temperatures of -20 °C to +60 °C.

For operational restrictions, see the technical gearbox specification.

Temperature class

Depending on their speed, ratio and design, the category II2G (explosive atmosphere gas) gearboxes are approved for temperature classes T3 and T4.

For the gearbox's temperature class, refer to the type plate.

Ambient conditions

Ventilate the gearboxes sufficiently and prevent external heat transmission (e.g. via couplings).

Accumulating dust must not exceed a thickness of 5 mm.

High-pressure jets are not permissible for cleaning the gearbox. Hosing down the gearbox with detergent and water is prohibited. This may damage seals and attached parts.

Protection type

All gearbox versions comply with protection type IP55.

6.5 Fastening bolts

The following table lists the fastening bolts of strength class 10.9 that are required for attachment to the foundation in the respective position:

Type	Size	Gearbox position			
		R1/R2	S5	T6	U3/U4
PB					
PB	10	4x M10x45			
PB	12	4x M12x70			
PB	16	4x M16x110			
PB	20	4x M20x130			
PB	25	4x M20x160			
PB	31	6x M24x180			
PB	40	6x M24x200			
PB	45	6x M30x160			

Type	Size	Gearbox position			
		R1/R2	S5	T6	U3/U4
PLB					
PLB	10	4x M10x45	4x M12x45	4x M12x80	4x M14x65
PLB	12	4x M12x70	4x M14x100	4x M14x100	4x M20x80
PLB	16	4x M16x110	4x M20x130	4x M20.6. 20x130	4x M24x100
PLB	20	4x M20x130	4x M24x150	4x M24x150	4x M30x120
PLB	25	4x M20x160	4x M24x180	4x M24x180	4x M30x120
PLB	31	6x M24x180	4x M24x180	4x M24x180	4x M30x180
PLB	40	6x M24x220			
PLB	45	6x M30x160			

Type	Size	Gearbox position			
		R1/R2	S5	T6	U3/U4
PC / PD / PLC / PLD / PWC / PWD					
PC/PD PLC/PLD PWC/PWD	14	6x M10x45	4x M12x90	4x M12x90	4x M14x65
PC/PD PLC/PLD PWC/PWD	16	6x M10x80	4x M12x90	4x M12x90	4x M14x65
PC/PD/PE PLC/PLD PWC/PWD	18	6x M12x55	4x M14x100	4x M14x100	4x M20x80
PC/PD/PE PLC/PLD PWC/PWD	20	6x M12x90	4x M14x100	4x M14x100	4x M20x80
PC/PD/PE PLC/PLD PWC/PWD	22	6x M16x65	4x M20x130	4x M20x130	4x M24x100
PC/PD/PE PLC/PLD PWC/PWD	25	6x M16x90	4x M20x130	4x M20x130	4x M24x100
PC/PD/PE PLC/PLD PWC/PWD	28	6x M20x80	4x M24x150	4x M24x150	4x M30x120
PC/PD/PE PLC/PLD PWC/PWD	31	6x M20x110	4x M24x160	4x M24x160	4x M30x120
PC/PD/PE PLC/PLD PWC/PWD	35	8x M20x85			4x M36x330
PC/PD/PE PLC/PLD PWC/PWD	40	8x M20x120			4x M36x330
PC/PD/PE PLC/PLD PWC/PWD	42	8x M24x100			4x M42x400
PC/PD/PE PLC/PLD PWC/PWD	45	8x M24x120			4x M42x400

Installation and commissioning



Type	Size	Gearbox position			
		R1/R2			R1/R2
PC / PD / PLC / PLD / PWC / PWD					
PC/PD/PE PLC/PLD PWC/PWD	47	8x M24x250			4x M48x400
PC/PD/PE PLC/PLD PWC/PWD	50	8x M30x120			4x M56x400
PC/PD/PE PLC/PLD PWC/PWD	53	8x M30x180			4x M56x400
PC/PD/PE PLC/PLD PWC/PWD	56	8x M30x250			4x M56x400
PC/PD/PE PLC/PLD PWC/PWD	60	8x M36x150			
PC/PD/PE PLC/PLD PWC/PWD	63	8x M36x200			
PC/PD/PE PLC/PLD PWC/PWD	67	8x M36x250			
PC/PD/PE PLC/PLD	71	8x M42x250			
PC/PD/PE PLC/PLD	75	8x M42x320			
PC/PD/PE PLC/PLD	80	8x M42x360			
PC/PD/PE PLC/PLD	85	8x M42x450			

6.6 Tightening torque

Tightening torque at friction coefficient $\mu=0.12$		
Screw size	Strength class	
	10.9 [Nm]	8.8 [Nm]
M4	4.4	3
M5	8.7	5.9
M6	15	10
M8	36	25
M10	72	49
M12	125	85
M14	200	135
M16	310	210
M18	430	300
M20	610	425
M22	830	580
M24	1050	730
M27	1550	1100
M30	2100	1450
M36	3500	2460
M39	4530	3230
M42	5610	3990

6.7 Installation at operation site

- Requirements**
1. Ensure that all preparations are performed and all requirements are met. See ↪ *Chapter 6.2 'Preparations' on page 84*, ↪ *Chapter 6.3 'Additional ATEX requirements' on page 84* and ↪ *Chapter 6.4 'Installing the gearbox in category II2G and II2D' on page 85*.
- Setup and screwing fast**
2. Set up the gearbox at the installation site.
 3. Screw the gearbox to the foundations. Observe the specifications under ↪ *Chapter 6.5 'Fastening bolts' on page 86* and the tightening torques under ↪ *Chapter 6.6 'Tightening torque' on page 89*.
- Aligning**
4. Align the shaft.
 5. Fill with gear oil. See ↪ *Chapter 6.15 'Filling oil' on page 123*.
 6. Check the shaft alignment by measuring.
 7. **Setting up motor and gearbox on their bases:**
Align the motor and connect it to the gearbox via the coupling.
- Motor bell housing and gearbox set up on its base:**
Align the motor and connect the flanges without generating stresses.
- Gearbox and motor on a frame:**
PIV Drives GmbH has aligned and connected the gearbox and motor appropriately.
- Connecting additional components**
8. To connect the lubrication system, connect it to the gearbox and connect any water lines to the water supply correctly.
 9. Mount any additional parts such as brake, pawl etc. in accordance with the respective manufacturers' operating instructions.

Transmission elements

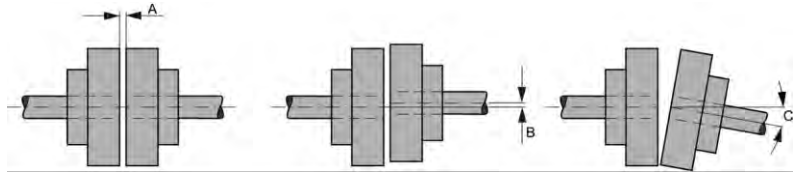


Fig. 31: Transmission elements

- A Maximum and minimum distance
- B Axial offset
- C Angular offset

10. Attach the transmission elements.

For couplings, belts etc. observe the maximum permissible torque. Observe the maximum and minimum distance (A), axial offset (B) and angular offset (C) specified by the coupling manufacturer.



If the gearbox dimensions sheet specifies positions for the transmission elements on the shaft, observe these specifications during assembly.

Belt pulleys

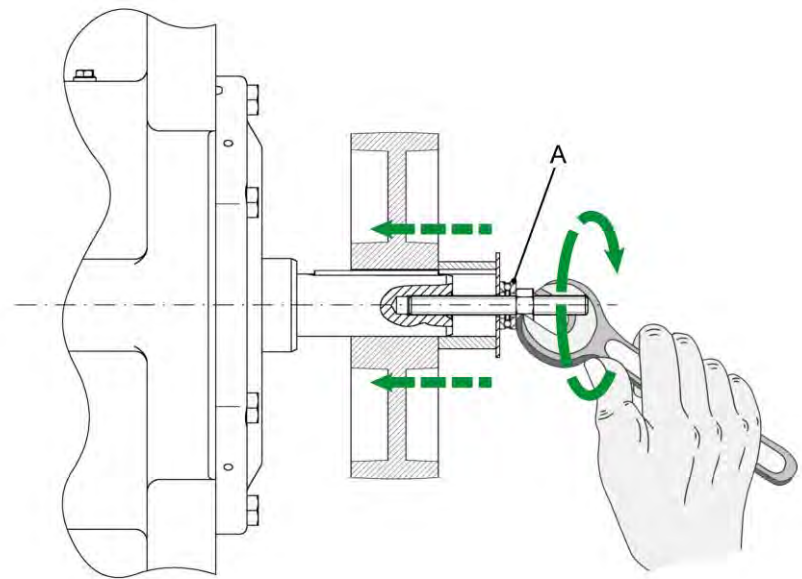


Fig. 32: Axial bearing (A)

11. Slide belt pulleys fully onto the shaft towards the centre of the gearbox.

Fig. 32 shows a retractor for fitting hubs to gearbox or motor shaft ends.

If necessary, leave out the axial bearing (Fig. 32/A) on the retractor.

Transverse forces



NOTICE!

Damage through insufficient alignment!

Insufficient alignment of transmission elements can result in increased vibration and premature wear.

12. To avoid excessive transverse forces, assemble gear wheels or sprockets in accordance with Fig. 33.

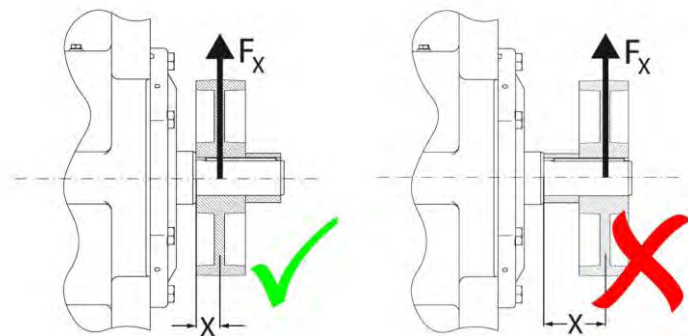


Fig. 33: Alignment: Left is right, right is wrong

Barriers

- 13.



WARNING!

Risk of crushing through moving parts!

Cover transmission elements such as gear wheels or sprockets, clutches, belt pulleys etc. with a barrier to protect against inadvertent contact.

6.8 Overview of output shaft assembly

Output shaft assembly

Overview of options for output shaft assembly:

- Assembly of output shaft as hollow shaft with keyway linkage
↳ page 93
- Assembly of output shaft as hollow shaft with shrink disc
↳ page 101
- Assembly of output shaft as flanged coupling
↳ page 110

6.9 Assembly of output shaft as hollow shaft with keyway linkage

General information



Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads.

Observe the minimum key length specified in the dimensions sheet. If a longer key is to be used, align it symmetrically with the hollow shaft's longitudinal axis.

Installation and commissioning



6.9.1 Machine shaft dimensions

6.9.1.1 Sealing using shaft seal rings

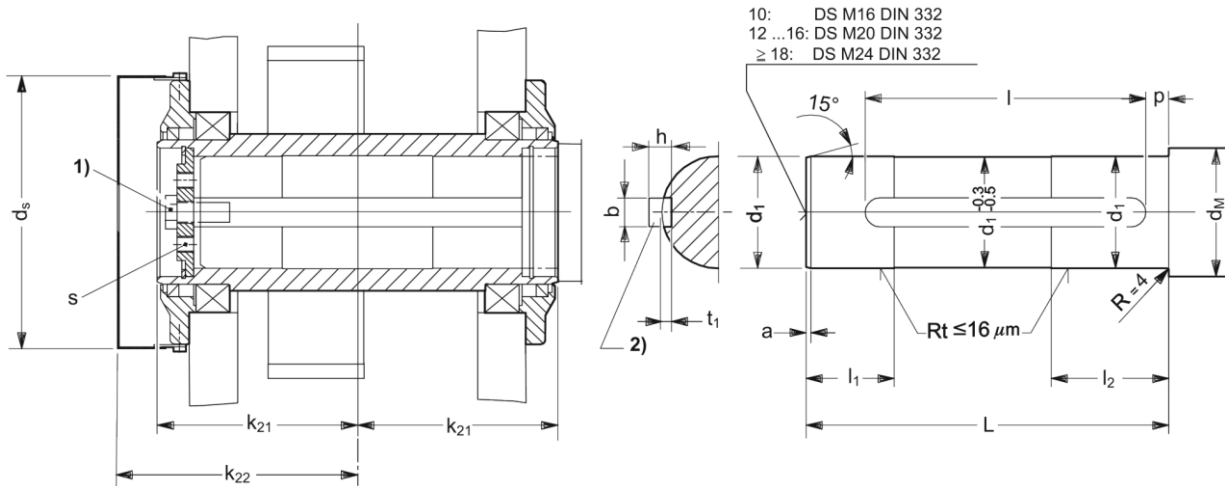


Fig. 34: Machine shaft dimensions

Machine shaft key and secured bolt 1) are not included in scope of supply. Tolerance class of keyway width in hollow shaft: P9.

		a	∅ d ₁	∅ d _{M min}	∅ d _s	k ₂₁	k ₂₂	l ₁	l ₂	L	l _{min}	p	t ₁	s	x) 1) ISO4014	y) 2) b x h
PC, PD, PE PLC, PLD, PWC, PWD	14	5	65 h6	77	180	123	140	50	72	215	180	19	4,8	M 10	M 20 x 55	18 x 7
	16	5	75 h6	96	230	123	139	60	82	215	180	18	7,5	M 12	M 20 x 55	20 x 12
	18	5	90 h6	107	230	157	173	70	95	279	250	18	6,2	M 12	M 24 x 60	25 x 9
	20	5	100 h6	120	285	157	173	80	109	276	220	24	10	M 16	M 24 x 65	28 x 16
	22	5	110 h6	128	285	189	205	90	119	340	280	24	10	M 16	M 24 x 65	28 x 16
	25	6	130 h6	150	310	215	250	100	132	388	280	26	11	M 20	M 24 x 70	32 x 18
	28	6	140 h6	160	340	250	300	110	147	453	320	29	12	M 20	M 24 x 70	36 x 20
	31	6	160 h6	180	365	250	300	125	162	453	320	27	13	M 20	M 24 x 70	40 x 22
	35	6	170 h6	190	380	285	320	135	180	515	400	35	13	M 20	M 24 x 70	40 x 22
	40	6	190 h6	210	410	285	320	150	195	515	400	32	15	M 20	M 24 x 70	45 x 25
	42	6	200 h6	220	470	315	360	160	215	565	400	40	15	M 20	M 24 x 70	45 x 25
	45	6	220 h6	240	495	320	360	175	225	578	400	34	17	M 20	M 24 x 70	50 x 28
	47	6	235 h6	255	540	330	355	190	235	603	400	26	20	M 20	M 24 x 70	56 x 32
50	6	250 h6	270	570	390	425	205	250	723	400	26	20	M 20	M 24 x 70	56 x 32	
53	6	270 h6	290	615	390	600	220	275	715	400	25	20	M 20	M 24 x 70	63 x 32	
56	6	290 h6	310	615	390	600	235	290	715	400	25	20	M 20	M 24 x 70	63 x 32	
PLB	10	5	42 h6	53	180	123	140	40	58	219	140	18	3,9	M 10	M 16 x 45	12 x 6
	12	5	65 h6	77	180	157	174	60	82	283	180	18	4,8	M 10	M 20 x 55	18 x 7
	16	5	75 h6	96	230	189	206	60	82	347	180	18	7,5	M 12	M 20 x 55	20 x 12
	20	5	100 h6	120	282	220	236	80	109	402	220	24	10	M 16	M 24 x 70	28 x 16
	25	6	120 h6	140	308	265	297	95	123	492	280	22	11	M 16	M 24 x 70	32 x 18
	31	6	140 h6	160	338	310	354	110	149	573	320	29	12	M 20	M 24 x 70	36 x 20
	40	6	170 h6	190	380	380	412	135	180	705	400	35	13	M 20	M 24 x 70	40 x 22
45	6	200 h6	220	470	445	605	160	215	825	400	40	15	M 20	M 24 x 70	40 x 25	

Fig. 35: Machine shaft dimensions

x) Bolts

y) Key

6.9.1.2 Labyrinth-type seals

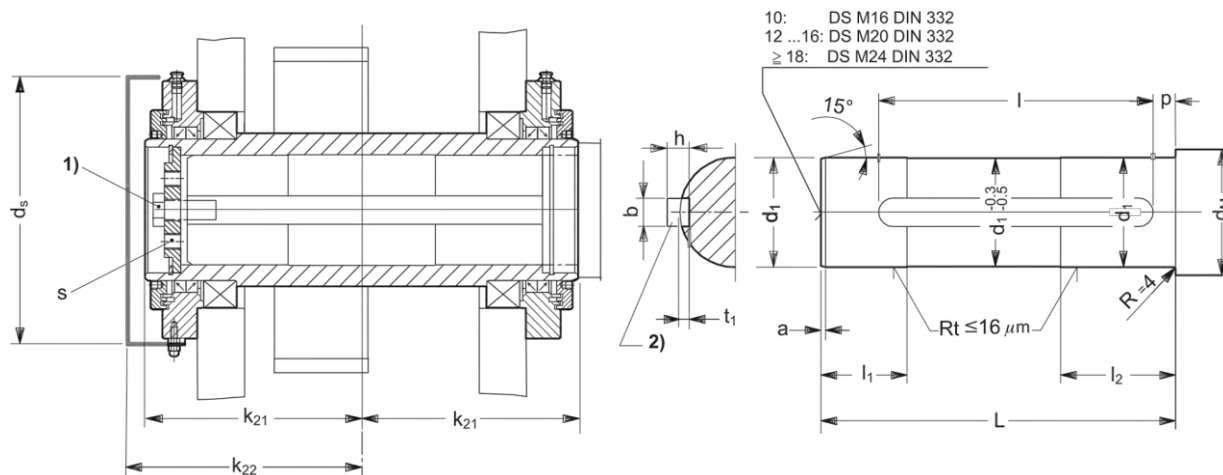


Fig. 36: Machine shaft dimensions

Machine shaft key and secured bolt 1) are not included in scope of supply. Tolerance class of keyway width in hollow shaft: P9.

		a	∅ d ₁	∅ d _{M min}	∅ d _s	k ₂₁	k ₂₂	l ₁	l ₂	L	l _{min}	p	t ₁	s	x) 1) ISO4014	y) 2) b x h
PC, PD, PE PLC, PLD, PWC, PWD	14	5	65 h6	77	150	160	225	60	82	289	180	19	4.8	M 10	M 20 x 55	18 x 7
	16	5	75 h6	96	200	170	240	80	102	309	180	18	7.5	M 12	M 20 x 55	20 x 12
	18	5	90 h6	107	200	206	280	85	110	378	250	18	6.2	M 12	M 24 x 60	25 x 9
	20	5	100 h6	120	250	205	285	80	110	372	220	24	10	M 16	M 24 x 65	28 x 16
	22	5	110 h6	128	310	240	335	90	120	442	280	24	10	M 16	M 24 x 65	28 x 16
	25	6	130 h6	150	310	235	250	100	132	428	280	26	11	M 20	M 24 x 70	32 x 18
	28	6	140 h6	160	340	280	315	110	148	513	320	29	12	M 20	M 24 x 70	36 x 20
	31	6	160 h6	180	365	280	315	125	162	513	320	27	13	M 20	M 24 x 70	40 x 22
	35	6	170 h6	190	380	305	335	135	180	555	400	35	13	M 20	M 24 x 70	40 x 22
	40	6	190 h6	210	410	305	345	150	195	555	400	32	15	M 20	M 24 x 70	45 x 25
	42	6	200 h6	220	470	315	352	160	215	565	400	40	15	M 20	M 24 x 70	45 x 25
	45	6	220 h6	240	495	335	385	175	225	607	400	34	17	M 20	M 24 x 70	50 x 28
	47	6	235 h6	255	540	355	375	190	235	652	400	26	20	M 20	M 24 x 70	56 x 32
PLB	50	6	250 h6	270	570	390	425	205	250	723	400	26	20	M 20	M 24 x 70	56 x 32
	53	6	270 h6	290	615	390	600	220	275	715	400	25	20	M 20	M 24 x 70	63 x 32
	56	6	290 h6	310	615	390	600	235	290	715	400	25	20	M 20	M 24 x 70	63 x 32
	10	5	42 h6	53	150	160	225	40	58	293	140	18	3.9	M 10	M 16 x 45	12 x 6
	12	5	65 h6	77	150	195	260	60	82	359	180	18	4.8	M 10	M 20 x 55	18 x 7
	16	5	75 h6	96	200	236	305	60	82	441	180	18	7.5	M 12	M 20 x 55	20 x 12
	20	5	100 h6	120	250	268	350	80	109	498	220	24	10	M 16	M 24 x 70	28 x 16
	25	6	120 h6	140	310	281	295	95	123	524	280	22	11	M 16	M 24 x 70	32 x 18
31	6	140 h6	160	340	340	350	110	149	633	320	29	12	M 20	M 24 x 70	36 x 20	
40	6	170 h6	190	380	400	430	135	180	745	400	35	13	M 20	M 24 x 70	40 x 22	
45	6	200 h6	220	470	445	605	160	215	825	400	40	15	M 20	M 24 x 70	40 x 25	

Fig. 37: Machine shaft dimensions

x) Bolts

y) Key

6.9.2 Fitting the gearbox onto the machine shaft

Machine shaft dimensions



The machine shaft must meet the requirements of [Chapter 6.9.1.1 'Sealing using shaft seal rings' on page 94](#) or [Chapter 6.9.1.2 'Labyrinth-type seals' on page 95](#).

Scope of supply

The scope of supply includes:

- One retainer ring
- One end plate

The scope of supply does not include:

- Threaded rod
- Nut
- Fastening bolt
- Ejector screws

Assembly

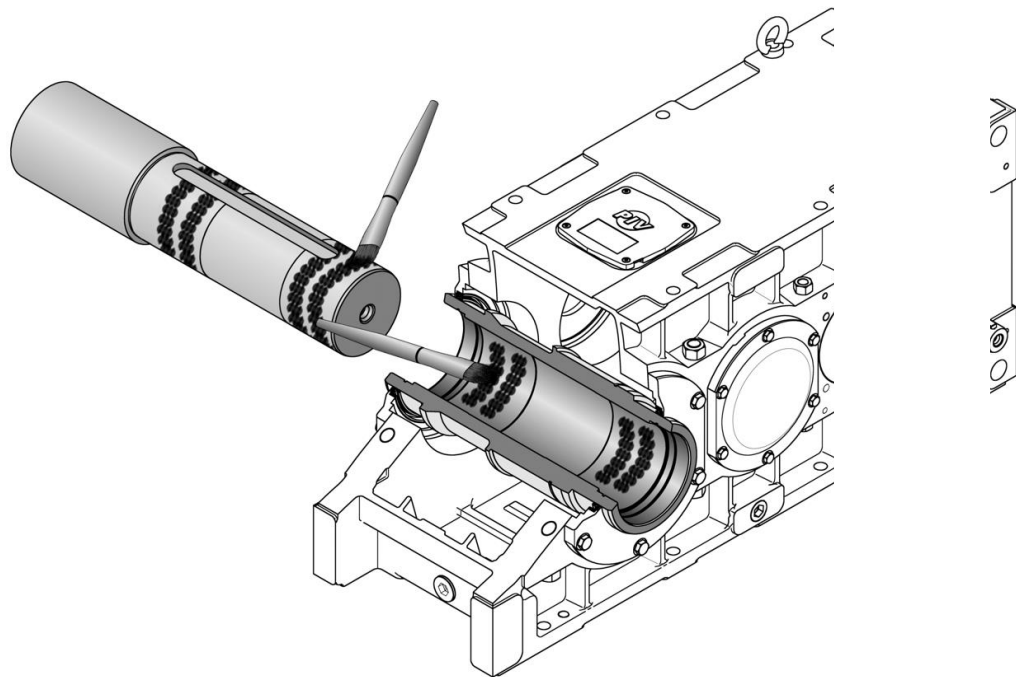


Fig. 38: Applying lithium grease

1. Apply lithium grease ([Chapter 8.6 'Grease' on page 133](#)) into the hollow shaft and onto the machine shaft's end.

End plate and retainer ring

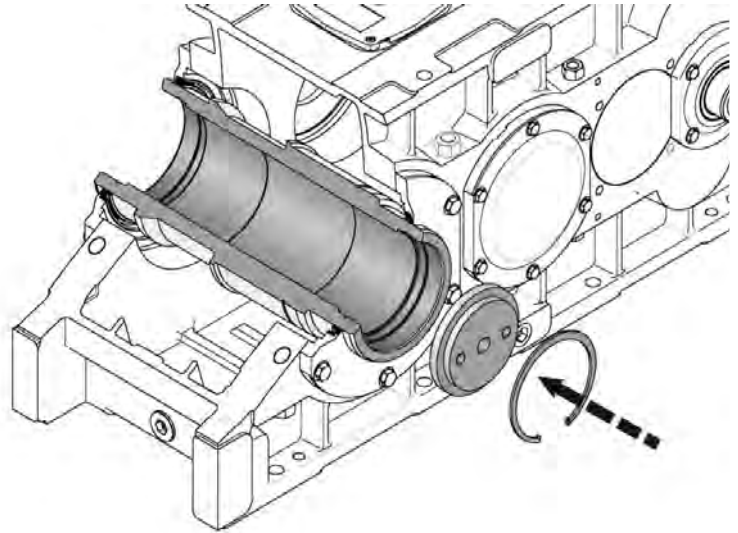


Fig. 39: End plate and retainer ring

2. Place end plate on the hollow shaft's offset and secure using the retainer ring.

Screwing in threaded rod

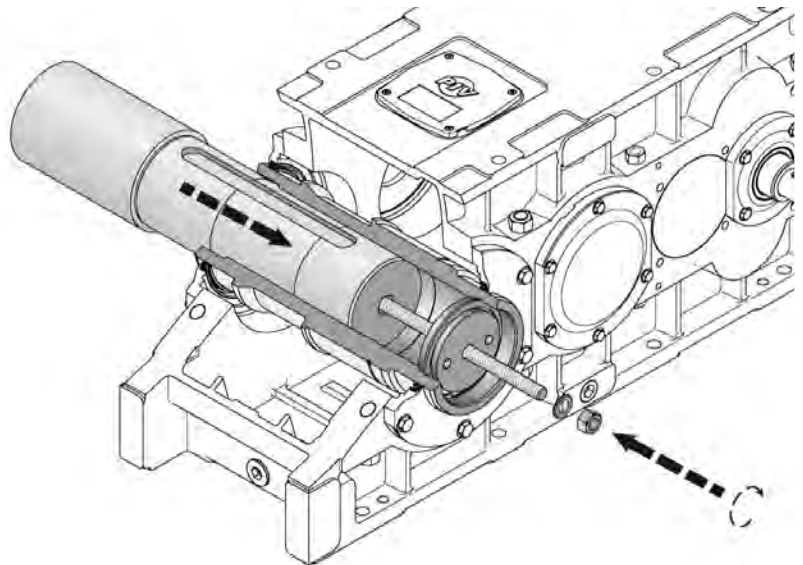



Fig. 40: Screwing in threaded rod

3.  For ease of assembly, grease the threaded rod and nut with lubricant.

Screw the threaded rod into the machine shaft. Observe the specified tightening torques (☞ Chapter 6.6 'Tightening torque' on page 89).

Tightening machine shaft

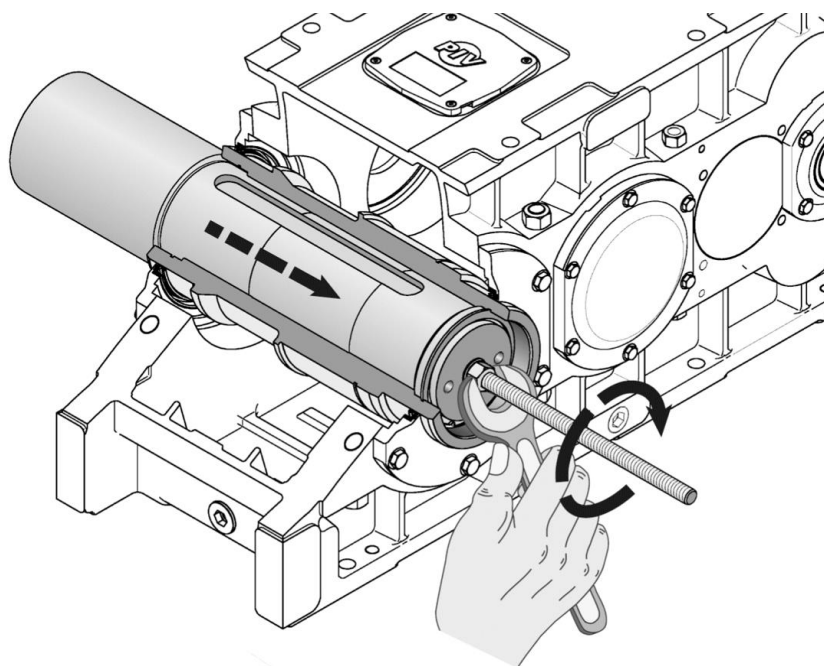


Fig. 41: Tightening machine shaft

4. Tighten the machine shaft using a nut until the shaft end connects with the end plate.

Unscrewing threaded rod

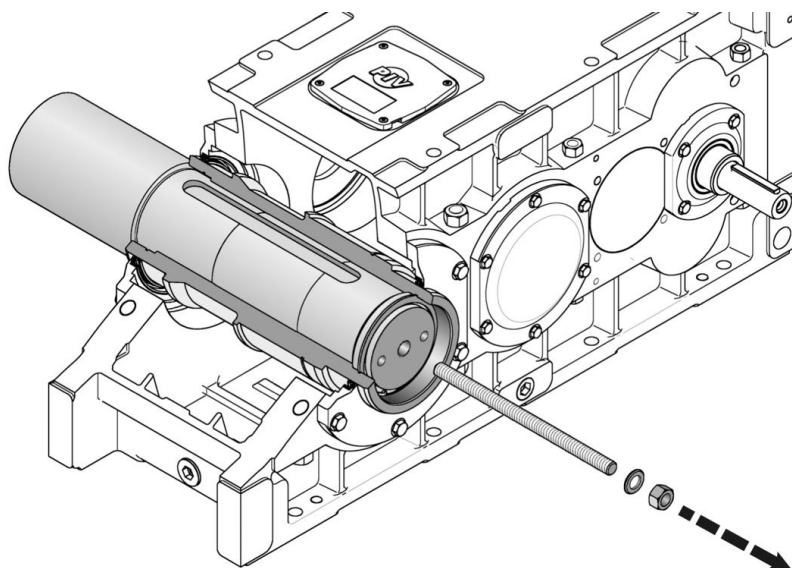


Fig. 42: Unscrewing threaded rod

5. Undo the nut and screw out the threaded rod.

Fastening bolt

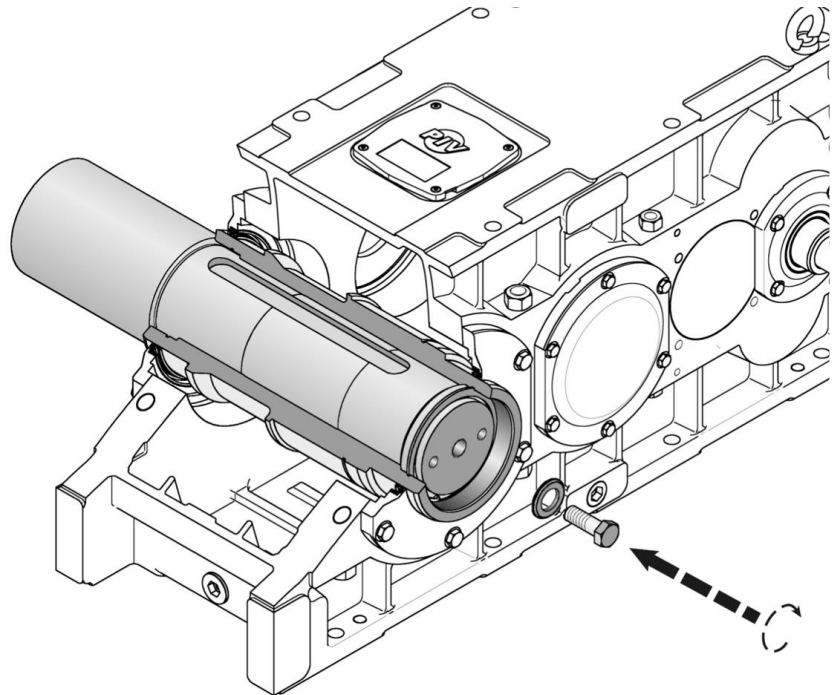


Fig. 43: Fastening bolt

6. Secure the machine shaft with a fastening bolt.

Bolt locking

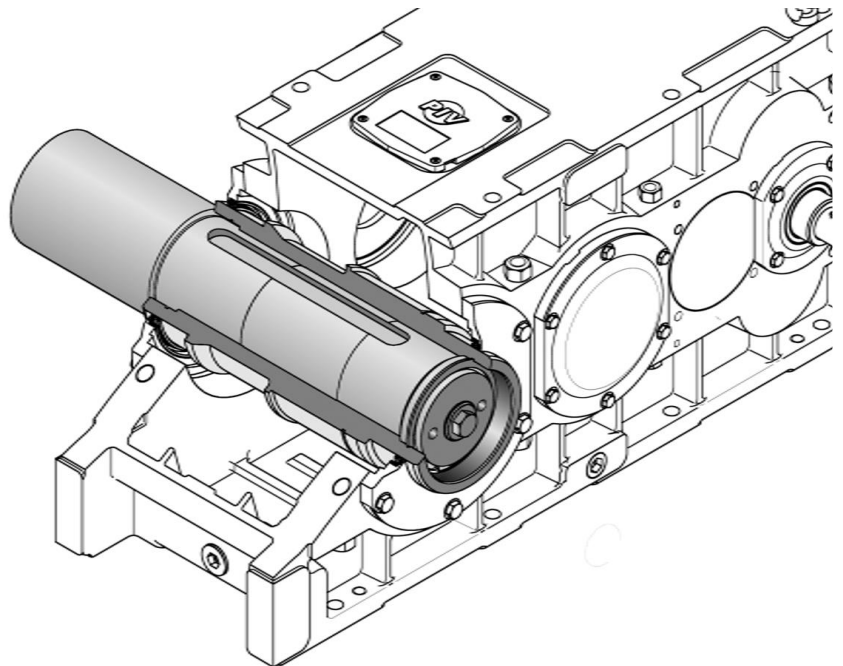


Fig. 44: Bolt locking

7. Additionally secure the fastening bolt with a suitable bolt lock. Observe the specified tightening torques (☞ *Chapter 6.6 'Tightening torque' on page 89*).

6.9.3 Removing the gearbox from the machine shaft

High weight



WARNING!

Risk of crushing through high weight!

Due to its high weight, moving the gearbox can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See *Chapter 5 'Transport, packaging and storage'* on page 46.
- Always secure the gearbox before releasing any connections.

Disassembly

1. Secure the gearbox against falling.

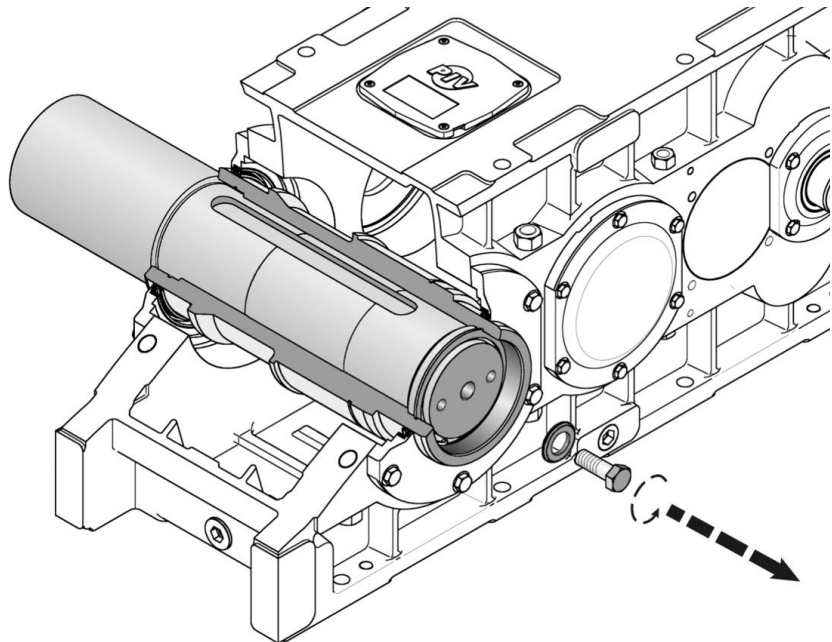


Fig. 45: Undoing the fastening bolt

2. Undo the fastening bolt and remove it.

Ejector screws

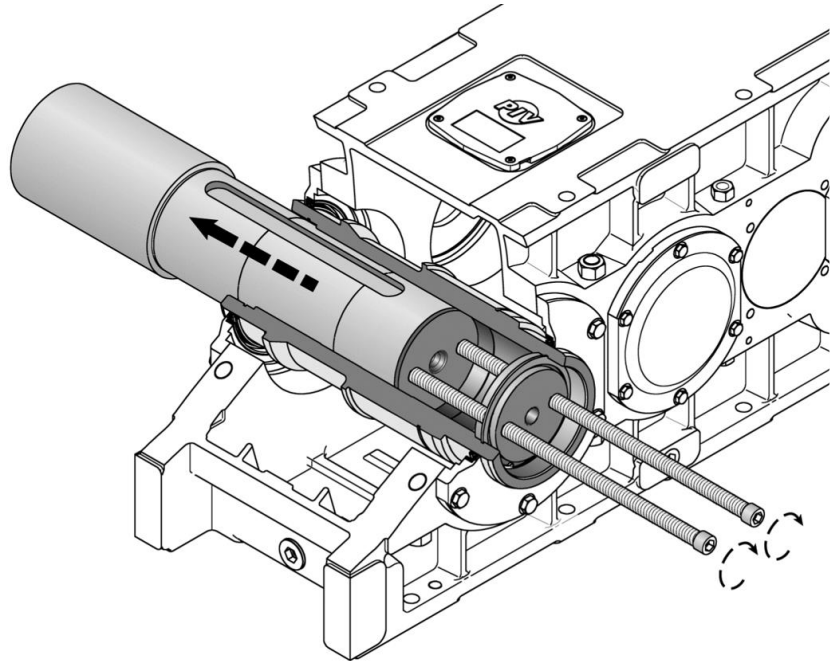


Fig. 46: Screwing in ejector screws

3.



For ease of disassembly, grease the ejector screws and the threads in the end plate with lubricant.

Screw the two ejector screws into the threads in the end plate in order to detach the gearbox from the machine shaft.

6.10 Assembly of output shaft as hollow shaft with shrink disc

General information



Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads.



Assemble and disassemble the shrink disc as per the instructions issued by the shrink disc's manufacturer.

6.10.1 Machine shaft dimensions

6.10.1.1 Sealing using shaft seal rings

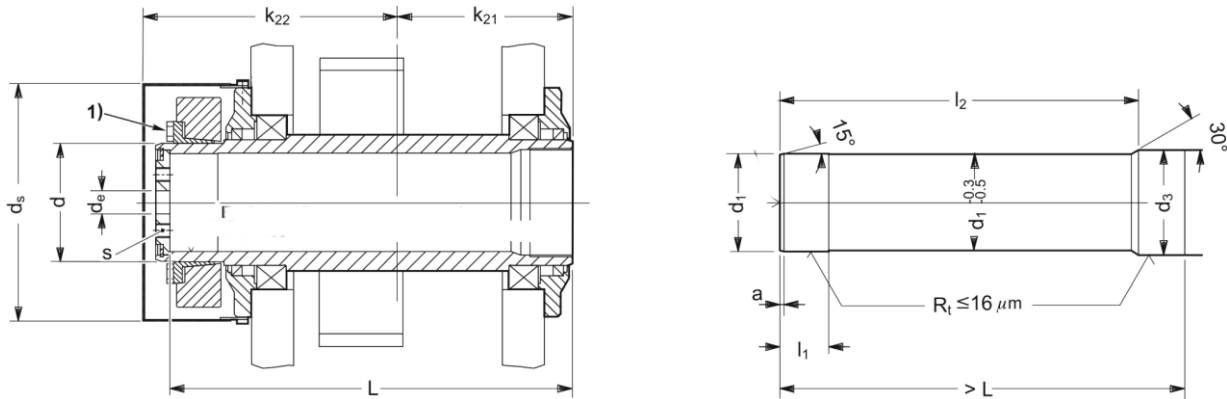


Fig. 47: Machine shaft dimensions

		1)				2)						3)				
		4)	$\varnothing d$	5) ¹⁾	Ta ¹⁾ [Nm]	$\varnothing d_s$	k_{21}	k_{22}	$\varnothing d_e$	s	L	a	$\varnothing d_1$	$\varnothing d_3$	l_1	l_2
PC, PD, PE PLC, PLD, PWC, PWD	14	80-81	80	M 10	70	150	123	197	22	M 10	283	5	70 h6	70 f6	34	256
	16	100-81	100	M 10	70	200	123	197	23	M 12	290	5	80 h6	80 f6	44	253
	18	110-81	110	M 12	121	200	157	231	25	M 12	367	5	90 h6	90 f6	50	325
	20	125-81	130	M 12	121	250	157	247	27	M 16	371	5	100 h6	105 f6	54	324
	22	140-81	140	M 14	193	250	189	279	27	M 16	443	5	110 h6	115 f6	58	392
	25	165-81	170	M 16	295	315	215	340	27	M 20	504	6	130 h6	135 f6	70	442
	28	175-81	180	M 16	295	345	250	360	33	M 20	576	6	140 h6	150 f6	70	514
	31	200-71	200	M 16	250	365	250	375	33	M 20	594	6	160 h6	170 f6	85	517
	35	220-71	220	M 16	250	385	285	430	33	M 20	677	6	170 g6	180 f6	104	581
	40	240-71	240	M 20	490	420	285	435	33	M 20	682	6	190 g6	200 f6	108	582
	42	260-71	260	M 20	490	470	315	475	33	M 20	750	6	210 g6	220 f6	119	639
	45	280-71	280	M 20	490	500	320	485	33	M 20	763	6	230 g6	240 f6	130	641
	47	300-71	300	M 20	490	540	330	515	33	M 20	800	6	245 g6	250 f6	138	670
	50	320-71	320	M 20	490	555	390	574	33	M 20	918	6	260 g6	270 f6	138	788
	53	340-71	340	M 20	490	615	390	600	33	M 20	933	6	270 g6	280 f6	152	789
56	360-71	360	M 20	490	615	390	600	33	M 20	939	6	290 g6	300 f6	158	789	
60	380-71	380	M 24	840	695	465	705	33	M 20	1093	6	310 g6	320 f6	162	939	
63	400-71	400	M 24	840	695	465	705	33	M 20	1108	6	330 g6	340 f6	162	939	
67	400-81	400	M 27	1450	695	465	705	33	M 20	1108	6	330 g6	340 f6	177	939	
71 ... 85	6)															
PLB	10	55-81	55	M 8	35	150	123	197	17	M 10	278	5	45 h6	45 f6	33	252
	12	80-81	80	M 10	70	150	157	231	22	M 10	349	5	65 h6	65 f6	34	322
	16	100-81	100	M 10	70	200	189	263	23	M 12	422	5	80 h6	80 f6	44	385
	20	125-81	130	M 12	121	250	220	310	27	M 16	495	5	100 h6	105 f6	54	448
	25	155-81	160	M 14	193	315	265	365	27	M 16	599	6	120 h6	130 f6	64	543
	31	175-81	180	M 16	295	345	310	415	33	M 20	697	6	140 h6	150 f6	70	635
40	220-71	220	M 16	250	385	380	525	33	M 20	867	6	170 g6	180 f6	104	770	
45	260-71	260	M 20	490	470	445	605	33	M 20	1010	6	210 g6	220 f6	120	900	

Fig. 48: Machine shaft dimensions

- 1) Shrink disc
- 2) Hollow shaft
- 3) Machine shaft
- 4) Type
- 5) Bolt
- 6) Upon request

6.10.1.2 Labyrinth-type seals

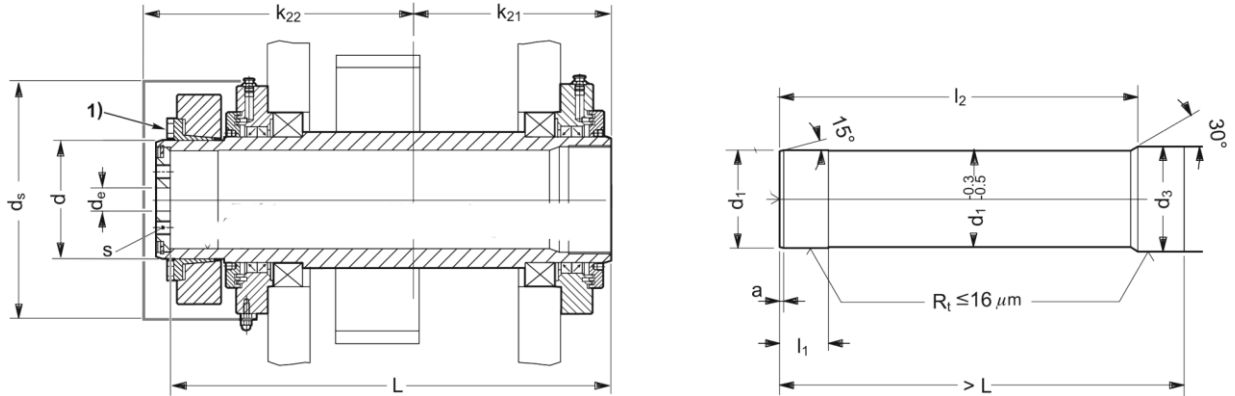


Fig. 49: Machine shaft dimensions

		1)				2)						3)				
		4)	$\varnothing d$	5)	$Ta^{1)}$ [Nm]	$\varnothing d_s$	k_{21}	k_{22}	$\varnothing d_e$	s	L	a	$\varnothing d_1$	$\varnothing d_3$	l_1	l_2
PC, PD, PE PLC, PLD, PWC, PWD	14	80-81	80	M 10	70	150	160	225	22	M 10	358	5	70h6	70 f6	35	331
	16	100-81	100	M 10	70	200	170	240	23	M 12	386	5	80h6	80 f6	45	349
	18	110-81	110	M 12	121	200	206	280	25	M 12	463	5	90h6	90 f6	50	420
	20	125-81	130	M 12	121	250	205	285	27	M 16	464	5	100h6	105 f6	55	417
	22	140-81	140	M 14	193	250	240	335	27	M 16	546	5	110h6	115 f6	60	495
	25	165-81	170	M 16	295	315	235	340	27	M 20	544	6	130h6	135 f6	70	482
	28	175-81	180	M 16	295	345	280	380	33	M 20	629	6	140h6	150 f6	70	567
	31	200-71	200	M 16	250	365	280	390	33	M 20	640	6	160h6	170 f6	85	565
	35	220-71	220	M 16	250	385	305	445	33	M 20	710	6	170g6	180 f6	105	615
	40	240-71	240	M 20	490	420	305	460	33	M 20	722	6	190g6	200 f6	110	622
	42	260-71	260	M 20	490	470	315	475	33	M 20	750	6	210g6	220 f6	120	639
	45	280-71	280	M 20	490	500	335	505	33	M 20	800	6	230g6	240 f6	130	678
	47	300-71	300	M 20	490	540	355	540	33	M 20	847	6	245g6	250 f6	140	717
	50	320-71	320	M 20	470	555	390	574	33	M 20	918	6	260g6	270 f6	140	788
	53	340-71	340	M 20	490	615	390	600	33	M 20	933	6	270g6	280 f6	155	788
56	360-71	360	M 20	490	615	390	600	33	M 20	939	6	290g6	300 f6	160	789	
60	380-71	380	M 24	840	695	465	705	33	M 20	1093	6	310g6	320 f6	165	939	
63	400-71	400	M 24	840	695	465	705	33	M 20	1108	6	330g6	340 f6	165	943	
67	400-81	400	M 27	1450	695	465	705	33	M 20	1108	6	330g6	340 f6	180	943	
71 ... 85	6)															
PLB	10	55-81	55	M 8	35	150	160	225	17	M 10	354	5	45h6	45 f6	35	328
	12	80-81	80	M 10	70	150	195	260	22	M 10	427	5	65h6	65 f6	35	400
	16	100-81	100	M 10	70	200	236	305	23	M 12	518	5	80h6	80 f6	45	481
	20	125-81	130	M 12	121	250	268	350	27	M 16	590	5	100h6	105 f6	55	543
	25	155-81	160	M 14	193	315	281	385	27	M 16	631	6	120h6	130 f6	65	575
	31	175-81	180	M 16	295	345	340	450	33	M 20	751	6	140h6	150 f6	70	689
40	220-71	220	M 16	250	385	400	540	33	M 20	900	6	170g6	180 f6	105	805	
45	260-71	260	M 20	490	470	445	605	33	M 20	1010	6	210g6	220 f6	120	900	

Fig. 50: Machine shaft dimensions

- 1) Shrink disc
- 2) Hollow shaft
- 3) Machine shaft
- 4) Type
- 5) Bolt
- 6) Upon request

6.10.2 Fitting the gearbox onto the machine shaft

Machine shaft dimensions



The machine shaft must meet the requirements of Chapter 6.10.1.1 'Sealing using shaft seal rings' on page 102 or Chapter.

Scope of supply

The scope of supply includes:

- One retainer ring
- One end plate

The scope of supply does not include:

- Threaded rod
- Nut
- Fastening bolt
- Ejector screws

Assembly

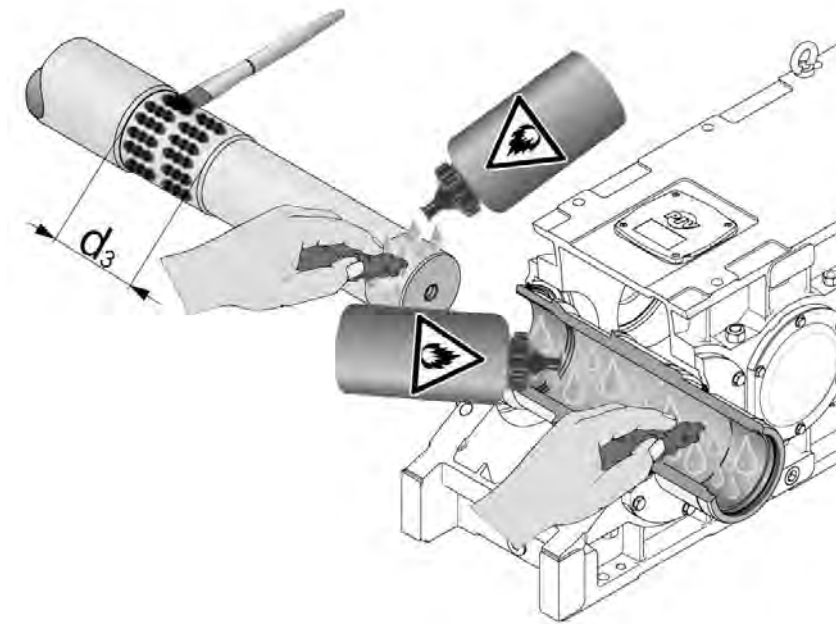


Fig. 51: Greasing

1.



The shrink disc's clamping range between the hollow shaft and the machine shaft must remain free of grease under all circumstances.

Prior to assembly of the gearbox, grease the hollow shaft and the machine shaft.

2. Apply lithium grease to the machine shaft in the area of $\varnothing d_3$.

End plate and retainer ring

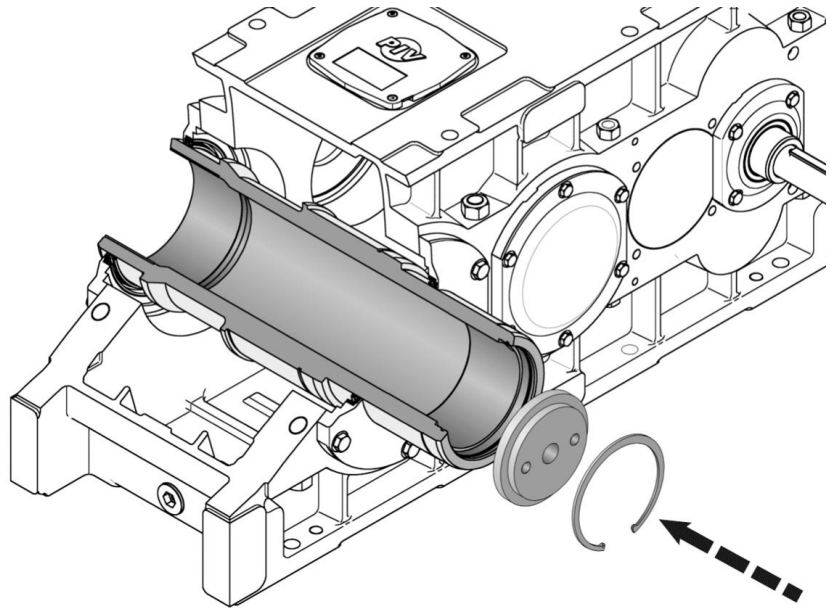


Fig. 52: End plate and retainer ring

- Place end plate on the hollow shaft's offset and secure using the retainer ring.

Screwing in threaded rod

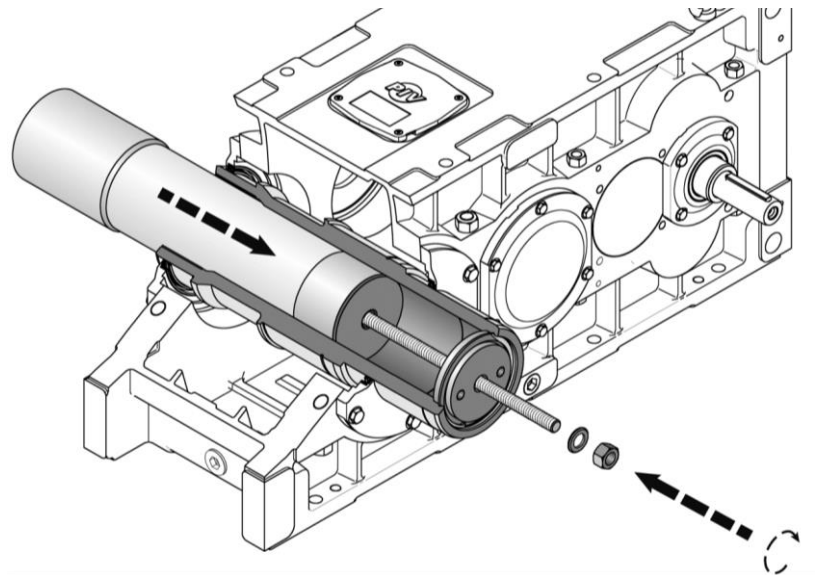



Fig. 53: Screwing in threaded rod

-  For ease of assembly, grease the threaded rod and nut with lubricant.

Screw the threaded rod into the machine shaft. Observe the specified tightening torques (↪ Chapter 6.6 'Tightening torque' on page 89).

Tightening machine shaft

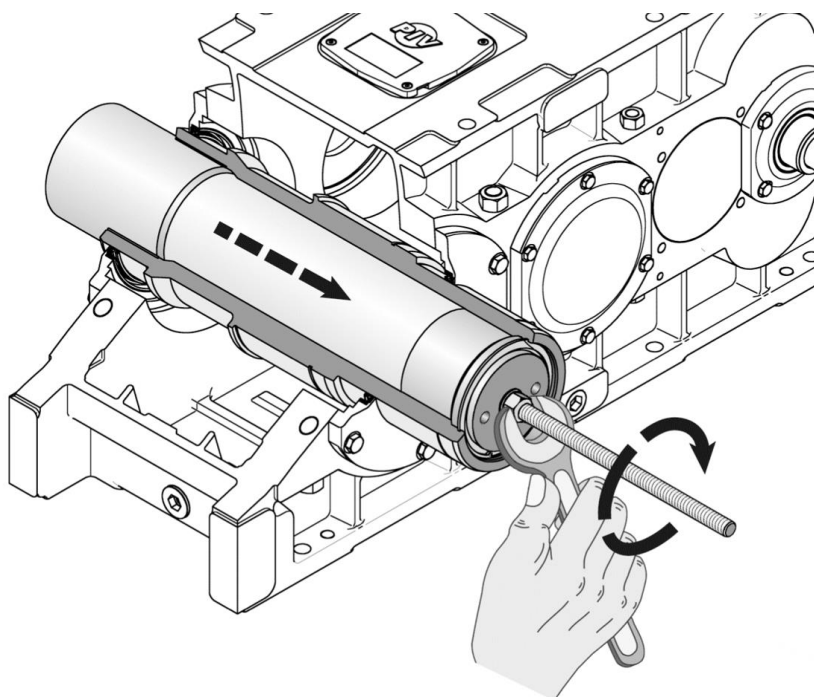


Fig. 54: Tightening machine shaft

5. Tighten the machine shaft using a nut until the shaft end connects with the end plate.

Unscrewing threaded rod

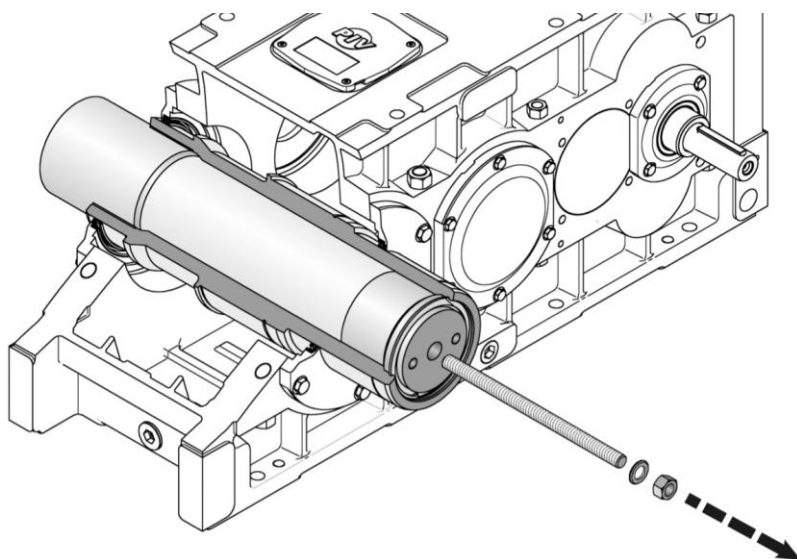


Fig. 55: Unscrewing threaded rod

6. Undo the nut and screw out the threaded rod.

Fastening bolt

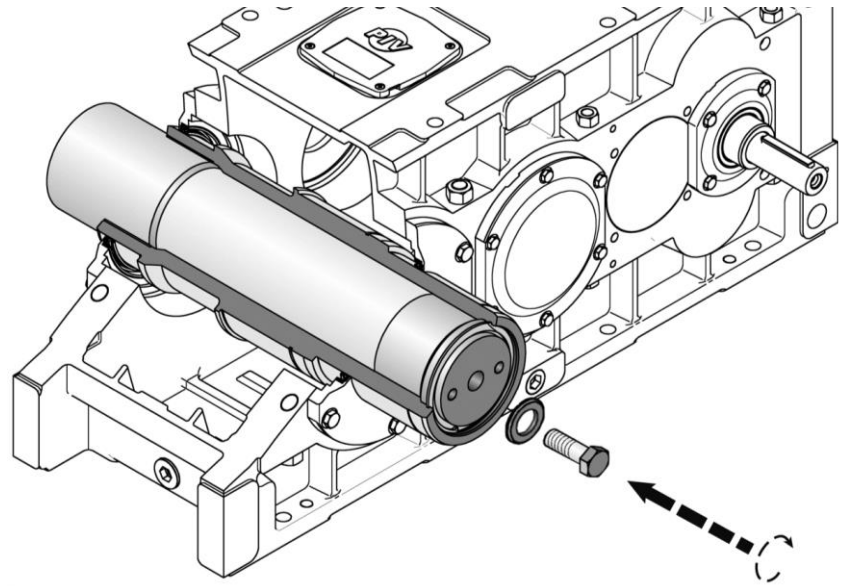


Fig. 56: Fastening bolt

7. Secure the machine shaft with a fastening bolt.

Additionally secure the fastening bolt with a suitable bolt lock. Observe the specified tightening torques (↪ *Chapter 6.6 'Tightening torque' on page 89*).

Shrink disc

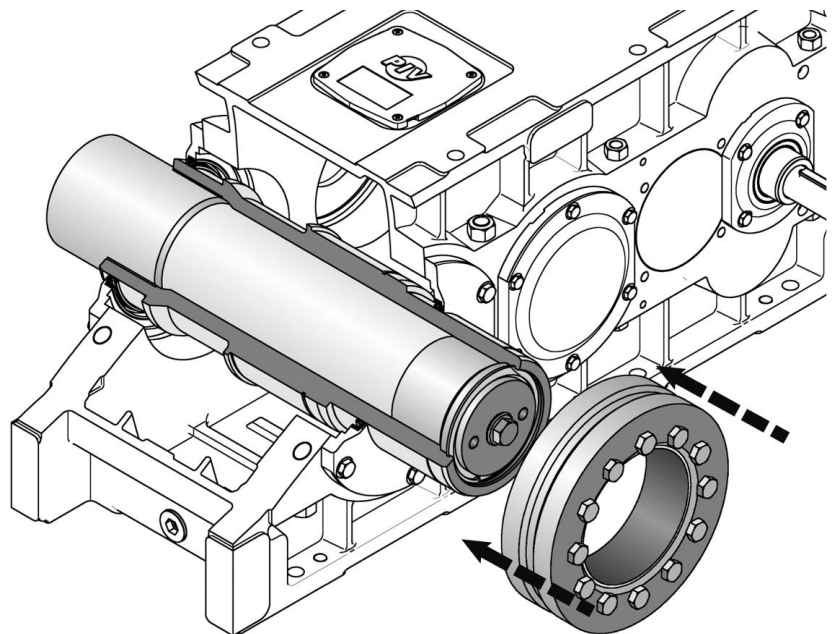


Fig. 57: Bolt locking

8. Slide the untightened shrink disc onto the hollow shaft. For fitting the shrink disc, observe the separate instructions issued by the manufacturer.

6.10.3 Removing the gearbox from the machine shaft

High weight



WARNING!
Risk of crushing through high weight!

Due to its high weight, moving the gearbox can result in serious or even fatal injury.

- Use suitable lifting equipment with sufficient load capacity. See *Chapter 5 'Transport, packaging and storage'* on page 46.
- Always secure the gearbox before releasing any connections.

Disassembly

1. Secure the gearbox against falling.

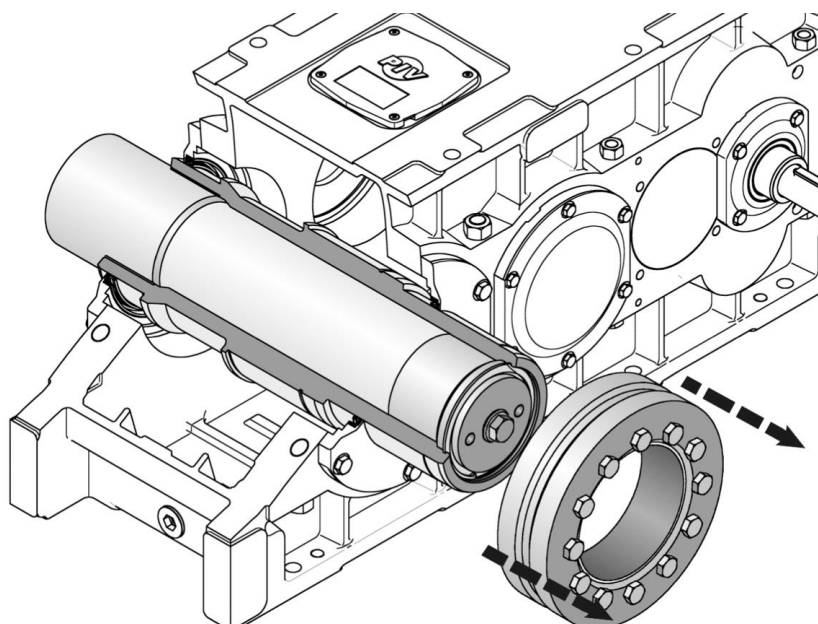


Fig. 58: Shrink disc

2. Remove the shrink disc in accordance with the instructions issued by the manufacturer.

Fastening bolt

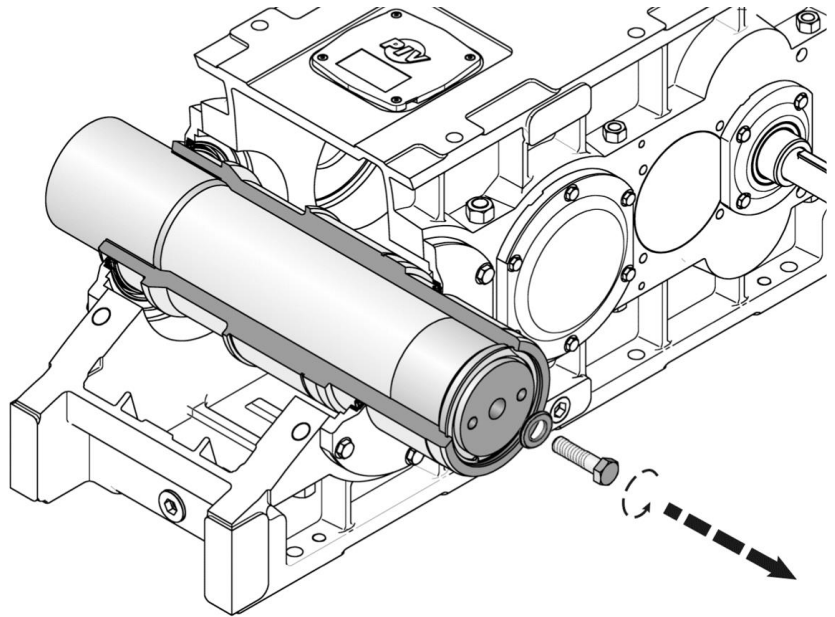


Fig. 59: Undoing the fastening bolt

3. Undo the fastening bolt and remove it.

Ejector screws

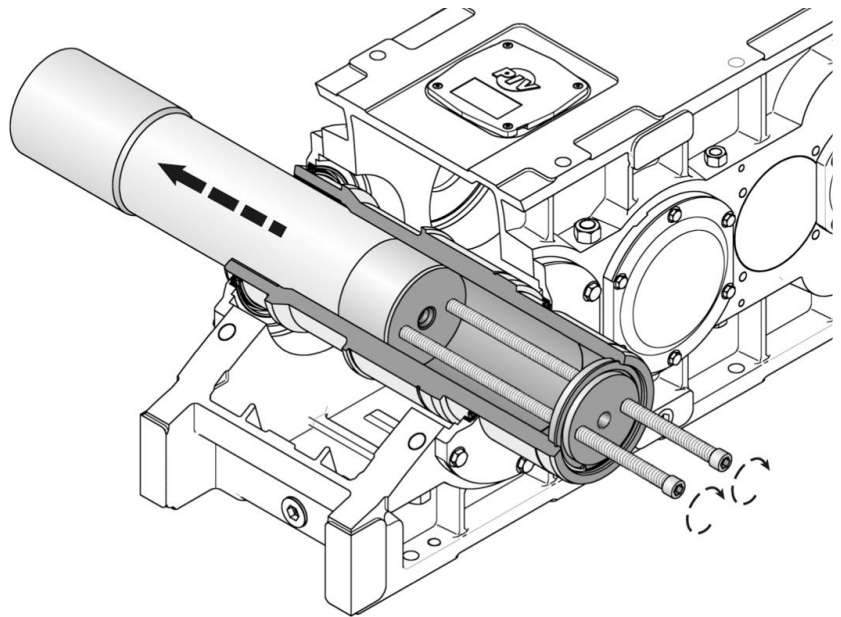


Fig. 60: Screwing in ejector screws

- 4.



For ease of disassembly, grease the ejector screws and the threads in the end plate with lubricant.

Screw the two ejector screws into the threads in the end plate in order to detach the gearbox from the machine shaft.

6.11 Assembly of output shaft as flanged coupling

General information



Dimension the machine shaft material and keyway linkage at customer's side in accordance with the occurring loads.

6.11.1 Flanged coupling dimensions

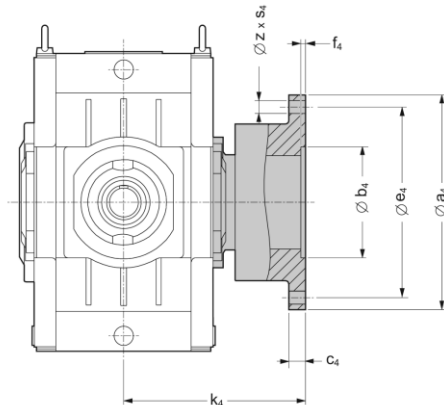


Fig. 61: Flanged coupling dimensions

		k_4	a_4	e_4	b_4	f_4	c_4	z	s_4	1) $\varnothing x_4$
PC, PD, PE PLC, PLD, PWC, PWD	16	230	300	260	150 H7	10	25	16	22	M20x70
	18	265	300	260	150 H7	10	25	16	22	M20x70
	20	275	320	280	160 H7	10	25	18	22	M20x70
	22	320	370	320	180 H7	10	30	16	26	M24x90
	25	345	390	340	190 H7	10	30	18	26	M24x90
	28	387	430	380	220 H7	12	38	20	26	M24x100
	31	397	470	420	240 H7	12	38	22	26	M24x100
	35	442	510	450	260 H7	12	42	18	33	M30x120
	40	457	540	480	280 H7	12	42	22	33	M30x120
	42	514	620	540	310 H7	14	48	24	33	M30x130
	45	527	710	630	360 H7	17	55	28	33	M30x140
	47	542	740	660	360 H7	17	55	30	33	M30x140
	50	623	750	660	410 H7	18	60	24	39	M36x160
	53	638	800	710	410 H7	18	60	26	39	M36x160
	56	653	860	770	460 H7	18	65	30	39	M36x160
60	748	930	830	460 H7	18	65	30	39	M36x170	
63	790	1000	895	570 H7	20	75	26	45	M42x200	
67	790	1000	895	570 H7	20	75	26	45	M42x200	
71	915	1120	1015	640 H7	20	85	30	45	M42x220	
75	915	1120	1015	640 H7	20	85	30	45	M42x220	
80	967	1250	1145	700 H7	22	95	34	45	M42x230	
85	967	1250	1145	700 H7	22	95	34	45	M42x230	
PLB	16	296	300	260	150 H7	10	25	16	22	M20x70
	20	338	320	280	160 H7	10	25	18	22	M20x70
	25	390	390	340	190 H7	10	30	18	26	M24x90
	31	447	430	380	220 H7	12	38	20	26	M24x100
	40	537	510	450	260 H7	12	42	18	33	M30x120
	45	644	620	540	310 H7	14	48	24	33	M30x130

Fig. 62: Flanged coupling dimensions

1) Bolts

6.11.2 Assembly of flanged coupling with compressed-oil interference fit

Incorrect assembly



WARNING!

Risk of injury through incorrect assembly!

Incorrectly performed work on the flanged coupling with compressed-oil interference fit can cause serious injury and major damage.

- Observe the instruction manuals of the ejector tool, retractor and pumps.
- The oil pressure must not exceed the specified maximum pressure of 3,000 bar.
- Protect the seals on the input and output side from damage and heating up beyond 80 °C.
- Observe the maximum force of the hydraulic cylinder.
- Observe the tightening torques.

Requirements

The following components are required for relief after joining:

- A number of high-pressure oil pumps (at least 3,000 bar each) corresponding to the number of oil bores on the hub
- Pressure gauge
- Connection lines as necessary

Assembly

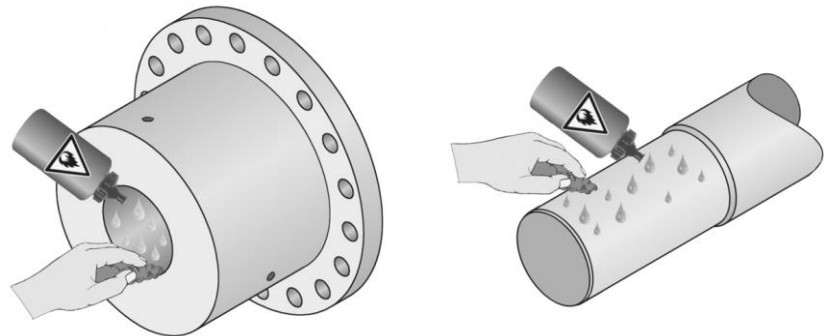


Fig. 63: Cleaning the mating faces

1. Clean and degrease the mating faces, oil connection bores and oil distributor grooves.
2. Make sure that the transitions between the mating faces, side-walls and oil distributor and drain grooves are smoothly rounded and free of burrs.

Joining temperature

3.



WARNING!
Risk of burning through hot surfaces!



Protect the seals on the input and output side from damage and heating up beyond 80 °C.

Heat the hub to the specified joining temperature (max. 250 °C) in an oven.

4. Quickly fit the hub to the shaft, preferably vertically.
5. Make sure that the fitted hub is fixed and that it can cool in the intended position on the shaft.
6. After joining, wait for the parts to cool to a temperature of approx. 20 to 25 °C.

Stresses

7.



WARNING!
Risk of injury through pressurised oil!

To relieve any stresses that may be produced during the shrinking process, use a suitable number of pumps to pump SKF mounting fluid LHM 300 or suchlike around the hub until a fully closed ring of oil escapes from both sides of the gap.

If necessary, correct the hub position while constantly pressing oil into the gap.

Observe the permissible maximum pressure of 3,000 bar.

Relieving oil pressure

8.



WARNING!
Risk of injury through ejecting oil!

Carefully relieve the oil pressure by opening the return valve.

9. Allow the joint to rest for 24 hours so that the oil can escape through the gap.

10.



NOTICE!
Pollution through escaping oil!

Collect escaped oil and dispose of it in an environmentally responsible manner and in accordance with the local regulations.

11. Once the waiting period has elapsed, screw the locking bolts into the connector threads.

⇒ The joint can be loaded.

Flange surfaces

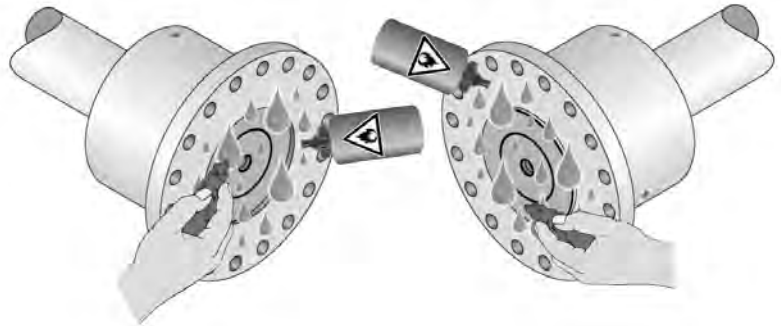


Fig. 64: Flange surfaces

12. Clean the two front flange surfaces.

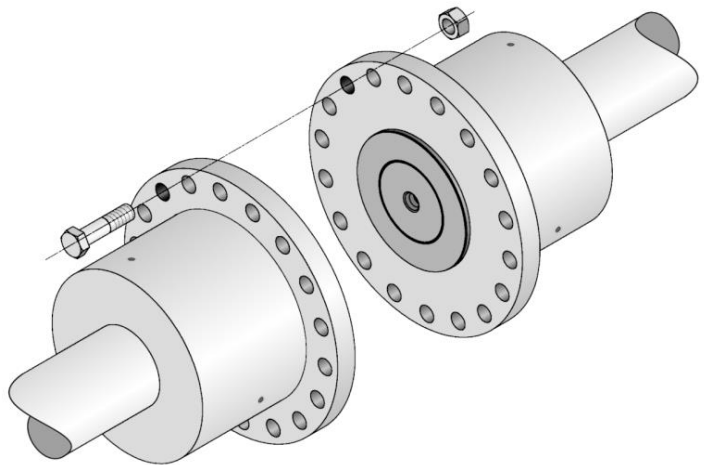


Fig. 65: Aligning

13. Align the bores of the two flange halves with one another and join them together.

Tightening bolts

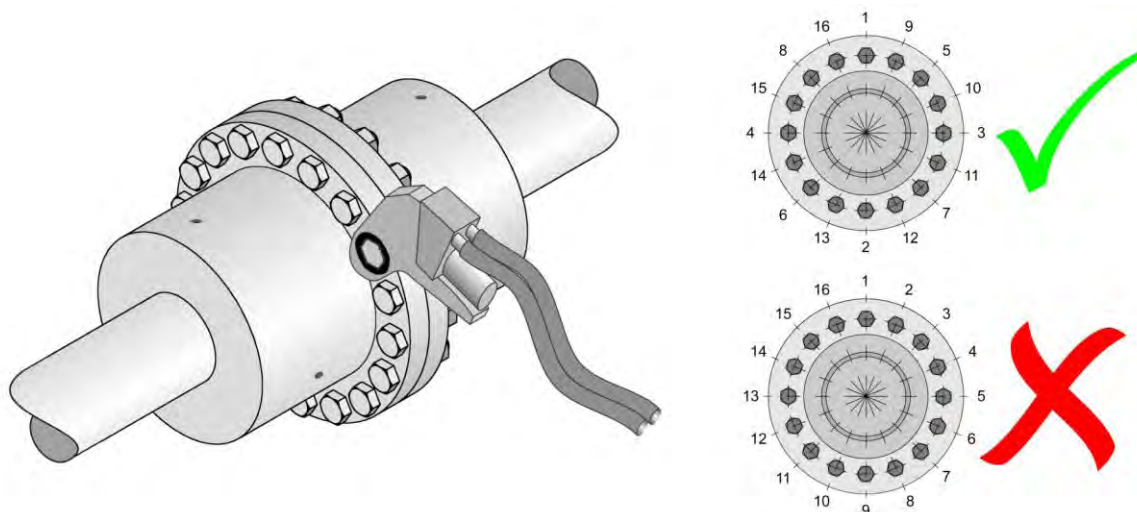


Fig. 66: Tightening bolts

14.



NOTICE!
Damage through incorrect tightening torques!

Tightening bolts Sequence according to Fig. 66. Observe the tightening torques (↪ Chapter 6.6 'Tightening torque' on page 89).

If necessary, use a hydraulic torque wrench.

6.11.3 Disassembly of flanged coupling with compressed-oil interference fit

Incorrect disassembly



WARNING!

Risk of injury through incorrect assembly!

Incorrectly performed work on the flanged coupling with compressed-oil interference fit can cause serious injury and major damage.

- Observe the instruction manuals of the ejector tool, retractor and pumps.
- The oil pressure must not exceed the specified maximum pressure of 3,000 bar.
- The sequence for oil pump activation must be observed under all circumstances.
- Observe the maximum force of the hydraulic cylinder.
- For couplings with a conical bore, apply an axial arrester to secure against sudden movements of the coupling part to be released.

Requirements

The following components are required for disassembly of the compressed-oil interference fit:

- One hydraulic cylinder (Lukas) with oil pump for shifting the flanged coupling along the shaft
- A number of high-pressure oil pumps (at least 3,000 bar each) corresponding to the number of oil bores on the hub for forcing oil between shaft and flanged coupling
- Pressure gauge
- Connection lines as necessary

Hydraulic cylinder

The displacement and compression force of the hydraulic cylinder must be observed.

The hydraulic cylinder (Lukas) is used only for shifting the hub along the shaft.

When retracting it, the hub must float on an oil film to prevent the shaft and hub from being damaged. Retraction must be performed in an even motion and without jarring.

Separating flanges

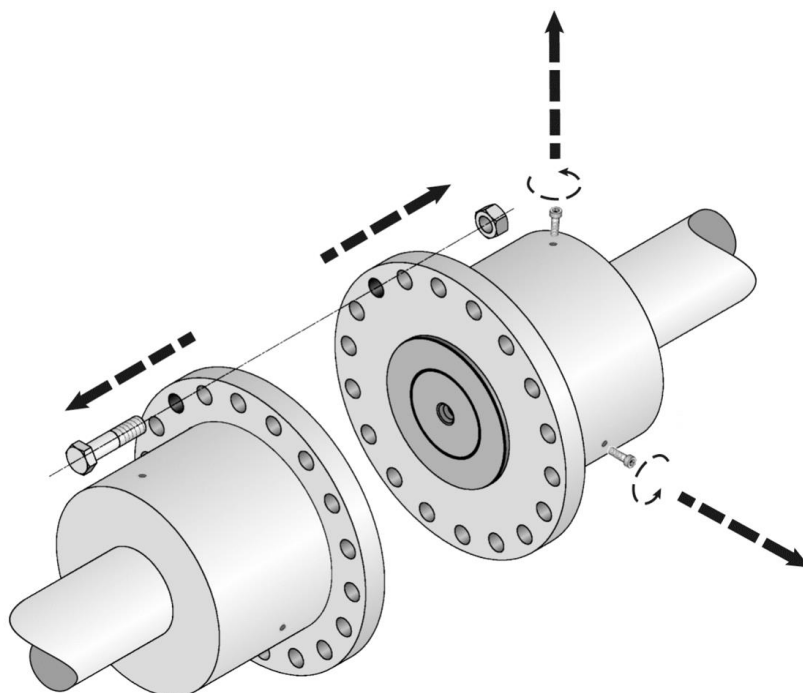


Fig. 67: Separating flanges

1. Undo the bolts and separate the flanges.
2. Remove the locking bolts of the hydraulic ducts for the disassembly tool.
3. Clean and degrease the mating faces, oil connection bores and oil distributor grooves.
4. Make sure that the transitions between the mating faces, side-walls and oil distributor and drain grooves are smoothly rounded and free of burrs.

Disassembly utilities

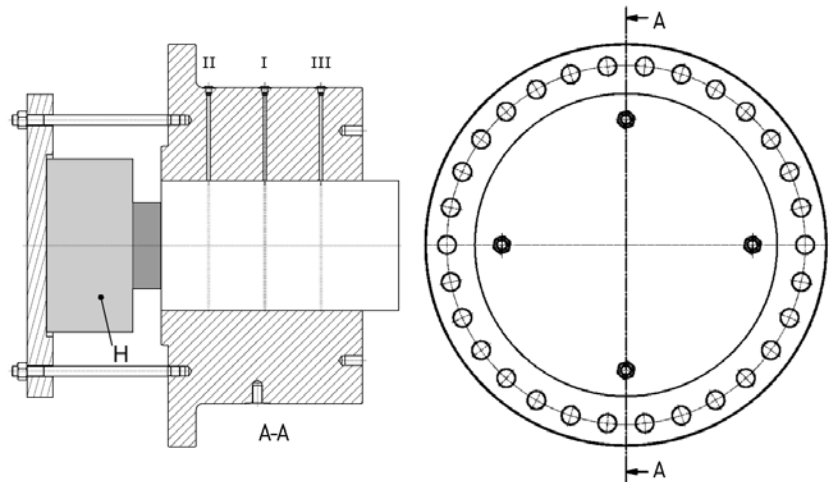


Fig. 68: Disassembly utilities

5. To avoid damage to the mating surfaces, continue pumping disassembly oil (e.g. SKF LHDF 900) into the gap and pull the hub off vertically, keeping it afloat on the oil film produced.
6. Fit the disassembly utilities and the hydraulic cylinder “H” according to Fig. 68.

7.



NOTICE!
Pollution through escaping oil!

Remove the screw plugs from all oil ducts.


8.




WARNING!
Risk of crushing through falling components!

For couplings with a conical bore, apply an axial arrester to secure against sudden movements of the coupling part to be released.

Oil pump


9.  *Always generate pressure using the oil pumps from the centre outwards.
The sequence for oil pump activation must be observed under all circumstances.*

Bleed the first oil pump and connection line and connect it to the centre (Fig. 68/I) oil duct.

10.  **WARNING!**
Risk of injury through pressurised oil!

Use the oil pump to generate oil pressure until oil begins escaping from the adjacent oil ducts. Observe the maximum oil pump pressure during all work steps.

11. Bleed the second oil pump and connection line and connect it to the next (Fig. 68/II) oil duct.
Generate pressure until oil escapes in an even ring at the shaft's front end.
12. Bleed the third oil pump and connection line and connect it to the next (Fig. 68/III) oil duct.
Generate pressure until oil escapes in an even ring at the coupling's front end.
13. Keep the oil pressure constant in all connected oil lines throughout the entire retraction process.

14.  **NOTICE!**
Damage to shaft or hub through lack of oil!

When the oil film escaping at both faces has become constant, pull the hub of the shaft using a hydraulic cylinder.

Make sure that the oil escaping from the gap always forms an uninterrupted ring.

Observe the maximum force of the hydraulic cylinder.

Additional notes

- If the hub does not begin to float despite constant pumping of oil, use oil with a higher viscosity.
- If, with a hub featuring several oil bores, the hydraulic cylinder fails to remove the hub from the shaft in a single stroke and thus needs to be repositioned, make sure that the hydraulic cylinder stops between two oil bores.

6.12 Assembly of fin-tube integrated cooler

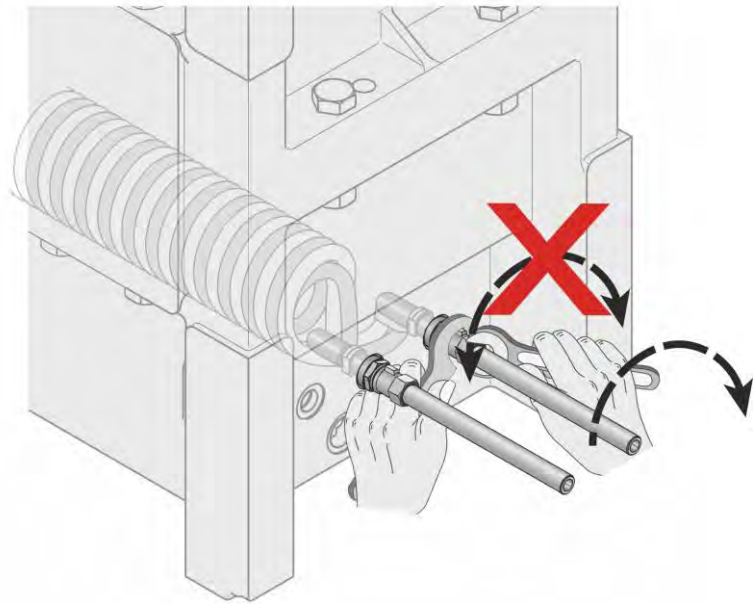


Fig. 69: Fin-tube integrated cooler

1.



NOTICE!

Damage through incorrect installation of fin-tube integrated cooler!

If the cooling coil connections outside of the gearbox become twisted, the cooling coil's connection points inside the gearbox may tear free and coolant may enter the oil.

Use a hook spanner or similar tool to secure the cooling coil connections on the gearbox against twisting when assembling the connections at the customer's site. See Fig. 69, left hand.

2. Secure the customer-side connections. See Fig. 69, right hand. Do not turn your left hand when doing so.

The connection points at risk are indicated by a sticker on the gearbox.

6.13 Connecting to power supply

Personnel: ■ Electrically skilled person with additional explosion protection qualifications



Observe the wiring diagram.

1. Establish the correct connections in the terminal box in accordance with the attachment parts' wiring diagrams.



WARNING!

Risk of explosion through differences in potential!

Differences in potential can generate ignition sparks and trigger explosions.

2. Secure the earthing points.

6.14 Checks prior to commissioning in explosive area

Personnel: ■ Specialist for explosive areas

1. Carefully work through every single item on the following check list.

Activity	Check notes
Remove transport safeguards	
Make sure that the values specified on the gearbox's type plate are not exceeded.	
The design must match that listed on the gearbox's type plate and in the order confirmation.	
<p>The following specifications on the gearbox's type plate must match the permissible explosive area on site:</p> <ul style="list-style-type: none"> ■ Device group ■ EX category ■ EX zone ■ Temperature class ■ Maximum surface temperature 	
Make sure that there no explosive atmosphere, no oils, acids, gases, vapours, dusts or radiation exists during assembly of the gearbox.	
All input and output elements to be assembled must be ATEX approved.	
<p>Check the gearbox's earthing for correct function.</p> <p>Additional electrical attachments must feature their own fully functional earthing.</p>	
The oil level must match that listed on the gearbox's type plate.	
All oil level inspection ports, drain plugs and bleeder screws and valves must be freely accessible.	
<p>When assembling a coupling:</p> <p>Do not use spacer sleeves as an assembly aid!</p>	
<p>When assembling a belt drive:</p> <p>The belt must feature sufficient shunt resistance $< 10^9 \Omega$ between the input-side shaft end and the motor shaft.</p> <p>The belt pulley must be balanced. During operation, no radial or axial forces may be generated.</p>	
<p>Before assembly of the integrated protective cover:</p> <p>The manufacturer must verify by way of an ignition source analysis that no ignition sources (e.g. spark showers through grinding) can be produced.</p>	
Make sure that the gearboxes are sufficiently ventilated and that external heat transmission (e.g. via couplings) is prevented. The cooling air may not exceed a temperature of 40 °C.	

Installation and commissioning



Activity	Check notes
<p>For mains-powered motors: Check that the data specified on the gearbox's and the motor's type plate and in the order confirmation match the ambient conditions at the site of operation.</p>	
<p>When assembling gearboxes with hollow shaft and shrink disc: The hood must be installed correctly.</p>	
<p>Make sure that the ambient temperature is observed in accordance with the order confirmation and type plate.</p>	

6.15 Filling oil

Personnel: ■ Specialist for explosive areas



Only fill oil while the gearbox is at a standstill.

1. Close all gearbox apertures apart from the oil filler opening and the gearbox bleeder aperture and secure them against inadvertent opening.

2.



NOTICE!
Pollution through escaping oil!

Fill the specified oil type and quantity (↪ *Chapter 8.5 'Oil type selection' on page 132*) into the filler opening.

3. When the gearbox is not running, the oil level must reach the marking on the dipstick or the centre of the oil sight glass. If necessary, adjust the oil level.
4. Close all oil filler openings and secure them against inadvertent opening.

6.16 Commissioning

The following checks must be performed during the trial run:

- Personnel: ■ Specialist for explosive areas
 ■ PIV service personnel

Requirements: If a cooling and lubrication system exists, it must be running.

1. Remove corrosion protection using environmentally compatible solvents.
2. Check oil level and top up if necessary (↪ *Chapter 6.15 'Filling oil' on page 123*).
3. Check that the oil drain cocks are “closed”.
4. Check temperature switches and all other sensors for correct function.
5. Check that all protective covers are complete and fully functional.
6. For long-term corrosion protection, screw plugs are used. Check that these have been replaced with the bleeder screws; do so if this is not the case.
7. Check the gearbox's alignment.
8. Start up the gearbox within the operating temperature and condition parameters.



If a pawl is installed, the minimum release speed needs to be achieved.

9. Check all fastening bolts for firm seating and retighten if necessary. Observe the tightening torques (↪ *Chapter 6.6 'Tightening torque' on page 89*).
10. Ensure that the cooling air supply is unobstructed. Exhaust air from other machines must not impair cooling.
11. Inspect for abnormal noise, leaks, vibration and temperatures. Fill in commissioning report.
12. Refill the cooling and lubrication system with oil.
13. Check the attachment parts for correct function.

6.17 Checks during gearbox trial run in explosive area



*Design modifications or a change of the tilt angle if set up at an angle require prior approval by PIV Drives GmbH.
Prior consultation is required to maintain ATEX approval!*

Personnel: ■ Specialist for explosive areas

- Carefully work through every single item on the following check list.

Activities	Check notes
Measure surface temperature after 3 hours. The difference to the operating temperature may not exceed 5 K. If the difference exceeds 5 K, immediately shut down the drive and consult PIV Drives GmbH.	
Measure oil temperature. Add 10 K to the measured value. Use this value to determine the lubricant change interval.	
For gearboxes with pawl: The minimum release speeds for the pawls may not be fallen below during nominal operation.	

7 Operation

7.1 Normal mode

After starting the lubrication system, drive and installed auxiliary units and once it has reached the desired output speed, the gearbox is running in normal mode.

Protective equipment:

- Protective work clothing
- Light breathing protection
- Safety goggles
- Protective gloves
- Hearing protection

1. Observe the output torques and permissible transverse forces.
2. Regularly inspect the gearbox for temperature-induced discolouration and for leaks.
3. In explosive areas, regularly check for accumulated dust. Remove dust ↪ *Chapter 8.7.2 'Removing dust' on page 134.*

7.2 Shutting down the gearbox

1.



WARNING!
Risk of injury through inadvertent motor start-up!

Switch off the drive motor, see the drive motor's operating manual.

Secure the drive motor against unauthorised activation.

Disconnect the drive motor from its power source.

2. Switch off any auxiliary units or linked systems connected to the gearbox, see the the corresponding units' and systems' operating manuals.

Secure heaters, auxiliary drives, pumps and other electrical devices against unauthorised activation.

3.



NOTICE!
Risk of pollution through coolant!

On gearboxes with external coolant supply, disconnect the pump from its power source and secure it against unauthorised activation.

Drain the coolant and dispose of it in an environmentally responsible manner.

4. On gearboxes with cooling and lubrication system, disconnect the oil pump from its power source and secure it against unauthorised activation.

Consult PIV Drives GmbH on any further activity.

5. Depending on the ambient conditions and the gearbox's service life, even a short planned gearbox downtime may necessitate preservation.

In case of questions, please contact service or a representative. See ↪ *Chapter 1.3 'Customer service' on page 8.*

8 Maintenance

8.1 Safety notes for maintenance

Explosion protection



WARNING!

Risk of explosion during maintenance!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning maintenance work, obtain written work permission and keep it outside the danger zone.
- Never perform maintenance work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.
- Do not perform welding work on the gearbox.
- Do not use the gearbox as an earth point for welding work.

Failure to observe these notes will eliminate the explosion protection.

8.2 Spare parts



WARNING!

Risk of injury through use of incorrect spare parts!

The use of incorrect or faulty spare parts can put the personnel at risk, lead to damage, malfunctions or complete failure and to explosions in explosive areas.

- Only use genuine PIV Drives GmbH spare parts or spare parts approved by PIV Drives GmbH.
- In any case of doubt, always consult PIV Drives GmbH.



Voiding of warranty

Using non-approved spare parts voids the warranty and invalidates approval for explosive areas.

To ensure that the gearbox remains ready for operation, stock wear parts and spare parts that may be needed quickly at the site of operation. In case of questions, contact customer service ↗ *Chapter 1.3 'Customer service' on page 8.*

When ordering spare parts, use the information provided in the enclosed spare parts lists and the package and spare parts drawings referenced in the spare parts lists.

Procure spare parts from authorised dealers or directly from PIV Drives GmbH. Contact details ↗ *Chapter 1.3 'Customer service' on page 8.*

Provide the following information when ordering spare parts:

- Gearbox designation
- Serial no. (see type plate)
- Order no.
- Photo of component if necessary

8.3 Maintenance schedule

The following sections describe the maintenance work required for optimal and fault-free operation of the gearbox.

If regular inspections show increased wear, reduce the maintenance intervals to match the actual wear. In case of questions regarding the maintenance work and intervals, contact PIV Drives GmbH ↗ *Chapter 1.3 'Customer service' on page 8.*



Maintenance

Interval	Maintenance work	Personnel
As per manufacturer's specifications	Check belt tension and re-tension if necessary. See ↪ Chapter 8.7.9 'Checking and adjusting belt tension' on page 139.	Specialist for explosive areas
	Clean filter elements or replace if necessary.	Specialist for explosive areas
	Replace coolant. See ↪ Chapter 8.7.11 'Replacing coolant' on page 142.	Specialist for explosive areas
	Service external oil circuit. See ↪ Chapter 8.7.5 'Servicing external oil circuit' on page 137.	Specialist for explosive areas
Daily	Check oil level. See ↪ Chapter 8.7.3 'Checking oil level' on page 134.	Specialist for explosive areas
	Check bearings and shaft for temperature-induced discolouration. If necessary, shut down the gearbox and consult PIV Drives GmbH.	Specialist for explosive areas
	Check the earth connections and lines for correct function. Replace if necessary.	Electrically skilled person with additional explosion protection qualifications
	Check for accumulated dust and remove dust if necessary. Using a high-pressure jet to clean the gearbox and hosing down the gearbox with detergent and water is prohibited. This may damage seals and attached parts. See ↪ Chapter 8.7.2 'Removing dust' on page 134.	Specialist for explosive areas
During gearbox inspection	Check cooling and heating elements for deposits and scaling. See ↪ Chapter 8.7.7 'Checking heater elements for deposits' on page 138.	Specialist for explosive areas
Weekly	Top up or replace oil, see oil change schedule (↪ Chapter 8.4 'Oil change schedule' on page 131.)	Specialist for explosive areas

8.4 Oil change schedule

Overview



- Oil types ↪ *Chapter 8.5 ‘Oil type selection’ on page 132*
- Grease types ↪ *Chapter 8.6 ‘Grease’ on page 133*
- Check oil level ↪ *Chapter 8.7.3 ‘Checking oil level’ on page 134*
- Oil change ↪ *Chapter 8.7.4 ‘Oil change’ on page 135*
- Service external oil circuit ↪ *Chapter 8.7.5 ‘Servicing external oil circuit’ on page 137*

Interval	Maintenance work	Personnel
For intervals, see diagram “Guideline values for oil change intervals” Fig. 70.	Change oil.	Specialist for explosive areas
	Clean the oil sight glass/oil gauge.	Specialist for explosive areas
Initially after 500 h	Change oil.	Specialist for explosive areas
	Clean the oil sight glass /oil gauge.	Specialist for explosive areas
Daily	Check oil level and top up if necessary.	Specialist for explosive areas
	Check the gearbox for leaks.	Specialist for explosive areas
	Check the oil temperature.	Specialist for explosive areas
Weekly	Fill in oil up to centre of oil sight glass, dipstick marking or oil gauge.	Specialist for explosive areas

Increased humidity

The permissible average humidity is 75%. Over brief periods, a maximum of 85% humidity is permissible.

If humidity remains higher for longer periods, check the water content of the oil by means of an oil analysis.

The values specified by the oil’s manufacturer must not be exceeded.

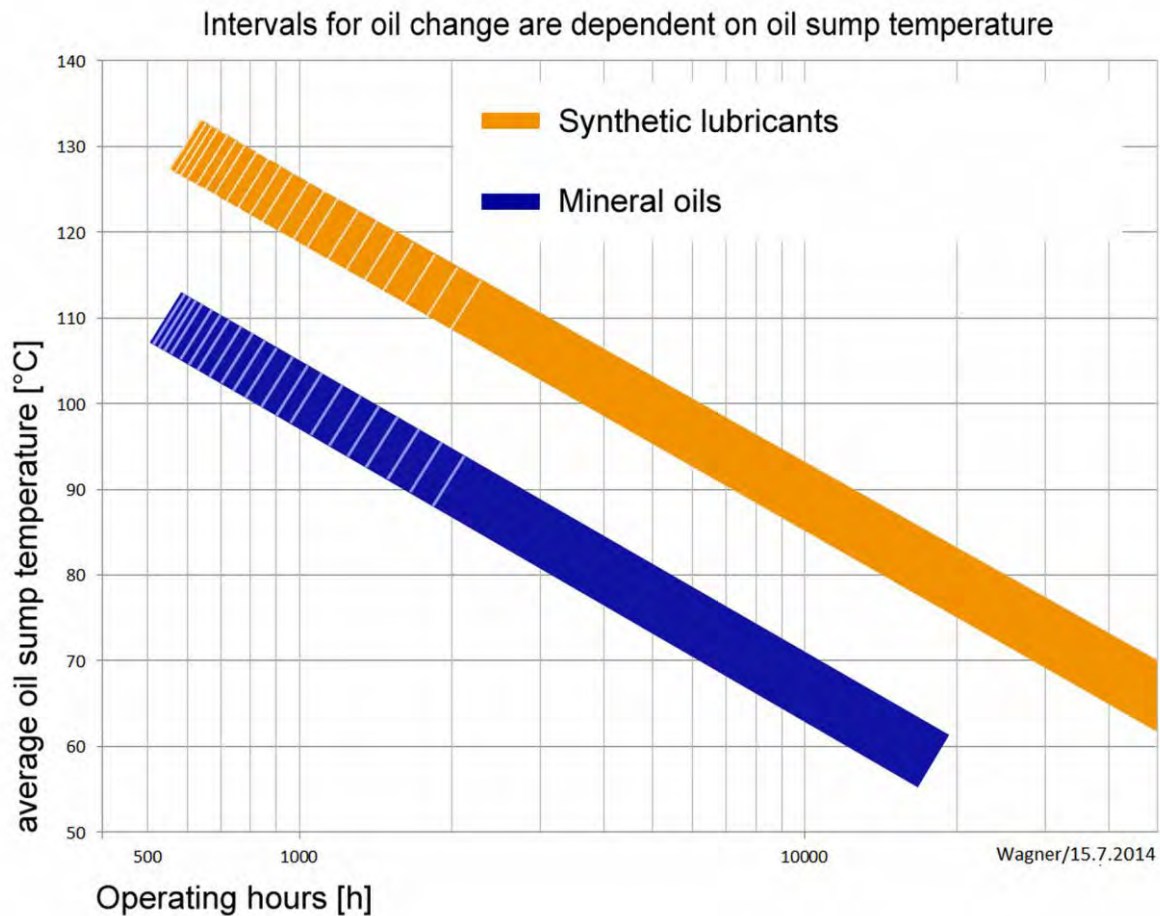


Fig. 70: Guideline values for oil change intervals

The oil change intervals specified are guideline values and may be longer or shorter depending on the application’s boundary conditions. By regularly performing oil analyses, it is possible to substantially extend the oil change intervals in consultation with the respective oil manufacturer.

8.5 Oil type selection

The lubricants used must meet the minimum requirements CLP in accordance with DIN 51517 part 3. The order confirmation and type plate list the oil viscosity and oil type.

8.6 Grease

For relubrication of the labyrinth-type seals, only lithium greases with mineral base oil of NLGI class 2 (DIN 51818) may be used.

8.7 Maintenance work

8.7.1 Preparation

Perform the following steps prior to all maintenance work:

- Personnel: ■ Specialist for explosive areas
 ■ Electrically skilled person with additional explosion protection qualifications
- Special tool: ■ Tools approved for the existing explosive area

Requirements: The spare parts drawings are available in order to prevent damage through incorrect disassembly or assembly.

1. Make sure that there is no explosive atmosphere.
2. Switch off the gearbox and wait for it to stop running.
3. Depressurise the cooling lubrication system. Relieve the pressure.
4. Disconnect drives and auxiliary units from their power supplies and secure them against reactivation.

5.



DANGER!

Risk of explosion through thermal resistor!

A hot thermal resistor can evaporate the remaining oil and cause it to explode.

Switch off any existing heaters and prevent them from being switched on inadvertently.

6. Allow the gearbox to cool.
7. Mechanically secure the gearbox against inadvertent start-up or rotation.
8. Disconnect any electrical power supply and secure against reactivation.
9. If maintenance covers need to be opened for the maintenance work, be ready for oil mists.

8.7.2 Removing dust

- Personnel: ■ Specialist for explosive areas
- Protective equipment: ■ Safety goggles
 ■ Protective gloves
 ■ Breathing protection
 ■ Protective suit

1.



NOTICE!

Damage through high-pressure jet!

Incorrect cleaning can damage seals and attachment parts.

- Never use a high-pressure jet.
- Do not hose down the gearbox with detergents and water.



Do not disperse dust.

Dust accumulations of more than 5 mm in areas exposed to explosion hazards must be removed professionally.

8.7.3 Checking oil level



Only check the oil level once the gearbox has cooled down and come to standstill.

Oil gauge, oil level viewport



Fig. 71: Example marking

In gearboxes with an oil gauge or oil level sight glass, the oil level must be at the marking or in the center of the gauge while the gearbox is not in operation and the oil surface has calmed down.

Oil dipstick

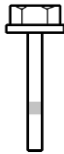


Fig. 72: Example marking

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective work clothing
 ■ Protective gloves
 ■ Safety goggles
 ■ Light breathing protection

1. Undo and remove oil dipstick.
2. Wipe the dipstick with a clean cloth.
3. Reinsert the dipstick fully and then pull it back out again.
 ⇒ The oil level must lie between the markings.
4. Top up the oil if necessary ↪ Chapter 6.15 'Filling oil' on page 123.
5. Dispose of the cloth correctly.

8.7.4 Oil change

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective work clothing
 ■ Protective gloves
 ■ Safety goggles
 ■ Breathing protection

Special tool: ■ Oil collection pan

1. Shut down gearbox and secure against restart.
- 2.



In cold state, the oil's fluidity is limited and complete draining is difficult. To drain the oil, the gearbox must therefore be at operating temperature.

Oil collection pan

3. Place the oil collection pan under the oil drain screw.



CAUTION!
Risk of burning through hot oil!

For ease of processing, the oil's temperature is still high. There is thus a risk of burning.

4. Open the oil drain screw. Open all filler openings and ventilation screws and valves.

⇒ The oil drains into the oil collection pan.

Oil sight glass

5. Clean the oil sight glass.

Filter

6. Change filter. See the manufacturer's operating instructions.

7. Open the oil filler opening.

Oil type

- 8.



NOTICE!
Damage through different oil types!

Never mix different oil types.

If the oil type is to be changed, flush with the new oil type. To do so, fill the new oil and drain it again.

- 9.



NOTICE!
Damage through contaminants in oil barrel!

Fill the gearbox with fresh oil using a filling filter (filter unit max. 25 µm).

⇒ This will prevent any contaminants from the oil barrel entering the gearbox.

The correct fluid level can be seen using the oil sight glass, dipstick, oil gauge or overflow opening.

Magnetic bolt

10. If necessary, flush with new oil to remove oil sludge and grit from the gearbox.

Clean the magnetic bolt.

11. Close all filler openings, ventilation screws and valves and secure them against inadvertent opening.

- 12.



If the gearbox is operated using an external lubrication system, the pipelines need to be bled.

13. Collect any oil that may have been spilled during this process..

Used oil

14. Dispose of used oil in an environmentally sound manner.

15. Document oil change using the oil change log (↗ Appendix B 'Documentation' on page 163).

8.7.5 Servicing external oil circuit

See the manufacturer's operating instructions.

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective work clothing
 ■ Protective gloves
 ■ Safety goggles
 ■ Light breathing protection

1. Clean filter elements or replace if necessary.
2. For gearboxes with cooling and lubrication system, change the oil in the lubrication system.

8.7.6 Checking linking elements

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective work clothing
 ■ Protective gloves
 ■ Safety goggles
 ■ Light breathing protection

1. Check all links between the gearbox and the surrounding system

or attachment parts for correct operation and firm seating.

2. Check hoses for damage.
Replace any damaged hoses.
Observe the hoses' maximum service life.

8.7.7 Checking heater elements for deposits

Personnel: ■ Electrically skilled person with additional explosion protection qualifications

Protective equipment: ■ Protective gloves
■ Protective work clothing
■ Safety goggles
■ Light breathing protection

1. Disconnect heater element from power supply and allow to cool.
Secure heater from being switched on inadvertently.
2. Allow oil to cool.
3. Check heater elements for deposits and damage.
4. Remove any deposits or replace heater element.

8.7.8 Checking flexible transmission elements on couplings



See the manufacturer's operating instructions.

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective work clothing
■ Protective gloves
■ Safety goggles
■ Light breathing protection

1. Check elastomer in accordance with the coupling manufacturer's operating instructions and replace the transmission elements if necessary.
Observe the elastomer's service life.

8.7.9 Checking and adjusting belt tension

Personnel: ■ Specialist for explosive areas

Protective equipment: ■ Protective gloves

■ Safety goggles

1. Check the belt tension and adjust if necessary, see the manufacturer's operating instructions.

8.7.10 Relubricating taconite seals and non-contact labyrinth-type seals with lubricating grease

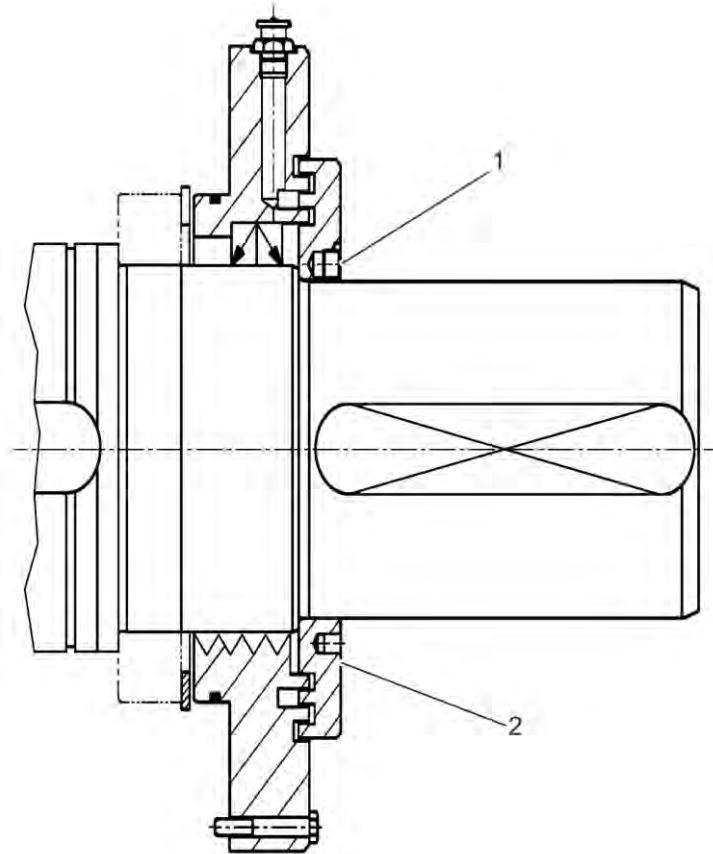


Fig. 73: Seals

- 1 Taconite seal variant
- 2 Non-contact labyrinth-type seal variant

- Personnel: ■ Specialist for explosive areas
- Protective equipment: ■ Protective work clothing
 ■ Protective gloves
- Materials: ■ Lithium roller bearing grease for seals

1. Shut down the gearbox by switching off the motor and secure against inadvertent start-up.
2. Every 3,000 operating hours or after 6 months at the latest, inject lithium grease into the lubrication points of the taconite seals or non-contact labyrinth-type seals (flat-type grease nipple AR ¼ DIN 3404) until lithium grease is expelled from the seal.

Grease quantity [ml]

⇒		Gear unit size		Grease quantity [ml]						
		Type of gear unit		14/16	18/20	22/25	28/31	35/40	42/45/47	50/53/56
PC, PD, PE	AN	45	60	70	70	90	120	130	180	
	AB	110	170	190	250	220	290	400	370	
PLC, PWC	AN	20	40	55	60	110	110	130	130	
	AB	110	170	190	250	220	290	400	370	
PLD, PWD	AN	15	20	40	40	55	60	110	110	
	AB	110	170	190	250	220	290	400	370	

⇒		Gear unit size		Grease quantity [ml]						
		Type of gear unit		10	12	16	20	25	31	40
PB	AN	45	60	70	160	120	130	190	200	
	AB	60	70	110	170	190	250	220	290	
PLB	AN	30	40	55	60	110	110	130	200	
	AB	60	70	110	170	190	250	220	290	

AN Input shaft side

AB Output shaft side

3. Evenly and slowly rotate the shaft to distribute the grease evenly.
4. Collect escaped used grease and dispose of it in an environmentally sound manner.

8.7.11 Replacing coolant



See cooling system's operating instructions.

8.8 Post-maintenance measures

Personnel: ■ Specialist for explosive areas

After completion of the maintenance work and prior to restarting the gearbox, perform the following:

1. Check unusual all previously undone threaded connections for tightness and secure them against inadvertent release.
2. Check whether all previously removed safety equipment and covers have been reinstalled correctly.
3. Make sure that all tools, materials and other equipment used have been removed from the workspace.
4. Clean the workspace and remove any escaped substances such as fluids, processing materials or similar.
5. Make sure that all the gearbox's safety equipment is fully functional.
6. Make sure that nobody remains inside the danger zone.
7. Remove any warning signs and notices that were attached.

9 Faults

The following chapter describes possible fault causes and the work required to remedy them.

If faults occur frequently, reduce the maintenance intervals to match the actual loads.

Observe the shorter intervals for employment in explosive areas.

In the event of faults that cannot be remedied based on the following notes, consult PIV Drives GmbH ↗ *Chapter 1.3 'Customer service' on page 8.*

9.1 Safety notes for troubleshooting

Explosion protection

**WARNING!****Risk of explosion during troubleshooting!**

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning troubleshooting, obtain written work permission and keep it outside the danger zone.
- Never perform troubleshooting in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Faults

Conduct in the case of faults

General conduct:

1. In the case of faults that pose an immediate danger to persons or property, immediately shut down the gearbox.
2. Immediately notify the person responsible on site of the fault.
3. Identify the fault cause.
4. Depending on the type of fault, have it remedied by PIV service personnel or have your own specialist personnel remedy it.



All of the faults lists in the following fault table may be remedied by:

- Specialist for explosive areas
- PIV service personnel

9.2 Fault indicators

The following indicate a fault:

- Motor or gearbox not turning
- Increased temperature
- Unusual noises
- Vibrations
- Accumulated dust
- Measurement sensor displays (if included)
- Leaking fluids or mist formation

9.3 Fault table

Personnel:	<ul style="list-style-type: none"> ■ Specialist for explosive areas ■ PIV service personnel
Protective equipment:	<ul style="list-style-type: none"> ■ Protective work clothing ■ Protective gloves ■ Safety footwear ■ Breathing protection ■ Safety goggles
Special tool:	<ul style="list-style-type: none"> ■ Tools approved for the existing explosive area



Faults

No.	Fault description	Cause	Remedy	Personnel
1	Unusual, uniform noises	Storage damage	Check oil, replace bearings.	
		Irregularities in the tooth-ing	Contact PIV Drives GmbH customer service.	
		Casing stress	Check the gearbox's fas-tening and correct if nec-essary.	
		Faulty gearbox founda-tions	Reinforce gearbox founda-tions.	
		Unsuitable motor speeds	Check frequency conver-ter.	
		Insufficient alignment	Align the gearbox.	
2	Unusual, irregular noises	Oil contaminated by for-eign bodies	Shut down the gearbox. Check the oil. Contact PIV Drives GmbH cus-tomer service.	
		System sluggish	Check system.	
3	Noises from gearbox fastening	Gearbox fastening loose	Replace fastening ele-ments if necessary and secure them. Observe the tightening torques (☞ <i>Chapter 6.6 'Tightening torque' on page 89</i>).	
4	Bearings overheated	Oil level too low. Oil too old.	Correct oil level or change oil.	
		Bearings damaged	Check bearings and re-place if necessary. Con-tact customer service.	
5	Increased temperature at pawl or impaired locking function	Pawl faulty	Check pawl and replace if necessary. Contact PIV Drives GmbH customer service.	

Faults

No.	Fault description	Cause	Remedy	Personnel
6	Operating temperature too high	Oil level too high	Correct oil level.	
		Oil viscosity too high	Use the oil specified in the technical specification.	
		Oil too old	Change oil.	
		Oil contaminated	Change oil.	
		Ambient temperature too high	Limit external temperature.	
		For gearboxes with fans: Fan or gearbox soiled	Clean air intake and casing.	
		For gearboxes with integrated cooler: Deposits in cooling system. Coolant flow rate too low. Temperature too high.	See operating manual of fin-tube integrated cooler.	
		Cooling system malfunction	See operating manual of cooling system.	
		Gearbox sluggish	Contact PIV Drives GmbH customer service.	
		System sluggish	Check system.	
7	Oil leaking from oil drain or bleeder	Too much oil.	Correct oil level.	
		Drive in unfavourable position	Correct position.	
		Oil foaming	Check oil type and replace if necessary.	
		Awkward position of bleeder screw	Contact PIV Drives GmbH customer service.	

No.	Fault description	Cause	Remedy	Personnel
8	Oil leaking from other locations	Seals leaking	Retighten bolts on corresponding cover. Observe the tightening torques (↪ <i>Chapter 6.6 'Tightening torque' on page 89</i>). If oil continues to leak, contact PIV Drives GmbH customer service.	
		Sealing lip of shaft seal ring folded over	Replace shaft seal ring. If oil continues to leak, contact PIV Drives GmbH customer service.	
		Shaft seal ring faulty	Replace shaft seal ring. Contact PIV Drives GmbH customer service.	
9	Heavy V-belt wear	Incorrect alignment of V-belt pulley	Align V-belt pulley and check belt tension.	
		Ambient effects	Limit ambient effects as far as possible.	
		Overload	Contact PIV Drives GmbH customer service.	
10	No intake by oil pump. Pressure switch not switching.	Air in oil pump's intake line	Bleed. See operating manual of oil pump.	
		Oil pump faulty	Replace oil pump. Contact PIV Drives GmbH customer service.	
11	Pressure switch not switching	Pressure switch faulty	Replace pressure switch. Contact PIV Drives GmbH customer service.	



Faults

No.	Fault description	Cause	Remedy	Personnel
12	Cooling system malfunctions		See cooling system's operating instructions.	
13	Cold-start temperature not reached	Oil heater faulty or incorrectly connected	Check oil heater for correct connection and function, replace if necessary.	
		Ambient conditions cause excessive heat loss	Limit heat loss. Contact PIV Drives GmbH customer service.	
14	Safety equipment faults: thermosensor, thermometer-resistor, float switch		See safety equipment's operating instructions.	

9.4 Troubleshooting work

9.4.1 Replacing shaft seals

Contact customer service.

Personnel: ■ Specialist for explosive areas
 ■ PIV service personnel

Special tool: ■ Sandpaper grain size 400

Materials: ■ Loctite 5188 sealant

1. Check shaft's seal ring clearance fit for damage.
2. Eliminate damage through unrifled grinding with grain-size 400 sandpaper.
3. Remove old seal ring from bearing cover.
4. Clean and degrease sealing surfaces on casing and bearing cover.
5. Insert new seal ring into bearing cover.
6. Grease seal ring clearance fit.
7. Coat bearing cover's sealing surfaces with sealant, e.g. Loctite 5188.
- 8.



Do not damage seal ring's lips, cover keyway if necessary.

Fit bearing cover by carefully turning it back and forth.

9. Tighten bearing over. Observe the tightening torques (↪ Chapter 6.6 'Tightening torque' on page 89).

9.4.2 Replacing roller bearings on gearboxes with two-part casings in explosive areas

In explosive areas, the bearings require replacement at shorter intervals.



Before beginning work on the roller bearings, contact PIV Drives GmbH, ↗ Chapter 1.3 'Customer service' on page 8.

Zones 0 and 20

Replacement interval: after 50% of the calculated service life LH10.
For storage shelf-life, see technical gearbox specification.

Zones 1 and 21

Replacement interval: after 90% of the calculated service life LH10.
For storage shelf-life, see technical gearbox specification.

Personnel: ■ PIV service personnel
■ Specialist for explosive areas

Special tool: ■ Tools approved for the existing explosive area

1. Drain oil ↗ Chapter 8.7.4 'Oil change' on page 135.
2. Mark bearing cover, undo fastenings and remove bearing cover.



Bearing covers made of rubber-coated sheet metal cannot be reused after disassembly.

3. Undo the two-part housing's connection bolts and remove them.

4.



Take the weight into account. Secure with lifting gear if necessary.

Remove the top casing.

5.



Do not damage the seal ring clearance fit.

Remove the entire shaft from the casing.

6. Pull the faulty bearings from the shaft.

7.



CAUTION!

Risk of burning through hot components!

Gear wheels and bearings are hot. Skin contact may cause burns.

Preheat new gear wheels and bearings to 110 °C and slide them on.

8. Coat shaft with lubricant, e.g. MoS₂.

9. Clean and degrease the casings sealing surfaces.

10. Coat the casing's sealing surfaces with sealant, e.g. Loctite 5188.

11. Place the top casing in position.

12. Measure bearing play and correct if necessary. Numerical values are available from customer service upon request.

13. Screw in the casing's connection bolts.

Observe the tightening torques (☞ *Chapter 6.6 'Tightening torque' on page 89*).

14. Coat bearing cover's sealing surfaces with sealant.

15. Fit bearing cover by carefully turning it back and forth.

16. Tighten cover.

Observe the tightening torques (☞ *Chapter 6.6 'Tightening torque' on page 89*).


17. Secure the casing's connection bolts.

18. Fill with new oil. See ☞ *Chapter 8.7.4 „Oil change“ on page 135*.

19. Check and, if necessary, reconnect all earth and potential equalisation lines.

9.5 Replacing roller bearings on gearboxes with monobloc casings in explosive areas



Contact PIV Drives customer service. For contact details, see  Chapter 1.3 'Customer service' on page 8.

9.6 Commissioning after troubleshooting

After troubleshooting, perform the following steps for recommissioning:

1. Check all previously undone threaded connections for tightness and secure them against inadvertent release.
2. Check whether all previously removed safety equipment and covers have been reinstalled correctly.
3. Make sure that all tools, materials and other equipment used have been removed from the workspace.
4. Clean the workspace and remove any escaped substances such as fluids, processing materials or similar.
5. Make sure that all the gearbox's safety equipment is fully functional.
6. Make sure that nobody remains inside the danger zone. Remove any warning signs and notices that were attached.
7. Clear gearbox for use.

10 Dismantling and disposal

Once the gearbox's service life has expired, the gearbox needs to be dismantled and disposed of in an environmentally sound manner.

Disposal service

If desired, PIV Drives GmbH can provide professional disposal. Contact customer service ↗ *Chapter 1.3 'Customer service' on page 8.*

10.1 Safety notes for dismantling

Explosion protection



WARNING!

Risk of explosion during dismantling!

Introduction of ignition sources such as sparks, open lights and hot surfaces into the explosive area can cause explosions.

- Before beginning dismantling, obtain written work permission and keep it outside the danger zone.
- Never perform dismantling work in an explosive atmosphere.
- Only use tools approved for working in explosive areas.

Failure to observe these notes will eliminate the explosion protection.

Incorrect dismantling



WARNING!

Risk of injury through incorrect dismantling!

Stored residual energies, hard-edged components, tips and corners on and in the gearbox or the required tools can cause injury.

- Before beginning work, ensure that there is sufficient space.
- Handle open, sharp-edged components with care.
- Ensure that the workspace is tidy and clean. Loosely stacked or spread out components can cause accidents.
- Dismantle components correctly. Take into account the sometimes high weight of the components. If necessary, employ lifting gear.
- Secure components against dropping or toppling.
- In any case of doubt, always consult PIV Drives GmbH.

Torsional moment



WARNING!

Risk of injury through torsional momenta!

Tension within the system can produce torsional momenta in the shaft connections. When disconnecting the shafts, the torsional momenta can cause injury and damage.

- Before beginning any work, relieve the system tension at suitable points.

10.2 Disassembly

Before beginning dismantling:

- Switch off gearbox, allow it to stop running and mechanically secure it against restarting.
- Completely physically disconnect the entire power supply from the gearbox and discharge stored residual energies.
- Remove operating fluids and auxiliary materials as well as any remaining processing materials and dispose of them in an environmentally responsible manner.
- Disassemble the protective barriers on the transmission elements of input and output shaft.
- To disconnect the gearbox from the drive, disconnect the transmission elements.
- Disconnect the earth lines and earthing bolts.
- Secure the gearbox with suitable lifting gear.
- Undo the fastening bolts.

Properly clean the assemblies and components and dismantle them in accordance with the locally applicable work health and safety and environmental regulations.

Dismantling the output shaft



- Dismantling the output shaft as hollow shaft with keyway linkage
↳ *Chapter 6.9.3 'Removing the gearbox from the machine shaft' on page 100*
- Dismantling the output shaft as hollow shaft with shrink disc
↳ *Chapter 6.10.3 'Removing the gearbox from the machine shaft' on page 108*
- Dismantling the output shaft as flanged coupling
↳ *Chapter 6.11 'Assembly of output shaft as flanged coupling' on page 110*

10.3 Disposal

If no return or disposal agreement has concluded, introduce dismantled components to recycling:

- Scrap metals.
- Submit plastic elements for recycling.
- Dispose of remaining components in accordance with material properties.

Incorrect disposal



NOTICE!
Danger of pollution through incorrect disposal!

Incorrect disposal may cause pollution.

- Have electrical waste, electronic components, lubricants and other auxiliary materials disposed of by certified professional disposal services.
- If in doubt, consult your local municipal authorities or special disposal companies on matters of environmentally sound disposal.

Gear oil, grease, cooling lubricant and filters



NOTICE!
Pollution through gear oil, grease, cooling lubricant and filters!

Gear oil, grease, cooling lubricant and filters may contain toxic substances.

- Have environmentally hazardous substances disposed of by certified professional disposal services.
- If in doubt, consult your local municipal authorities or special disposal companies on matters of environmentally sound disposal.

- If desired, we can provide professional disposal. Please contact our service department.

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12 Appendix

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A.A Checks during gearbox trial run in explosive area

B Documentation

Activity	Check notes
Remove transport safeguards	
<p>The following specifications on the gearbox's type plate must match the permissible explosive area on site:</p> <ul style="list-style-type: none"> ■ Device group ■ EX category ■ EX zone ■ Temperature class ■ Maximum surface temperature 	
Make sure that the values specified on the gearbox's type plate are not exceeded.	
Make sure that there no explosive atmosphere, no oils, acids, gases, vapours, dusts or radiation exists during assembly of the gearbox.	
The design must match that listed on the gearbox's type plate.	
All input and output elements to be assembled must be ATEX approved.	
<p>Check the gearbox's earthing for correct function.</p> <p>Additional electrical attachments must feature their own fully functional earthing.</p>	
The oil level must match that listed on the gearbox's type plate.	
All oil level inspection ports, drain plugs and bleeder screws and valves must be freely accessible.	
<p>When assembling a coupling:</p> <p>Do not use spacer sleeves as an assembly aid!</p>	
<p>When assembling a belt drive:</p> <p>The belt must feature sufficient shunt resistance $< 10^9 \Omega$ between the input-side shaft end and the motor shaft.</p> <p>The belt pulley must be balanced. During operation, no radial or axial forces may be generated.</p>	
<p>Before assembly of the integrated protective cover:</p> <p>The manufacturer must verify by way of an ignition source analysis that no ignition sources (e.g. spark showers through grinding) can be produced.</p>	

Activity	Check notes
<p>Make sure that the gearboxes are sufficiently ventilated and that external heat transmission (e.g. via couplings) is prevented. The cooling air may not exceed a temperature of 40 °C.</p>	
<p>For mains-powered motors: Check that the data specified on the gearbox's and the motor's type plate match the ambient conditions at the site of operation.</p>	
<p>When assembling gearboxes with hollow shaft and shrink disc: The hood must be installed correctly.</p>	
<p>Make sure that the ambient temperature is observed in accordance with the order confirmation and type plate.</p>	

A.A Checks during gearbox trial run in explosive area

Activities	Check notes
Measure surface temperature after 3 hours. The difference to the operating temperature may not exceed 5 K. If the difference exceeds 5 K, immediately shut down the drive and consult the manufacturer.	
Measure oil temperature. Add 10 K to the measured value. Use this value to determine the lubricant change interval.	
For gearboxes with pawl: The minimum release speeds for the pawls may not be fallen below during nominal operation.	

B Documentation

The following documents serve as templates for copying:

- Preservation record ↗ *Document, Appendix*
- Oil change log ↗ *Document, Appendix*
- Instruction protocol ↗ *Document, Appendix*

A copy must be made, completely filled out and filed away every time a re-application of corrosion protection is applied.

Gear unit designation according to nameplate	Gear unit serial number according to nameplate	Delivery date of gear unit
Date of first corrosion protection	Date of second corrosion protection with physiologically nonhazardous oil	

Inspection prior to re-application of corrosion protection

Mineral, synthetic or biodegradable oil Physiologically nonhazardous oil
 Loss of oil at gear unit Yes No Was there any indication of corrosion Yes No
 Contact with PIV Drives GmbH Yes No Contact Person: _____
 Was a sample of used oil taken? Yes No Identification number of the oil sample: _____
 Condition of used oil based on visual inspection: _____

Inspection after re-application of corrosion protection

Producer and designation of fresh oil: _____
 Was an oil filter used while filling the oil? Yes No
 Was a sample of fresh oil taken? Yes No Identification number of the oil sample: _____
 Were the axles turned? Yes No
 Fresh oil with special corrosion protection drained again
 Gear unit completely filled with fresh oil for corrosion protection
 Gear unit sealed air-tight with a plug when using oil with special corrosion protection? Yes No
 Gear unit sealed air-tight with a dry cartridge plus an intermediate oil expansion tank when oil filling is complete? Yes No
 Non-contact seals available on gear unit Yes No
 Non-contact seals greased Yes No Designation of grease: _____
 Condition and age of Branorost paper for axle protection: _____
 Branorost paper for axle protection renewed Yes Partially No
 Total compliance with gear unit storage protocol Yes No

Functional integrity of the oil seals	Date Name	Date Name	Date Name	Date Name	Date Name
Radial shafts tested for leaks					
Axle drive shaft turned until the output shaft has made at least one complete rotation					

Peculiarities/special features: _____

Name of technician: _____ Company: _____

Location: _____ Date: _____ Signature: _____

A copy must be made, completely filled out and filed away every time the oil is changed.

Gear unit designation according to nameplate	Gear unit serial number according to nameplate
Target oil change interval according to technical description [h]	Date of last oil change
Actual number of operating hours since last oil change [h]	Specified oil grade according to nameplate
Oil operating temperature in last oil change interval [°C]	Prescribed amount of oil according to nameplate [L]

Inspection prior to oil change

Oil producer and oil designation of old oil: _____

Oil level based on visual inspection glass, dipstick or oil sight: _____

Loss of oil at gear unit Yes No Loss of oil at oiling system Yes No

Oil filter dirty Yes No Deposits in gear unit Yes No

Humidity level constant at 75% Yes No If not, actual humidity level: _____

Additional information: _____

Was a sample of the used oil taken? Yes No Identification number of oil sample: _____

Condition of the used oil after visual inspection: _____

Inspection after oil change

Oil producer and oil designation of fresh oil: _____

Amount of oil filled: _____ [L] Target oil level adhered to? Yes No

Was a sample of the fresh oil taken Yes No Identification number of oil sample: _____

Was an oil filter used for changing the oil? Yes No Grade of filtration _____ µm

Was the gear unit rinsed with fresh oil before new oil was added? Yes No

Designation of oil used for rinsing: _____

If applicable, was the oiling system rinsed with fresh oil before new oil was added Yes No

Designation of oil used for rinsing: _____

Peculiarities / special features: _____

Name of technician: _____ Company: _____

Location: _____ Date: _____ Signature: _____

A copy must be made, completely filled out, and filed away for every instruction

- Routine instruction
- Instruction for a specific reason: _____

Topics of instruction

- Meaning of the instructions for the gear unit and attachments
- Particularities of the work area and local conditions of the premises
- Risk of working with hazardous materials (fire and explosion)
- Risk assessment of working on the gear unit and attachments
- Recent near accidents and incidents
- Hazards specific to the assignment
- Work clothing and protective equipment
- Closing of hazardous areas
- Hazards of gear unit transportation, use of lifting equipment and load securing
- Hazards of switching on electrical power
- Hazardous substances
- Procedures in the event of a malfunctions and accidents. First aid procedures
- Additional topics _____

- The person being instructed claimed to have understood and to be able to apply the contents of the instruction.
- The instruction was carried out in its entirety as specified above

Name of instructor:	Function of instructor:	Signature of instructor:
Place of instruction:	Date:	Time:
Name of person being instructed:	Function of person being instructed:	Signature of person being instructed:

SALES AND SERVICE NETWORK

VERTRIEBS- UND SERVICENETZWERK

PIV Drives GmbH

Justus-von-Liebig Straße 3
61352 Bad Homburg / Germany
Phone +49 (0) 6172 102-0
Fax +49 (0) 6172 102-380
info@piv-drives.com
www.piv-drives.com

Brevini Power Transmission S.p.A.

Via Luciano Brevini 1
42124 Reggio Emilia / Italy
Phone +39 (0) 522 928-1
Fax +39 (0) 522 928-200
info@brevini.com
www.brevini.com

Subsidiaries Worldwide

Australia

Brevini Australia Pty. Ltd.
Girraween, NSW 2145 Australia
Tel. +61-2-8848 4000
sales@brevini.com.au

Brazil/Latin America

**Brevini Latino Americana
Industria e Comercio Ltda.**
13487-220 Limeira Sao Paulo
Tel. +55-19-34468600
brevini@brevini.com.br

Canada

Brevini Canada Ltd.
Toronto ON M9W 5R8
Tel. +1-416-6742591
amurphy@brevini.ca

China

**Shanghai Brevini Gearboxes
Co., Ltd**
Room 1601, Building 2nd,
Huayi Mansion
No. 2020 West Zhongshan Rd.
Xuhui District, 200030 Shanghai
Tel. +86-21-3356 1901
3356 1902
shanghai@brevinichina.com.cn

India

Brevini India Private Limited
Mumbai 400102
Tel. +91-22-26794262
brevind@vsnl.com

Japan

Brevini Japan Ltd.
650-0047 Kobe
Tel. +81(0)78-304-5377
info@brevinijapan.co.jp

Korea

Brevini Korea Co. Ltd.
1254 Seoul
Tel. +82-2-2065-9563/4/5
brevini@chol.com

Mexico

**Brevini de Mexico
S.A. de C.V.**
76120 Querétaro
Tel. +52-4422-100389(104889)
(104679)

New Zealand

Brevini New Zealand Ltd.
PO Box 58-418
Greenmount Auckland
Tel. +64-9-2500050
info@brevini.co.nz

South Africa

**Brevini Power Transmission
South Africa Pty Ltd.**
1504 Benoni, Johannesburg
Tel. +2711421-9949
ccrause@brevinisa.co.za

South East Asia

Brevini S. E. Asia Pte. Ltd.
Singapore 608780
Tel. +65-6356-8922
brevini@brevini-seasia.com.sg

USA

Brevini USA, Inc.
Yorktown, IN 47396
Tel. +1-765-759-2300
info@breviniusa.com

PIV Drives national
sales manager
S. Wayne Tougher
w.tougher@breviniusa.com

Subsidiaries Europe

Denmark

Brevini Danmark S.A.
2690 Karlslunde
Tel. +45-461-54500
mail@brevini.dk

Finland

Brevini Finland Oy.
02270 Espoo
Tel. +358-20-743 1828
info@brevini.fi

France

**Brevini Power
Transmission France**
69516 VAULX EN VELIN Cedex
Tel. +33(0) 4728-12555
brevini@brevini-france.fr

Ireland

Brevini Ireland Ltd.
Allenwood, Naas, Co. Kildare
Tel. +353-45-890100
info@brevini.ie

Netherlands

Brevini Nederland B.V.
2408 AB Alphen aan de Rijn
(Nederland)
Tel. +31-172-476464
info@brevini.nl

Norway

Brevini Norge AS
3255 Larvik
Tel. +47 33 11 71 00
brevini@brevini.no

Russia

Brevini Russia
196233 Sankt Petersburg
Tel. +7 812 380 2162

Spain

Brevini España, S. A.
28350 Ciempozuelos (Madrid)
Tel. +34-91-8015165
brevini_es@brevini.es

Sweden

Brevini Svenska AB.
601 16 Norrköping
Tel. +46-11-4009000
info@brevini.se

Turkey

**Brevini Power Transmission
Reduktor**
ve San. Tic. Ltd. Sti
34775 Istanbul
Tel. +90 216 540 59 09
info-tr@brevini.com

UK

Brevini UK Ltd.
Warrington WA1 1QX
Tel. +44-1925-636682
sales@brevini.co.uk

UK

**Brevini UK Ltd.
PIV Division**
DN15 8NJ Scunthorpe,
North Lincolnshire
Tel. +44 (1724) 281868
sales@brevini.co.uk

Distributors

Bosnia and Herzegovina

PORD Beograd d.o.o.
11000 Beograd
Tel. 00381 (11) 3241-248
predag.banovic@pord.rs
www.pord.rs

China

Shanghai Deuchi Machinery
201612 Shanghai
Tel. +86-13671959630
only Variators
piv.service@sdm-drives.com

Czech Rep.

IOW CZ s.r.o.
74705 Opava
Tel. +420 553654803
jaromir.halfar@iow.cz
www.iow.cz

Egypt

Heavy Ind. Services Co.
11361 Cairo
Tel. +202-2672479-480
mail@hisco.org

Greece

VIOMER – T. Kotzabassiakos
18535 Piraeus
Tel. +30-210-4101-550
viomer@ath.forthnet.gr

India

**K.L. Engineering Works
Pvt. Ltd.**
Kolkata – 700 013,
West Bengal
Tel. +91 33 22116206
only Variators
klengg@vsnl.com

Iran

Sepidan Tejarat Eng. & Trad.
15868 Tehran
Tel. +98-21-8757636
sepidan1@dpimail.net

Italy

Favari Variatori SPA
20157 Milano
Tel. +39-02-3570441
only Variators
favari@favari.it
www.favari.it

Japan

K. Brasch & Co. Ltd.
Tokyo (J-104-0052)
Tel. +81-3-55607591
only Variators

Montenegro and Serbia

PORD Beograd d.o.o.
11000 Beograd
Tel. 00381 (11) 3246737
pord@eunet.yu

Pakistan

Brady & Co of Pakistan Ltd.
Karachi 74000
Tel. +92 21 3271043233
brady@brady@brady.com.pk

Poland

IOW TRADE Sp. z o.o.
04-761 Warszawa
Tel. +48-22-6158121
iow@iow.pl
www.iow.pl

Slowakia

IOW Trade Sp. Z o. o.
04-761 Warszawa
Tel. +48 (22) 615 81 21
iow@iow.pl
www.iow.pl

Slovenia

Sensor d.o.o.
2000 Maribor
Tel. +386-2-6131831
sensor@siol.net
www.sensor.si

Spain

Mecanica Moderna S.A.
08005 Barcelona
Tel. +34-93-3000357
only Variators
mecmod@mecmod.com
www.mecmod.com

Switzerland

Hans Meier AG
8627 Grüningen
Tel. +41 44 936 70 20
info@hansmeier-ag.ch

USA

AC Compacting LLC
North Brunswick,
NJ 08902-7266
Tel. +1-732-2496900
only Variators
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Visit our Brevini YouTube channel:



PIV Drives GmbH
Justus-von-Liebig-Straße 3
61352 Bad Homburg/Germany
Tel. +49 (0) 6172-102 0
Fax +49 (0) 6172-102 381
info@piv-drives.com

www.piv-drives.com

www.brevini.com

