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--	03.08.2020	First Issue	MHPSE	MHPSE	R.Westphal
REV.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPR'D

PROJECT/OWNER

**PTOLEMAIS UNIT V
660 MW POWER PLANT
CONTRACT DMKT - 11 09
5052**



PUBLIC POWER CORPORATION S.A.

CONTRACTOR



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SUBCONTRACTOR



SUBCONTRACTOR DWG. NO.

N-100170-M-D01-GM04-00009

TITLE

**Mill System, General Information,
5 OHFC10/20/30/40/50/60/70/80 AJ001**

SCALE	DRAWING NO.	SHEET	REV.
	4311-M-D01-GM04-00009	COVER	--

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DGS[®] Mill 180

Type	DGS[®]
Size	180


Mill designs

M10, M30, M60 and M80	L (Left-hand)
M20, M40, M50 and M70	R (Right-hand)

KKS-no.		Machine-no.
	5 0HFC10 AJ001	368
	5 0HFC20 AJ001	369
	5 0HFC30 AJ001	370
	5 0HFC40 AJ001	371
	5 0HFC50 AJ001	372
	5 0HFC60 AJ001	373
	5 0HFC70 AJ001	374
	5 0HFC80 AJ001	375

Repair gate valve (see chapter 4.3 and 8.13)

KKS-no.	5 0HFC10 AA051
	5 0HFC20 AA051
	5 0HFC30 AA051
	5 0HFC40 AA051
	5 0HFC50 AA051
	5 0HFC60 AA051
	5 0HFC70 AA051
	5 0HFC80 AA051

Kom.-Nr./Job-No.	EC-Declaration of Conformity Machinery acc. European Directive 2006/42/EC, Annex II A	
N-100200		
Kennwort/Codeword		
Turow		
MHPS-EDE Dok.-Nr./ Doc.-No.	N-100170-M-D01-GM10-00001-__-__	

Manufacturer

Mitsubishi Hitachi Power Systems Europe GmbH
 Schifferstr. 80
 D-47059 Duisburg

Description of machine

Designation Pulverizer system
Type DGS ®
Maschine no. 368 – 375
Nominal size 180

DRAFT !!!

Applied harmonized standards

DIN EN ISO 12100

Additional standards

DIN EN 12952-9

The undersigned manufacturer declares that the machinery, especially the design, manufacture, inspection and technical documentations, comply with the requirements of the

EC Machinery Directive 2006/42/EC

Authorised person for documentation:

Michael Textores
 Mitsubishi Hitachi Power Systems Europe GmbH
 Schifferstraße 80
 D-47059 Duisburg



The system may only be put into operation after completion of the safety equipment installation and after the acceptance test. Only in this case the system / machine is according to the Machinery Directive.

Note:


This declaration of conformity is only valid in conjunction with the signed acceptance report for the plant to which this declaration relates and after the addition of the second signature. We hereby confirm that the certification procedure has been carried out in accordance with the Council Directive on the alignment of the laws of the Member States relating to the machinery Directive 2006/42 / EC of 17.05.2006, in particular Article 8 (1)-(2) and Annex IIA and the regulations of the standard 45 014 "General criteria for the declaration of conformity of suppliers" have been complied with.

Name of the attorney 1 _____ Signature _____

Name of the attorney 2 _____ Signature _____

Stamp of Manufacturer

Date xx.xx.xxxx

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Ptolemais V

Pulverizer Plant

05HFC10 AJ001

(This description is also generally valid for
05HFC20 AJ001, 05HFC30 AJ001, 05HFC40 AJ001, 05HFC50 AJ001,
05HFC60 AJ001, 05HFC70 AJ001, 05HFC80 AJ001)

DGS[®] Pulverizer 180

Job No.: N-100170-M-D01

05HFC10 AJ001 – Pulverizer No. 368

05HFC20 AJ001 – Pulverizer No. 369

05HFC30 AJ001 – Pulverizer No. 370

05HFC40 AJ001 – Pulverizer No. 371


05HFC50 AJ001 – Pulverizer No. 372

05HFC60 AJ001 – Pulverizer No. 373

05HFC70 AJ001 – Pulverizer No. 374

05HFC80 AJ001 – Pulverizer No. 375

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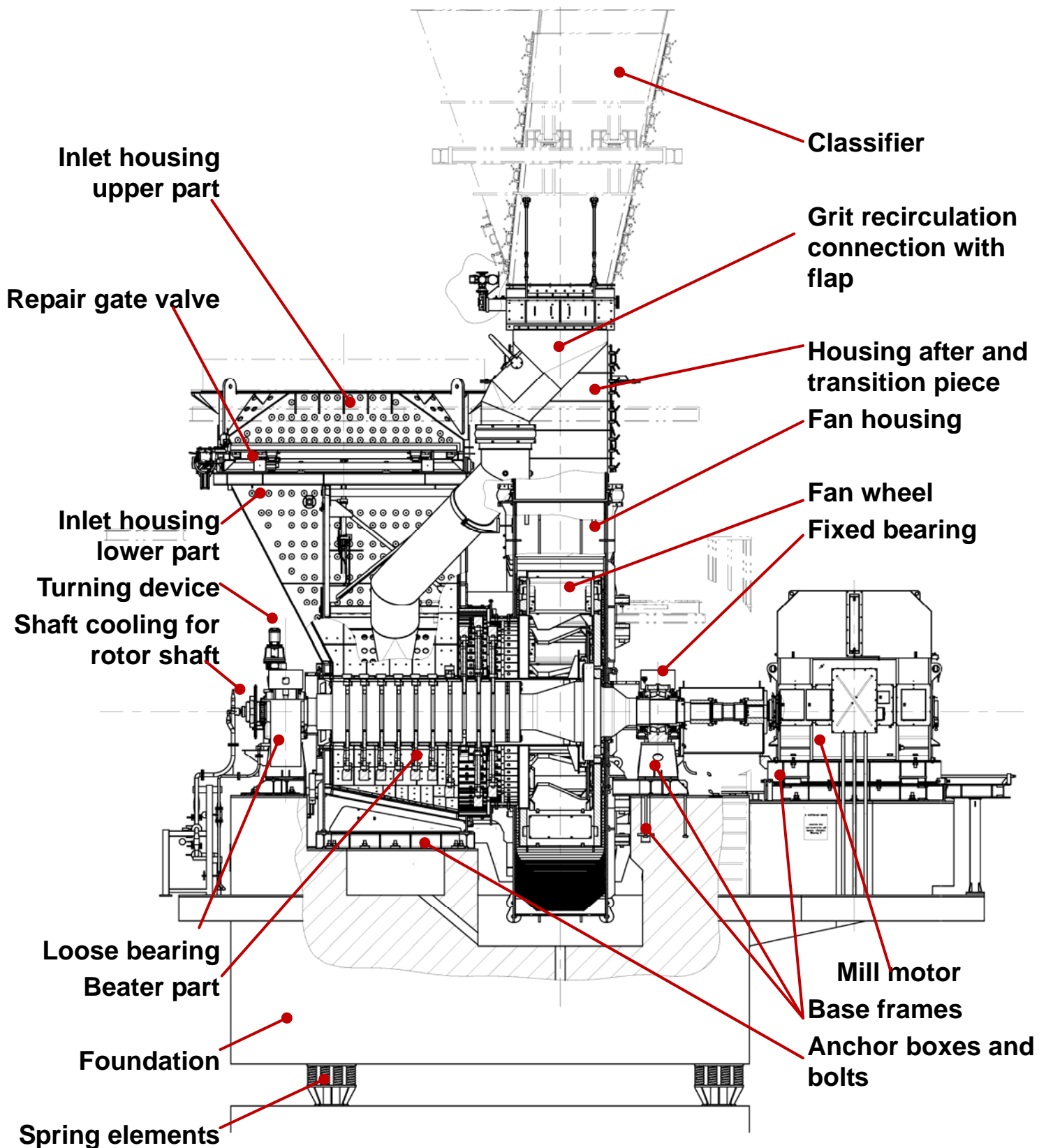
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Revision listing

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DGS® Pulverizer





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General

This document contains the plant specification, information on processes and specific descriptions of individual units and their maintenance.

The document does not claim to be complete in that it does not list all possible instructions and operations when operating the plant. It is not intended as a replacement for the essential training of operating personnel.

The manufacturer/supplier accepts no liability for damage caused by improper use, incorrect operation, deliberate damage, corrosion or erosion.

Correct use means that the plant is under constant expert supervision and rapid communication is possible between the control room and all the main local sections of the plant.

Safety norms or devices must never be fully or partially bypassed. In the event of such emergency operation, the supplier cannot assume responsibility for the resulting risks and consequences.

In addition to the operating instructions, the relevant national statutory and/or official requirements for operation of the plant apply.


The following regulations also apply to plants installed outside of Germany:

- The standard general national regulations for the operation of steam boilers
- The standard national regulations for the operation of firing systems
- The standard national accident prevention regulations

The supplier reserves the right to amend or supplement the document if new operational experience so requires.

It is in the interest of the operator to handle this document with care. In particular, it is important not to remove any individual pages.

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The operator is requested to inform the supplier of important new performance data in order to ensure that the master document can be amended or corrected accordingly.


The master document is located at:

Mitsubishi Hitachi Power Systems Europe GmbH
 Department: "Grinding Systems"
 Schifferstraße 80
 47059 Duisburg
 Tel.: +49 203 8038 0

Structure of the Ptolemais power plant document in accordance with the general plan:

- B: Primary document Operating Manual (OM) including P&I diagrams
- C: Components/trades document (Operating technical document – OTD) Pulverizer

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Coal pulverizer

Coal pulverizer DGS® 80 with transition piece, repair gate valve, frequency controlled motor and oil supply system

Components

Mill type	: DGS® 180
Machine No.	: 368 / 369 / 370 / 371 / 372 / 373 / 374 / 375
Plant	: Ptolemais V
Job. No.	: N-100170
KKS No.	: 05HFC10 AJ001 05HFC20 AJ001 05HFC30 AJ001 05HFC40 AJ001 05HFC50 AJ001 05HFC60 AJ001 05HFC70 AJ001 05HFC80 AJ001
Number of mills	: 8
Shaft cooling	: Yes
Circulating lubrication	: Yes
Shaft protection tube	: Yes (air cooled)
Shut- off gate valve	: Yes (ahead of mill)
Vapour separation	: Yes
Housing after mill with grit recirculation	: Yes
Turning device	: Yes
Hydraulic unit	: Yes
Rotor transport truck	: Yes
Gear control coupling	: No
Mill motor	: Frequency controlled and water cooled
Foundation	: Vibration isolated
Turning device	: 1x per unit
Pressure oil lubrication	: 1x per bearing, 2x per pulverizer
Monorail beam for blade replacement	: 1x per pulverizer (hoist no MHPSE supply)
Safety	: Firefighting water connection in the inlet housing
Pulverizer foundation	: vibration-isolated

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1 General information on the operation, maintenance, inspection and repair of pulverizers

Symbols used



Hazard

The symbol indicates a potentially threatening hazard. Non-observance of this symbol may result in serious damage to health or even life-threatening injuries.



Caution

The symbol indicates a potentially hazardous situation. Non-observance of this symbol could result in less serious damage to health.



Danger of falling objects

The symbol indicates a potentially threatening hazard. Non-observance of the accident prevention regulations may result in serious damage to health or even life-threatening injuries.



Keep hands clear

The symbol indicates a potentially hazardous situation. Non-observance of this symbol could result in less serious damage to health.


Warning of injury to hands



Hazard

The mill doors of the cooled off mill are to be opened in such a way that no person will be endangered.

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Caution

Blow-out risk !

Moreover, arrangements have to be made that it is impossible to start the mill driving motor when the mill doors are open.

Any low temperature pockets present are to be cleared. The following directives regarding safety are to be strictly observed



Caution

Hazard

Knowledge of the basic safety information and regulations is relevant to safe and smooth plant operation. All personnel working in this area must follow the safety instructions.

Personal protective equipment must be worn.

To prevent hazards, the product standards that have been harmonized on the basis of the application, the specific EU directives, the user manual and all generally applicable standards apply for the operation, maintenance and repair of pulverizing and firing systems. The pulverizing and firing system must be operated and maintained only by reliable, qualified, professionally trained personnel who have been instructed accordingly.

It may only be used in perfect working order and for its designated use, having due regard for safety, an awareness of hazards and in due compliance with the following operating instructions. Faults that could compromise safety must be eliminated immediately.

The plant may only be operated for the designated use (grinding of coal in the specified coal quality range). The manufacturer accepts no liability for damage resulting from non-designated use.

Designated use includes observance of the respective operating instructions and compliance with the inspection and maintenance requirements. This includes the more detailed operating instructions for the individual units (e.g. pumps). This manufacturer documentation forms part of the overall documentation.

Modifications to the plant that might compromise safety must not be made without the manufacturer's approval; this includes the installation and adjustment of safety devices and valves, as well as welding on pressure parts or components subject to static and dynamic stress.

No additional welds may be carried out on the DGS® pulverizer plant and its components without consultation with and the approval of MHPSE since the resulting heat could cause consequential damage. Warranty claims against MHPSE on this basis will be rejected.


Safety devices, such as electric interlock chains, must never be fully or partially bypassed. Work on electrical equipment must be carried out by a qualified electrician.

Modifications to programmable control systems are prohibited.

Hydraulic hoses must be replaced at specified or appropriate intervals, even if no safety related defects are detected. Work on hydraulic equipment must only be carried out by personnel with specialist knowledge and experience of hydraulics.

The location and use of fire extinguishers and the fire alarm and firefighting equipment should be noted.

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To ensure a high degree of mill availability with preferably short standstill times when operations are interrupted, it is of the utmost necessity to have important mill parts in stock even prior to the beginning of the test run and afterwards at all times in sufficient quantities.

It is also imperative that the spare parts for the planned maintenance work are procured in good time, so they are available when they needed.

The numerous imponderables means that, in keeping with the stage reached in research, mill part wear can neither be qualitatively nor quantitatively forecast and it cannot be precisely hinted at or elucidated upon.

Therefore it is only possible to predict the service life of the wear parts on the basis of empirical values and the precedence given regarding power consumption, degree of grinding fineness, throughput, fail-safe operations, availability, accident risk, costs and time outlay.

Full utilization is restricted on the material side for reasons associated with strength & stability. Larger coal ash contents are responsible for placing at risk, in particular, the rotating parts as well as the peripheral and floor cladding of the fan housing.

The basic maintenance recommendation is not to undertake repairs and renewals when there is no other course but to run a preventative form of upkeep so as to achieve a high degree of operational dependability and availability and to avoid undesired mill standstills.

The plant is built according to the state of the art and generally accepted safety rules.

With regard to safety, three specific EU directives were reviewed for their relevance to the pulverizer: the Pressure Equipment Directive (PED), the Machinery Directive (MD 2006/42/EC) for mechanical hazards and the ATEX Directive for explosion hazards.

EU Pressure Equipment Directive (PED)

The PED is not relevant to the pulverizer and firing system, including the hopper, because the criterion medium pressure $p > 0.5$ bar is not met.


1.1 EU Explosion Protection Directive (ATEX, 94/4/EC)

This directive is not relevant to the pulverizer because the criteria “explosive mixture” and “ignition energy/temperature” cannot coincide due to the inert operation of the mill and the structural design (DIN EN 12952-9).

1.2 EU Machinery Directive (2006/42/EC)

This directive is relevant to the hopper and pulverizer areas because the criteria “assembly of linked parts or components, at least one of which moves” and “joined together for a specific application” are relevant.


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1.3 Other important reference standards and documents:

- DIN EN ISO 12100 Safety of Machinery
- DIN EN 12952-9 Requirements for firing systems for pulverized solid fuels
(Replaces TRD 413 and CEN/TC 266)
- DIN EN 1011-1 to 8 Welding
- DIN EN 13155 Cranes
- DIN EN 50110-1 and 2 Operation of electrical installations
- DIN EN 50156 (VDE 0116) Electrical equipment for firing systems
- DIN 4420-1 and 3 Working and protective scaffolds
- VGB-M 213 H Coal pulverizing plants
- VGB R 200 Design and operation of power plant firing systems
- VGB M 112 und VGB R 112 Fire protection in power plants
- Federal Ministry of Justice accident prevention regulations §15
- Operator's accident prevention regulations

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1.4 Further information on operating the pulverizer

Essential requirements for operating and maintaining plants/machines are listed below. Non-compliance may result in injury and damage.

The DGS[®] pulverizer is used for pulverizing lignite coal in the defined fuel range.

- There are no metallic foreign bodies in the grinding path that could impair the function of the pulverizer and cause damage.
- The use of appropriate magnetic separators upstream of the coal bunker prevents metallic parts from entering the pulverizer with the coal.
- To prevent coal dust deposits and fire, there must be no foreign bodies, such as cotton waste, firing cables and welding wires, in the pulverizer.
- The iron collecting box has to be cleared out and its door locked.
- All access openings, doors and hand holes on the pulverizer are closed.
- Turning device must be disconnected from mill shaft. The cover must be closed.
- The coal feeder containing coal has been moved forward manually so that, on start-up, coal is immediately fed into the inlet housing.
- Before switching on/starting the plant, ensure that no-one is potentially at risk by the operation of the machine/plant.

Any changes, including changes to operating characteristics, must be reported to the responsible plant section without delay. If necessary, the plant must be shut down immediately. The on/off procedures and control indicators specified in the operating instructions must be observed.



Caution

Hazard

Operation with bypassed/defective limit monitors is prohibited. The manufacturer assumes no liability for damage caused by exceeding the limit values.




Hazard

The pulverizer must not be operated without material to be ground.

The grinding tools – wearing parts and beater heads – are very hard materials with corresponding fracture properties.


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All monitoring instruments, pipelines and bolt/screw connections must be checked both for correct and secure installation and for correct function according to the technical data and properly adjusted in accordance with the manufacturer's specifications.

During each start-up operation, monitor the power consumption of the pulverizer drive motor.

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1.5 Information on accessing the pulverizer for maintenance and repair

Essential requirements for operating and maintaining plants/machines are listed below. Non-compliance may result in injury and damage.

- Only access in accordance with customer specifications and when the pulverizer has been deactivated at the control desk.
- Always access the pulverizer with another person.
- Drive motors for the pulverizer, coal feeder and hydraulic units cannot be switched on and have also been enabled.
- Only access when the repair gate valve is closed.
- Only access when the pulverizer is shut down and the pulverizer turning device is not in operation.
- With pulverizer cooled and cleaned (pulverizer and coal feeder).
- Only access after beater wheel has been secured against turning.




Caution

The pulverizer must not be cleaned inside and outside with water.

- When welding, ensure that the equipotential bonding is directly adjacent to the device protecting the roller bearings against current passage.
Welding, torch cutting and grinding work to the plant may only be performed with express approval, e.g. there are no fire or explosion hazards.
Before welding, torch cutting or grinding, remove dust and combustible materials from the plant and its surroundings and ensure adequate ventilation (explosion hazard).
- All work must be documented in accordance with customer specifications.
- The setting, maintenance and inspection work and dates specified in the operating instructions must be carried out on schedule by specialist personnel and documented.
- Machinery and equipment on which inspection, maintenance and repair work are carried out must be switched off – if specified.
If work on live parts is necessary, a second person must be present to operate the emergency stop or mains switch with voltage tripping mechanism in an emergency. Working areas must be cordoned off with a red and white safety chain and a warning sign. Electrical work must be carried out with insulated tools.
- After inspection or maintenance the pulverizer must be cleaned, all temporary installations removed, all residua removed, all people leaving the mill, all doors and openings must be closed properly.

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1.6 Checks before Mill Start-up

Following checks have to be carried out after repairs, inspections and longer periods of standstills:

1. Examination of the mill inside as regards foreign matter
2. Examination of all wear parts as to their further deployment
3. Clearing of the iron collecting box
4. Check on the fastenings of:
 - Beater heads
 - Beater arm protections
 - Hub bolt locking mechanisms (after any dismantling or beater change)
 - Shaft protection tube (after any dismantling or beater change)
 - Shaft seals, on loose and fixed bearing side (after possible dismantling)
5. Mill turning device decoupled
6. Check rotor as to smooth running
7. Flue gas gate valve outside of the mill
8. Openings closed at the mill, such as:
 - Flue gas gate valve damper
 - Doors in the housing after mill
 - Fan housing door
 - Inlet housing door
 - Iron collecting box door
 - Lateral doors of the fan housing
 - Corner cladding doors
 - Upper cover casing of the fan housing
 - Erection flaps in the lateral insert piece and in the intermediate piece
9. Ease of movement and seal tightness of the rotation union (shaft cooling)
10. Examination of the speed probes as to position and cleanliness (if existing)
11. Installation of all protection hoods
12. Inspecting the oil and cooling water temperatures, flows and qualities (visual check, if needed, analysis)
13. Inspecting the oil level in the mill bearings
14. Inspection of the oil filters at the oil lubricating system of the mill bearings
15. Inspection as to the seal tightness of the oil and cooling water system
16. Examination of the gaps between mill- and boiler foundation as to minimum size and foreign matters

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Caution

The notification of operational readiness is to be recorded in writing!

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2 Functional description of the pulverizer



Caution

Hazard

- Starts without prior warning
- Service, maintenance and repair work may only be carried out with a special permit
- Hot, burn/scald hazard
- Vibrations may occur
- Area only accessible to authorized personnel
- Take heed of rotating parts
- Pulverizer inspections must be carried out by at least two people

The DGS[®] pulverizer combines the grinding effect of the beater mill with the gas supply of a fan mill. Minimal two of this 8 mill is in stand-by: only 6 DGS[®] mills are necessary for operating the maximum boiler load (by using best coal).


Raw coal and drying gases enter the mill tangential-axially. Since the beater rows are arranged in stages in the beater section an intensive pre-crushing and pre-drying of the feed material takes place. In the beater section the temperature of the drying gases drops considerably so that the temperature upstream of the fan wheel is only about 380°C. The fan wheel produces the required pressure to overcome the resistances upstream and downstream of the mill.

The reference input of the mill control is the fuel mass flow. In operation, the temperature operating range after mill is between 110 °C and 200 °C. This temperature range is controlled by adjusting the mill speed, and by the addition of primary air and cold gas. The speed of the fan wheel is proportional to the feed fuel mass flow. In part load situation, with less demand of fuel, there is also less drying energy (hot gas) necessary. This results in a lower speed of the fan wheel but fan wheel speed reduction is limited. There is a minimum transport gas velocity for pneumatic conveying of pulverized lignite. Furthermore there is also a minimum speed for lignite milling necessary.

In part load situation the hot flue gas flow is partly substituted by a mixture of primary air and cold gas under consideration of the oxygen limit.

The procedural relationships of the mills in terms of mill speed, coal throughput, temperature, cold gas flow and primary air flow is defined for stationary mill operation, for starting and stopping the mill.

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In this way, a safe automatic mill operation and an inert atmosphere inside the mill are guaranteed for all operating conditions and thus a dust explosion can be safely excluded.

Due to high coal quality and a high degree of coal drying and the two staged grinding process the mill plant is designed without a classifier.

The following benefits are:

- Less abrasion on fan wheel
- Better pressure built up of mill
- Higher Throughput of mill
- Better (lower) specific grinding work
- Operation with higher charging

DGS[®] mill is the preferred mill for coals with high ash content.

The volume flow downstream of one mill is distributed to 3 burners / pulverized coal lines (see also description firing system).

The oil lubrication of spherical roller bearings and the shaft of the rotor are equipped with water cooling.

All curves and values shown in this specification are defaults. The final curves and values are set during commissioning.

KKS-numbers are related to mill 10.




Caution

Hazard

If the pulverizer turning device is not attached correctly, there is a risk of injury caused by the rotation of the pulverizer turning device.

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3 General technical data

3.1 Pulverizer

Pulverizer type		DGS®
Pulverizer size		180
Machine No.		368 / 369 / 370 / 371 / 372 / 373 / 374 / 375
Number of pulverizers per boiler	pcs.	8
Pulverizer revolution frequency	min ⁻¹	265 - 420
Turning direction	:	right turning HFC20, 40, 50, 70 left turning HFC10, 30, 60, 80
Number of beater rows	pcs.	8
Number of beater heads per row	pcs.	3
Material of beater heads		G20Mn5
Number of beater rows	pcs.	2
Number of beater heads per row	pcs.	6
Material of beater heads		G20Mn5
Fan mill wheel diameter	mm	4600
Fan mill wheel width	mm	1360
No. of wheel blades	pcs.	12
Rotor bearing		Loose bearing, shaft diameter 380 mm Fixed bearing, shaft diameter 380 mm
Material of pulverizer inlet housing		S235JR G2
Material of pulverizer van housing		S235JR G2
Weight of pulverizer (with motor / without foundation and platforms)	kg	approx. 261.058
Max. dimensions foundation	m	11,85 x 5,8 x 4,405
Overall height pulverizer (incl. classifier)	m	14,5
Opening inlet housing	mm	3730 x 3730
Openings at the pulverizer housing		1 inlet housing door 1 iron collecting box door 1 fan housing door 2 corner cladding doors 2 lateral access doors 2 fan housing upper covers

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Caution

Do not open one of these doors during operation!

Discharge for foreign matter

Through the beater part into the pulverizer iron collecting box with manual discharge

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3.2 Oil circulation lubrication systems

(For further data, see OTD, 50HFC11...81 and 50HFC12...82)

Number of oil circulation lubrication systems per mill	pcs.	2
Dimensions (L x W x H)	mm	545 x 860 x 1196
Weight	kg	140


3.3 Pulverizer drive motor

(For further data see OTD, 50HFC10...80 AJ001)

3-phase current asynchronous motor

Number of pulverizer drive motor per mill	pcs.	1
Dimensions (L x W x H)	mm	3195 x 2727 x 2787
Weight	kg	17500
Motor rated power	kW	2200
Motor speed range	min ⁻¹	306 – 420

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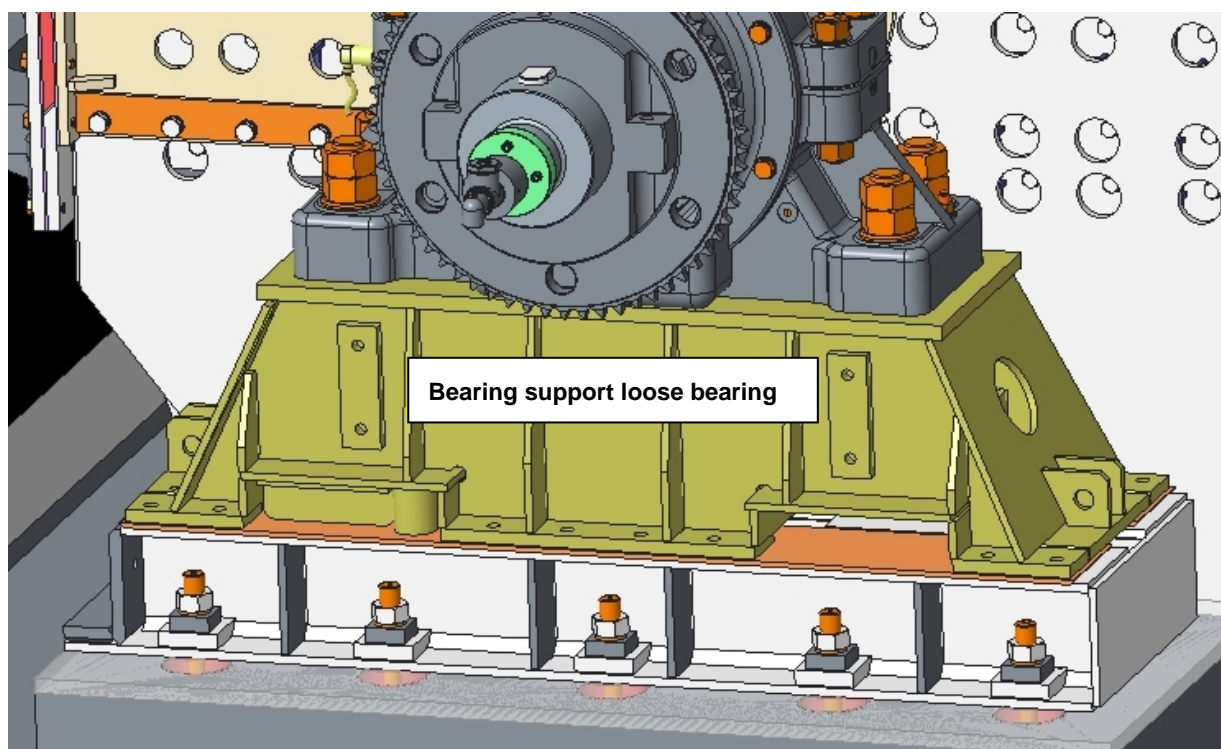
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4 Description of deliverables

4.1 Base frames, anchor boxes

The base frames for loose bearing, inlet housing, fixed bearing, fan housing and mill motor are connected, via friction and positive locking anchor bolts and anchor boxes, to the reinforcement or the foundation block.

4.2 Bearing supports for loose and fixed bearing



The bearing supports for loose and fixed bearing are the intermediate parts between bearing housings and base frames. They are connected to the base frames via anchor bolts.

The bearing support for the loose bearing has borings for connection of the turning device.




Caution

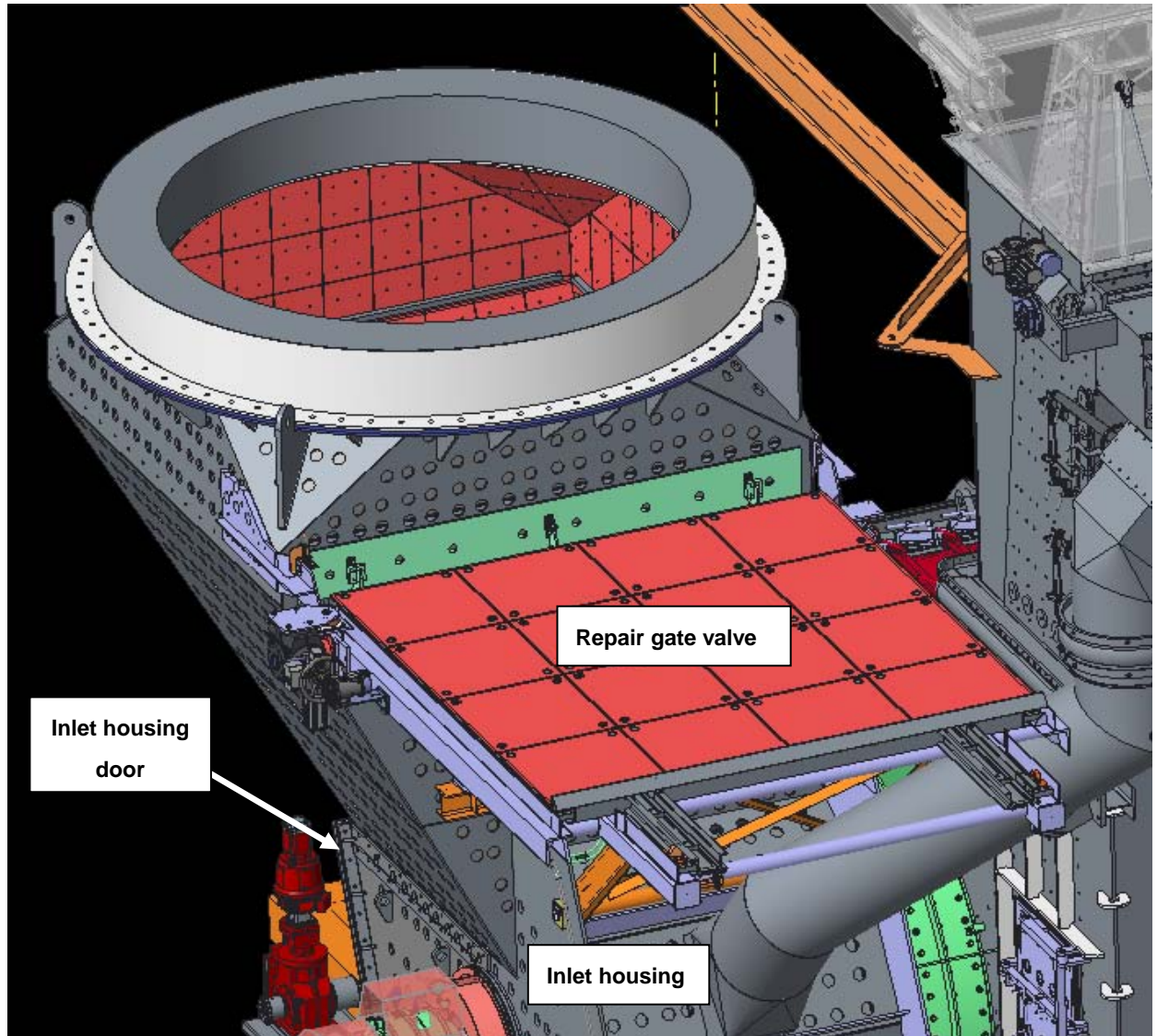
To avoid any influence of pulverizer vibration to the boiler foundation, the pulverizer foundation must be independently of another.

Pay attention that no inflexible connection between pulverizer respectively pulverizer foundation and boiler foundation exist.

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4.3 Inlet housing with repair gate valve, wearing plates, door




The inlet housing is the connection between the flue gas gate valve and the static beater part of the pulverizer. The repair gate valve (electrical driven) is located in the upper part of this housing.

The inlet housing of the DGS® mill is designed to protect against excessive heating of the supporting outer wall as a double wall.

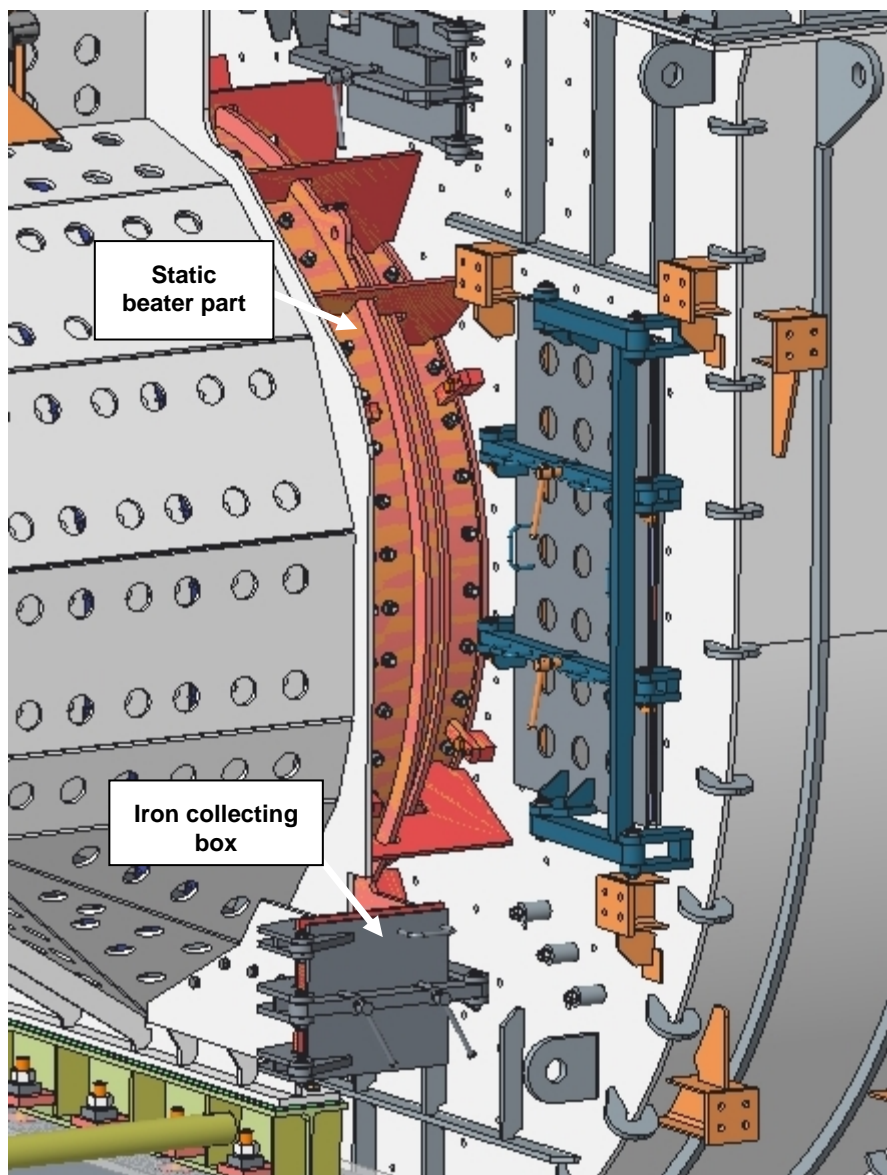
The housing is lined with interchangeable wear plates inside.

The access to the interior parts is possible through the inlet housing door.

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4.4 Static beater part, iron collecting box

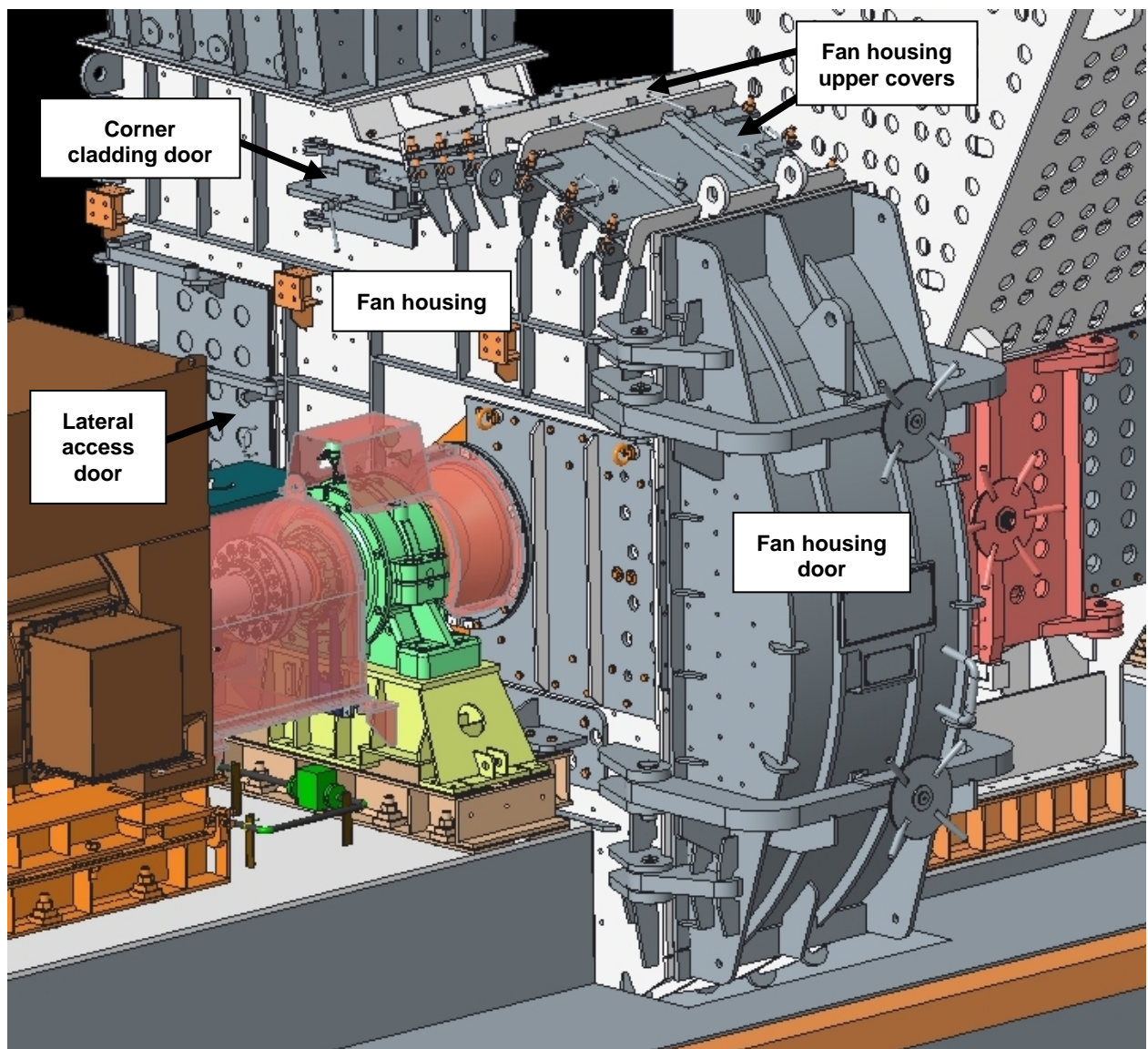


The static beater part is an intermediate part between the inlet and the fan housing. It is designed as stepped armor. The exchangeable peripheral armor is equipped with wear plates arranged parallel to the shaft. The iron collecting box is a part of the beater part below.

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4.5 Fan housing with wearing plates, doors

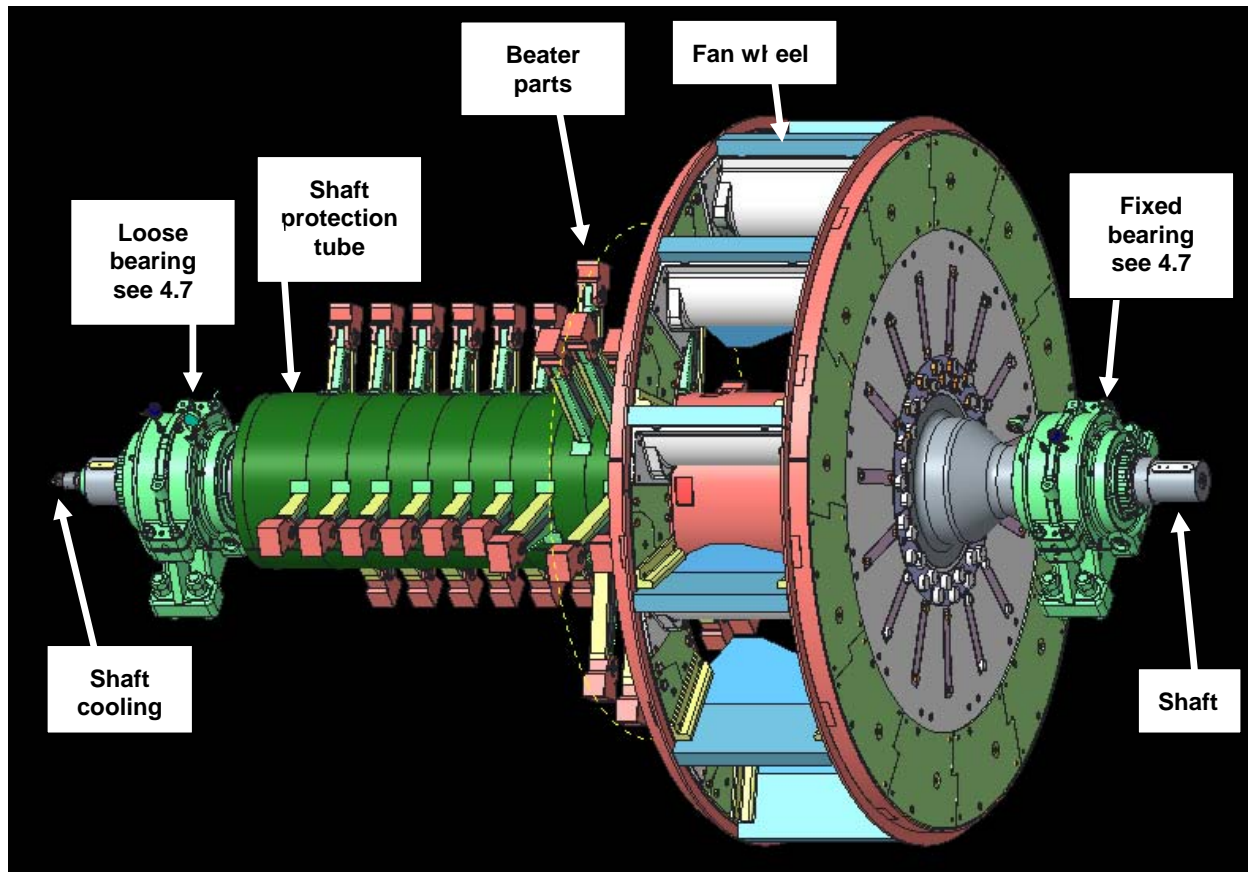


The fan housing, in which the fan wheel rotates, has an exchangeable sidewall wear plate liner. The wear protection on the circumference consists of strong, exchangeable square bars. The replaceable corner armor is divided several times to achieve optimum utilization. A large, smooth-running fan housing door allows easy replacement of the wear parts.

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4.6 Shaft with beaters and fan wheel



The complete rotor consists of the shaft, the beater parts, the shaft protection tube and the fan wheel. The beater parts consisting of the beater arms, arm protections and beater heads are fully interchangeable through the inlet housing door without dismantling the shaft.

The beater arms are connected by hub bolts to the hub disks of the shaft, the bolts being secured against axial displacement by the fuses on the end hubs.


The shaft bores of the shaft and the beater arms are additionally equipped with spring-loaded spring steel bushings (when installed in the shaft, the slot of the spring bush must point to the shaft center, for the arms the slot must face the beater head). A right-angled armguard protects the striking and inflow sides of the racket arm.

The beater heads are connected by bolts to the arms and secured with safety bars. The beater head is asymmetrical in order to counteract the higher wear on the impact and inflow side.

For a smooth running of the rotor, it is necessary that when reassembling the rotor always radially opposing beater heads, beater arms and beater arm protections are installed equal weight.

If fine balancing is required, see "Balancing instruction" and "Balancing protocol".

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In order to protect the part of the shaft located in the housing from wear and inadmissibly high temperatures, a shaft protection tube is provided. In the area of the hub discs, the protective tube to the shaft has an air gap of 50 mm.

During operation, the mill shaft is cooled externally and internally.

External cooling: Due to the prevailing negative pressure in the mill, cooling air flows from the boiler house between the shaft and the protective tube in the direction of the wheel. The air from the protective tube enters the wheel in front of the baffle plate.

Internal cooling: The water cycle is connected to the mill bearing and the mill shaft. The mill shaft is provided with a centric hollow bore. With a arranged on the floating bearing side and operated with water cooling device, the shaft is protected from unacceptably high temperatures. The feeding of the cooling water into the mill shaft and the return flow via a Deublin feed head.

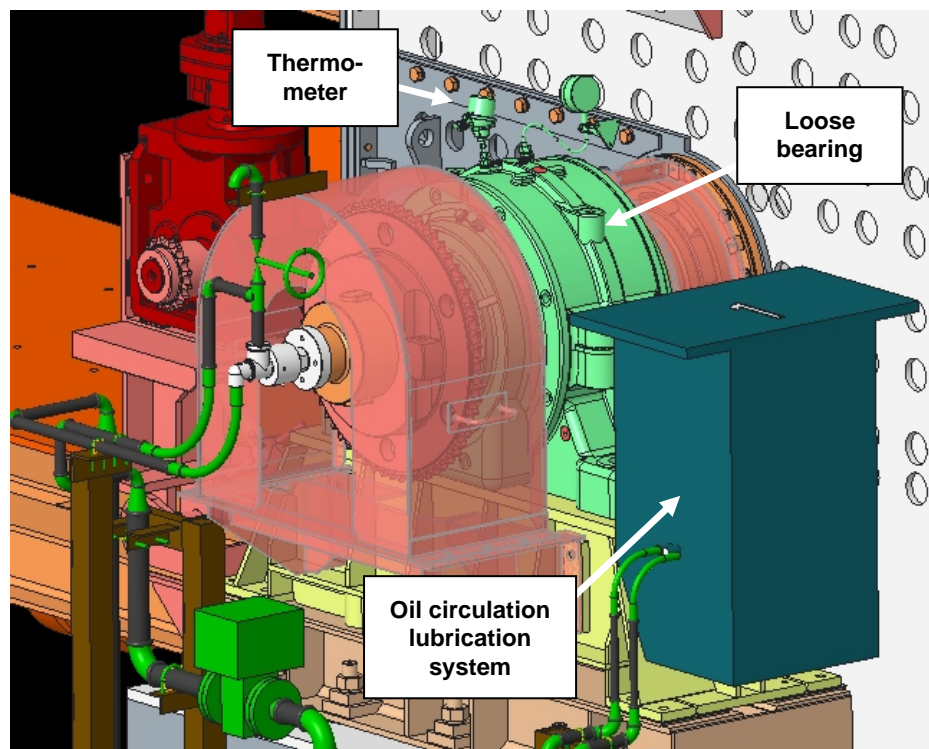


Caution


Do not pass cooling water into a heated shaft, because there is a risk of thermal shock on the inner bore.

4.7 Loose and fixed bearings with thermometers and oil circulation lubrication systems

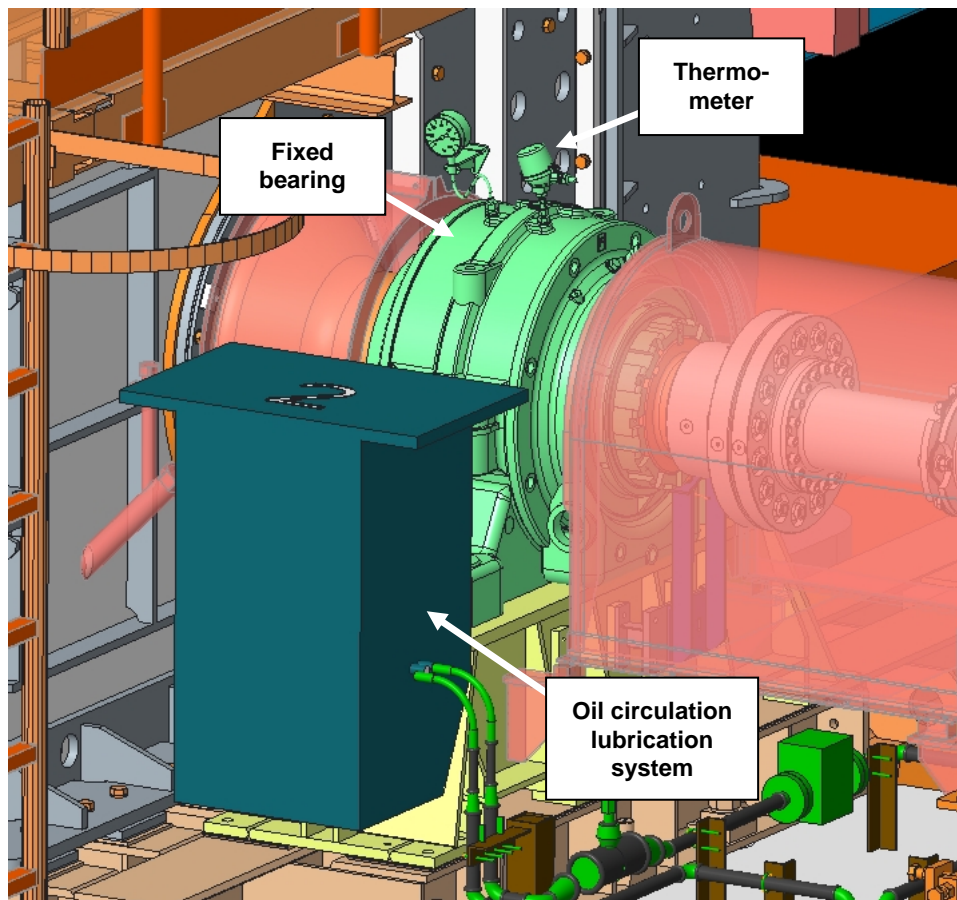
Loose bearing



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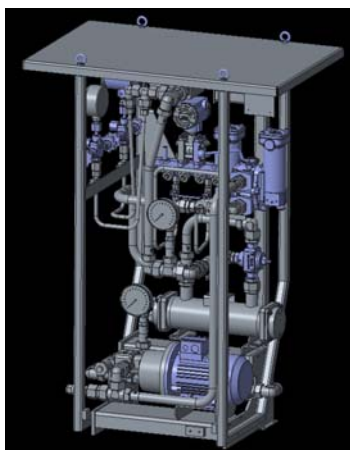
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Fixed bearing




The bearing close to the mill drive is designed as a fixed bearing. The bearing close to the inlet housing is designed as a loose bearing. The length changes occurring during operation due to the effect of heat are absorbed here.

The bearing temperatures are monitored by thermometers (50HFC11/12..81/82CT502), which can be read on site, and by resistance thermometers (50HFC11/12..81/82CT001), which are included in the mill locks.

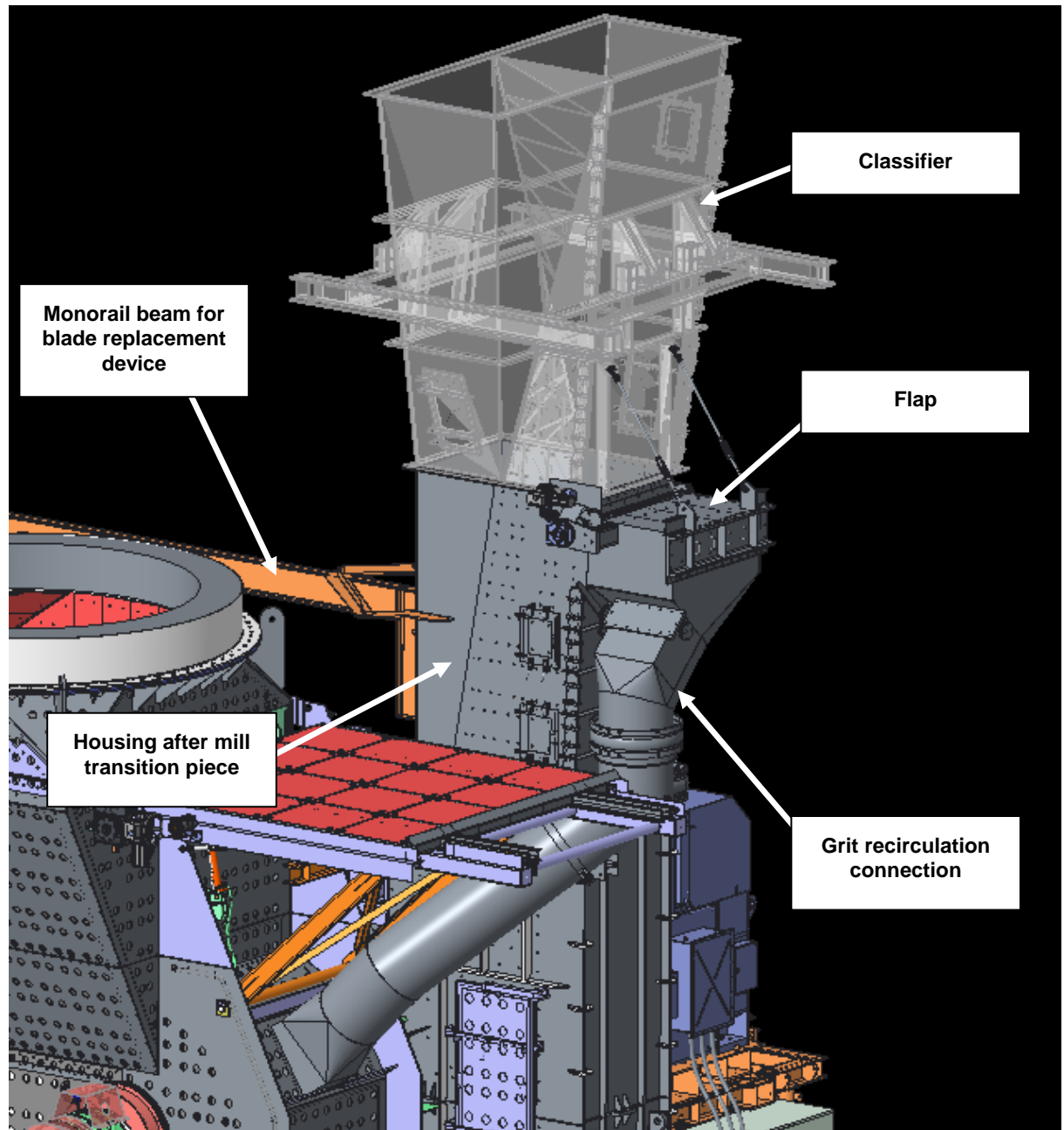


For the lubrication of the bearings there are two separate oil circulation lubrication systems installed. These contribute to a low oil temperature and thus to a much higher bearing life. The lubricating oil is circulated in circulation by oil pumps. The oil is cooled by oil coolers and filtered at the same time.

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4.8 Housing after mill / transition piece / classifier / grit recirculation connection

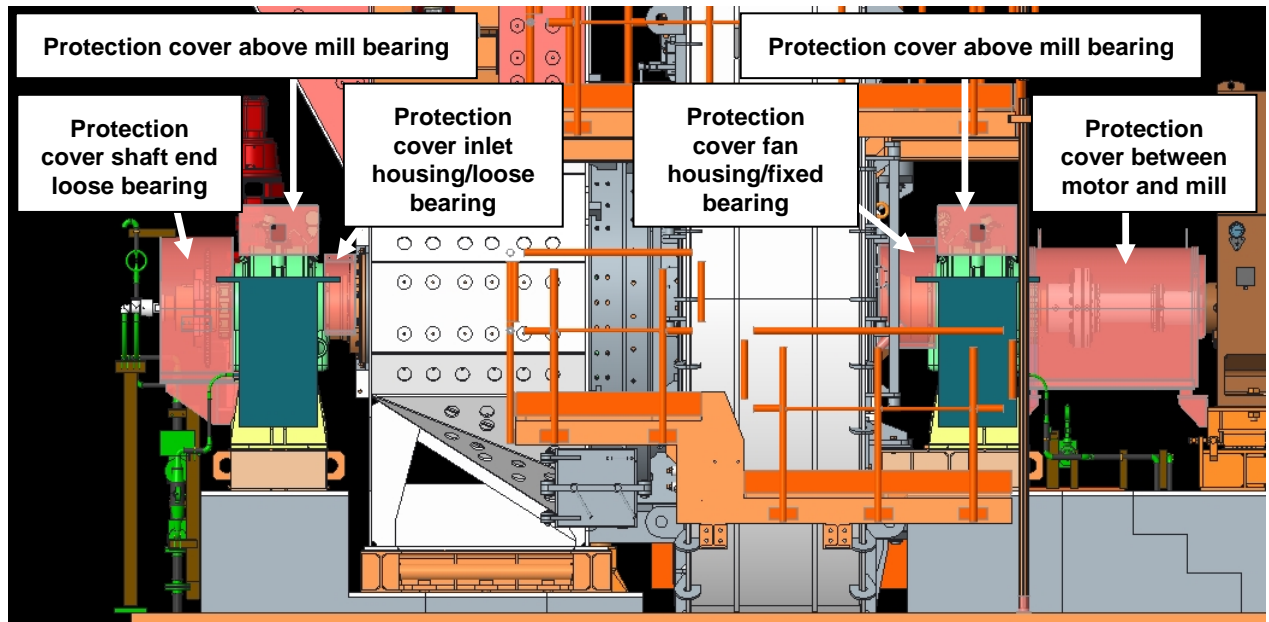


The transition piece is an intermediate part between the fan housing mill and the dust line. At this the monorail beam for the blade replacement device is welded.

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4.9 Protection covers



The following protective covers are installed for protection against accidents:


- Protection cover shaft end loose bearing
- Protection covers above mill bearings (2x)
- Protection cover inlet housing/loose bearing
- Protection cover fan housing/fixed bearing
- Protection cover between motor and mill



Caution

Ensure proper attachment.

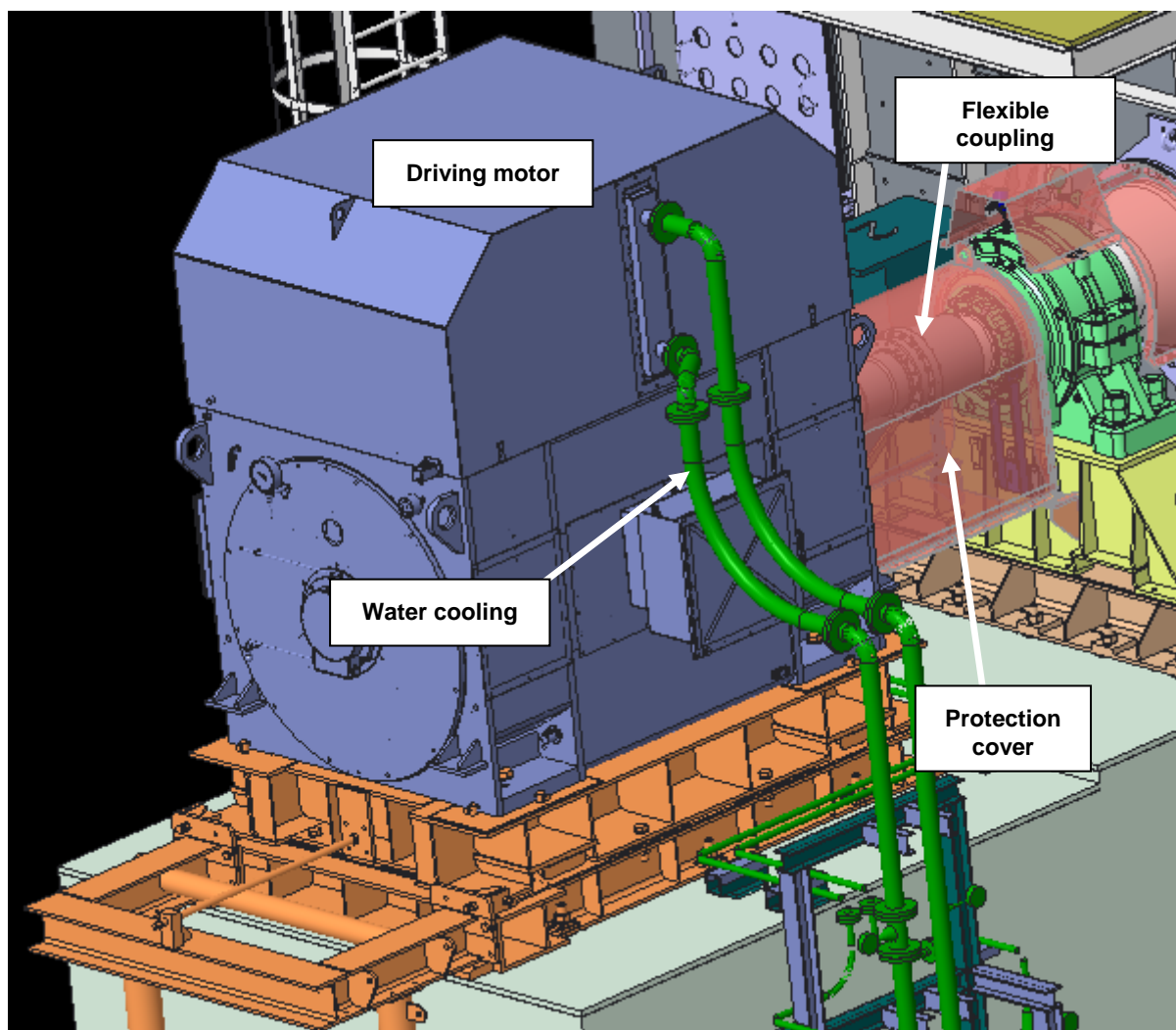
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4.10 Components

4.10.1 Pulverizer driving motor, frequency controlled

(For further data see OTD, 50HFC10...80 AJ001)




The system is driven by a three-phase asynchronous motor.

4.10.2 Flexible coupling

(For further data see OTD, 05HFC10...80 AJ001)

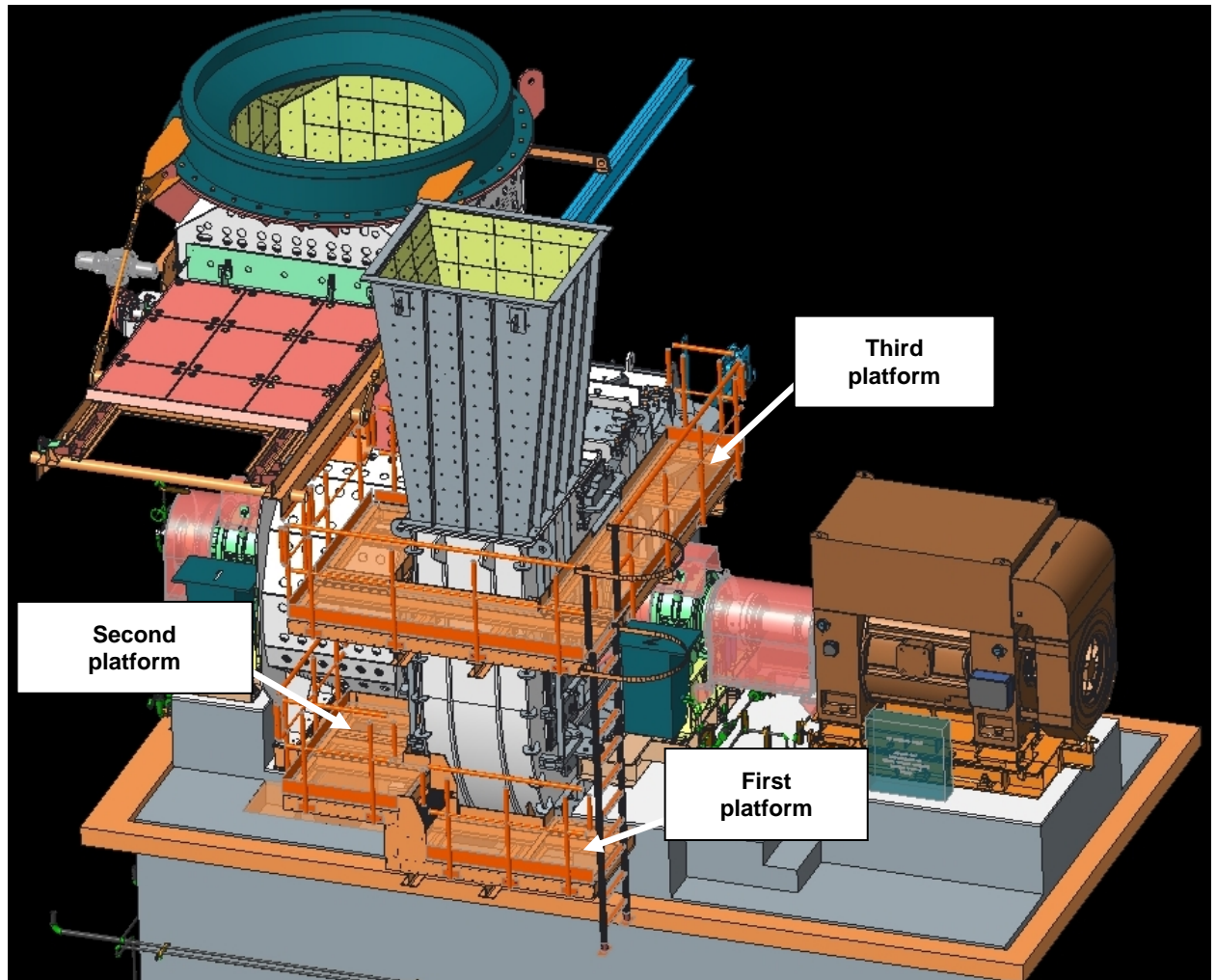
The motor torque is transferred to the shaft via a flexible coupling. A coupling protection cover is attached to the foundation as protection against accidental contact.

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4.11 Accessories

4.11.1 Platforms



Platforms are arranged on one side of the pulverizer on the following levels for maintenance and repair work:

1. First platform

The ascent is via the movable bearing foundation.

2. Second platform

The ascent is via the first platform by two steps.

The platform serves as:

- Access to the rear side lateral access door

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3. Third platform

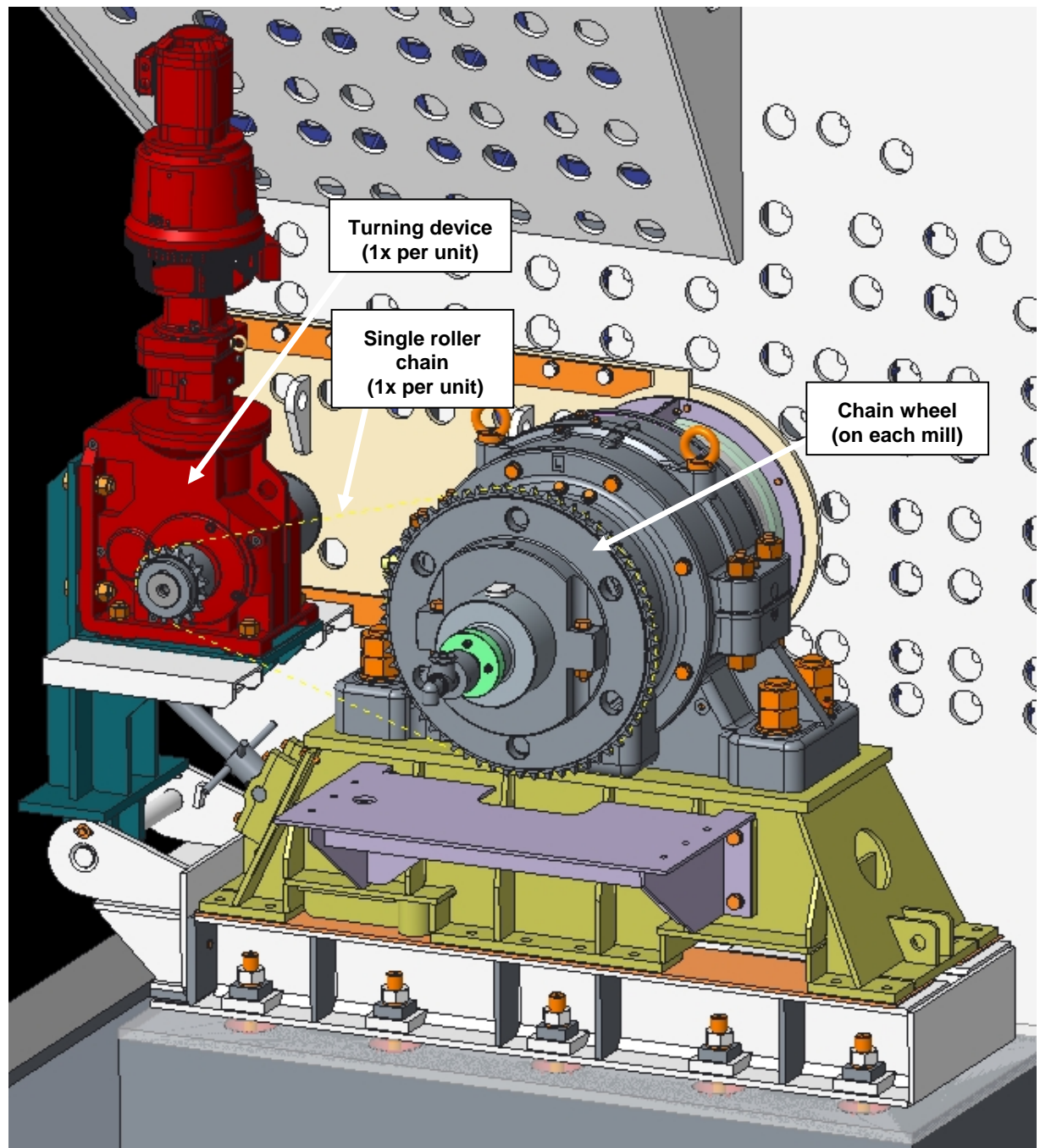
The ascent is via a ladder from the groundfloor.


The platform serves as:

- Access to both corner cladding doors

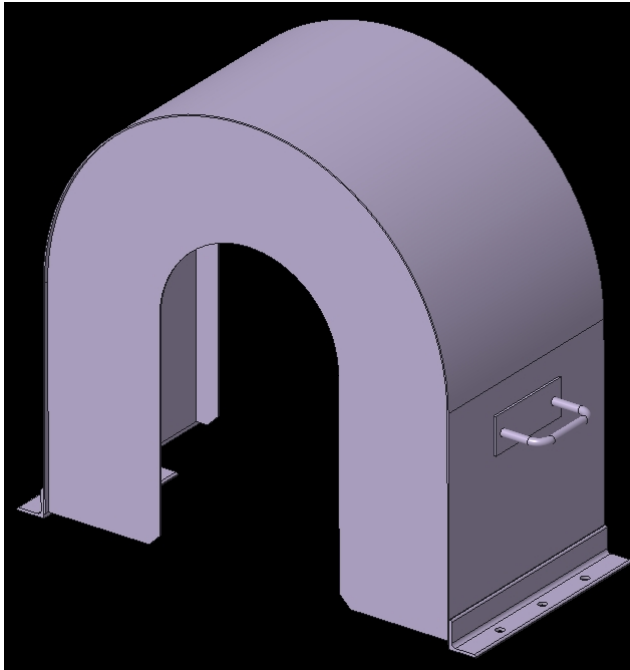
4.11.2 Pulverizer turning device (1x per unit)

(For further data see OTD, 05HFC10...80 AE001)



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The pulverizer turning device can be used for servicing the pulverizer, for removing and installing the grinding tools.




For operation with turning device, the protection cover must be removed.



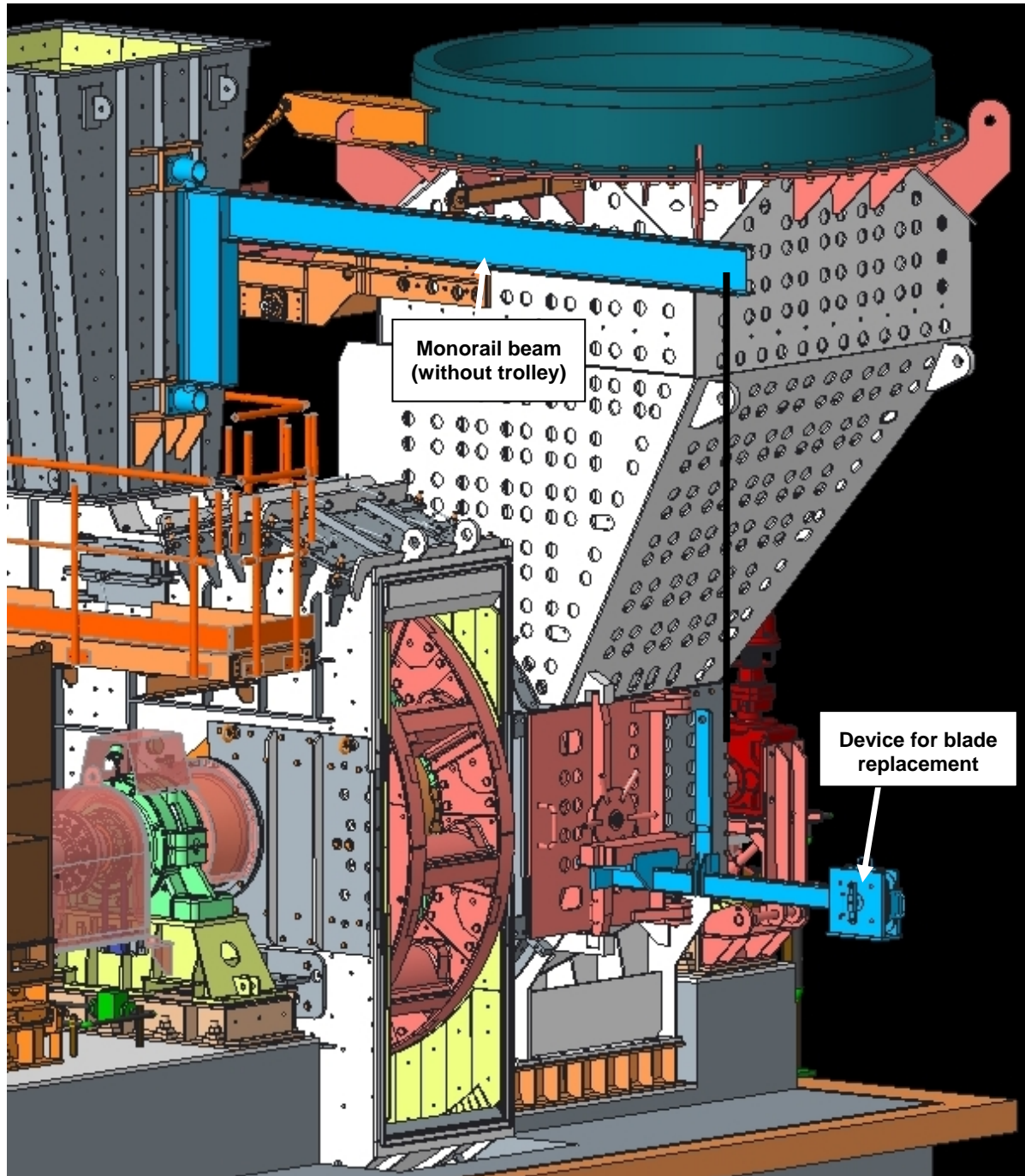
Caution

Keep sufficient distance during the operation of turning device.

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4.11.3 Monorail beam for blade replacement




The assembly and disassembly of the blades can be carried out by using the blade maintenance device by an open fan housing door.

The trolley is not part of the MHPSE supply.

Another way for carrying out is using by a fork lift by an open fan housing door.

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4.11.4 Lubricants

All approved lubricants for the DGS[®] pulverizers are specified in the lubricant list (see chapter 15).

4.11.5 Corrosion protection

All information about corrosion protection are specified in the painting instruction (see chapter 15).

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5 Assemblies and assembly weights


Signs and symbols:

*1 Component existing 1 time per unit, indication of weight for 1 unit.

() Was ignored in the summary of weights per one mill.


LOS	KKS	ASS		Weight per mill [kg]
M	D01	010	General technical data	
		011	Technical data	-
		012	Dimension plan	-
		013	Mill arrangement plan	-
		014	Space requirement for rotor transport	-
		015	Arrangement of cranes	-
		016	Functional diagram	-
		017	Name and rating plates	6
		018	Steam inerting diagram	-
		019	Arrangement of measuring points and electrical consumers	-
		020	Dimensions and weights for the transport	-
		021	General arrangement drawing	-
			Sum ass. 10:	6
M	D04	030	Lists	
		031	Electrical consumers	-
		032	Motors	-
		033	Fittings	-
		034	Cooling water	-
		035	Steam	-
		036	Measuring points	-
		037	Lubricants	-
		038	Pipes	-
		039	Spare parts	-
		040	Plates	-
		041	Set in concrete parts	-
			Sum ass. 30:	0

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LOS	KKS	ASS		Weight per mill [kg]
M	D05	050	Foundation	
		051	Foundation plan	-
		052	Conduits	-
		053	Anchor boxes	1.497
		054	Anchor bolts	437
		055	Quality control plan	-
			Sum ass. 50:	1.934
M	D07	070	Base frames	
		071	Base frame for mill loose bearing	1.230
		072	Base frame for inlet housing	1.316
		073	Base frame for hydraulic cylinder inlet housing door	-
		074	Base frame for fixed bearing and fan housing	1.799
		075	Base frame for mill gearing	-
		076	Base frame for mill motor	3.391
		077	Aligning material	1.234
		078	Aligning instruction	-
			Sum ass. 70:	8.970
M	D09	090	Bearing supports	
		091	Fixed bearing support, incl. fixing material	850
		092	Loose bearing support, incl. fixing material	854
			Sum ass. 90:	1.704

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LOS	KKS	ASS		Weight per mill [kg]
M	D11	110	Inlet housing	
		111	Inlet housing	5.526
		112	Double wall Ib (upper part, gate valve box, corner wall)	1.296
		113	Double wall I (housing upper part)	3.627
		114	Double wall I.2 (housing lower part)	1.121
		115	Double wall II (housing upper part)	2.983
		116	Double wall II.2 (housing lower part)	526
		117	Double wall III (housing upper part)	2.370
		118	Double wall IIIa (housing upper part, gate valve box)	1.619
		119	Double wall III.2 (housing lower part)	1.318
		120	Double wall Iva (housing upper part, gate valve box)	1.612
		121	Double wall IV (housing upper part)	2.199
		122	Double wall IV.2 (housing lower part)	1.321
		123	Double wall V(housing lower part)	2.908
		124	Double wall VI (housing lower part)	600
		125	Double wall VII (housing lower part)	682
		126	Double wall VIII (housing lower part)	713
		127	Double wall S1 (chute)	370
		128	Double wall S2 (chute)	1.173
		129	Double wall S3 (chute)	410
		130	Lateral insert piece with shaft sealing	1.017
		131	Grit recirculation connection	565
		132	Welding procedure sheets	-
		133	Repair gate valve before mill	-
		134	Frame for repair gate valve before mill	2.330
		135	Support for repair gate valve before mill	900
		136	Drive for repair gate valve before mill (manual)	-
		137	Drive for repair gate valve before mill (electrical)	195
		138	Repair gate valve before mill (slider)	3.091
		139	Repair gate valve before mill (limit switches)	8
			Sum ass. 110:	40.480

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LOS	KKS	ASS		Weight per mill [kg]
M	D14	140	Inlet housing door and flap	
		141	Inlet housing door	4.307
		142	Door bearing	-
		143	Door lockings	-
		144	Hoses and pipes for hydraulically operation inlet housing door	100
		145	Repair gate valve flap	793
		146	Hoses and pipes for hydraulically operation gate valve flap	-
			Sum ass. 140:	5.200
M	D16	160	Wearing parts for the inlet housing	
		161	Wearing plates for double wall Ib	401
		162	Wearing plates for double wall I	1.288
		163	Wearing plates for double wall I.2	303
		164	Wearing plates for double wall II	1.165
		165	Wearing plates for double wall II.2	163
		166	Wearing plates for double wall III	931
		167	Wearing plates for double wall IIIa	452
		168	Wearing plates for double wall III.2	470
		169	Wearing plates for double wall IVa	450
		170	Wearing plates for double wall IV	865
		171	Wearing plates for double wall IV.2	594
		172	Wearing plates for double wall V	483
		173	Wearing plates for double wall VI	226
		174	Wearing plates for double wall VII	222
		175	Wearing plates for double wall VIII	225
		176	Wearing plates for double wall S1	233
		177	Wearing plates for double wall S2	768
		178	Wearing plates for double wall S3	199
		179	Wearing plates for Lateral insert piece	189
		180	Wearing plates for the grift recirculation connection	212
		181	Wearing plates for the inlet housing door	1140
		182	Wearing plates for the flue gas shut-off gate valve flap	113
		183	Wearing plates for the repair gate valve	376
			Sum ass. 160:	11.468
M	D19	190	Beater part	
		191	Beater part	2.540

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LOS	KKS	ASS		Weight per mill [kg]
		192	Intermediate piece	467
		193	Grit recirculation connection	-
		197	Iron collecting box door	117
			Sum ass. 190:	3.124
M	D21	210	Armour- plating for the beater part	
		211	Armour-plating for the beater part	4.010
		212	Wearing plates for the grit recirculation connection	-
			Sum ass. 210:	4.010
M	D23	230	Fan housing	678
		231	Fan housing	8.031
		232	Side walls	10.400
		233	Upper cover casing	645
		234	Corner cladding door	192
		235	Lateral access door	1.474
		236	Lateral insert piece with shaft sealing	764
		237	Fan housing door	8.015
		238	Mounting sustainer	-
		239	Welding procedure sheets	-
		240	Lateral supporting flange	839
		241	Ribbing of side walls	1.448
		242	Connection piece for pressure measuring	3
			Sum ass. 230:	32.489
M	D25	250	Wearing parts for the fan housing	
		251	Wearing plates for the side walls	7.457
		252	Circumferential cladding	23.140
		253	Corner cladding	1.056
			Sum ass. 250:	31.653

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LOS	KKS	ASS		Weight per mill [kg]
M	D27	270	Shaft with beaters	
		271	Shaft with accessories	25.909
		272	Calculation	-
		273	Manufacturing and control inspection regulations	-
		274	Shaft cooling (Rotating union and hose)	39
		275	Shaft protection tube (loose bearing side)	-
		276	Shaft protection tube (beater section)	1.461
		277	Shaft protection tube (cone)	1.070
		278	Hub bolts	729
		279	Hub bolt locking device	82
		280	Beater arms with tension bushes	2.306
		281	Beater arm protection with fixing material	1.351
		282	Beater head bolts	95
		283	Beater heads	1649
		284	Chain wheel for the turning device (on rotor shaft)	188
		285	Pinion and chain for the turning device	-
		286	Speed measuring	16
		287	Torque support (in connection with induction brake)	-
			Sum ass. 270:	34.895
M	D29	290	Bearings	
		291	Fixed bearing housing with fixing material	2.116
		292	Loose bearing housing with fixing material	2.106
		293	Bearing supply parts (except mounting parts)	-
		294	Bearing accessories (mounting parts)	(176) *1
		295	Oil circulation lubrication system	320
		296	Manufacturing and control inspection regulations	-
			Sum ass. 290:	4.542

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LOS	KKS	ASS		Weight per mill [kg]
M	D31	310	Fan wheel	
		311	Fan wheel	17.489
		312	Fixing material wheel / shaft	454
		313	Calculations	-
		314	Wearing parts for the fan wheel	5.189
		315	Blades (rod and plate)	9.018
		316	Web	4.835
		317	Baffle disc	829
		318	Wearing plates for the baffle disc	599
		319	Manufacturing and control inspection regulations	-
			Sum ass. 310:	38.413
M	D33	330	Housing after mill (H.a.m)	
		331	Transition piece	-
		332	Vapor separator	-
		333	Vapor separating classifier	-
		334	Classifier	3.841
		335	Guiding plates and flaps	-
		336	Suspension	-
		337	Doors, covers, caps	538
		338	Wearing parts (assembly group 331-334)	2.548
		339	Grit recirculation connection with flap	5.143
		340	Wearing parts grit recirculation connection	-
		341	Expansion joint for transition piece and grit recirculation connection	747
			Sum ass. 330:	12.817

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LOS	KKS	ASS		Weight per mill [kg]
M	D35	350	Protection covers	
		351	Protection cover for coupling - driving motor / mill	298
		352	Protection cover for coupling - gearing / rotor shaft	-
		353	Protection cover between fan housing and fixed bearing	23
		354	Protection cover between inlet housing and loose bearing	26
		355	Protection cover for the shaft end loose bearing side	114
		356	Protection cover for oil circulation lubrication system	-
		357	Protection cover above mill bearings	34
		358	Protection cover for chain wheel / turning device	-
		359	Protection cover above bearing temperature display	-
			Sum ass. 350:	495
M	D37	370	Auxiliary mediums	
		371	Cooling water line (to the bearings and shaft)	-
		372	Steam system	-
		373	Oil lubricant piping for motor	-
		374	Connection firefighting water	7
			Sum ass. 370:	7
M	D39	390	Documentation	
		391	Time schedule	-
		392	Mounting instructions	-
		393	Operating instructions	-
		394	Maintenance instructions	-
		395	Training-records for operating personnel	-
			Sum ass. 390:	0
M	D41	410	Stairs, platforms, supports	
		411	Foundation	-
		412	Fan housing	3.750
		413	Inlet housing	-
		414	Inlet housing door (plug railings)	-
		415	Housing after mill (see assembly group 331-334)	-
		416	Moving structural	-
			Sum ass. 410:	3.750

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LOS	KKS	ASS		Weight per mill [kg]
M	D43	05	Accessories	
		431	Rotor transport frame	(28.474) *1
		432	Testing stand	-
		433	Incidentals	-
		434	Operational check	-
		435	Workshop erection	-
		436	Rotor removal device	-
		437	Monorail beam for blade replacement	982
		438	Blade maintenance device	(393) *1
		439	Bracket for turning device	(384) *1
		440	Superstructure for the rotor transport truck	-
		441	Removal device gear coupling	-
		442	Removal device mill motor	(535) *1
		443	Spacer ring mill drive	-
		444	Erection device for hub bolts	(40) *1
		445	Model test	-
		446	Rotor transport truck	(12.300) *1
		447	Coal chute for bunker emptying	(735) *2
			Sum ass. 430:	982

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LOS	KKS	ASS		Weight per mill [kg]
M	D45	05	Components	
		451	Driving motor, frequency controlled)	17.000
		452	Flexible coupling	503
		453	Starting coupling	-
		454	Speed control coupling	-
		455	Gearing	-
		456	Variable speed turbo coupling	-
		457	Flap drive (electrical, hydraulical)	-
		458	Induction brake	-
		459	Formwork- and reinforcement plan	-
		460	Vibration insulation	6.080
		461	-	-
		462	Hydraulic power station with connecting hoses	(225) *1
		463	Hydraulic cylinder for inlet housing door + gate valve flap	391
		464	Accessories for the rotor removal device (Pressing cylinders for bearing supports and beams, roller skates)	-
		465	Device for mill bearing (grease gun, pulling-of device)	-
		466	Chain hoist for the blade replacement (electical)	-
		467	Drive for the Turning device with manual control	(63) *1
		461	Cleaning device for shaft hole	-
		461	Vibration and balancing measurement device	-
		461	Measuring, controlling, monitoring	-
		461	Purchasing parts for bearings	-
		461	Purchasing parts for cooling water (shaft, bearing, brake)	-
		461	Purchasing parts for steam inerting system	-
		474	Lubricants	145
		461	Means of preservation	-
		476	Feeler gauge	(2.366) *1
			Sum ass. 450:	24.119
			Sum ass. 10 - ass. 450 :	261.058

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6 Maintenance and inspection operations




Caution

Hazard

1. General
2. Work instruction for maintenance, disassembly and replacement of sealing cords
3. Work instruction for a pulverizer inspection
4. Lifetime of mill wear parts
5. Change the oil of the circulation lubrication systems and analyse the oil
6. Check the rotating beater parts
7. Check the internal pulverizer parts
8. Check the cooling water device for the mill shaft
9. Check the drive for repair gate valve before mill
10. Check the electric actuator for repair gate valve flap before mill
11. Check the flexible pin type coupling
12. Check the self-aligning roller bearing, loose and fixed bearing
13. Lubricants generally
14. Maintenance and inspection checklist for DGS[®] pulverizer and components

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6.1 General

To achieve high operational safety and good availability, scheduled servicing of the pulverizer and its parts and scheduled maintenance involving the repair and/or replacement of parts should be carried out when the system has been shut down.

All inspection work must be documented in a work report.

As a rule, it is therefore recommended that maintenance work involving the repair and replacement of parts is not left until it is absolutely necessary but that preventive maintenance is carried out on a continuous basis in order to prevent unplanned pulverizer shutdowns.



Caution

Connection parts and small parts have to be putted in a bag/box. The bag/box has to be marked to make sure that each connection part and each small part get back in the right position.

If there are no special instructions given in drawings, pre-tension forces and starting torques have to be used according to the tables in chapter 10.2.

6.2 Work instruction for maintenance, disassembly and replacement of sealing cords



Caution


Hazard

Essential safety requirements according "MSDS - Material Safety Data Sheet" of the sealing cords have to be fulfilled.

Attention should be paid to the requirements of personal protective equipment and of inhalation protection.

Inobservance of the safety requirements could cause heavy unhealthy effects, which could end in dangerous to life disease.

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6.3 Work instruction for a pulverizer inspection

Work instructions of chapter 1.6 and 6.2 are full filled.

1. Inspection door opened.
2. Pulverizer ready for inspection.
3. After finishing the work, release the pulverizer for operation and document.
(If no further work is to be carried out.)


6.4 Lifetime of mill wear parts

Due to undefinable flow, depending on mill size, beater arrangement and a multitude of process parameters, an exact prediction of the lifetime of static and rotating wear parts is **not possible**. The following table lists the wear parts and the **expected** lifetimes.

Especially for the static parts, the wear can be very **different locally**, depending on the flow. It is therefore important to record lifetimes after commissioning in order to define meaningful maintenance intervals.

Ass.	Designation	Material	Expected lifetime [h]	Checking wear parts see chapter
160	Wearing parts for the inlet housing	1.4713 1.5415	7000 - 14000	6.7.1
210	Wearing parts for the beater part	1.0038	7000 - 14000	6.7.2
251	Lateral cladding for the fan housing	1.0038	5000 - 7000	6.7.3
252	Circumferential cladding for the fan housing	5.3201 1.0038	3000 - 7000	6.7.3
253	Corner cladding for the fan housing	CR 4800	3000 - 7000	6.7.3
275	Wearing parts for the loose bearing sided shaft protection tube	1.5415	3000 - 7000	6.7.4
281	Beater arm protection	1.6220	7000	6.6
283	Beater head	1.6220	3000 - 4000	6.6
314	Wearing parts for the fan wheel	1.5415	10000 - 14000	6.7.5
314	Wearing strip	1.6220	4000 - 5000	6.7.5
315	Blade rod	1.8935	4000 - 5000	6.7.5.1
315	Blade plate	1.0117	4000 - 5000	6.7.5.2
318	Wearing parts for the baffle disc	1.5415	7000 - 10000	6.7.5
338	Wearing parts for the housing after mill and classifier	1.0038	7000 - 10000	6.7.6

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6.5 Change the oil of the circulation lubrication systems and analyse the oil

Work instructions of chapter 6.3 are full filled.

For intervals, lubricants and quantities information see chapter "Lubricants" 4.11.4.

The lubricant change must be documented.

In the initial operating period, carry out oil analyses to determine the optimum oil change intervals.


In the following tables the max. allowable contamination of the oil circulation lubrication systems are shown. If the following requirements are not fulfilled, the oil has to be changed.

Limits
TAN > 1,0
TAN > TBN
Neutralisation [mgKoH] < 0,1
IR - no absorption degradation
Viscosity (at 40 °C [mm ² /S]) reduction more than 10 %

Following the allowable contamination levels of the lubrication oil are shown. If the following contamination levels or if the degree of purity 19/17/14 according ISO 4406-99 were exceeded, the oil has to be changed.


If the contamination levels of silicon and/or solids were exceeded, the whole grinding roller has to be disassembled, cleaned from the inside and filled with fresh oil.

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Material	Limit of contamination (1 mg/kg = 1 ppm)	Material
Iron	60 mg/kg	Lube oil pump, valves, oil cooler, oil heater, lube oil pipes, lube oil hoses
Chrome	6 mg/kg	Bearings
Aluminum	6 mg/kg	Lube oil pump, oil cooler, oil heater
Copper	4 mg/kg	Bearing cage, lube oil hoses
Lead	2 mg/kg	
Tin	2 mg/kg	
Nickel	2 mg/kg	
Silicon	20 mg/kg	Coal dust, dust, environmental influence,
Water	0,1 %	Condensed water, occurred by untighten oil cooler
Solids	0,05 %	Coal dust, dust, environmental influence

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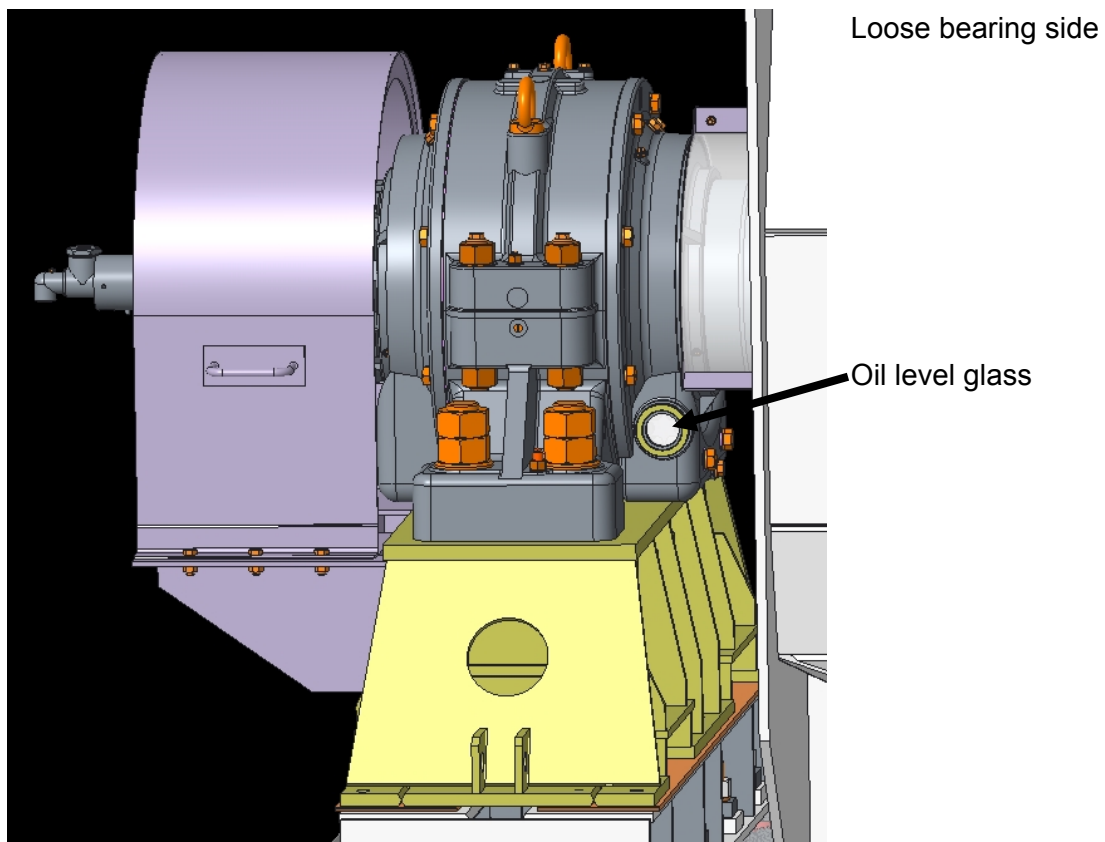
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6.5.1 Fill in fresh oil in the circulation lubrication system

Work instructions of chapter 6.3 are full filled.


Pulverizer ready for inspection.

If it is necessary to fill in fresh oil in the lubrication system, care should be taken not to fill in too much oil. The correct oil level is the middle of the oil level glass on the bottom side of the loose and the fixed bearing housings.



After finishing the work, release the pulverizer for operation and document.
(If no further work is to be carried out).

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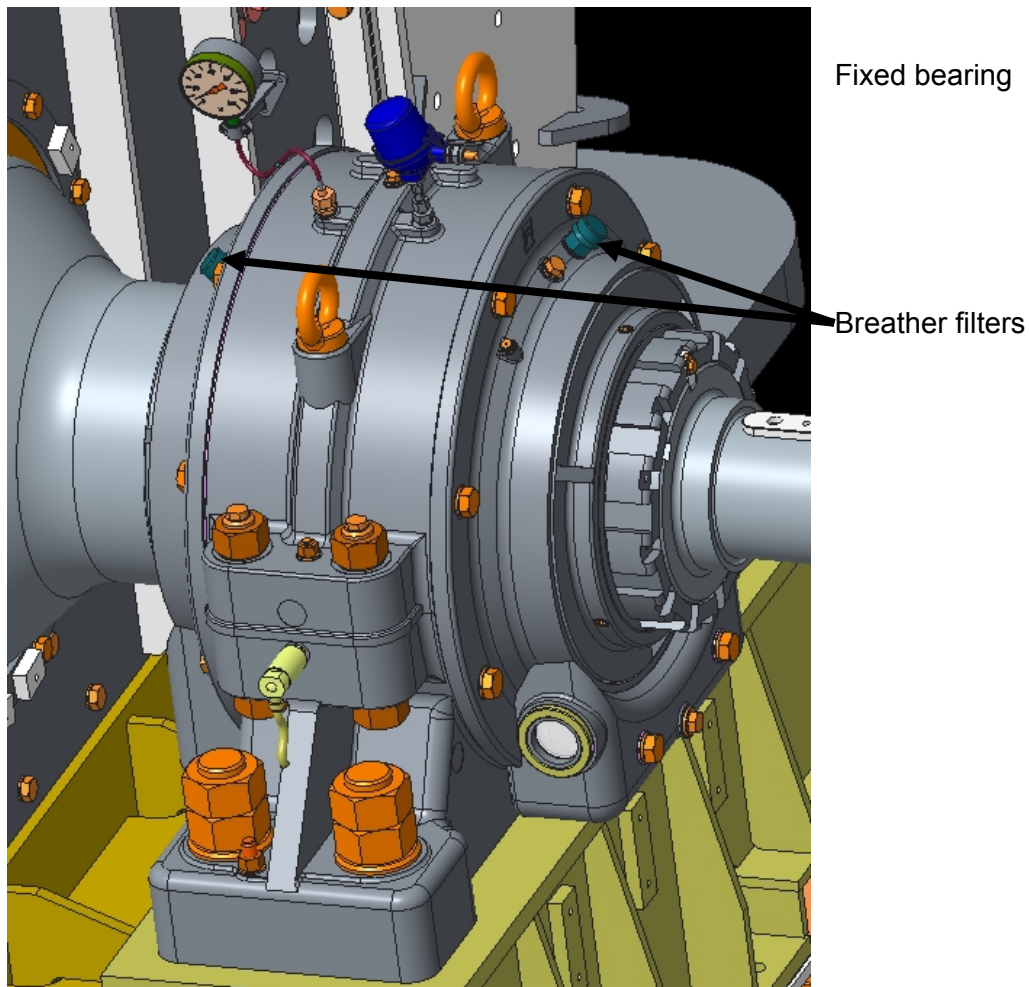
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6.5.2 Check the breather filters in the bearing housings

Work instructions of chapter 6.3 are full filled.


Pulverizer ready for inspection.

Wash/clean or replace the breather ventilation filters.



After finishing the work, release the pulverizer for operation and document.
(If no further work is to be carried out).

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6.6 Check the rotating beater parts

- For wear of the beater heads and beater arm protections

Work instructions of chapter 6.3 are full filled.

1. Inspection doors opened.
2. Pulverizer ready for inspection.

The beater heads and beater arm protections should be checked regularly. For the initial inspection and for all other intervals see chapter "Maintenance and inspection checklist for DGS® pulverizer and components". The results of these checks enable the operator to predict service life and to procure spare parts on time.



Caution


In line with the peripheral speed, the beater element is subjected to considerable centrifugal forces. To ensure smooth rotor running it is therefore necessary that evenly worn beater heads lying radially opposite each other together with beater arms and beater arm protectors of the same weight are in the mills.



Picture of a worn beater head

The optimal coal grinding takes place with new beater heads.

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6.7 Check the internal pulverizer parts

Work instructions of chapter 6.3 are full filled.

1. Inspection doors opened.
2. Pulverizer ready for inspection.

The intervals depend on how long the plant has been running and on the condition determined during the previous inspection. For the initial inspection and for all other intervals see chapter "Maintenance and inspection checklist for DGS[®] pulverizer and components".

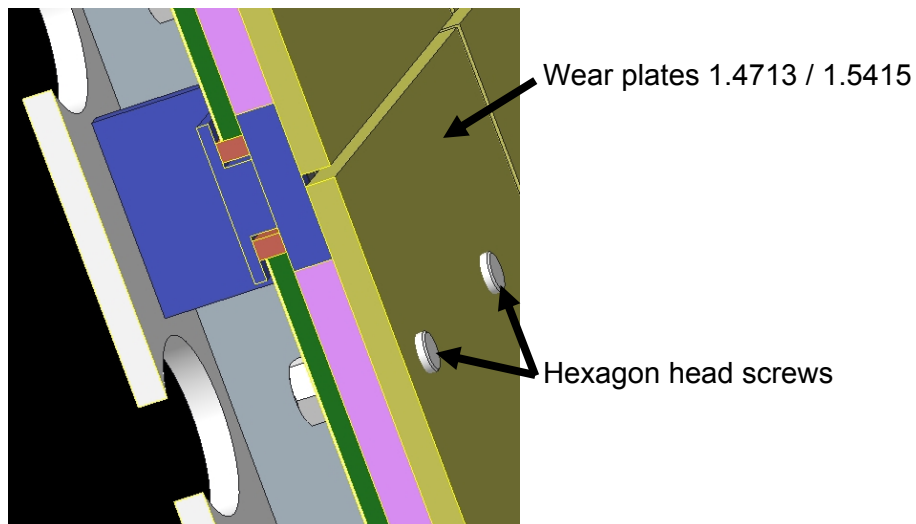


Caution

If needed the inspection intervals have to be shorten, to prevent the pulverizer against damages.


6.7.1 Check the inlet housing

- For foreign bodies
- For wear of the wear plates
- For deformation of the wear plates
- For tight fit of the wear plates



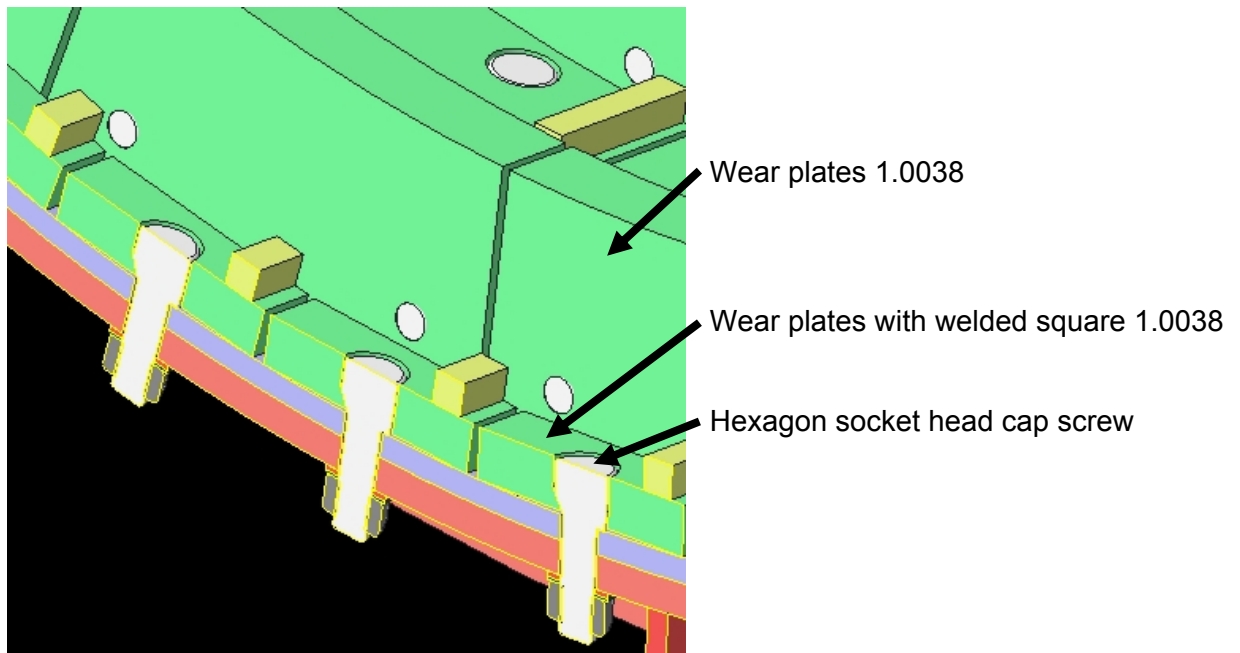
The wear plates (incl. screws) have to be renewed if there is a residual wall thickness of approx. 8 mm.

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6.7.2 Check the static beater part


- For foreign bodies
- For wear of the wear plates
- For deformation of the wear plates
- For tight fit of the wear plates



The optimal coal grinding takes place with new wear parts.

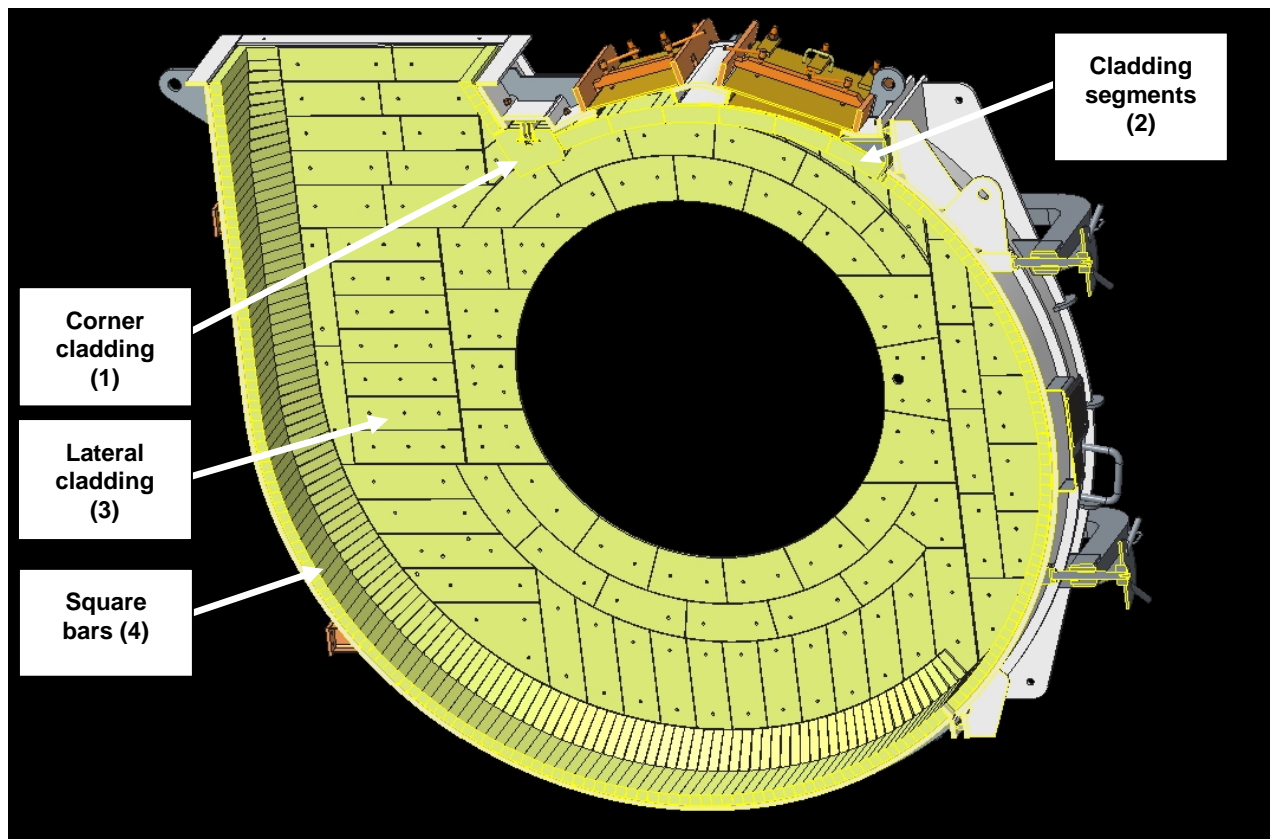
The wear plates (incl. screws) have to be renewed if there is a residual wall thickness of approx. 15 mm.

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6.7.3 Check the fan housing

- For foreign bodies
- For wear of the wear parts
- For deformation of the wear parts
- For tight fit of the wear parts




The wear of corner cladding (1) is not evenly distributed over the entire width, so a change of individual plates is possible.

The cladding segments (2) have to be renewed if there is a residual wall thickness of approx. 20 mm.

The lateral cladding plates (3) have to be renewed if there is a residual wall thickness of approx. 10 mm.

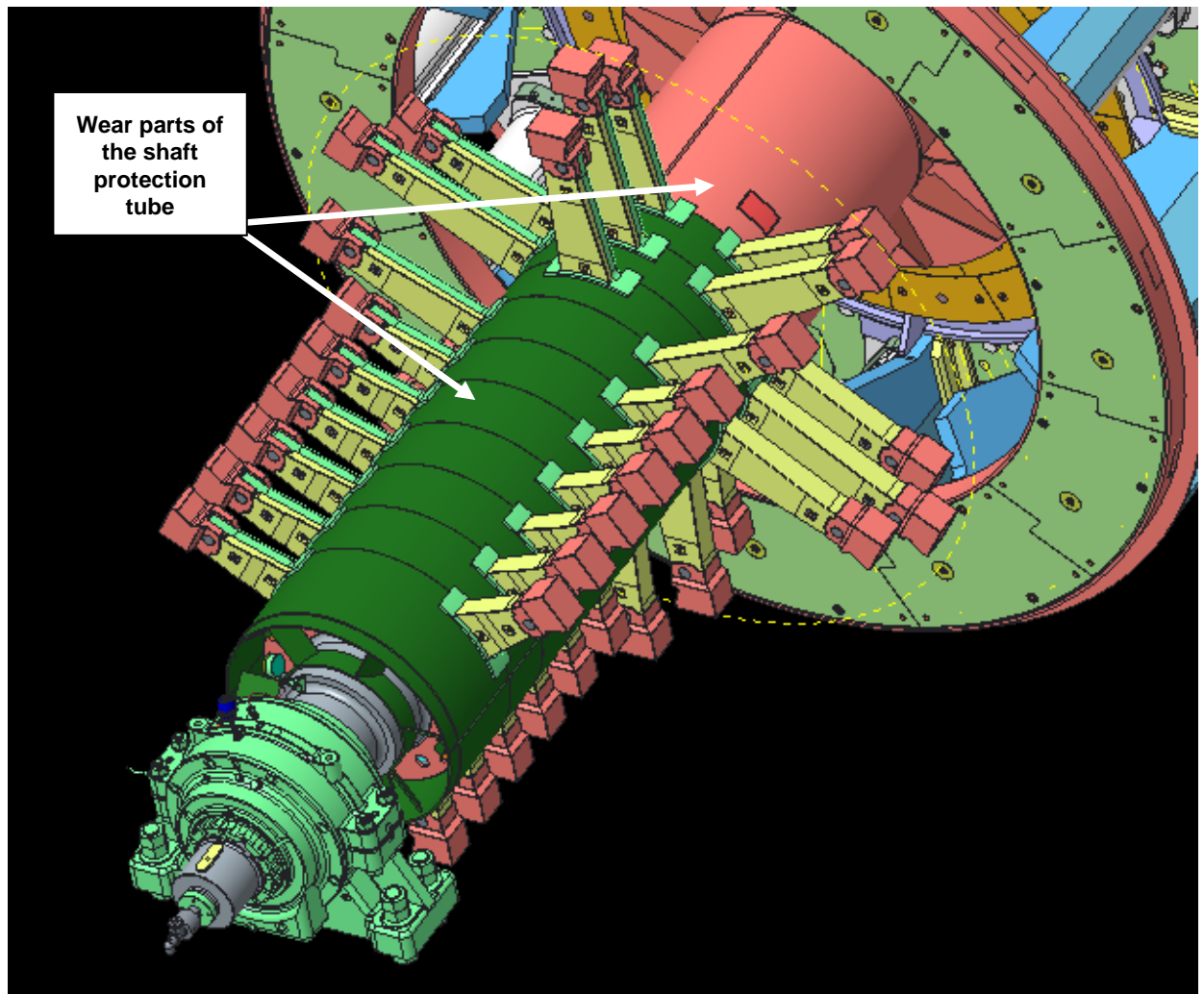
The square bars (4) have to be renewed if there is a residual wall thickness of approx. 10 mm.

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6.7.4 Check the shaft protection tube

- For wear of the wear parts
- For deformation of the wear parts



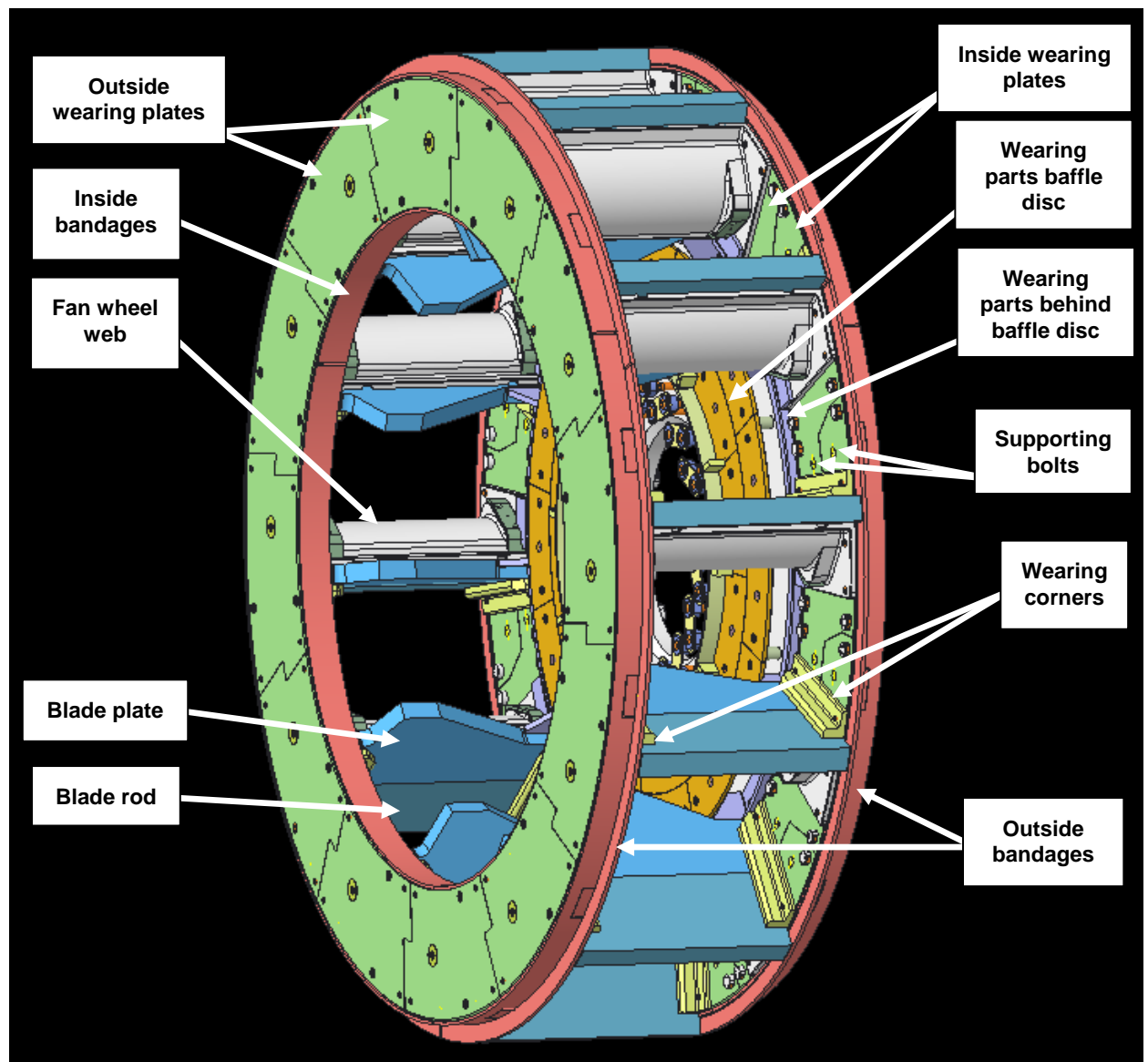
The wear parts have to be renewed if there is a residual wall thickness of approx. 5 mm.

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6.7.5 Check the fan wheel

- For wear of the wearing parts
- For deformation of the wear parts
- For damages



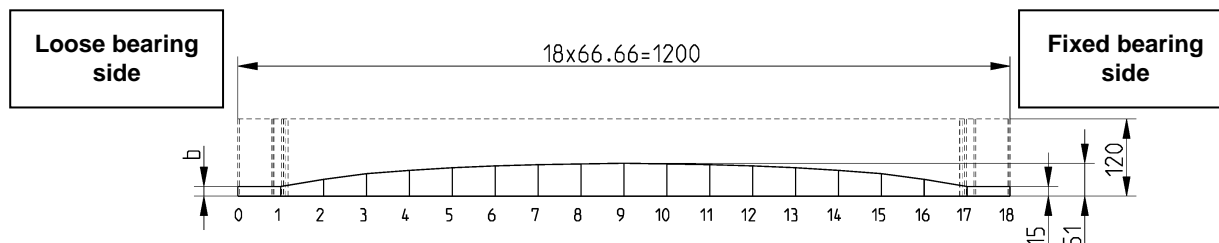
The wearing parts for baffle disc have to be renewed if there is a residual wall thickness of approx. 10 mm.

The wearing parts behind baffle disc have to be renewed if there is a residual wall thickness of approx. 8 mm.

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6.7.5.1 Check the blade rods of fan wheel

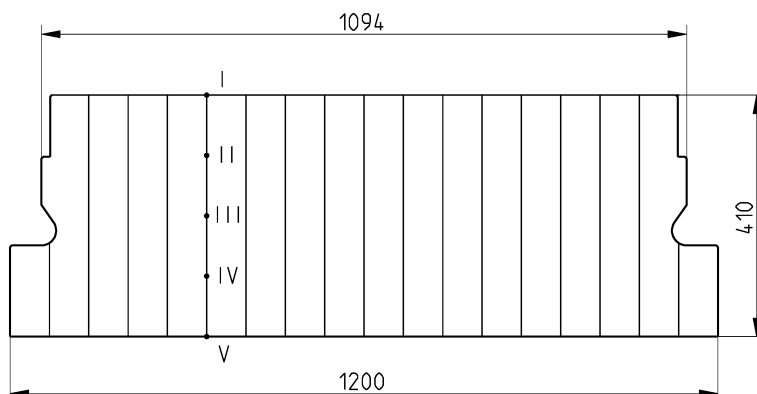
- For wear of the blade rods acc. following test template




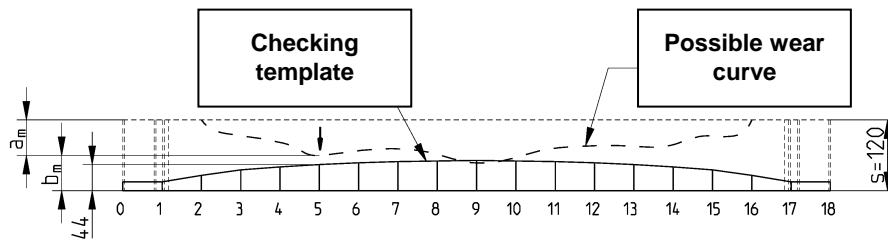
$b_m \geq b$
 In the area of level $h = 410$ mm the mean thickness b_m (15-51 mm acc. to the template shape) must not be lower than indicated

Punkt 0-18 Point 0-18	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Beispiel / Example Punkt 5 / Point 5
Mindestdicke b Minimum thickness	15	15	26	35	40	44	47	49	50	51	50	49	47	44	40	35	26	15	15	44
Ist- Verschleiß bei n= 5 Actual wear at n=5	I																			56
	II																			67
	III																			63
	IV																			84
	V																			75
$\sum a_i \dots a_n$																				345
$a_m = \sum a / n$																				69 = 345/5
$b_m = s - a_m$																				51 = 120-69
$b_m \geq b$	Ja Yes																			X
	Nein No																			

Preferably several measuring points are to be selected (here n= 5)

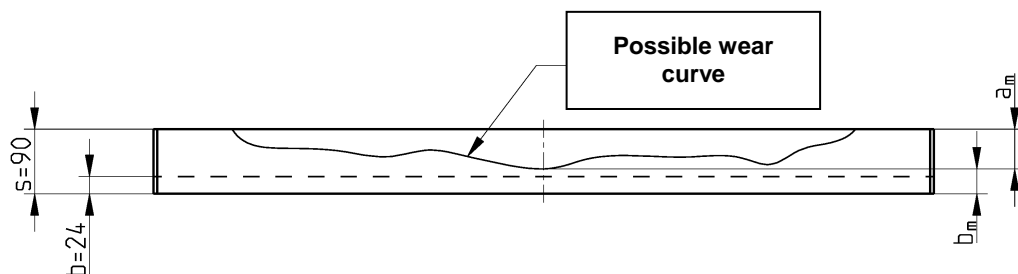


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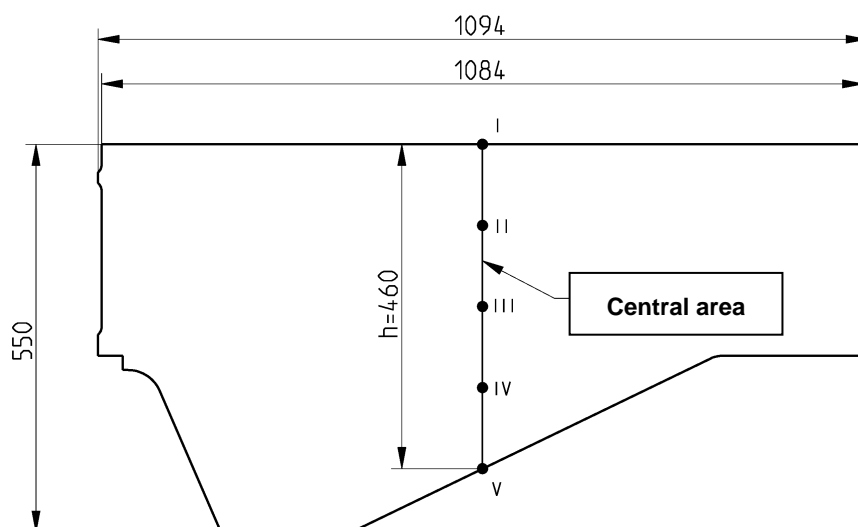
6.7.5.2 Check the blade plates of fan wheel

- For wear of the blade plates acc. following test template




$$b_m \geq b$$

The dimension $b = 25$ mm must not be lower than indicated, i.e. at any point of the blade plate, particularly in the central area (h).



Balancing instructions see chapter 11.


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Central area		Example
Minimum thickness b	25	25
Actual wear at n=5	I	54
	II	61
	II	63
	IV	59
	V	55
$\sum a_i \dots a_n$		292
$a_m = \sum a / n$		58.4 = 292/5
$b_m = s - a_m$		31,6 = 90-58.4
$b_m \geq b$	Ja	X
	Yes	
	Nein	
	No	

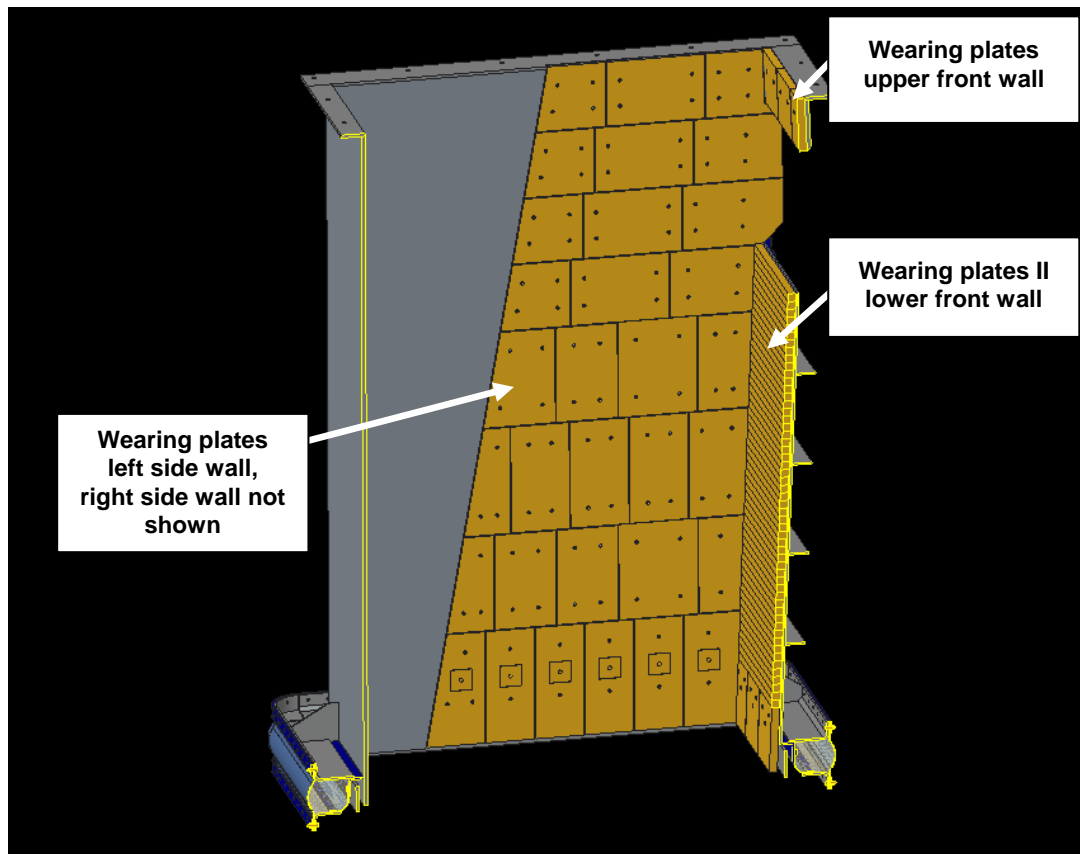
Preferably several measuring points are to be selected (here n= 5)

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6.7.6 Check the housing after mill / transition piece / classifier / grit recirculation connection

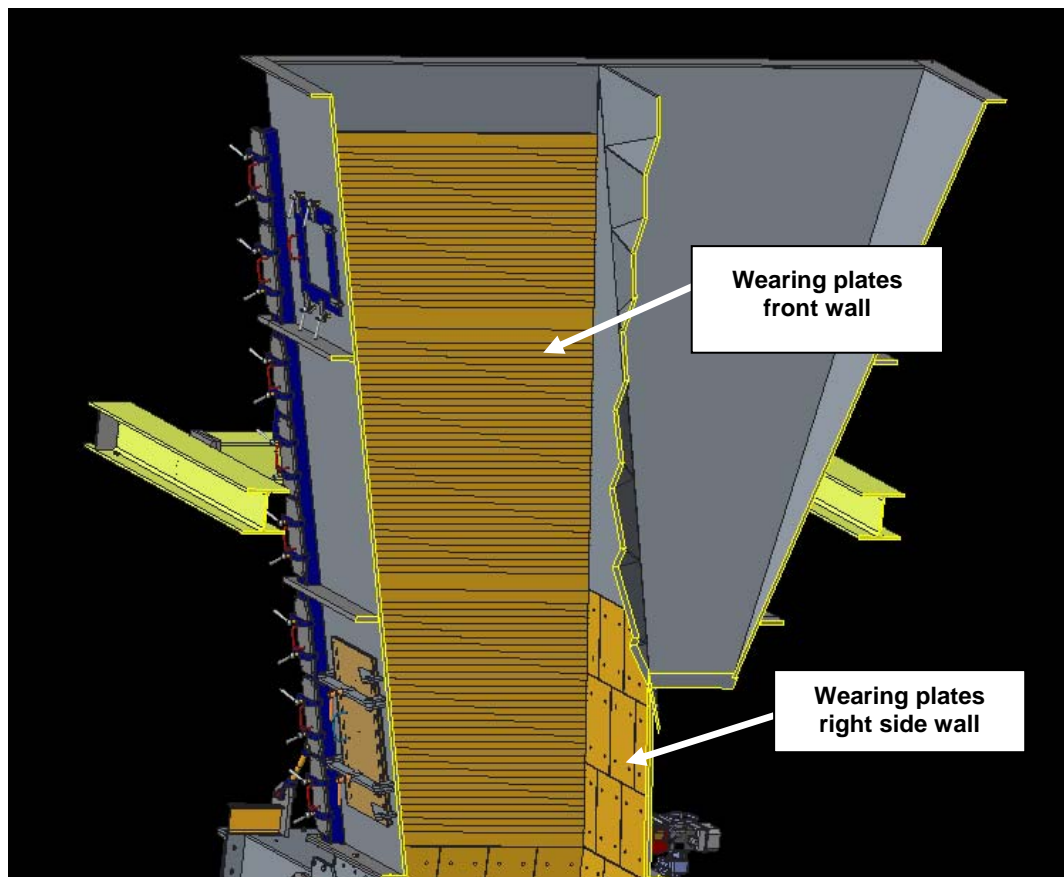
- For wear of the wearing plates
- For deformation of the wear plates
- For damages




The wearing plates I (incl. screws) have to be renewed if there is a residual wall thickness of approx. 8 mm. The wearing plates II (incl. screws) have to be renewed if there is a residual wall thickness of approx. 15 mm.

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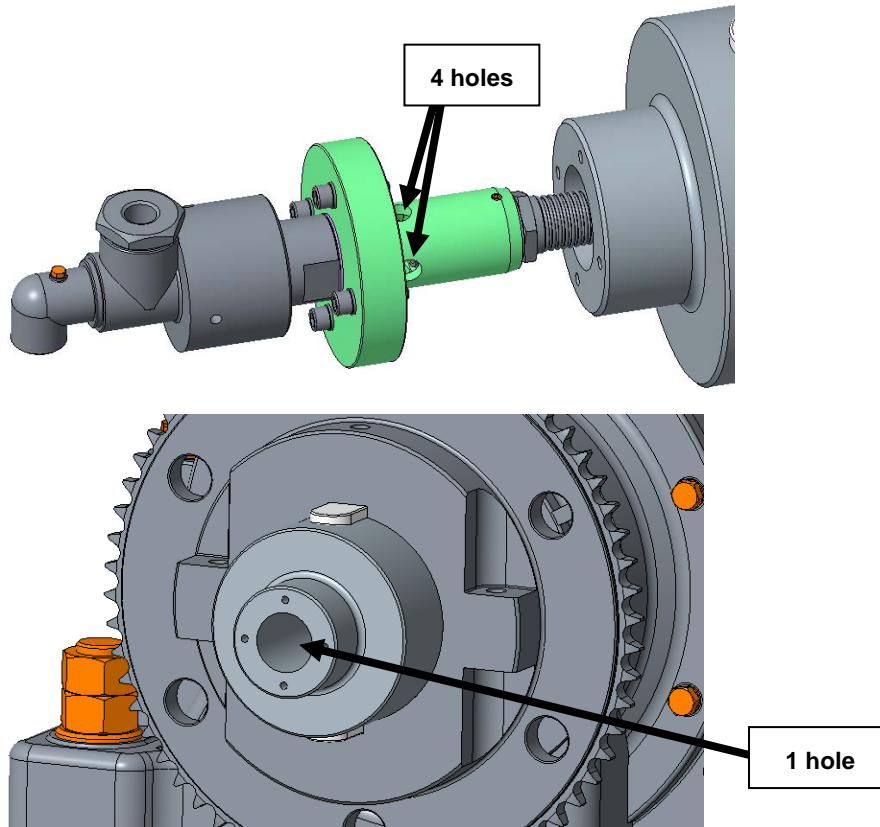


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6.8 Check the cooling water device for the mill shaft

Remove residues in the cooling water drill holes (4 in the head and 1 in the rotor shaft).




In order to avoid an impairment of the cooling due to residue formation, etc., only water that is clear and free of suspended matter may be used as cooling water. It is advisable that the value for pH 6.5 - 8 and for the carbonate hardness should be less than 4,5 mval/l (12,6 °dH).

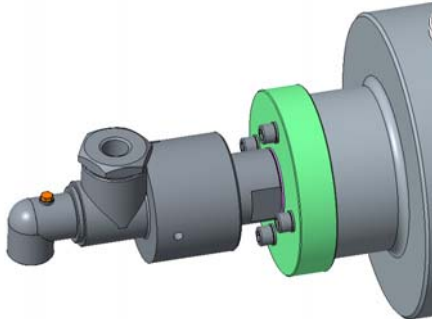
The shaft bore must be checked and cleaned at regular intervals. The period between two checks or cleanings depends on the intensity of the pollution, which in turn depends on the quality of the cooling water.

It should be at a max. thickness of pollution of 1 mm must be cleaned. The period is based on our experience in general about 6 months and longer.

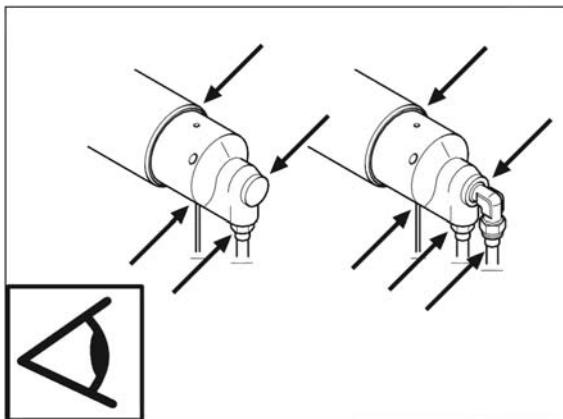
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6.8.1 Check the seal tightness of the rotating union




Carry out daily visual inspections in order to check whether leakages occurred at the connections (see arrows).



If you detect leakage:

1. Stop the machine
2. Replace the defective hoses with new ones
3. Seal leaking connections
4. If the rotating union is worn and leaks, replace it with a new one.
Repair kits for various models can be obtained from the manufacturer.

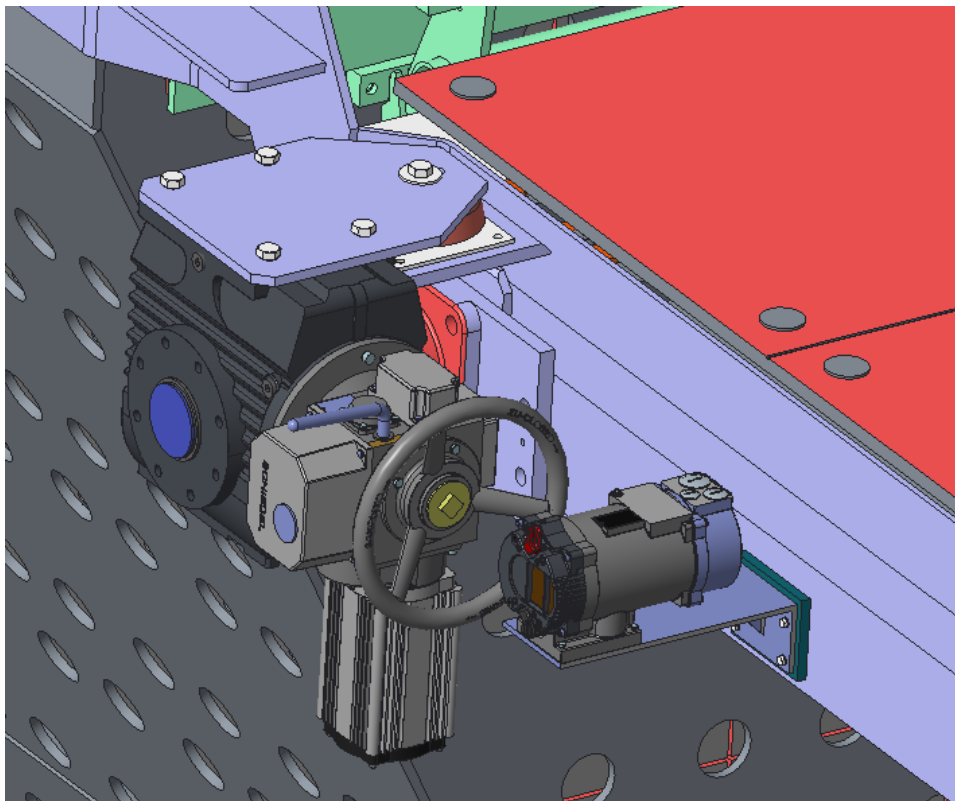
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6.9 Check the drive for repair gate valve before mill

Routine maintenance should include the following:

- Check actuator to valve fixing bolts for tightness
- Ensure valve stems and drive nuts are clean and properly lubricated
- If the motorized valve is rarely operated, a routine operating schedule should be set up
- Check the actuator enclosure for damage, lose or missing fasteners
- Ensure there is not an excessive buildup of dust or contaminant on the actuator
- Check for any loss of lubricant



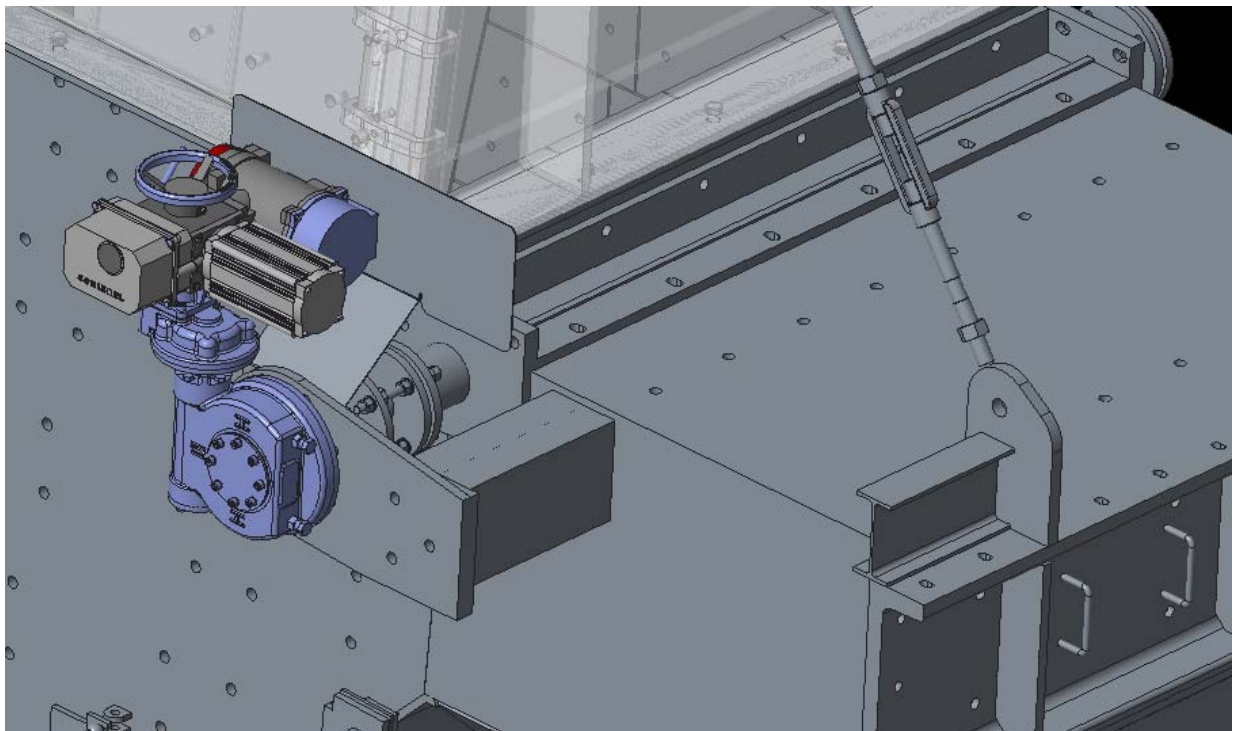
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6.10 Check the drive for flap grit recirculation connection

Routine maintenance should include the following:

- Check actuator to flap fixing bolts for tightness
- Ensure flap stems and drive nuts are clean and properly lubricated
- If the motorized flap is rarely operated, a routine operating schedule should be set up
- Check the actuator enclosure for damage, lose or missing fasteners
- Ensure there is not an excessive buildup of dust or contaminant on the actuator
- Check for any loss of lubricant



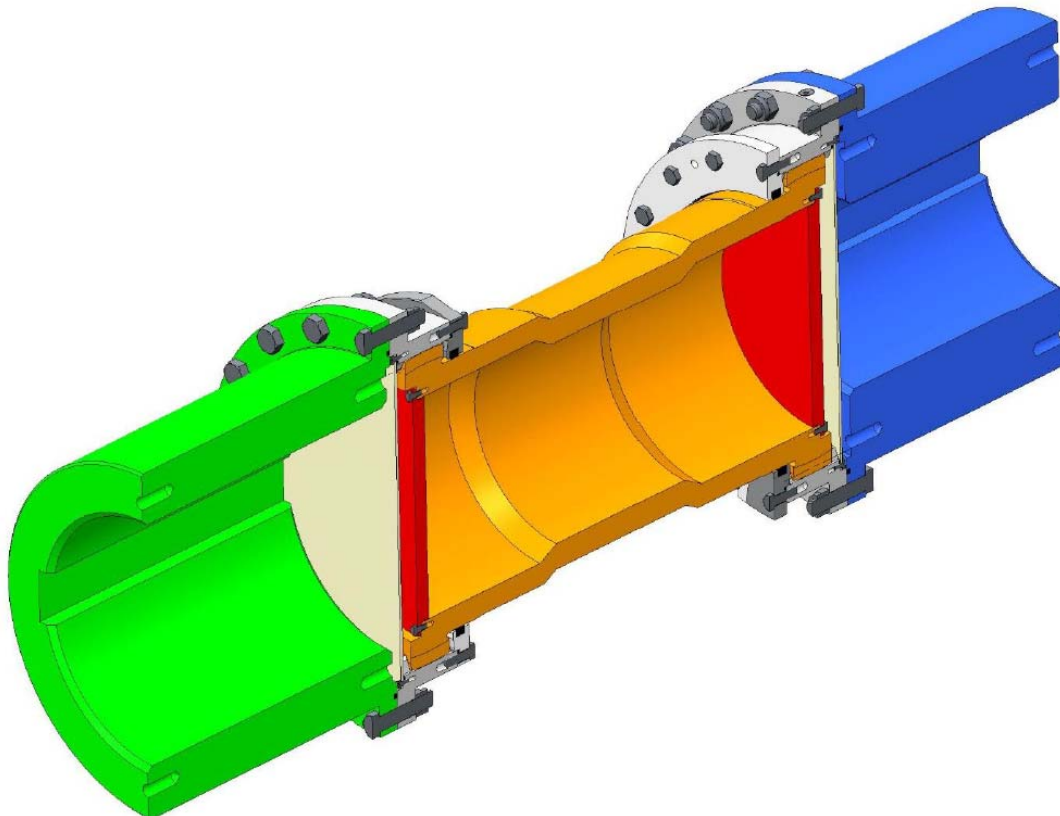
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6.11 Check the coupling

Routine maintenance should include the following:

- Check fixing bolts for tightness
- Check for damage, loosen or missing fasteners



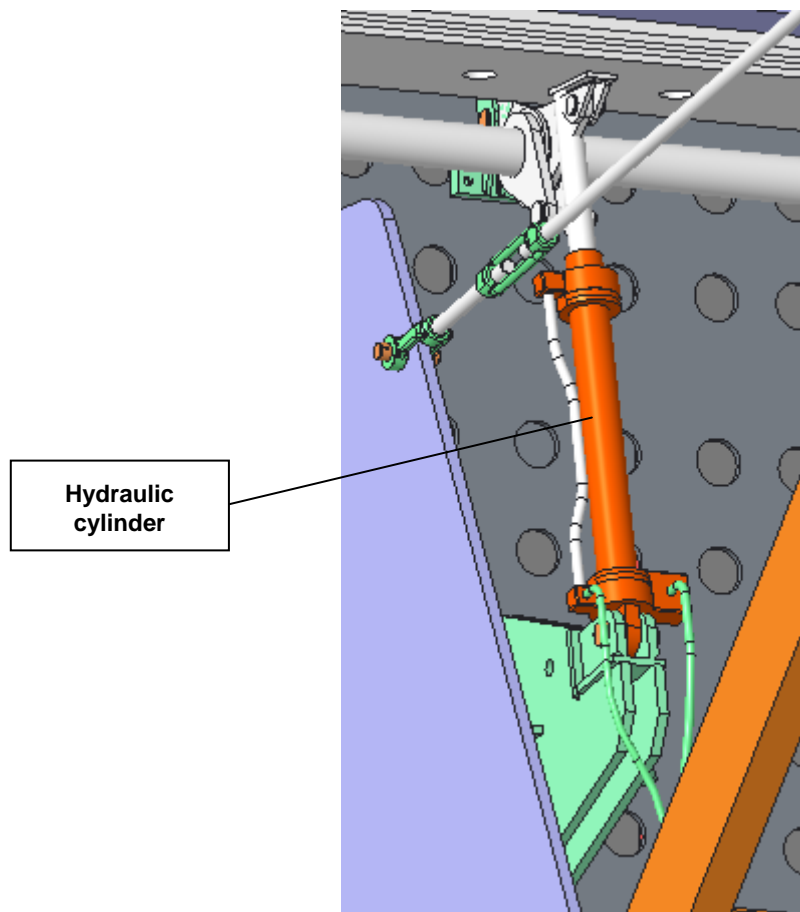
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6.12 Check hydraulic actuator for repair gate valve flap before mill

Routine maintenance should include the following:

- Check actuator to valve fixing bolts for tightness
- Check the actuator enclosure for damage, loosen or missing fasteners
- Ensure there is not an excessive buildup of dust or contaminant on the actuator
- Check for any loss of lubricant
- Perform test run



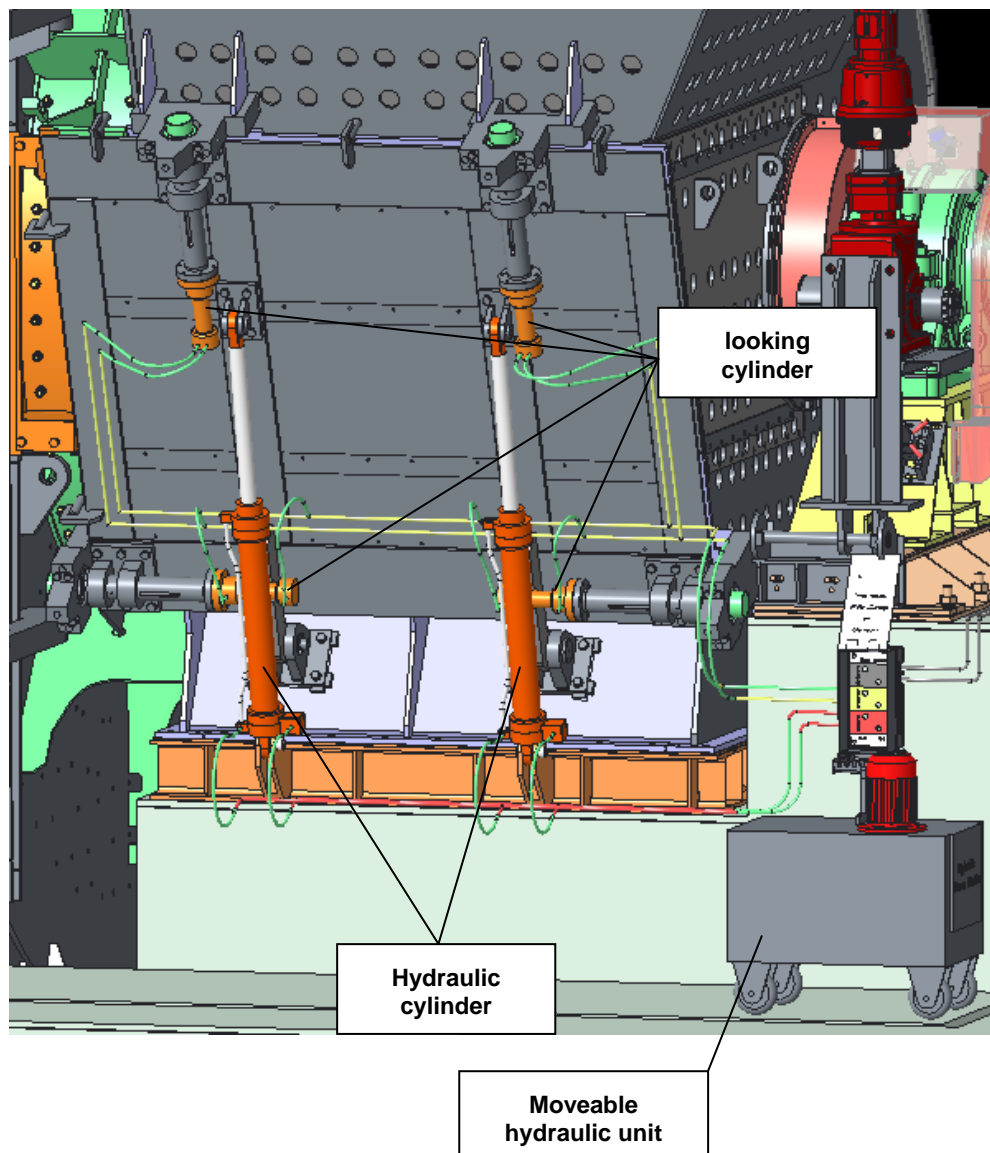
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6.13 Check hydraulic actuator for repair gate valve flap before mill

Routine maintenance should include the following:

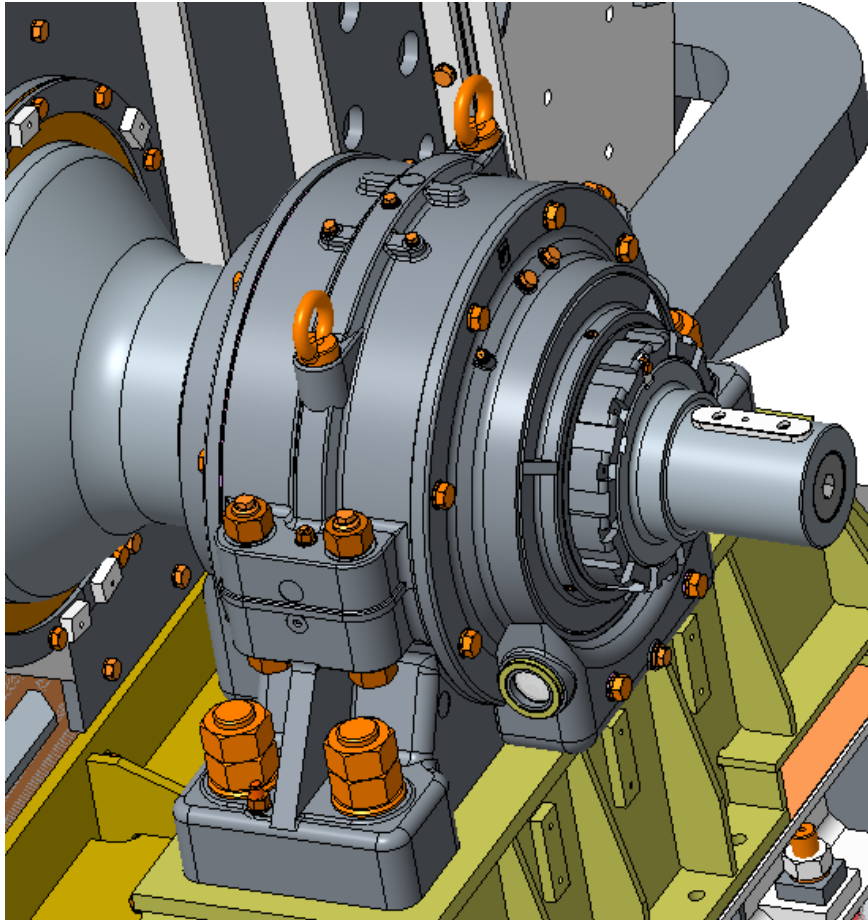
- Check fixing bolts for tightness
- Check for damage, loosen or missing fasteners
- Check for any loss of lubricant



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6.14 Check the self-aligning roller bearing, loose and fixed bearing



- Check oil level and oil temperature, vibrations, smooth running, running noises
- Check oil condition
- Drain oil and check on its state
- Examine condition of bearing
- Check for oil leakage


6.15 Lubricants generally

For all not shown equipment above (motors, fans and so on), intervals, lubricants and quantities information see chapter 4.11.4 "Lubricants".


The lubricant change must be documented.

Further data see OTD's of the manufacturer of the equipment.


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6.16 Maintenance and inspection checklist for DGS® pulverizer and components


No.	KKS No.	Component	Interval	Type of maintenance/inspection	Remarks
1.		Pulverizer; total plant	Daily during operation 2000 h	1. Quiet running 2. Abnormal sound 3. Visual inspection for leaks 4. Damage to plant parts 5. Temperature, pressures (local) oil bath levels 6. Filter elements of oil lubrication systems 7. Check coal dust discharge into the atmosphere Checking the switching function of all electrical sensors and locking criteria	Report any irregularities and initiate corrective measures  PAY ATTENTION !!! If gauge shows "RED", filters has to be cleaned or replaced Seal and clean-up
2.		Bolt/screw connections	500 h, next interval 2000 h	Check tightening torque and tighten if necessary	Generally applicable to all screw/bolt connections
3.		All doors on the housing	Each time opened	1. Visual check 2. Check position of the sealing cord 3. Seal stuck 4. Lubricate seal with grease	
4.		Cooling water device for the mill shaft	Roughly 6 months	Remove residues in the cooling water drill holes	Max. internal 1 mm layer, cleaning only with mill shutdown Heed safety provisions!
5.		Cooler of oil circulation lubrication system	Roughly 3 months then later as required and on the basis of experience	Remove residues in the cooling water lines	See operating instructions of the producer
6.		Deublin–Rotating union	Weekly	Seal tightness check	See operating instructions of the producer
7.		Self-aligning roller bearing Loose and fixed bearing	Twice daily after 1000 - 1500 op. hrs every 4000 or 8000 op. hrs. op. hrs. = operating hours	Check on oil level and oil temperature, vibrations, smooth running, running noises Check on oil condition Drain oil and check on its state, examine condition of bearing and if required, renew oil filling and change the grease in the bearing labyrinth seals	See operating instructions of the producer Change oil, if needed

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No.	KKS No.	Component	Interval	Type of maintenance/inspection	Remarks
8.		Beater heads, beater arms, housing cladding, complete blades	First weekly, then later as required and on the basis of experience	Verification of the state of wear	
9.		Hub bolts, shaft protection tube	As required or when mill is at a standstill and has been run cold	Verification of the state of wear, general condition of protection tube, weldings, fixing of hub bolt protection.	
10.		Iron collecting box	As required or when mill is at a standstill and has been run cold	Remove any foreign matter	
11.		Fan wheel, web, fixing of the web	First weekly, then later as required and on the basis of experience	Check of wear, check the webs for wear	ATTENTION! If wear is detected on the web, the MHPS-Mill-Design-Department must be informed immediately so that countermeasures can be determined and taken immediately.


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7 Removing and installing pulverizer parts

1. General
2. Housing after mill / transition piece / classifier / grit recirculation connection
3. Replacement of housing cladding
4. Replacement of rotating wear parts
5. Rotor assembly and disassembly
6. Replacement of self-aligning roller bearings (fixed and loose bearing side)
7. Motor, connecting coupling
8. Changing of the turning device from mill to mill

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7.1 General

Only access in accordance with customer specifications and when the mill has been deactivated at the control desk.

Only trained and qualified personnel may remove and install pulverizer parts.

Always access the pulverizer with another person.

We recommend consulting a specialist from the manufacturing plant when carrying out this work.

Only the original tools listed under chapter "Tools and devices" may be used.

The pulverizer parts are transported around the pulverizer by crane.

Equipment, cables and chains must be provided.

For component weights, see chapter "Assemblies and assembly weights".

Drive motors for the mill and coal feeders cannot be switched on. They must be interlocked.

Only access when the hopper has run empty and the bunker shut-off gates are locked.

With closed repair gate valves upstream and downstream the mill.

With pulverizer cooled and cleaned (mill and coal feeder).

Only carry out build-up welding of the grinding tools in the pulverizer with vapor extraction. The people in the vicinity must also be protected (observe the OH&S regulations).

The setting, maintenance and inspection work and dates specified in the operating instructions must be carried out on schedule by specialist personnel and documented.


Machinery and equipment on which inspection, maintenance and repair work are carried out must be switched off – if specified.

If work on live parts is necessary, a second person must be present to operate the emergency stop or mains switch with voltage tripping mechanism in an emergency.

Working areas must be cordoned off with a red and white safety chain and a warning sign.

Electrical work must be carried out with insulated tools.

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Caution

The work instructions listed under chapter 1.6 and 6.2 must be observed in full before start of removing and/or installing work!

Before disassembly of the pulverizer parts, they have to be marked to make sure that each pulverizer part get back in the same position at the pulverizer).

Connection parts and small parts have to be putted in a bag/box. The bag/box has to be marked to make sure that each connection part and each small part get back in the right position.

A reused part has to be checked against damages and has to be cleaned before it will be installed in the pulverizer again.

General form lock fixings have to be replaced against new parts without any evaluation of reusability of the old form lock fixings.

Before start removal and/or installation work of the pulverizer, check the transportation and drive way load to make sure that the pulverizer parts (incl. transportation equipment) are not too heavy for the transportation and drive way (weights of the pulverizer parts see chapter "Technical data for installation, operation and maintenance").

Before start removal and/or installation work of the pulverizer, check the area load around the mill to make sure that the pulverizer parts (incl. transportation equipment) are not too heavy for the area around the mill (weights of the pulverizer parts see chapter "Technical data for installation, operation and maintenance").


Make sure the hoisting hook is correctly attached and that the eyebolt(s)/lug(s) are fully screwed in before lifting.

Do not twist the steel wires and make sure the eyebolts have been firmly crewed and the sling angle is correct.

All screws will be set in with MoS2-paste. Then are the tightening torques are to be reduced around up to 20 %. If there are no special instructions given in drawings or lists, pre-tension forces and tightening torques have to be used according list of tightening torques, chapter 10.2.

If welding is needed, to prevent damage caused by passing or current (especially on all antifriction bearings) it is absolutely necessary to compensate for potential difference.

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7.2 Housing after mill / transition piece / classifier / grit recirculation connection

1. Pulverizer ready for removing and installing work.
2. Undo flange connections between transition piece / coal dust channel.
3. Support coal channel at the top (lugs on the coal dust line elbows) and raise by approx. 20 mm.



**Danger of
falling objects**

4. Undo flange connection at the top and bottom of the coal gravity duct spacer.
5. Pre-tension the expansion joint in the coal gravity duct, max 20 mm.
6. Dismantle coal gravity duct spacer and place at + 0.0 m AGL.



**Danger of
falling objects**

7. If necessary dismantle platform and barred all accesses to the transition piece platform. Barred all areas where the handrails are removed or where this platform was partly removed.




Caution



Hazard

Danger of falling objects!

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8. Dismantle the monorail beam for blade replacement from the transition piece and place it at + 0.0 m AGL.
9. Undo the pulverizer housing / transition piece connection flange.
10. Lift the transition piece with the pulverizer maintenance crane and place it at + 0.0 m AGL or on a transport trolley.
Use the 4 lifting eye bolts on the top of the transition piece.



**Danger of
falling objects**

11. Before reassembling the transition piece, check the position of the sealing cords. If necessary, replace the sealing cords (see chapter 6.2).



Caution

Hazard

Unhealthy!

12. The transition piece is assembled in reverse order of item 11 to 1.




Caution

Make sure that the monorail beam for blade replacement is installed correctly.

13. All connecting bolts should be tightened to the correct torque, see chapter 10.2.
14. After finishing the work, release the pulverizer for operation and document.
(If no further work is to be carried out).

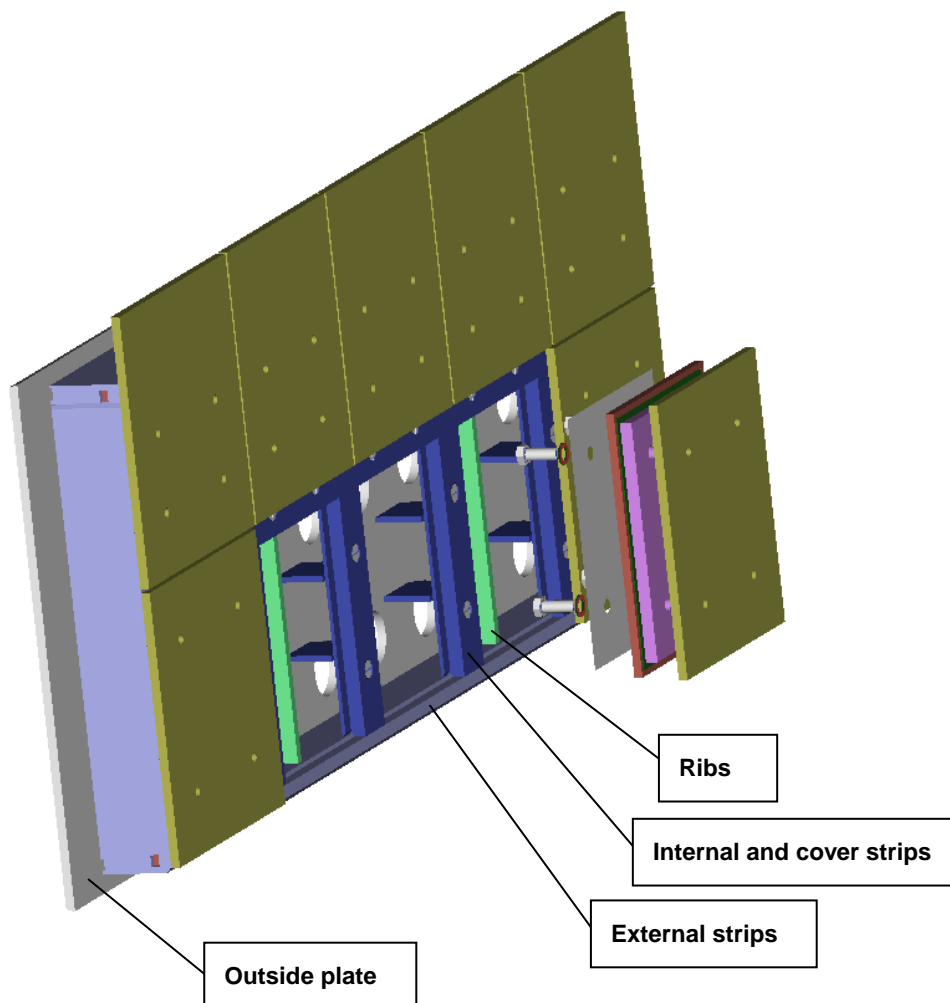
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7.3 Replacement of housing cladding

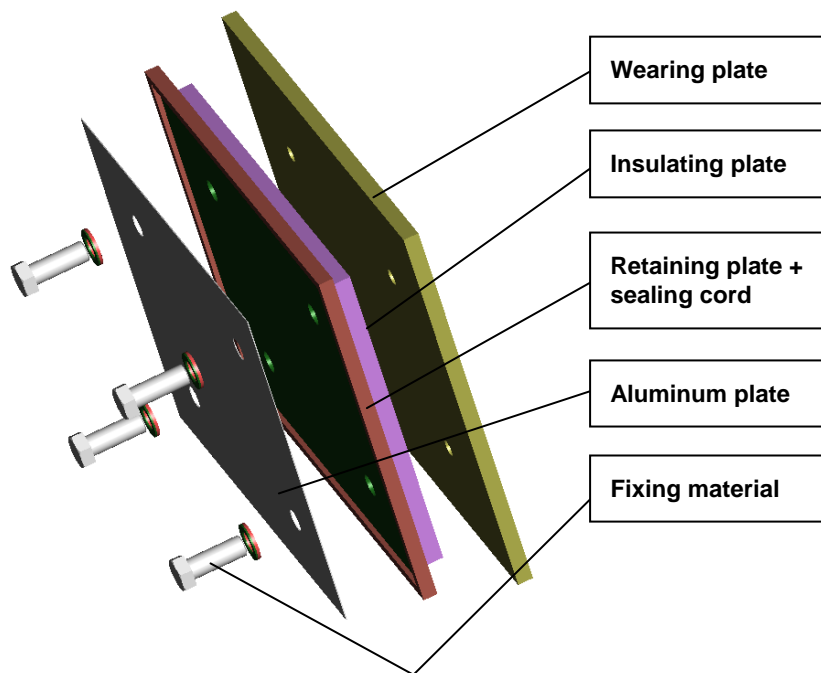


7.3.1 Inlet housing double wall

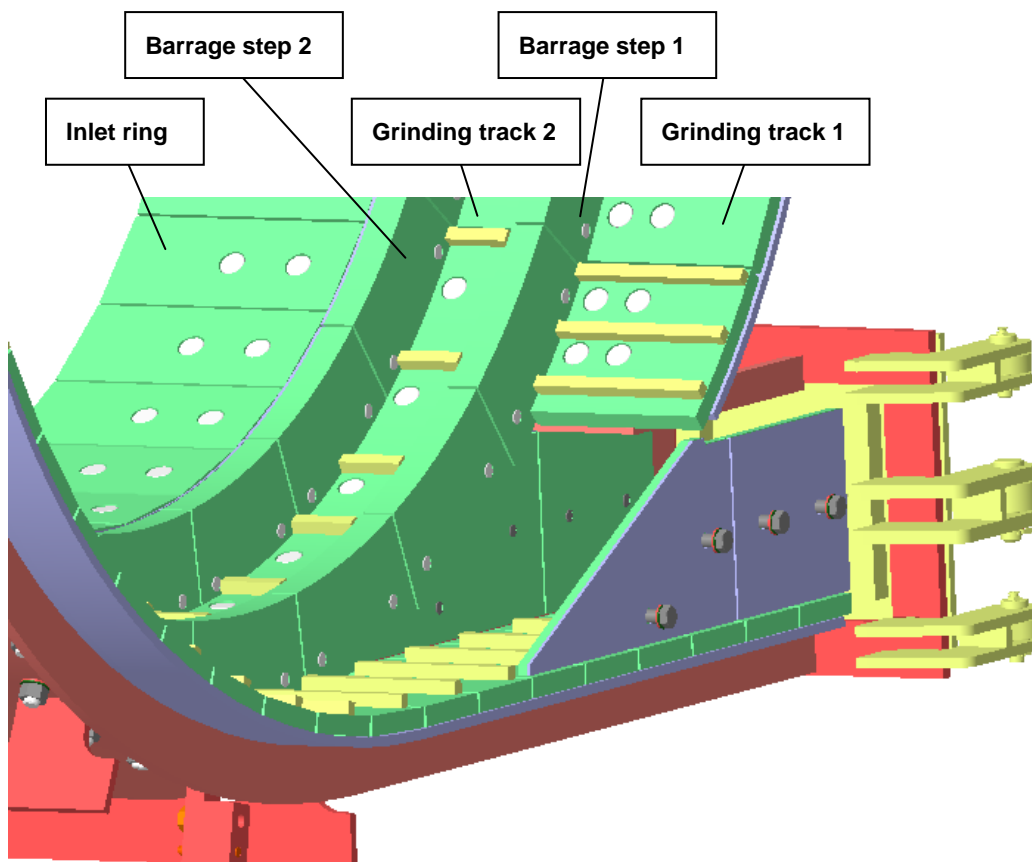


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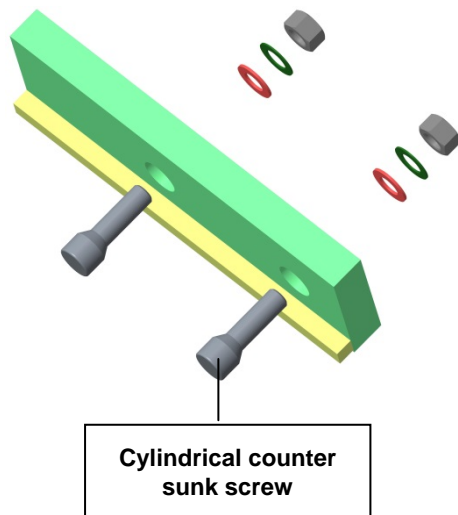
7.3.2 Beater part cladding elements



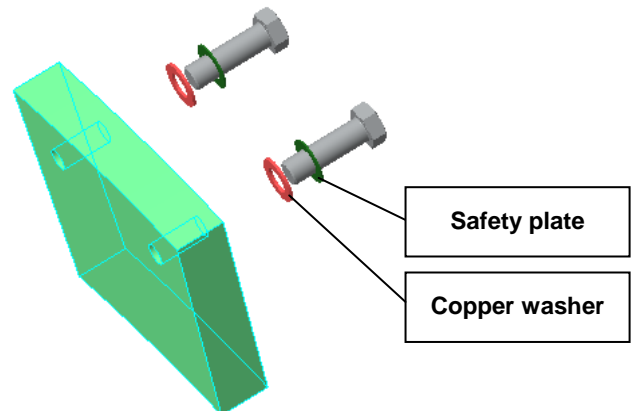
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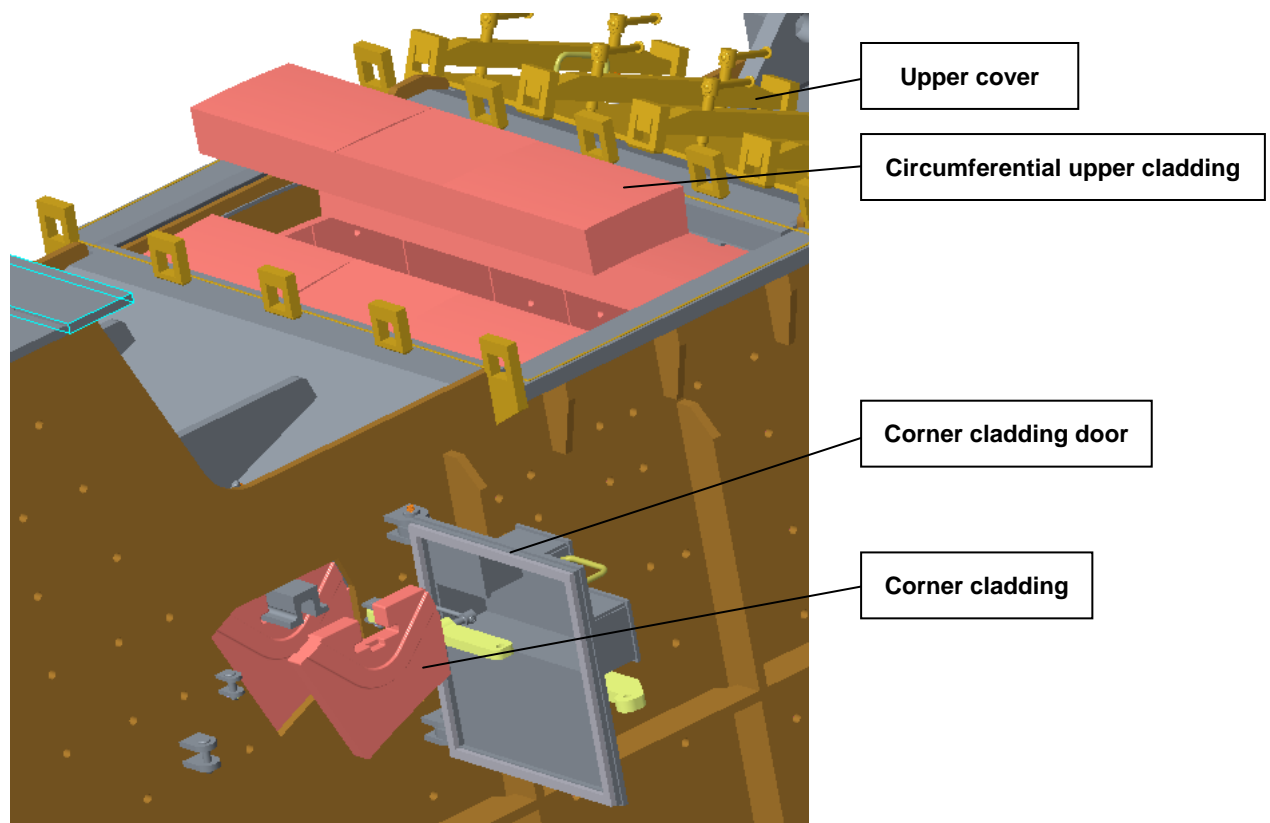
Grinding track + inlet ring




Barrage step

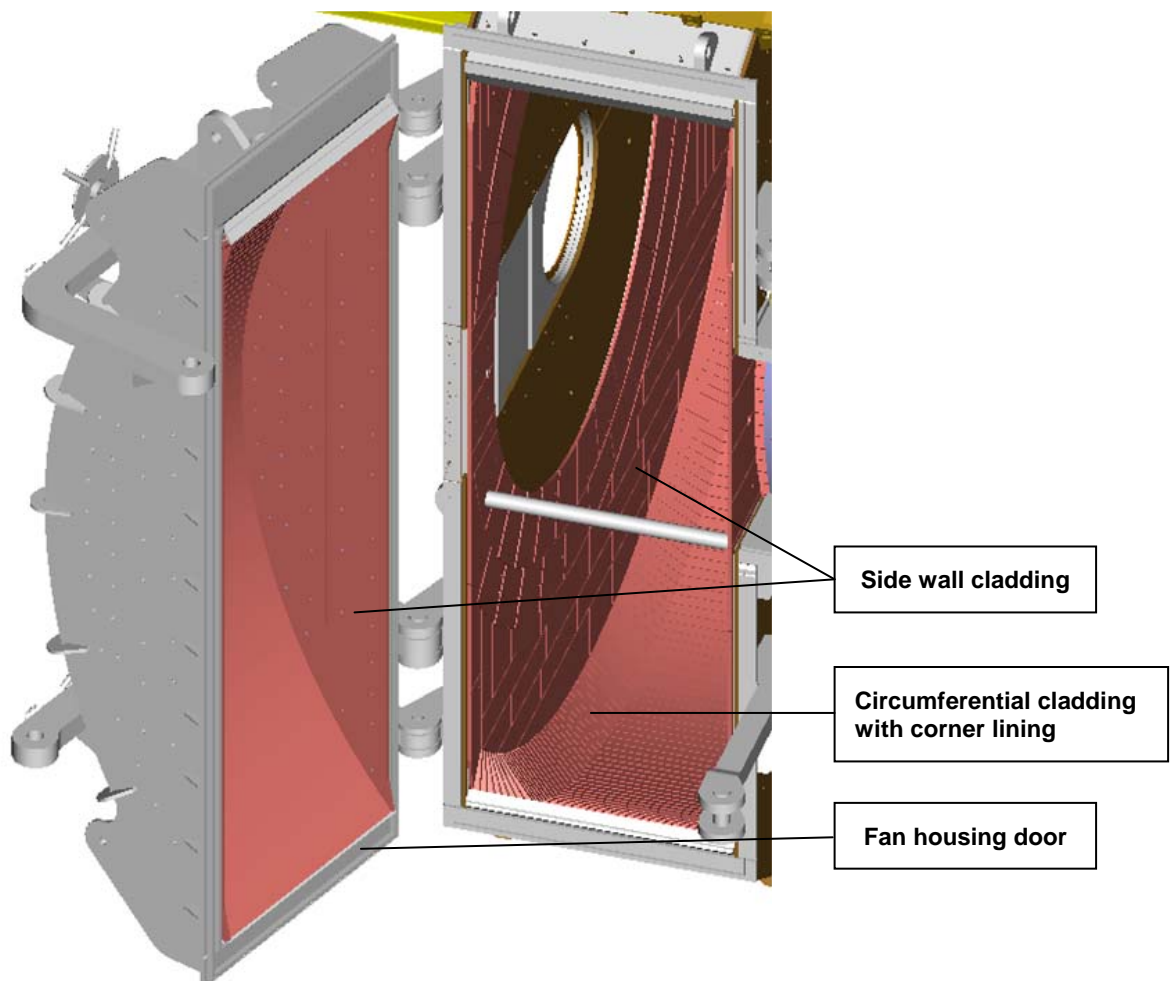
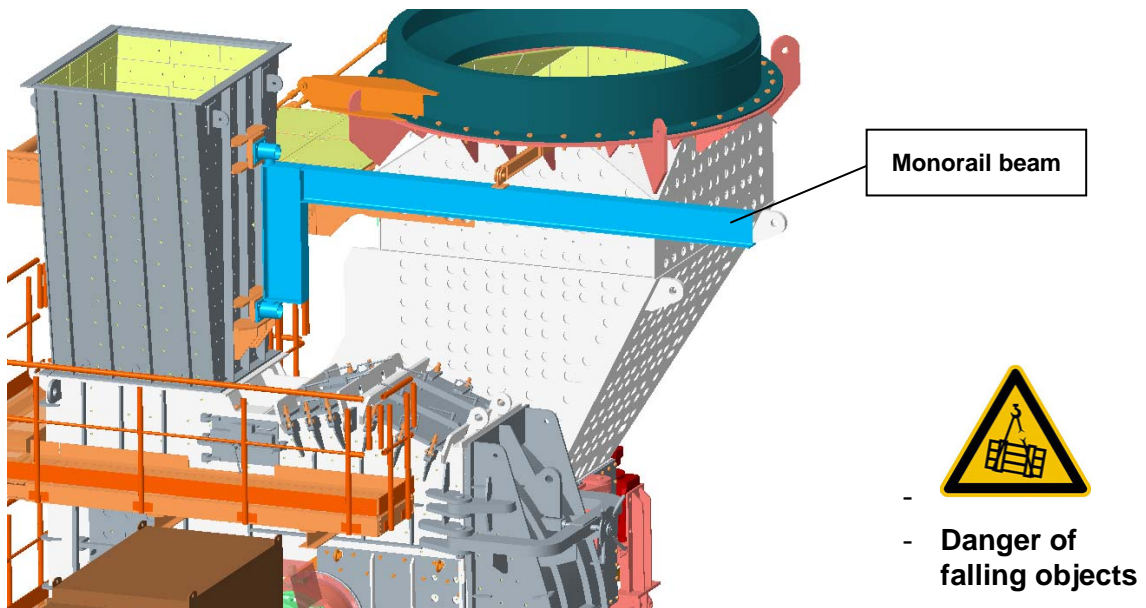


7.3.3 Fan housing cladding elements




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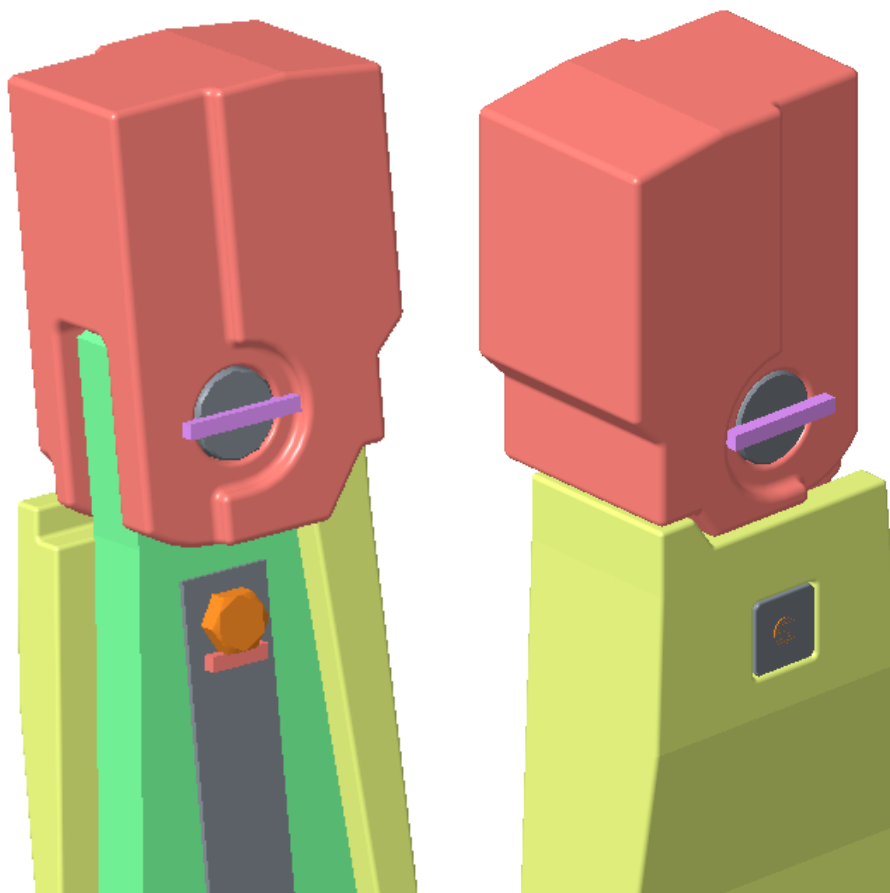
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7.4 Replacement of rotating wear parts

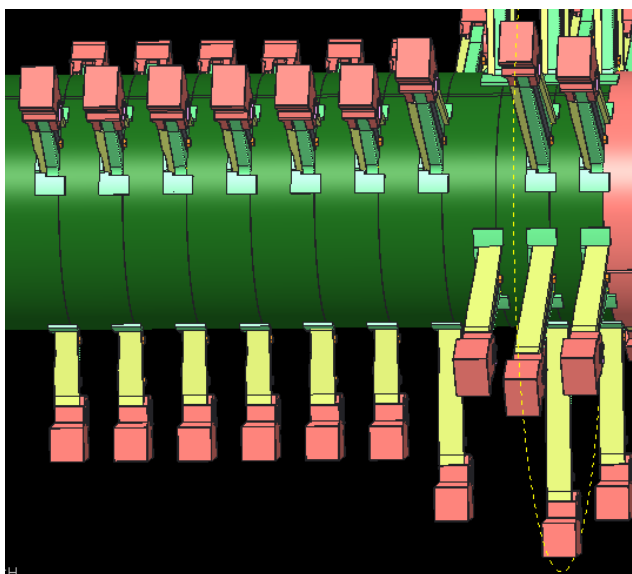
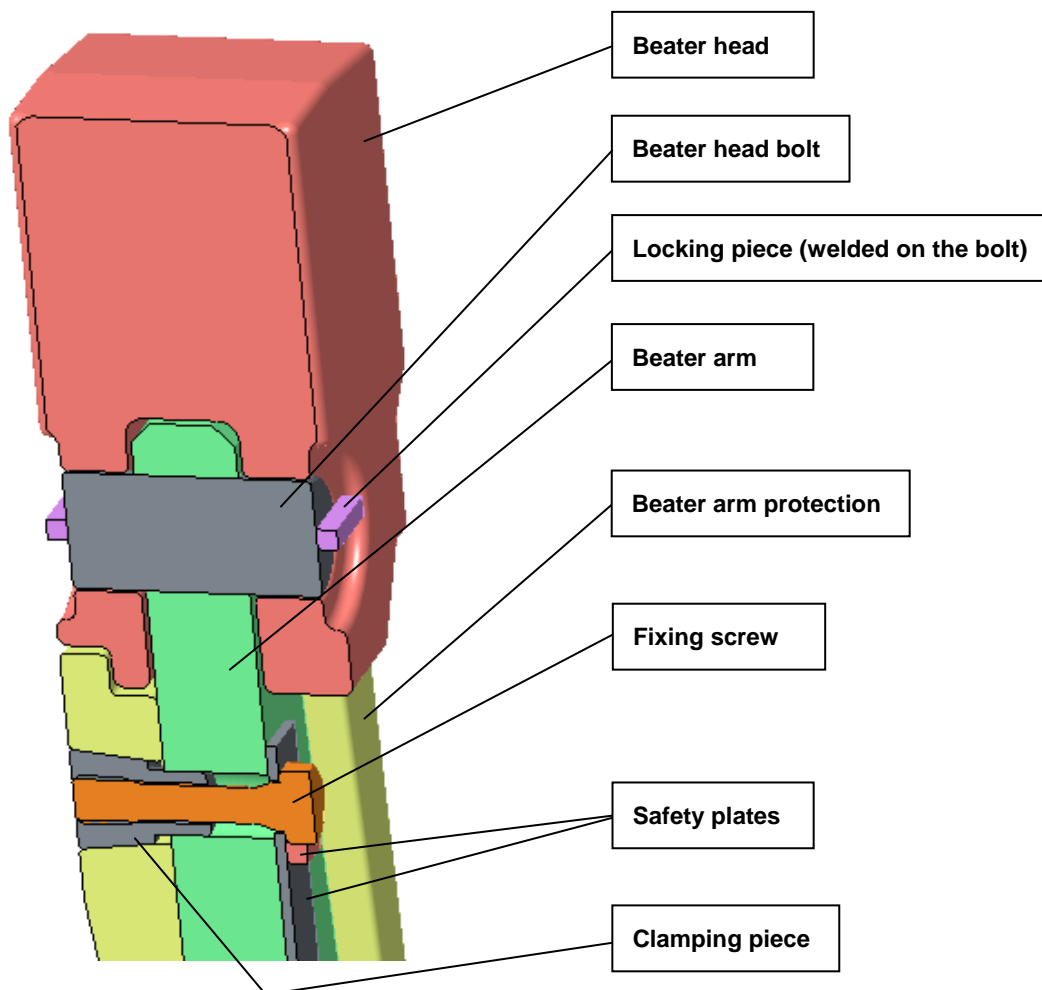
7.4.1 Beaters (beater heads and arm protections)




1. Pulverizer ready for removing and installing work.
2. Inlet housing door open.
3. Use the turning device for rotating the beater arms slowly (see chapter 4.11.2 and 7.8).

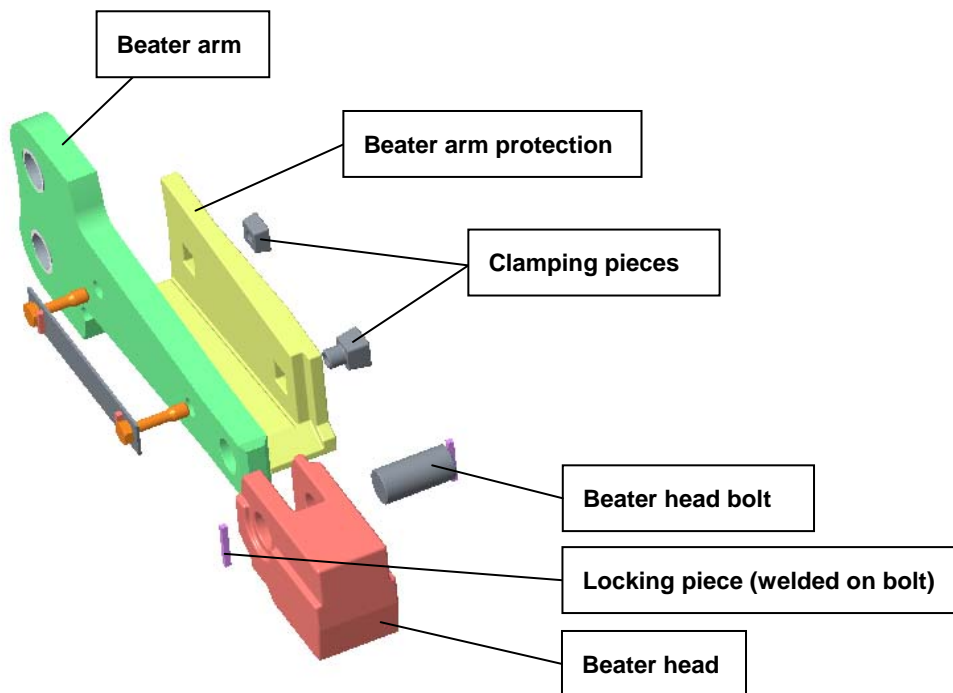


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Shaft, fully-equipped,
shown without protection tube

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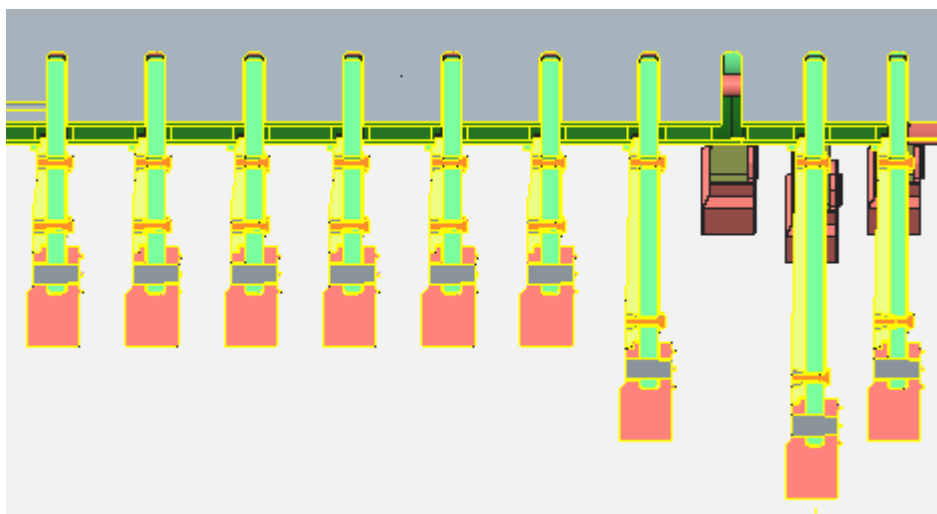
Dismantling of beater head and beater arm protection:

1. Remove the locking piece of the beater head bolt, dismantling of the beater head bolt.
2. Unbolt the fixing screws of the beater arm protection, dismantling of the beater arm protection.

The erection will be carried out in reverse order.

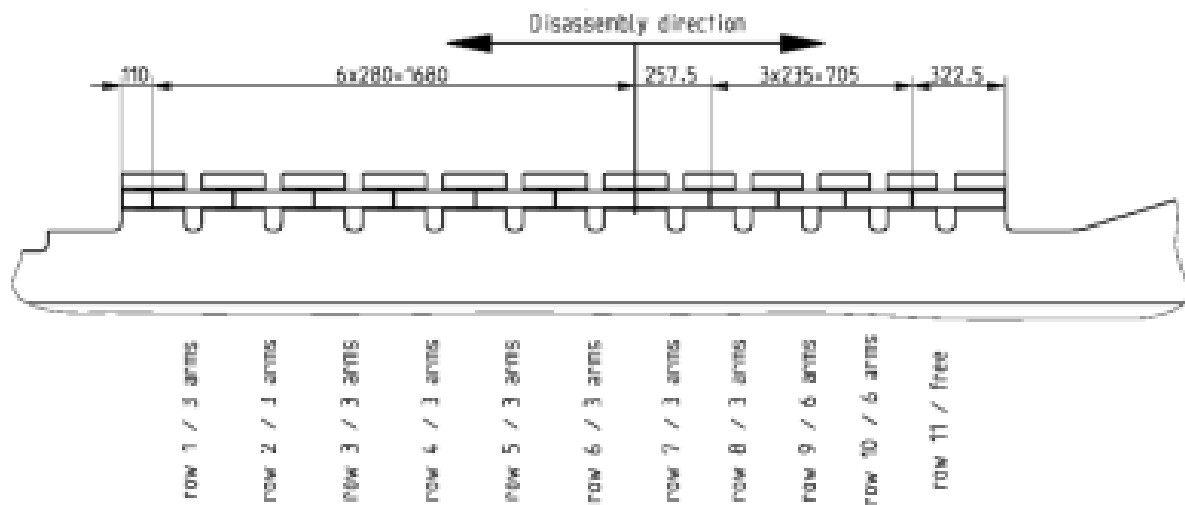
Sequence of assembly / disassembly:

(due to limited space conditions)



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Arrangement of hub bolts



Preliminaries, loose bearing side Preliminaries, fixed bearing side

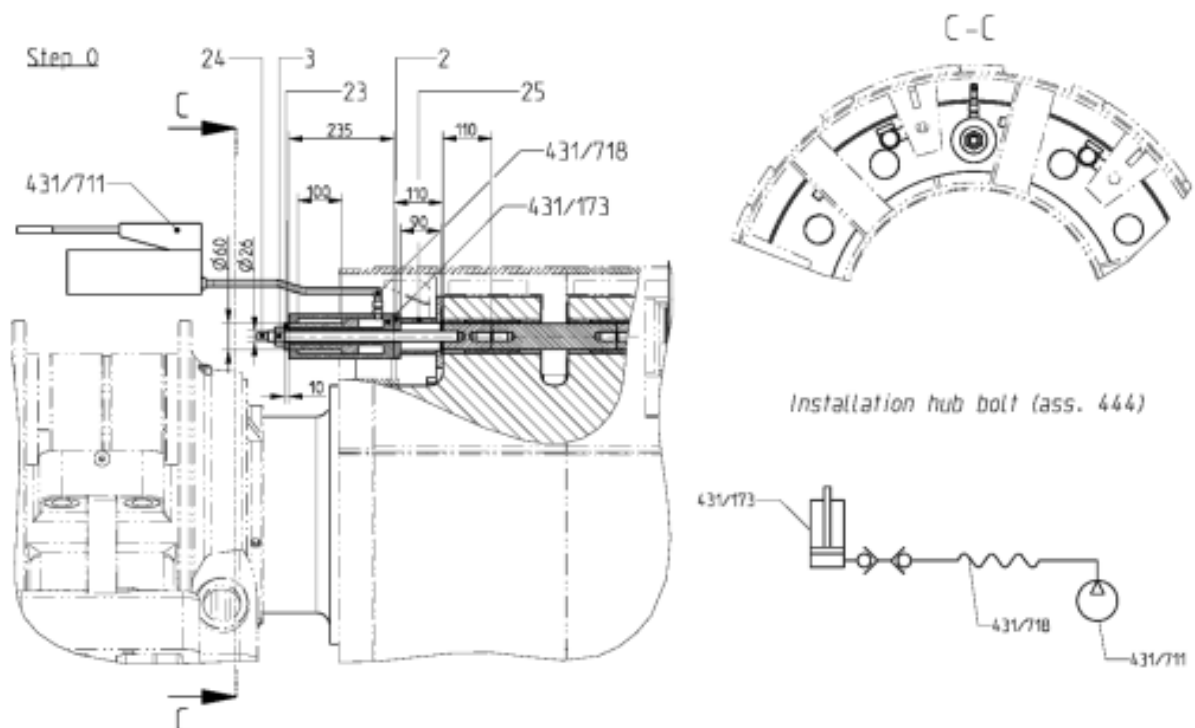
- 1.) Loosen the screws of the hub bolt locking device.
- 2.) Turn the locking device and set the hub bolts free
- 3.) Go on with step 0 or step 1

- 1.) Flame cut 2 disassembly hatches with the dimensions above shown.
- 3.) Turn the locking device and set the bolts free

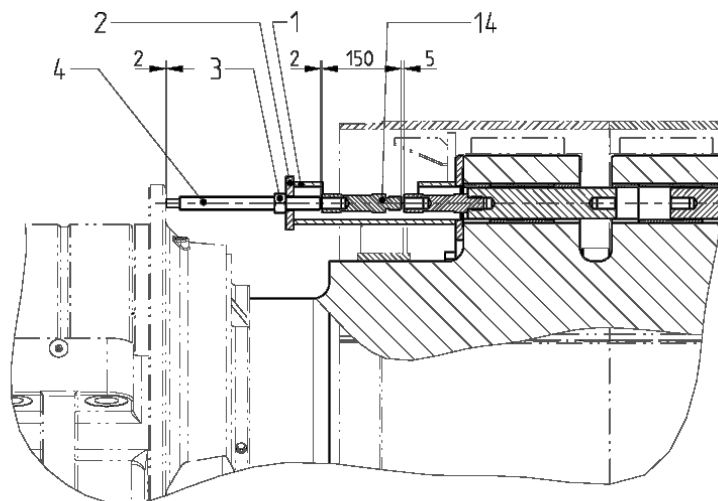
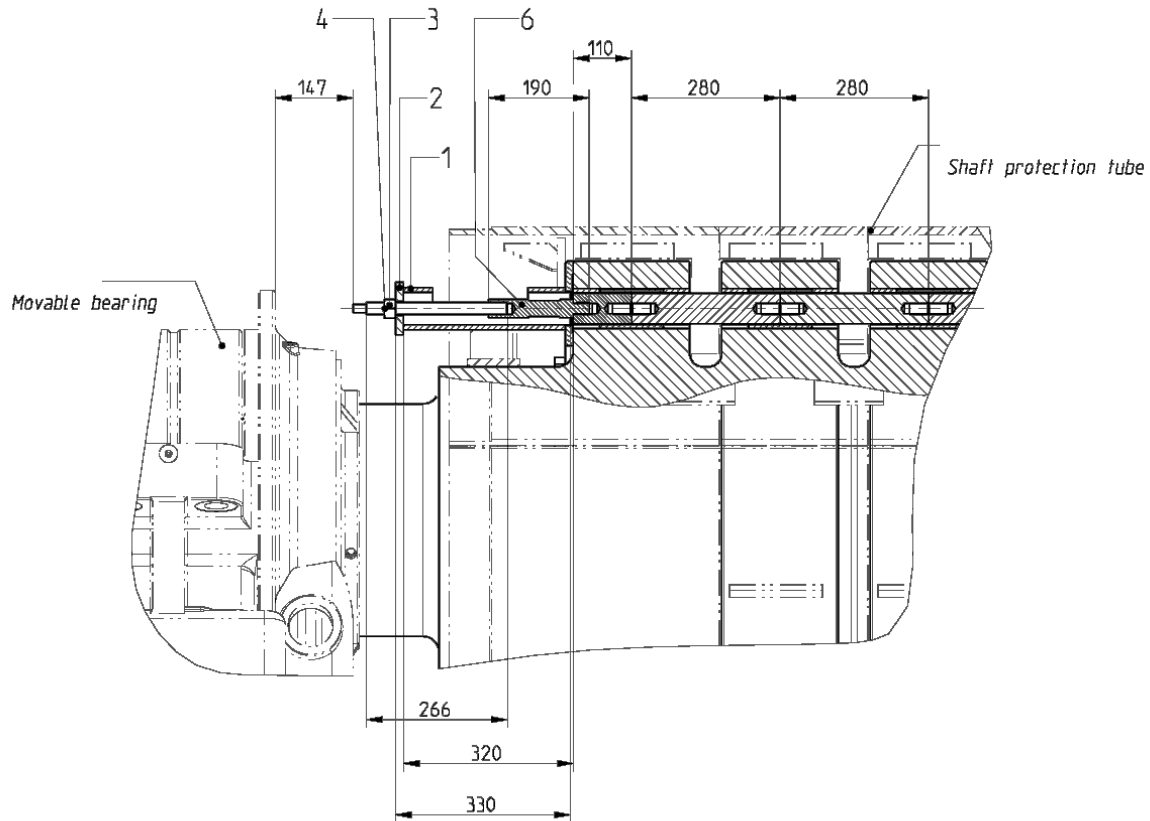
- 2.) Loosen the screws of the hub bolt locking device.
- 4.) Go on with step 11.2 when possible otherwise remove the hub bolts from movable bearing side

Disassembly of hub bolts for beater arm change


- Step 0 : loosen the hub bolts (if necessary)
Step 1. 1-6: disassembly row 1-6
Step 11. 1-2: disassembly row 7-11



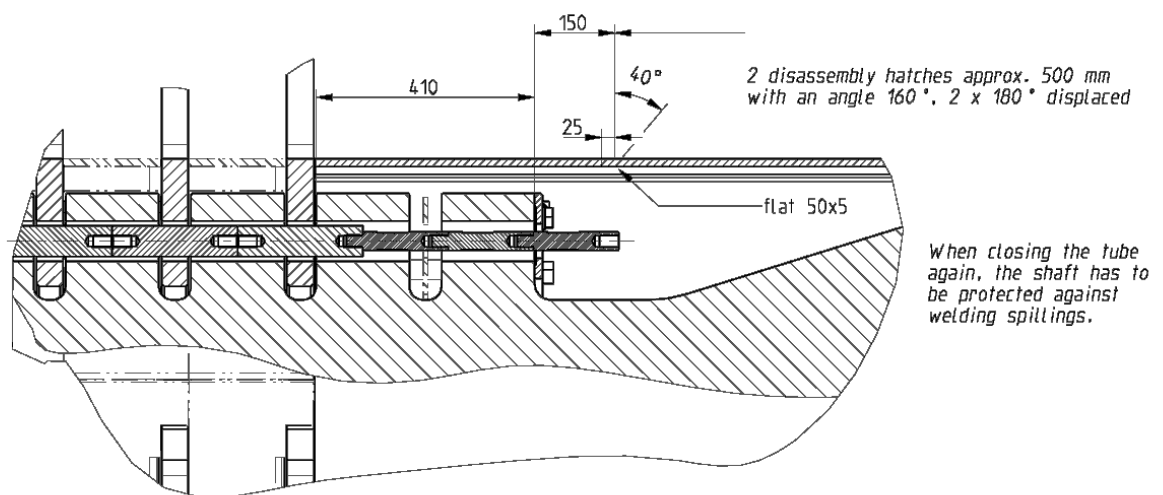
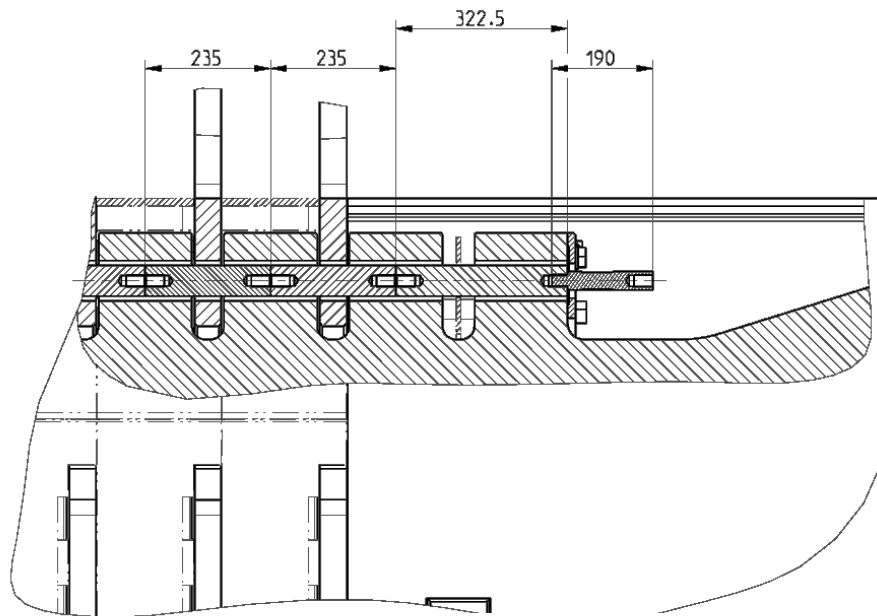
1) Disassembly on loose bearing side



More detailed information for disassembly of hub bolts see following drawings


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II) Disassembly on fixed bearing side



More detailed information for disassembly of hub bolts see following drawings:

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7.4.2 Replacement of the beater arms

Before dismantling the beater arms the movable and fixed bearing sided hub bolt protections have to be loosened and turned, so that the holes of the hub bolts in the shaft get free. On the fixed bearing side it is necessary to cut openings into the protection tube of the cone.

Then the hub bolts can be unplugged with help of hydraulic presses and threaded rods, if necessary. The beater arms can now be removed.

On refitting the beater arms, it has to be ensured that they are mounted opposite each other, with no difference in weight exceeding 0,05 kg.

Before refitting the hub bolts are to be cleaned and lubricated with Wolfrakote paste, thus facilitating removal at a later stage.



Please observe that all rotating parts have to be installed in pairs with defined differences in weight. These are defined in the balancing instructions

Dismantling of the beater arms


The following description refers to the drawing "Erection device for hub bolts".

- When dismantling, the beater arms are to be secured against falling out.
- Loose the screws of the hub bolt protection; turn the hub bolt protection, so that the holes of the hub bolts in the shaft get free.
- Screw the threaded bolt (item 4) in the first hub bolt; install high-pressure hoses (ass. 464, item 6) and square bar (item 1); screw hexagon nut item 3 onto the threaded bolt (item 4).
- Unplug the bolt by using the hydraulic press.
- Unplug the other bolts by using elongations with different lengths.
- Further procedure for eventually stucked bolts see drawing.

Assembly of the beater arms

- Place beater arms individually in position. Then push in the attendant hub bolts. Only put in hub bolts coated with Wolfrakote.
- On finishing installation, turn the hub bolt protection into position, that the holes in the shaft are covered. Then paste the screws with Wolfrakote and tighten.
- Weld in the cut pieces of the shaft protection for the cone.

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Uniform weights of the beater arms, beater arm protectors and beater heads

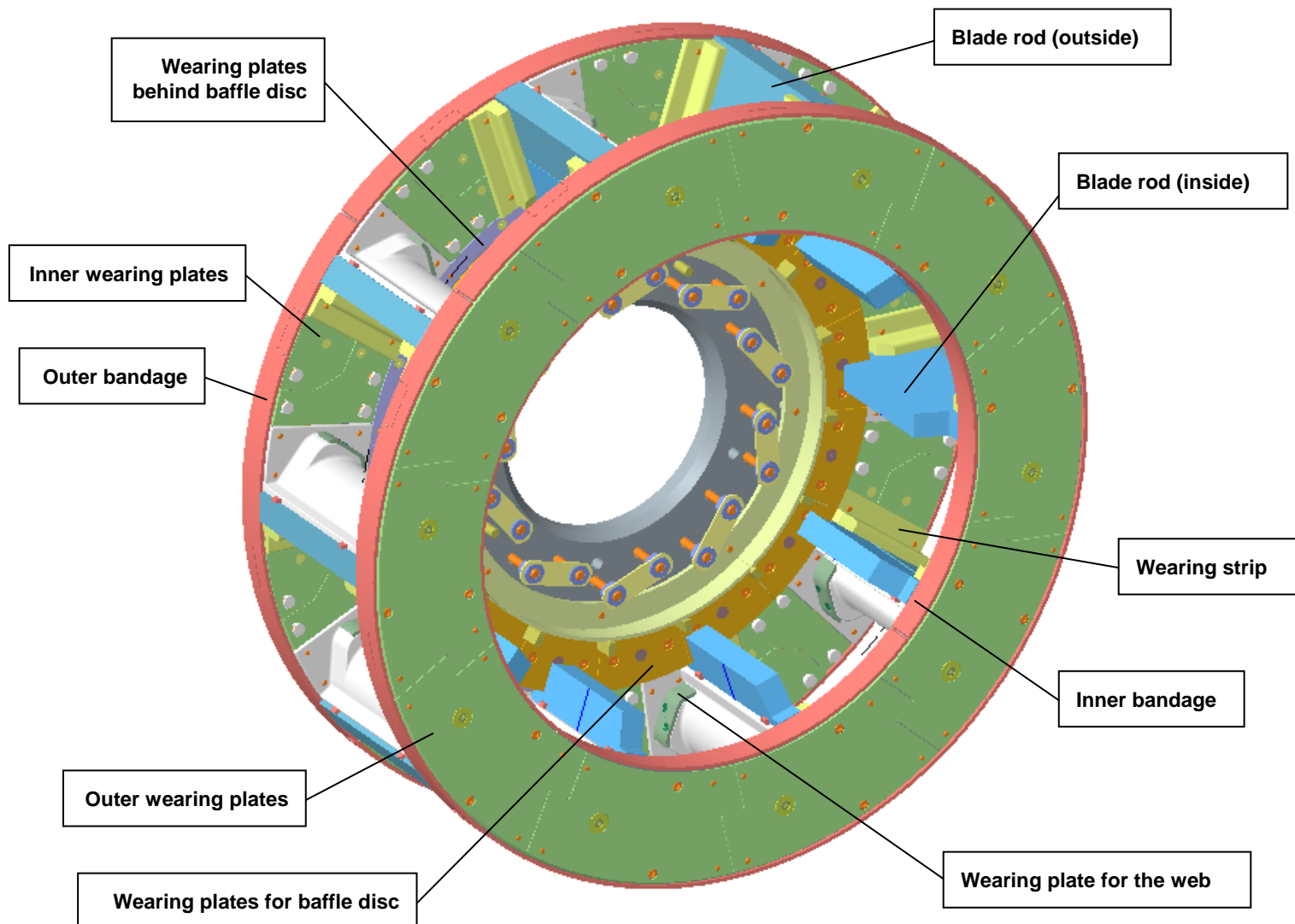
- In line with the peripheral speed, the beater element is subjected to considerable centrifugal forces. To ensure smooth rotor running it is therefore necessary that evenly weighted beater heads lying radially opposite each other together with beater arms and beater arm protectors of the same weight are fitted at all times. For this reason, the weight differences of the components are to be respected.
- This applies not only for complete re-fitting but also for part replacement or the slinging of heads and arms. The uniform weight installation of beaters lying opposite each other ensures practically perfect rotor balancing.


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7.4.3 Fan wheel



1. Pulverizer ready for removing and installing work.
2. Fan housing door open.
3. Use the turning device for rotating the fan wheel slowly (see chapter 4.11.2 and 7.8).



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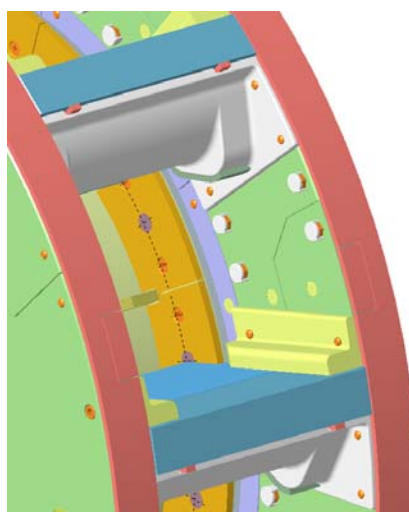
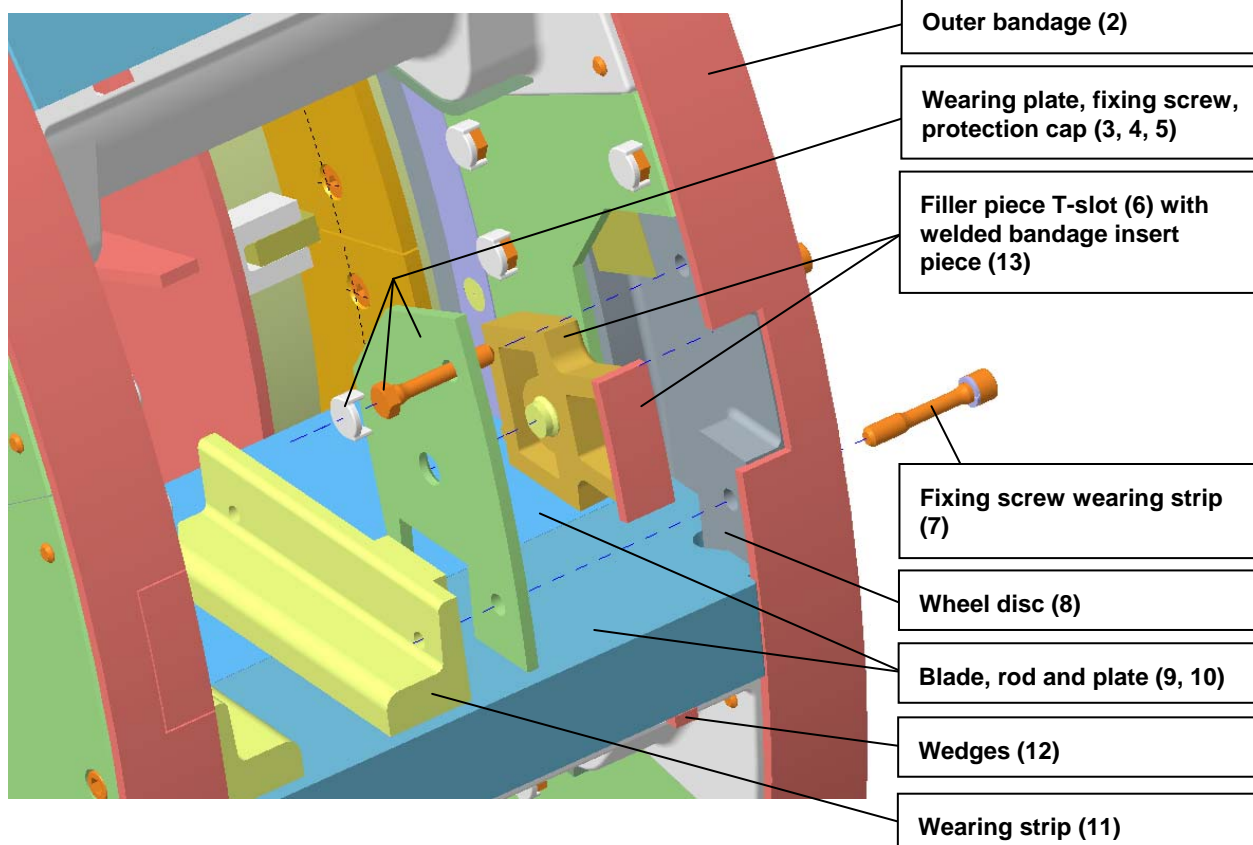


Caution

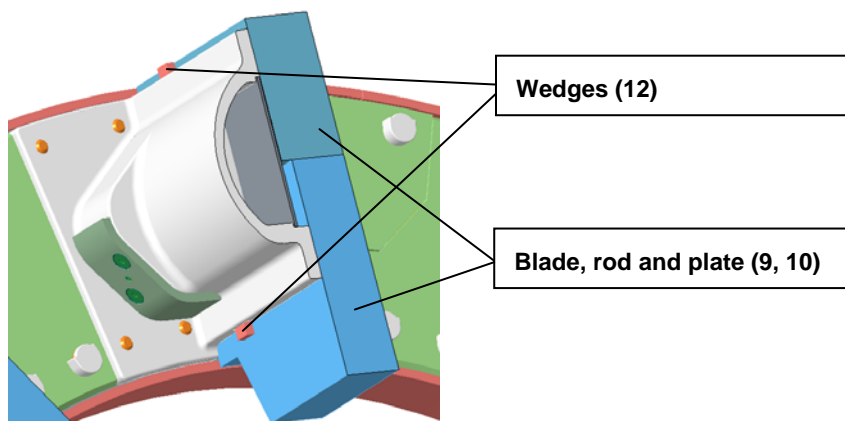
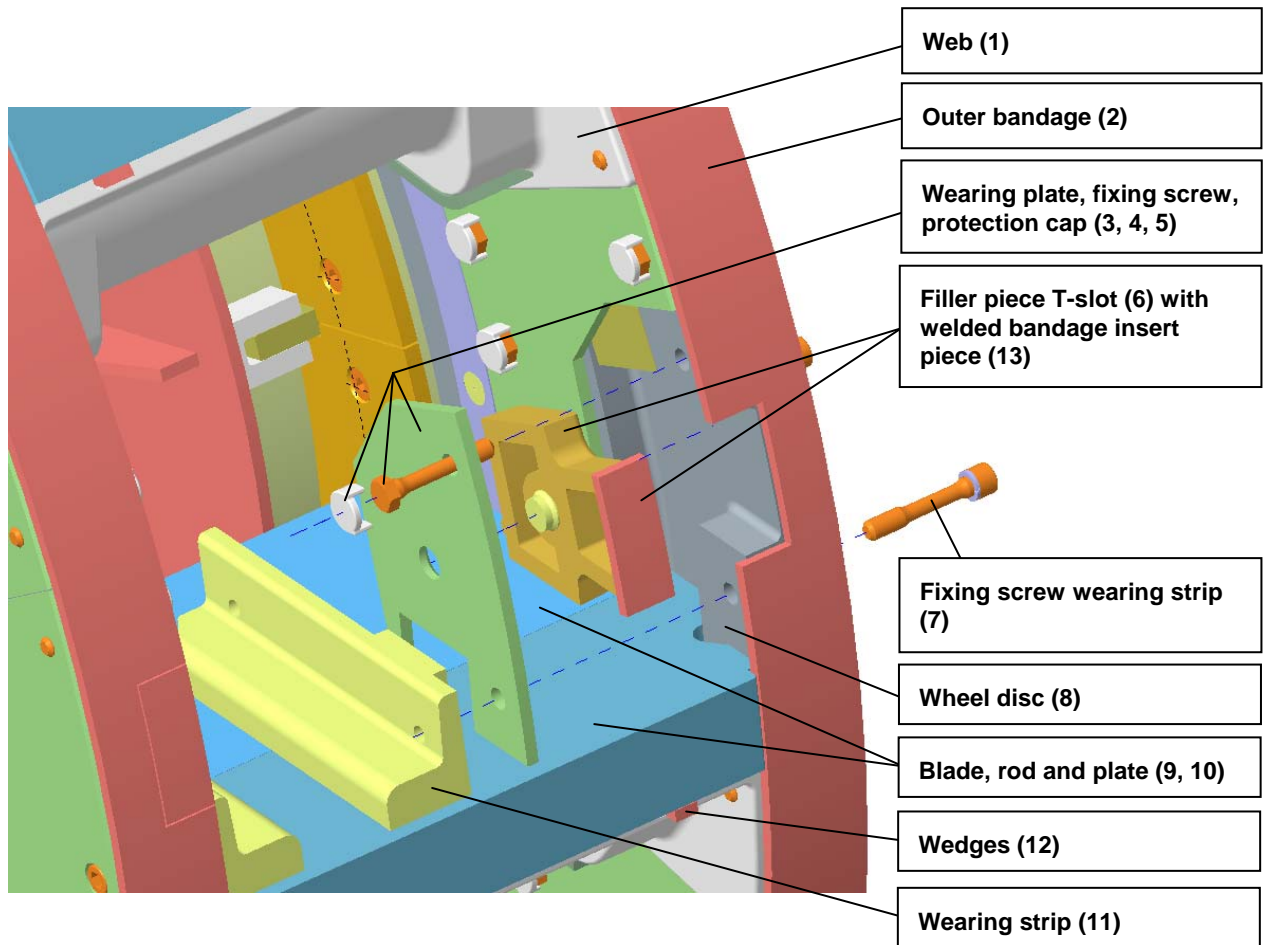
Hazard


**Keep
hands clear**

Preparation work for blade and rod exchange



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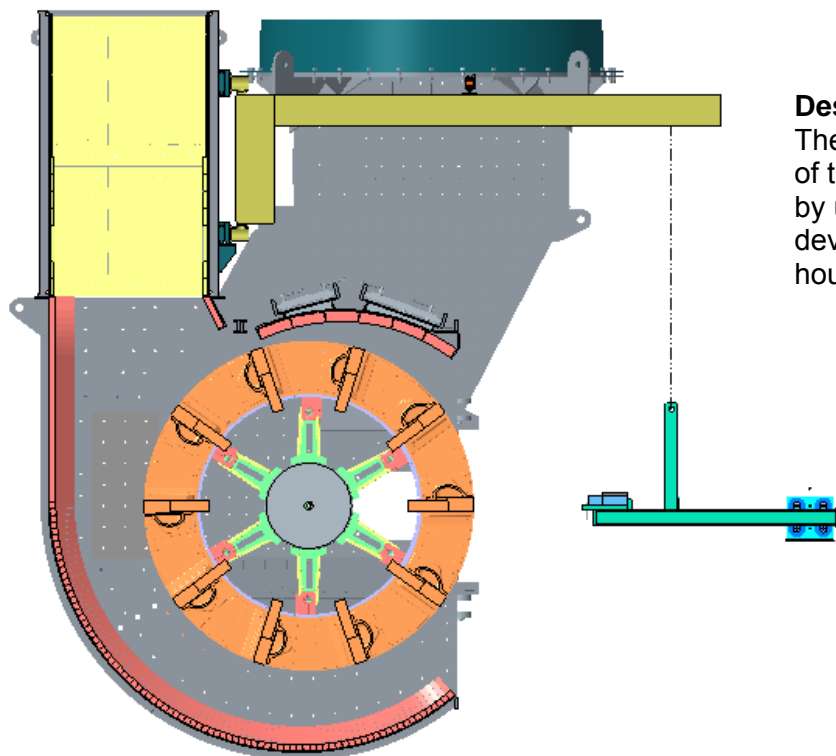
Description of preparation work

- Turning the wheel into disassembly position
- Securing of the blade rod
- Loosening the fixing screws (7) of the wearing strip and disassembly of the wearing strip
- Cutting of the weld seam between bandage (2) and bandage insert piece (13)
- Cutting of the weld seam between bandage (2) and wearing strip (11)
- Removing of protection caps (5) and loosening of the fixing screws (4), disassembly of the wearing plate
- Removal of the filler piece (6) in the T-slot
- Uptake of the blade rod (9) with a fork lift or the special tool
- Uptake of the blade plate (10) with a fork lift or the special tool

The erection of the new blades takes place in reverse order!

- Wedges (12) tack welded with rod and plate.
Both blade parts in operating position: Rod in contact with outer surface of the T-slot, plate in contact with the rod.


Blade exchange (Version 1)



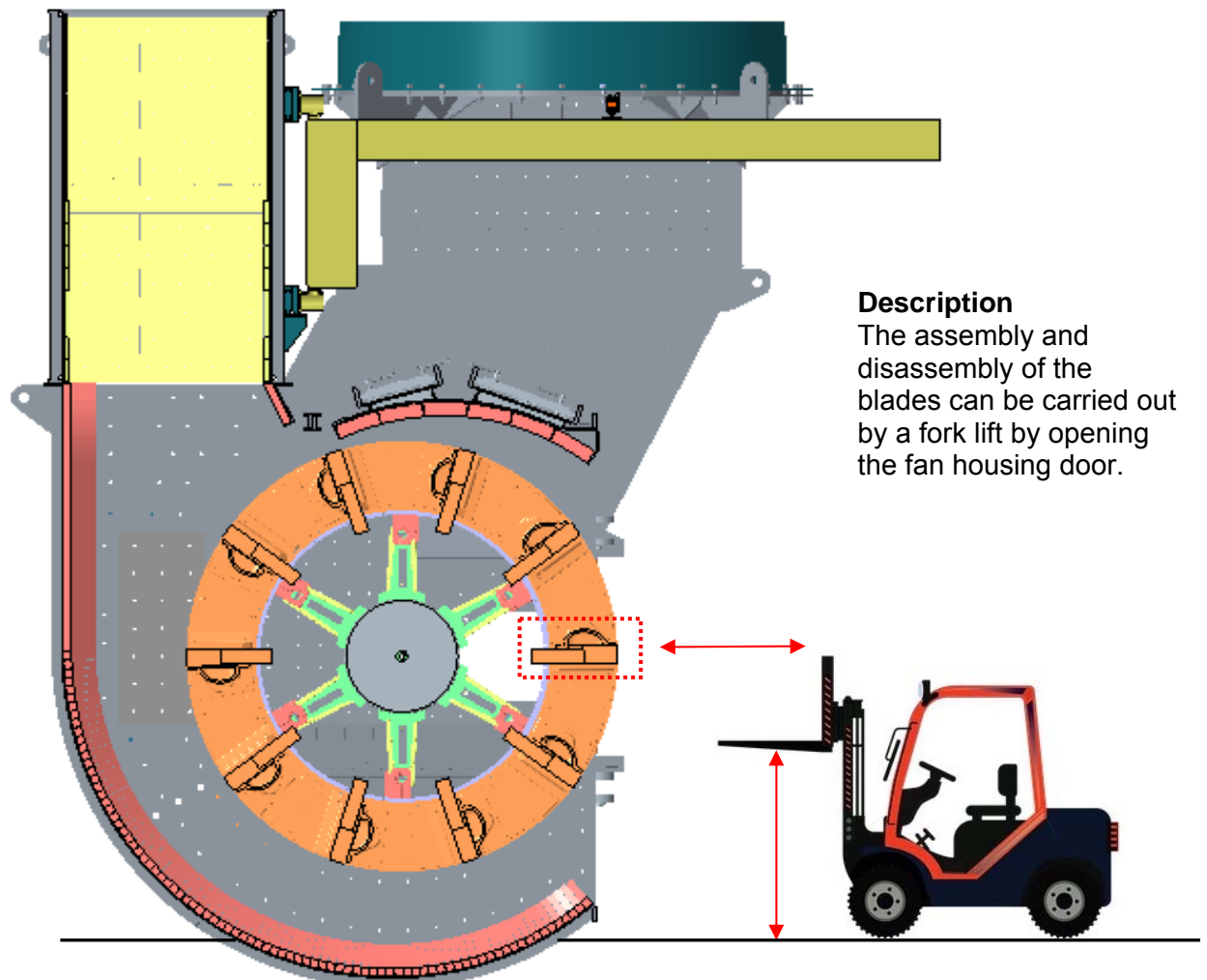
Description

The assembly and disassembly of the blades can be carried out by using the blade maintenance device by opening the fan housing door.

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Blade exchange (Version 2)



Smooth running of the newly fitted out mill depends on blades and wear strips of the same weight being fitted in each instance radially opposite each other.


The fitting weight is to be recorded in writing. A blade assembly consists of: 1 (one) blade rod and 1 (one) blade plate.

The blades arranged opposite each other in the blade wheel are only to have a maximum difference in weight of 0.50 kg. In manufacture and/or selection for equipping a wheel, it has to be seen to that the difference in weight between the lightest and the heaviest blade is a maximum 5 kg.

Before dismantling, the worn rods and plates as well as their seats in the blade wheel are to be numbered consecutively, by means of figure stamps, beginning with 1.

The point of labelling the blades and their arrangement in the blade wheel is to be in a position, by making use of the wear picture at the blades, to carry out changes, if need be, to the beater arm grouping or to the blades themselves. After labelling, the wear strips and blades are dismantled.

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Caution

When changing the blades, the rotor is to be adequately secured against further turning after each change in position.

For safety reasons, only those blades lying opposite each other are to be changed, for instance 1-7; 2-8; 3-9; 4-10, 5-11 and 6-12!


The design of the turning device allows no other procedure.

The following description refers to the drawing "Fan wheel".

- Place the blade to be removed in a horizontal position (centre T groove in the "3 o'clock position")
- Support the blade with the blade removal device
- Unscrew the bolts (item 314/15) of the wear strip (item 314/7,8), remove wear strip
- Remove protection caps (item 314/20), loose screw (item 314/14) of wearing plate (Pos. 314/5,6), remove wearing plate
- Sever weld between binding (item 314/10) and the binding- part above the T- slot, remove spacer (item 311/3) of the T- slot
- Lower blade bar (item 315/1) to the extraction opening of the T-groove and remove
- Shift blade plate (item 315/2) radially outwards and similarly lower and remove it
- Fit new blades in the reverse order
- Firstly tighten the bolted connections to the specified pre-tensioning figures, then completely relieve of tension to be and bring up to the specified final figures
- Making use of the extraction opening, protect the longitudinal crack from premature wear at the shroud ring part with welding bead
- All screws and bolts are to be inserted with Wolfrakote
- To establish dependable service lives (wear), the running times of the wheel equipment must be precisely recorded. Offering invaluable assistance here are wear test templates (see chapter 6.7.5.1 and 6.7.5.2)

To be in a position to ascertain the wear in percentage terms, it is essential when re-equipping that the weights are recorded separately for blade bar and blade plate and compared, after replacement, with those of the worn bars and plates. On re-ordering wear material, attention is to be paid, as regards the delivery times, to the prescribed quality and checking conditions for wear parts.

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7.4.4 Torch / welding work at the shaft protection tube

No welding, burning or partial heating up is to be undertaken on the shafts.

Should torch or welding work be required at the shaft protector, then protective measures are to be taken; e.g. by placing heat resistant plates underneath or working with a cutting-off wheel instead of welding torches. If burning, welding or uncontrolled grinding damage is present at the shaft, then it is to be methodically reamed or ground with emery paper. In so doing, there must be no trace of notches or edges in the marginal or transitional zones. The following is to be carried out afterwards:

- a) surface crack detection test and
- b) an etching using nitric acid of a 5% alcoholic content for revealing hardness zones.

If required, corrective work is to be carried out. The testing location is fine when there are no signs appearing either under a) or b). At any rate, it is highly recommended that information on the extent of damage is sent to the mill manufacturer.

7.4.5 Bandages

Should it be necessary to change the blade wheel bindings, then the following installation instruction is to be heeded.

- Grind down welds of the existing bandage. Separate bandage at the joint and remove from the wheel.




Caution

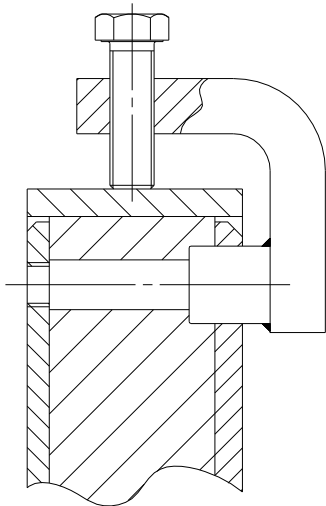
Keep heat down as low as possible penetrating into the wheel from grinding.

- Mount 2 bandage parts, in each instance, onto the wheel disks at the housing door and clamp down at the periphery using clamping elements (Sketch 1).
- Mark off T-grooves (Sketch 2).
- Again remove bandage parts and eliminate marked-off points by burning. Cleanly grind interfaces.
- Clamp bandage parts back onto the wheel disks and tack weld on both sides. Preheat tack-weld points to 150°C.
- The parts eroded by heat are to be welded onto the spacers.

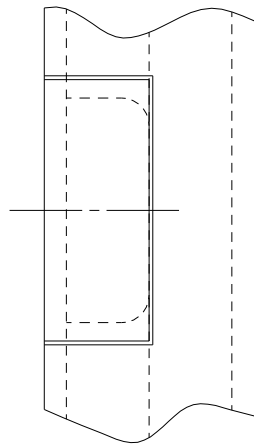
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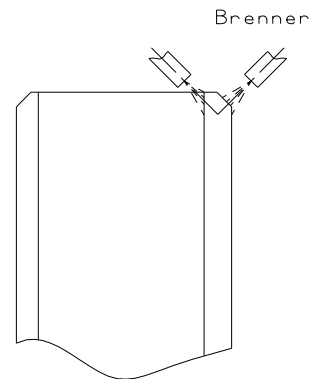
- Procedure with the other shroud ring parts is to be undertaken according to step 2-6. Adjustment is to be made to the welding joint, according to Item 1 in the welding procedure sheet.
- Turn blade wheel and use 2 shower-type burners to slowly heat up the area to be welded to around 200°C (Sketch 3). Weld tacked bandage alternately (Welding procedure sheet Items 2). Re-heat, if necessary.
- Weld the bandage parts one to the other (Welding procedure sheet Item 1). Fix runoff plates on both sides.
- 100% crack detection test of the welds after dye penetrant test. To be in a position to ascertain the wear in percentage terms, it is essential when re-equipping that the weights are recorded separately for blade bar and blade plate and compared, after replacement, with those of the worn bars and plates. On re-ordering wear material, attention is to be paid, as regards the delivery times, to the prescribed quality and checking conditions for wear parts.



Skizze/ sketch 1




Skizze/ sketch 2

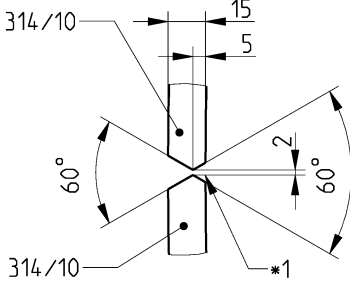
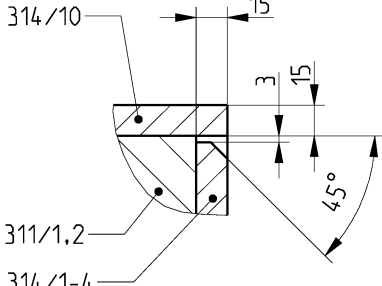


Skizze/ sketch 3


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7.4.6 Bandage welding procedure chart

<i>Remarks</i>		*1 <i>Insert protection before welding</i> *2 111: Ø 3.25, Ø 4.00 135: Ø 1.00, Ø 1.20	*2 111: Ø 3.25, Ø 4.00 135: Ø 1.00, Ø 1.20
<i>Non-destructive testing</i>		<i>Visual 100% / FE 100%</i>	<i>Visual 100% / FE 100%</i>
<i>Stress-relief annealing</i>		/	/
<i>Preheating / Max. working temp.</i>		100-150 °C max. 150 °C	100-150 °C max. 150 °C
<i>Welding procedure</i>	cm/min		
	Volt	111: nach/acc. Ø 135: 26 - 30 V	111: nach/acc. Ø 135: 26 - 30 V
	Ampere	Ø 3.25: 90 - 130 A Ø 4.00: 130 - 170 A Ø 1.00: 180 - 250 A Ø 1.20: 180 - 250 A	Ø 3.25: 90 - 130 A Ø 4.00: 130 - 170 A Ø 1.00: 180 - 250 A Ø 1.20: 180 - 250 A
<i>Filler material</i>	<i>Top layers</i>	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2
	<i>Fill layers</i>	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2
	<i>Root layers</i>	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2	111: DIN 1913- EMO B20+ 135: DIN 8559- SG-MO *2
<i>Welding procedure</i>	<i>Top layers</i>	111 135	111 135
	<i>Fill layers</i>	111 135	111 135
	<i>Root layers</i>	<u>111</u> 135	<u>111</u> 135
<i>Material combination</i>		1.5415 / 1.5415	1.5415 / 1.5415
<i>Evaluation</i> DIN EN ISO 5817		B	B
<i>Thickness</i>		15 / 15	15 / 15
<i>Drawing- item</i>		10 / 10	10 / 1,2,3,4
<i>Fan wheel bandage</i>	<i>Weld joint sketch</i>		
	<i>Sequence number</i>	I	II

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7.5 Rotor unit disassembly and assembly

A complete description regarding disassembly and assembly rotor unit see chapter 7.3.

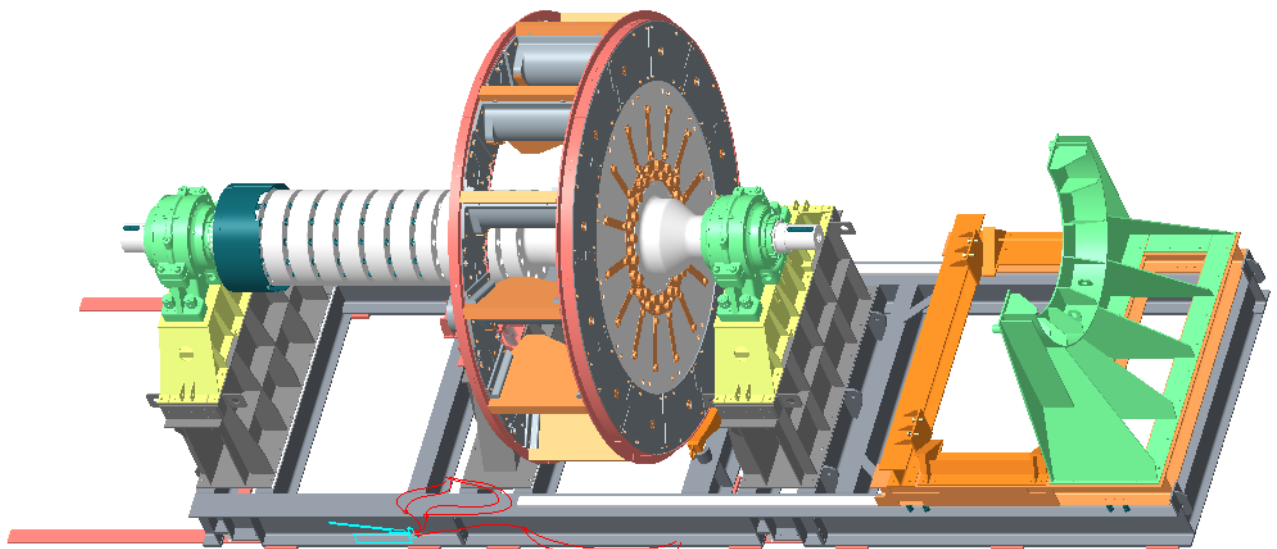
7.5.1 Moving the rotor onto the rotor transport truck



- **Caution**
- Hazard**
- Keep hands clear**
- Danger of falling objects**


Before the first installation of the rotor was the rotor delivered on a transport frame ready for insertion into the mill.

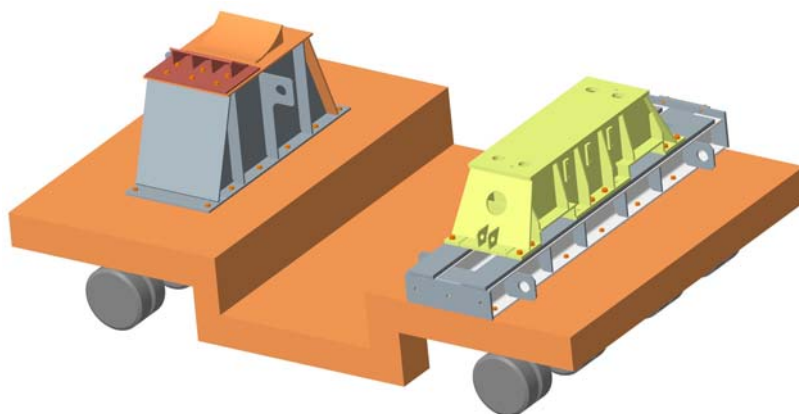
For transport to and installation into the mill, it is necessary to bring the rotor transport carriage with the associated structures next to the transport frame in position.



Transport frame

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Rotor transport truck with superstructure




Example for lifting the rotor unit

Then the rotor is to be lowered by crane on the rotor transport carriage. The rotor must be secured for transport that means the fixed bearing frame is bolted to the frame of the car and the insert piece of the support bracket in the lane area is installed.

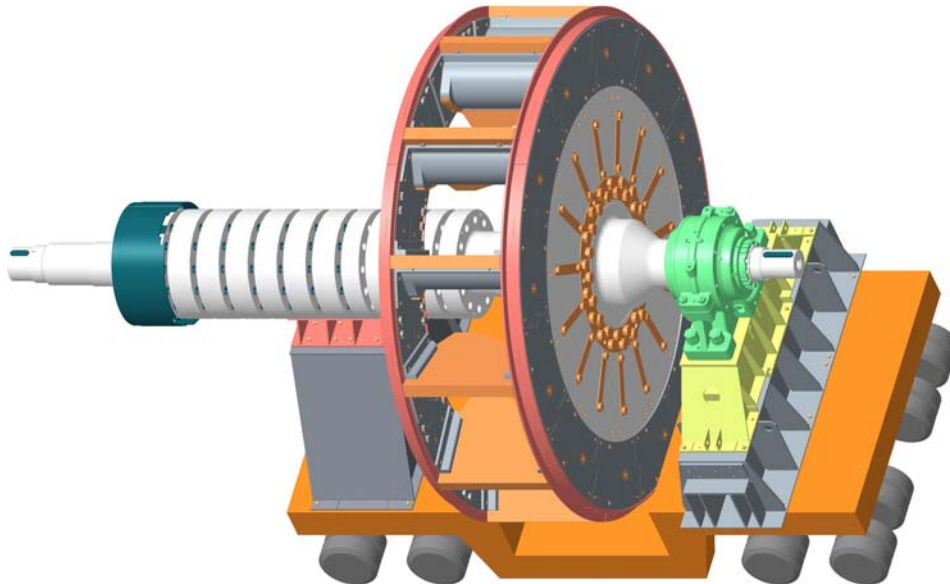
The loose bearing support has to be mounted.

For the transport of the rotor the safety instructions from the manufacturer of the rotor transport truck and the max. allowable speed have to be strictly observed. During the transportation the fan wheel has to be wedged into the intake of the truck to avoid lateral force to the fixed bearing.

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Rotor transport truck with rotor unit



7.5.2 Assembly of the rotor into the mill

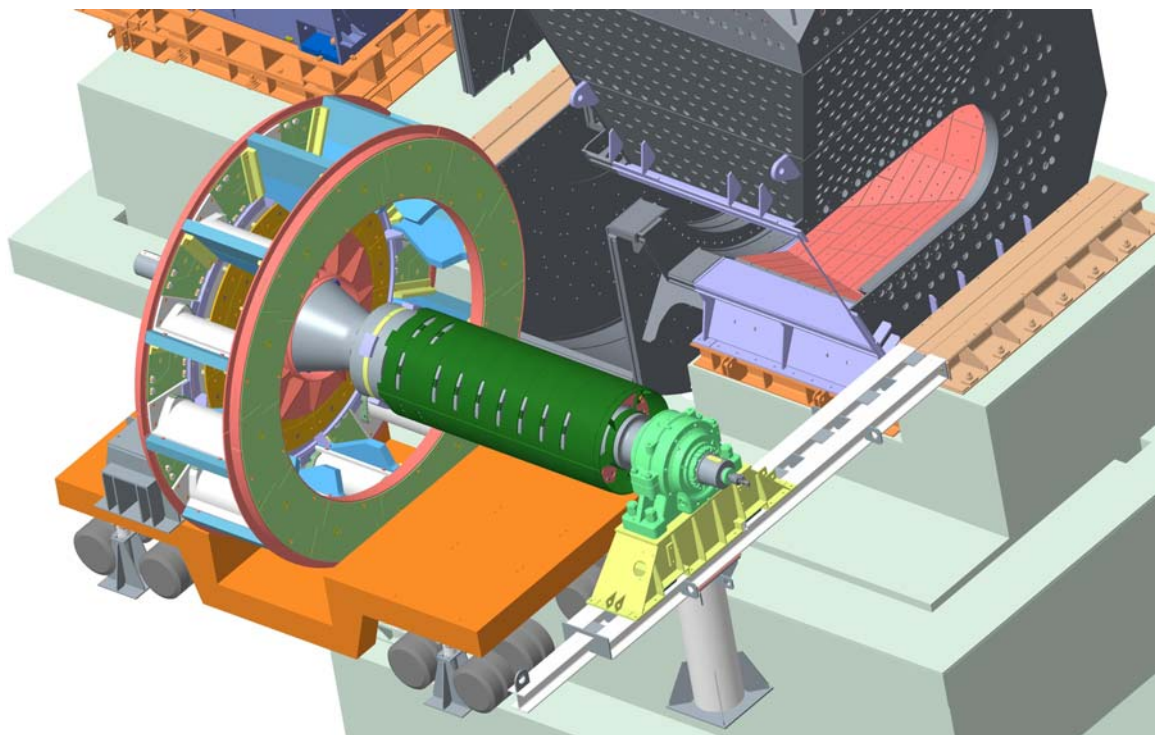
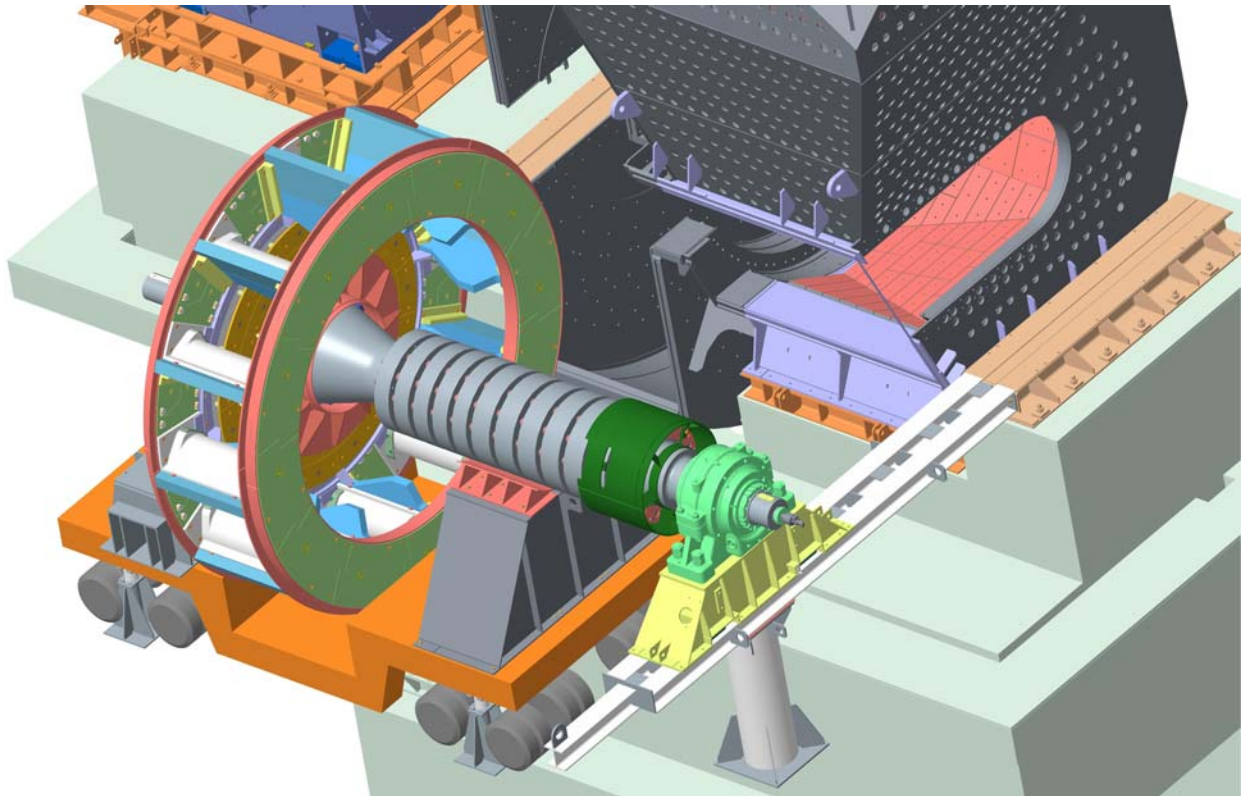
The rotor transport truck has to be placed and aligned in front of the mill acc. to drawing „Rotor installation“. Foundation frames and housings are mounted with exception of doors, intermediate piece and lateral insert pieces. The supports and the connecting beams are, as mentioned above drawing shown to assemble. The procedure is described for the disassembly. The steps for the assembly are opposite analogue.


Before retracting the rotor into the mill, install the protective tube in the lane area. To do this, pull the rotor in the direction of the mill or disassemble the support on the rotor transport carriage. The installation of the shaft protection tube in the beater section area starts from the movable bearing side. First of all, the split rings are mounted over the lanes 1-4. Then mount the supports and fillers in lane 5. For this purpose, the hub bolts from the fixed bearing side have to be installed in lane 5.

The hub bolt bores must then be closed using the hub bolt locking device. The half shells can then be mounted over the shaft cone.

After, by using cable pulls, the rotor was moved into the mill, the roller carriages have to be removed. Then the rotor has to be aligned, screwed and pinned with the foundation frame.

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7.5.3 Check measurements

Check measurements - with the rotor transported into place - are to be carried out together with measurement of the rotor, using shaft spirit level. Each measurement is to be accompanied with a check of the spirit level by turning it through 180°.

(Precise alignment according to the dimensions of the workshop written record).

7.5.3.1 Rotor shaft

The position of the tapered groove laid down in the manufacturing check sheet is at the top. The coupling seat represents the fixed bearing side monitoring point for the spirit level. The testing surfaces are to be cleaned of corrosion proofing and any rust and prepared with the finest emery paper for measurement analysis.

7.5.3.2 Movable and fixed bearing support

The measuring points are the 4 corners directly next to the bearing bases (in longitudinal and transverse direction). The measuring points are prepared as described under Item 7.5.3.1.

7.5.3.3 Bearings


Verification into the right-angled position of the bearing housing by measurement of the gap between housing and labyrinth ring at 4 locations, displaced through 90° in each instance. A feeler gauge is used for measuring purposes.

At the loose bearing housing, a check is to be made on the rebound stated in the drawing of the labyrinth ring to the bearing housing. This is important in view of the expansion of the shaft during operations. Testing is done with feeler gauge and capillary ruler.



Caution

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The rotor shaft sags from its intrinsic weight. The shaft is on the level when there is no difference in the level displacement on the loose and fixed bearing sides, although opposed. For the same reason, the gap is wider at the top on the mill side and at the bottom on the external side.

The values of alignment are to be entered in the written record.

7.6 Replacement of self-aligning roller bearings (fixed and loose bearing side)

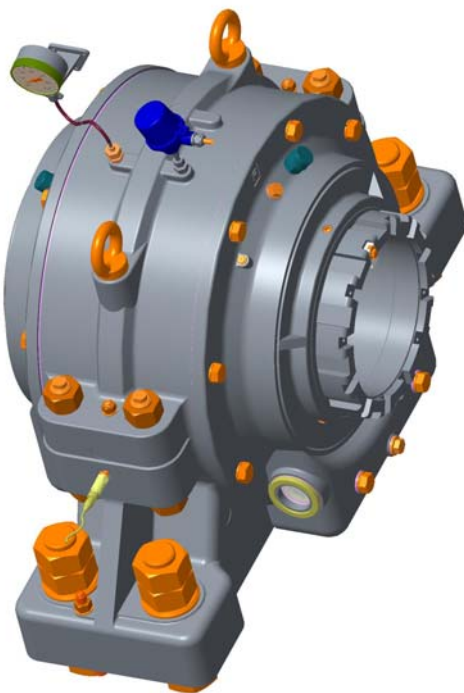
Pulverizer ready for removing and installing work

This chapter describes the bearing assembly




Function and operational safety are largely dependent on:

- The dimensional stability/condition of the reused parts
- Cleanliness
- Correct assembly
- All bearing seats, bolts and seals are fitted with the addition of Wolfrakote paste



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7.6.1 Prior to fitting

The self-aligning roller bearings are to be kept in a dry, dust-free room and are not to be unpacked prior to fitting. During fitting, care is to be taken to see that they are protected from any kind of fouling due to dust, sand, metal chips, water and the like. Absolute cleanliness is to prevail where the bearings are put down prior to fitting. Should the installation work be interrupted, then the bearings are to be re-packed and covered. Using cleaning wool to remove some dirt on the outside of the bearing cannot be tolerated. What is to be used is a non-fibrous, clean cloth. If penetration of the dirt into the bearing is suspected for whatever reason, then it has to be rinsed out using a cold cleaner and, if not to be immediately fitted, is to be oiled with roller bearing oil. Without aids which are available to the roller bearing producer, it is difficult to thoroughly wash and rinse out large bearings. Therefore work should proceed in such a manner that there is no necessity for rinsing. It is also important to make sure that the hemp ropes used to lift the bearings are not oily and dirty.




Caution

Given any cleaning or during a check, on no account is the internal ring to the outer ring to be axially twisted. It must be possible at all times to read the markings of the inner and outer ring face sides from the large diameter of the tapered bearing bore holes.

For all measurements, it is imperative that the adjusting spring groove marked in the installation instructions or in the fabrication check sheets is at the top. Prior to fitting, the inside of the housing is to be checked as to moulding sand pressure states. All parts fitted with the bearing system, such as spacer bushings, pull-off sleeves etc. have to be completely clean. All surfaces have to concur with the drawing particulars and during erection are to be covered with an oily film.

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Westphal	Ulbrich	13.07.2020	—

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7.6.2 Fitting

Reference is made to following pages regarding the designation of the parts.

- 1 : labyrinth ring (mill-sided)
- 2 : distance bush (mill-sided)
- 3 : labyrinth cover (mill-sided)
- 4 : cover sealing (mill-sided)
- 5 : bearing housing (two-piece)
- 6 : bearing system
- 7 : withdrawal sleeve
- 8 : cover sealing (at shaft end)
- 9 : labyrinth cover (at shaft end)
- 10 : distance bush (at shaft end)
- 11 : labyrinth ring (at shaft end)
- 12 : tension nut
- 13 : locking piece

At first, there is to be ease of fitting of the pre-assembled units - labyrinth ring 1 with spacer bushing 2 - onto the shaft at ambient temperature. The spacer bushing is turned onto the shaft so that one of the fastening bolts of the labyrinth/spacer bushing unit is at the top (as an aid for determining the position when screwing on labyrinth ring 1 later for possible maintenance purposes). Then the outer groove of the labyrinth cover plate 3 is filled with grease.


The contact surfaces of the two housing halves must be coated with sealant, e.g. Hylomar SQ 32, before they are screwed together, if this has not been carried out ex works or if the housing halves are delivered loose to the site.

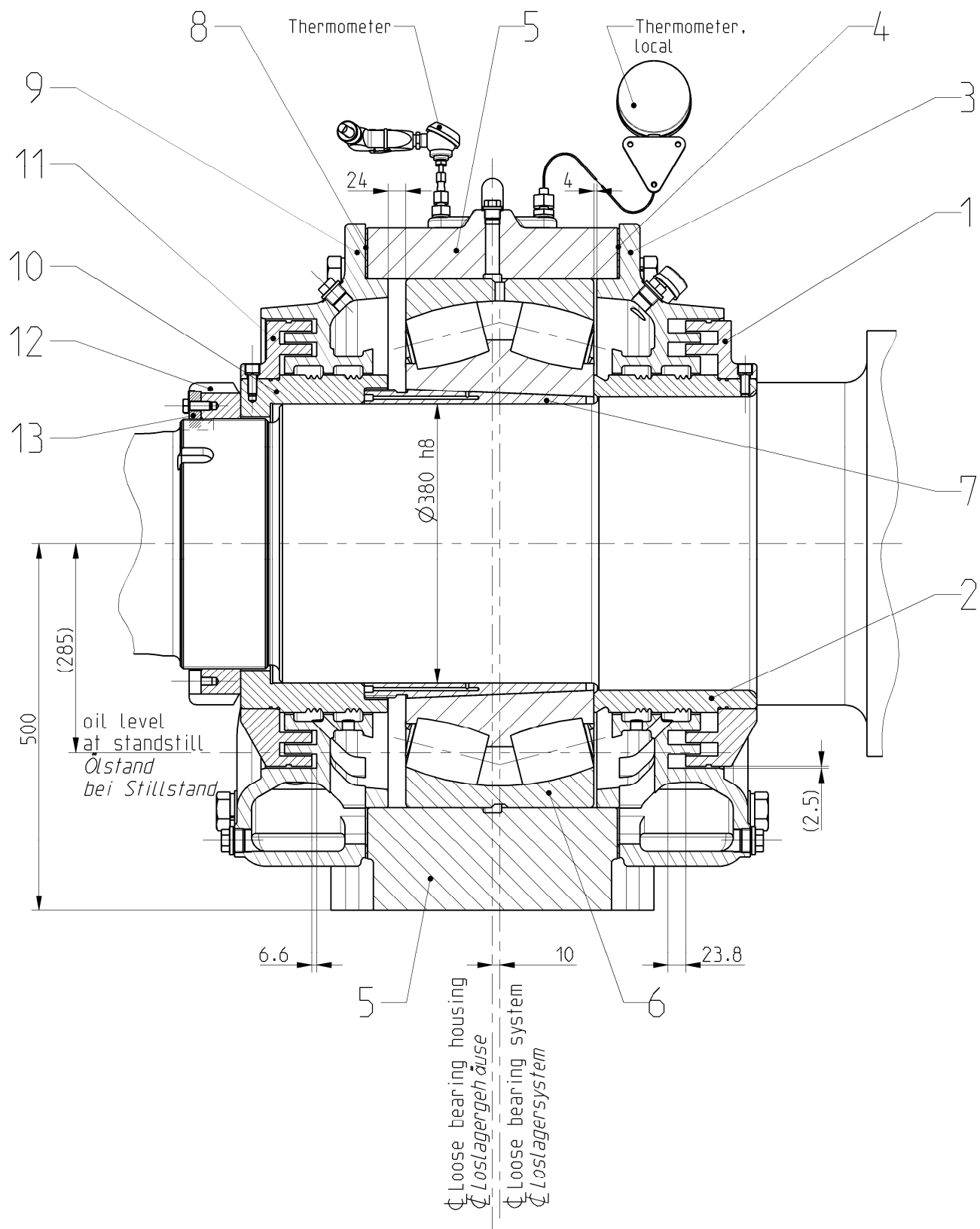
Following this, the pre-assembled unit - labyrinth cover 3, cover seal 4, bearing housing 5 and bearing system 6 - is placed over the shaft so that the large diameter of the tapered bearing system bore hole faces outwards. The inner ring of the bearing system has to be pressed firmly against the 1/2 unit.

There upon the pull-off sleeve 7 is manually pushed so far onto the shaft that the bearing system is centered. It should be made sure that there is no tilting of the slotted pull-off sleeve 7.

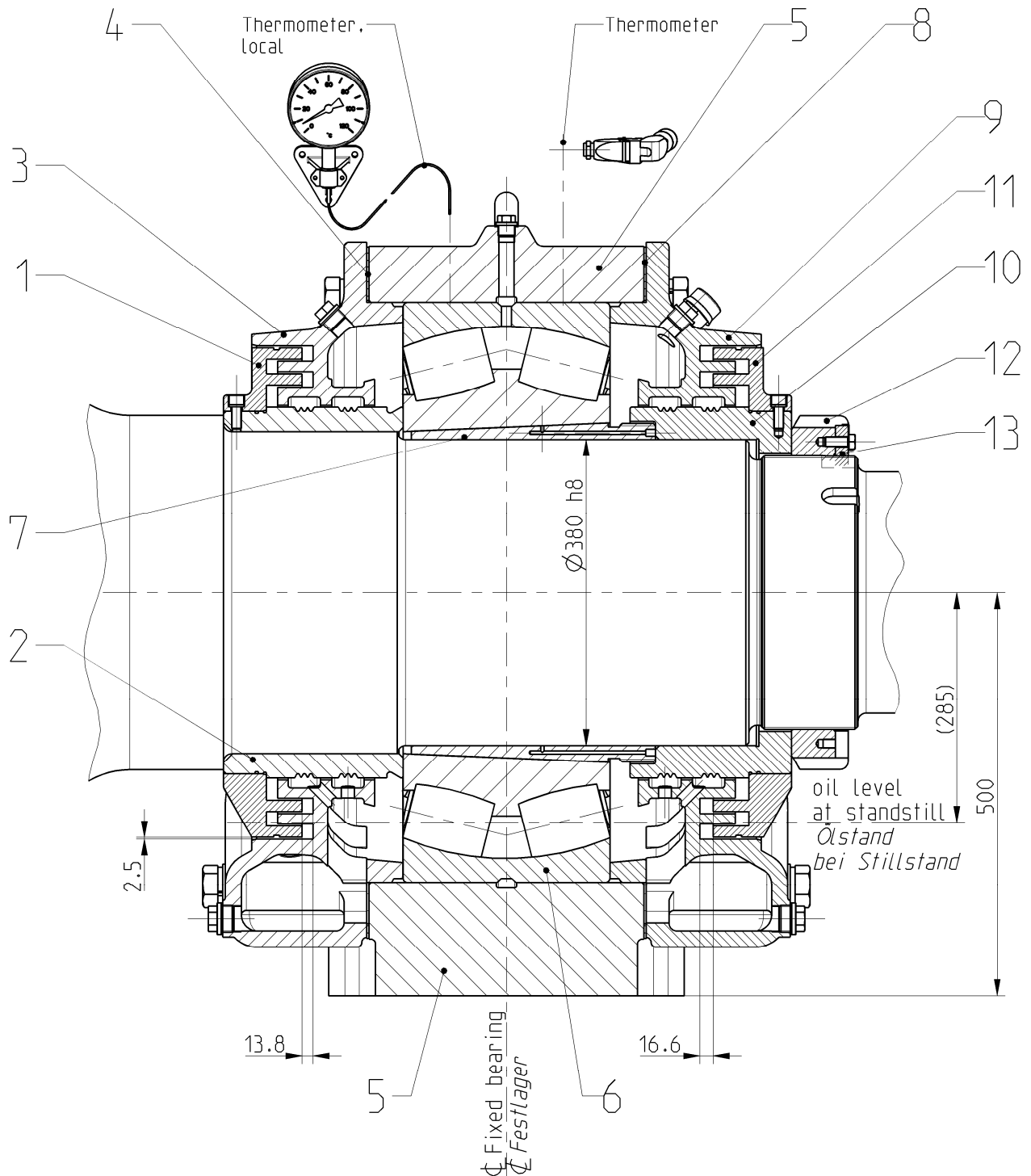
Given proper installation of all parts listed up to now, no movement of Pos. 1/2 should be possible by hand, either axially and radially.

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Prior to and during clamping and on measuring the radial clearance, it should be seen to that the rollers of both the roller rows of the bearing system are not staggered, so allowing measurements to be taken simultaneously on two rollers lying one behind the other. Moreover, the bearing inner ring and the bearing outer ring are, on no account, to be axially staggered. The front faces of both rings must be on a single plane. Measuring is done using feeler gauges, which with the bearing outer ring resting on top can be pushed through between the lower rollers and the bearing outer ring.

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7.6.3 Calibration and tightening the bearings



Caution

All test measurements are carried out on the freely suspended bearing.

The first thing is to gauge the start radial clearance as described above. Then the annular piston press (FAG) is to be screwed onto the pull-off bushing. The mounting bush is to be pressed, together with the shaft nut, against the annular piston press. HP flexible tubes connect the pull-off bushing with a universal gauge pressure press.

The tightening procedure begins by having oil compressed in both the bore holes of the pull-off bushing until it emerges along the whole extent between the fitting surfaces. To ensure when installing that the oil again runs off between the fitting surfaces, use should be made of an oil with a 300 mm²/s viscosity at operating temperature.

Compressing in oil allows a separating oil film to be created between shaft and bushing bore hole and bushing jacket surface and bearing bore hole - a film that considerably reduces the power required for installation.


The pull-off bushing has to be compressed into the bearing bore- hole at the same time as oil is pumped into the pull-off bushing.

Once the pull-off bushing has attained the envisaged position, the oil can flow off between the fitting surfaces and the erection nut can be undone.

A lowering of the oil pressure is to be awaited (roughly 3-5 min) before each check measurement.

8 - 10 minutes are to elapse before the final tension-relieving figure is measured.

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7.6.4 Provisions for ascertaining the final radial clearance

Self-aligning roller bearings of the C3 clearance class are deployed for the mill bearings

Example: DGS® 180.

Shaft-at loose bearing area:	380mm
Bearing designation:	23280-B-K-MB-56B-C3
(with pull-off bushing)	AH 3280 G-H
Bearing clearance before tensioning:	440 to 570 µm
Final radial play, MHPS-default, (*1):	190 to 330 µm
Relieving tension (decrease), (*2):	230 to 255 µm
Measured radial play	
prior to tightening:	0,505 mm
Radial clearance reduction:	- 0,245 mm
(Relieving tension values see *2)	
Aspired final radial clearance	260 µm \triangleq 245 µm reduction, \pm 10 µm)
Final radial clearance	_____
(target average value of *1):	0,260 mm



Caution


Tighten respectively measure when suspended!

Once the bearing has been tightened, the annular piston press and erection bushing are to be dismantled.

It has to be ensured that there is no slackening of the pull-off bushing when dismantling the clamping implements. Generally, there is no reason for fearing this could happen as there is a frictional fit between bearing bore hole, sleeve and shaft.

Then the cover seal 8 and labyrinth cover 9 are mounted and screwed down. The external groove of labyrinth cover 9 is filled with grease. Following on from this, the pre-assembled unit of leading distance sleeve 10 and labyrinth ring 11 are pushed onto the shaft. Secure the bearings with clamping nut 12 and fastening wedge 13.


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Check list of the DGS®-mill for the loose and fixed bearing			
Movable/Fixed bearing: FAG 23280-B-K-MB-56B-C3		Machine-no.:	KKS-no.:
Shaft-Ø: 380 mm / 380 mm	Month	Year:	Serial page no.:
I	2x daily at an interval of 12 hours: Oil level, oil temperature, vibrations , even running, running noise		

Day	Fixed bearing				Movable bearing			
	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								


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Day	Fixed bearing				Movable bearing			
	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

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Day	Fixed bearing				Movable bearing			
	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s	Time	Temp. °C Vibr. mm/s
26								
27								
28								
29								
30								
31								
II	Oil change carried out after the first 1000 wh				Lubricant type:		Date:.	Signature:
III	Oil check after another 1000 wh		Oil change Yes No		Lubricant type:		Date :	Signature:.
IV	Oil change after 4000wh		Oil change Yes No		Lubricant type:		Date:	Signature:
	Oil change after 8000wh		Oil change Yes No		Lubricant type:		Date:	Signature:
V	Grease filling in the labyrinths		First change after 1000 wh			Change after 4000 wh		
			Date:	Signature:	Date:	Signature:		

With this is to confirm the proper execution of the control list checks (chapter 5.6.6):

Date	Name	Signature	Remarks

7.6.5 Levelling of the drive section

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In consideration of the final level in operating condition, mill and motor are to align as follow.
Slopes of the shaft at loose and fixed bearing have to be measured before alignment of the mill drive.

Fixed bearing: NFB= 0,..... mm/m

Loose bearing: NLB= 0,..... mm/m

Distance center fixed bearing to the shaft end: 855 mm

Delta H1 center bearing to the shaft end due to bending of the shaft
 $\Delta H1 = NFB \times 0.855 \text{ m} = 0,.... \text{ mm}$

Value is reduced by approx. the half:
(relevant for the alignment) 0,.... Mm

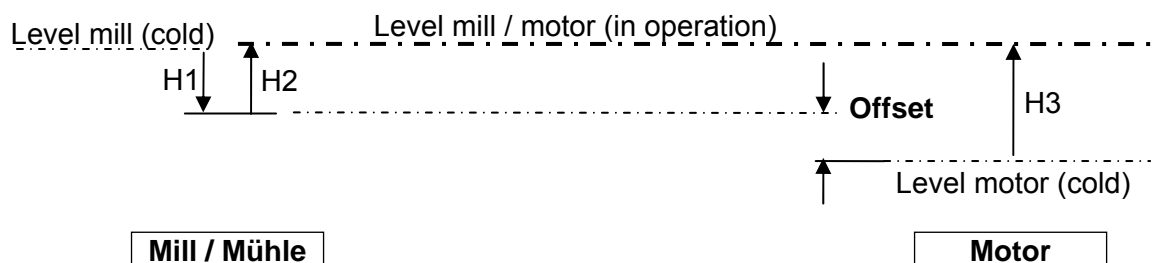
H2 = Distance from bottom foundation frame to center fixed bearing:
1.4 m

Expected Delta T
(Cold mill – In operation): approx. 30°C


Delta H2 (Cold mill – In operation) = $30/100 \times 1 \text{ mm/m} \times 1.4 \text{ m} = 0.42 \text{ mm}$

Delta H3 mill motor (in operation): 0.29 mm

Adjusted offset for the adjustment mill to
variable speed turbo coupling
Offset = - H1 + H2 – H3 = 0,....mm



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7.7 Motor, connecting coupling

As a matter of principle, attention is to be given to the erection, aligning and fitting instructions of the manufacturing companies. Once erection is over, our recommendation is to have an acceptance inspection carried out by the manufacturing companies.

Prior to erection of the above-indicated parts, an acceptance inspection of the foundation (inclusive of anchor holes) is to be jointly undertaken with site management.

Lay out and alignment of the lower motor frame, suspension of the anchor bolts and secures tightening. For height alignment, arrange jointly supplied base supports on both sides of each anchor bolt. Undertake casting after precise alignment.

Erection of the upper motor frame. Between upper and lower motor frame a fine alignment is possible. Therefore the upper motor frame can be lifted by hydraulic presses.

The mill-sided coupling segment and the motor- sided coupling segment are to be lifted onto the rotor shaft and motor shaft (if not already undertaken by the supplier of the motor), respectively.



Please note!

On no account are the couplings to be forced open as this would lead to damage to the motor or mill bearings. Further on the mounting instructions of the supplier (KWD) are strictly to be observed.

Tighten respectively measure when suspended!

Once the casting concrete has set, re-tighten anchor bolts, secure them with counter nuts and check on their alignment.

Above units are to be placed on the foundation frames and aligned, using the provided aligning material in keeping with the particulars of the drive line alignment.

Allowance is to be made here for the difference in the vertical extension under operating conditions.


The motor is aligned downstream of the mill-sided coupling segment with the aid of striking clocks in threes (2 radial, 1 radial). For alignment purposes, use is to be made of brass foils with a minimum 0.03 mm thickness. After alignment, pinning and bolting of the motor is to be undertaken on the foundation frame.

A written record is to be made of the aligning figures for the connecting coupling.

Pulverizer motor removal see also OTD, 50HFC10...80 AJ001.

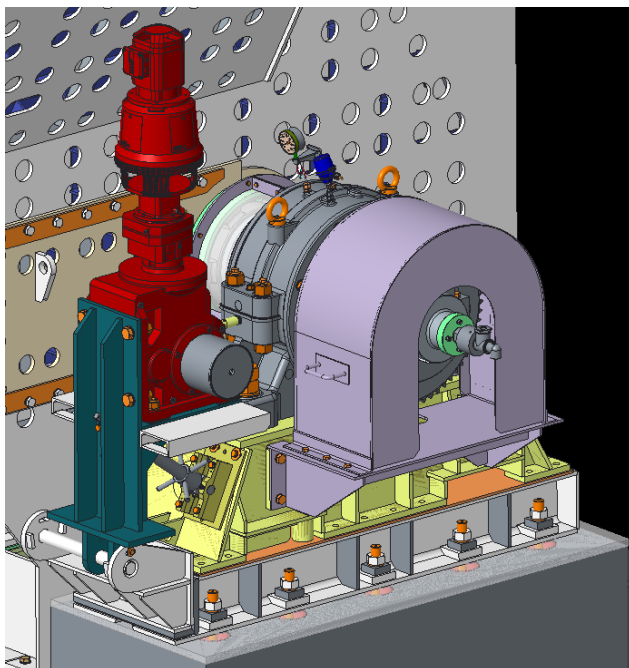
Pulverizer coupling removal see also OTD, 50HFC10...80 AJ001.

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7.8 Changing of the turning device from mill to mill

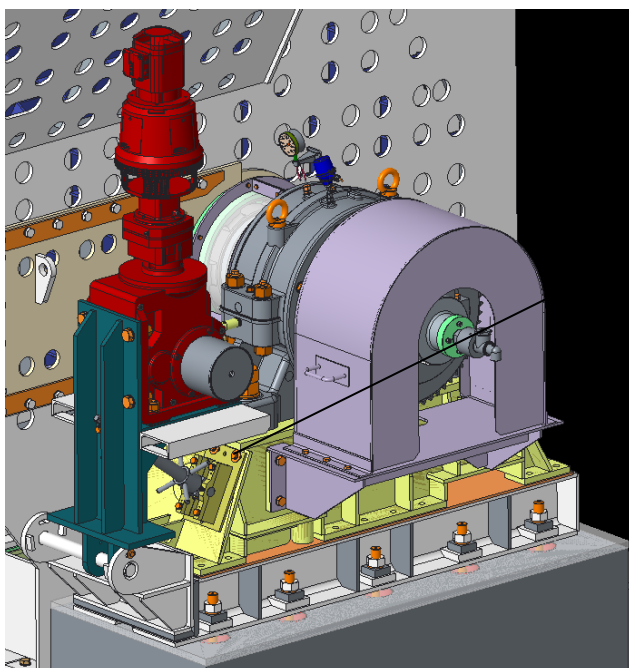
On the mill which needs maintenance work must install the turning device.



Turning device mounted at a mill (right-hand mill), not in operation.

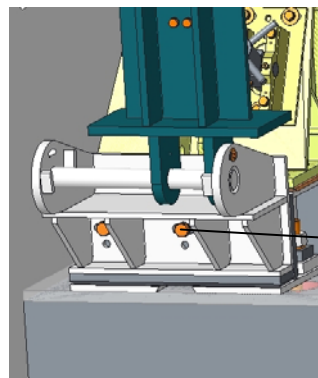
The turning device is created for both mill designs: for right-hand and for left-hand versions.

The device will be controlled by a hand control.



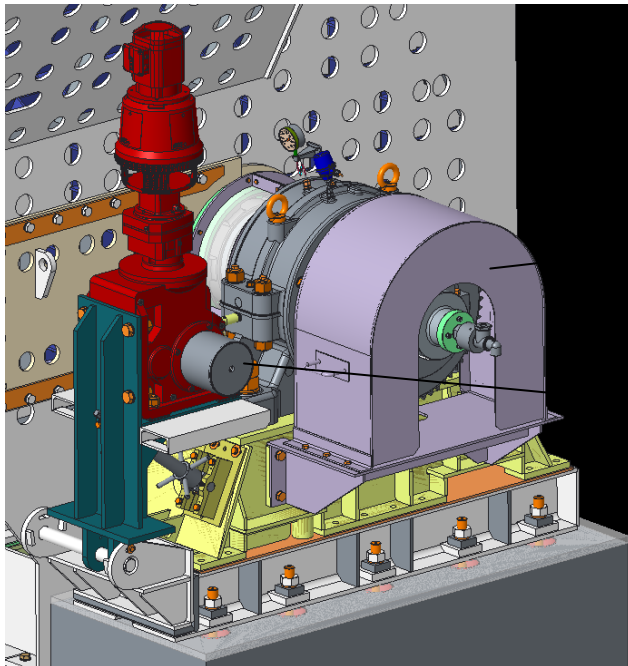
At first disassemble the turning device from the bearing support and from the foundation frame of the mill where the turning device was last needed.

Unscrew fixing elements (3)
bearing support



Unscrew
fixing
elements
(3)
bearing
frame

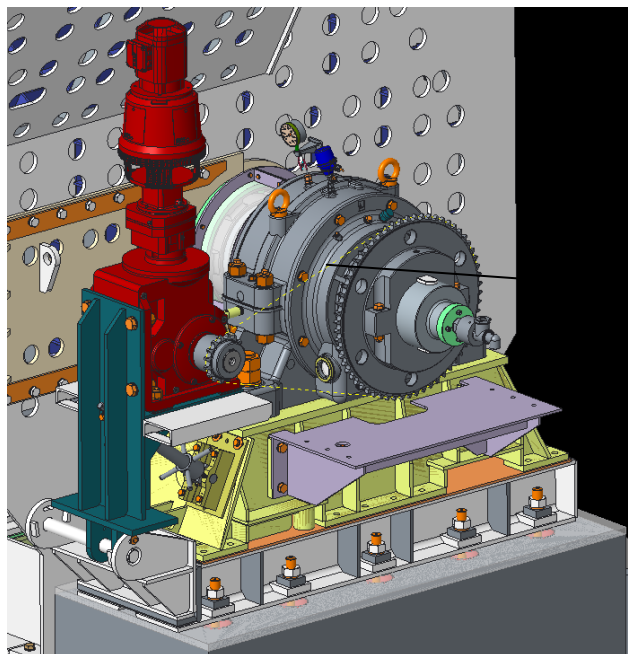
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Mount the turning device to the mill, which must be serviced with the same fixing elements.


Protection cover chain wheel
Ass. 355

Protection cover chain wheel
Ass. 439



Demount the protection covers chain wheels (assemblies 355 and 439) and install and tighten the chain.


Single roller chain

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8 Repairing pulverizer parts

1. General
2. List of special equipment for rotor assembly and disassembly
3. Rotor unit (replacement)
4. Repairing shaft protection tube
5. Replacement beater parts
6. Replacement fan wheel blade and rod
7. Replacement inlet housing wear plates
8. Replacement beater part cladding elements
9. Replacement fan housing wear parts
10. Replacement wear plates housing after mill / transition piece
11. Replacement the cooling water device on the loose bearing side of the mill shaft
12. Replacement of the buffers of the flexible pin type coupling
13. Replacement wear plates repair gate valve

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8.1 General

Only trained and qualified personnel in suitable workshops (clean, dust free and bright) may repair pulverizer parts. Good tools are required for the repair work.

To prevent errors, it is recommend that repairs are carried out by the manufacturer or consulting a specialist from the manufacturing plant when carrying out this work.

Only the original tools listed under chapter "Tools and devices" may be used.

The pulverizer parts are transported around the pulverizer by crane.

Equipment, cables and chains must be provided.

For component weights, see chapter "Assemblies and assembly weights".



Caution

The work instructions listed under chapter 1.6 and 6.2 must be observed in full before start of removing and/or installing work!

Before disassembly of the pulverizer parts, they have to be marked to make sure that each pulverizer part get back in the same position at the pulverizer.

Connection parts and small parts have to be putted in a bag/box. The bag/box has to be marked to make sure that each connection part and each small part get back in the right position.

A reused part has to be checked against damages and has to be cleaned before it will be installed again.

General form lock fixings have to be replaced against new parts without any evaluation of reusability of the old form lock fixings.

Before start removal and/or installation work of the pulverizer, check the transportation and drive way load to make sure that the pulverizer parts (incl. transportation equipment) are not too heavy for the transportation and drive way (weights of the pulverizer parts see chapter "Assemblies and assembly weights").

Before start removal and/or installation work of the pulverizer, check the area load around the mill to make sure that the pulverizer parts (incl. transportation equipment) are not too heavy for the area around the mill (weights of the pulverizer parts see chapter "Assemblies and assembly weights").


Make sure the hoisting hook is correctly attached and that the eyebolt(s)/lug(s) are fully screwed in before lifting.

Do not twist the steel wires and make sure the eyebolts have been firmly screwed and the sling angle is correct.

All screws will be set in with MoS2-paste. Then are the tightening torques are to be reduced around up to 20 %. If there are no special instructions given in drawings or lists, pre-tension forces and tightening torques have to be used according list of tightening torques, chapter 10.2.

If welding is needed, to prevent damage caused by passing or current (especially on the antifriction bearings) it is absolutely necessary to compensate for potential difference.

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8.2 List of special equipment for rotor assembly and disassembly


8.2.1 Necessary hydraulic equipment

<i>Hydraulic equipment for rotor assembly and rotor removal</i>					
Ass.	Item	Qty.	Items-No.	Designation	Manufacturer
464	1	4	4610.00000.425	Press 200 kN, stroke 30 mm	FKW
464	2	2	4610.00000.425Di	Press 200 kN, stroke 30 mm (Oil seal set)	FKW
464	3	1	4601.00000.360	Step piston manual pump, 5 liter	FKW
464	4	1	4606.00000.091	Stop valve, M14x1,5, for 4 operating elements	FKW
464	5	2	4604.00000.051	High pressure hose 5m, M14x1,5, 1x coupling	FKW
464	6	2	4604.00000.101	High pressure hose 10m, M14x1,5, 1x coupling	FKW
464	7	15 Liter	0088.69991.1005	Hydraulic oil	FKW
464	8	4	4610.00000.595	Press 400 kN, stroke 100 mm	FKW
464	9	2	4610.00000.595Di	Press 400 kN, stroke 100 mm (Oil seal set)	FKW
464	10	8	Model A, Size III	Heavy duty roller carriage, 40 t roller cart load	Börkey
464	11	4	4606.00000.020	FKW - screw plug	FKW
464	12	20	A10 x 13,5	FKW - oil seal , A10 x 13,5	FKW

8.2.2 Necessary mechanical equipment

Mechanical equipment for rotor assembly and rotor removal			
Ass.	Item	Amount	Designation
446	1	1	Rotor transport truck
440	2	1	Shaft support
440	3	1	Fixed bearing support
436	4	1	Support for movable bearing beam
436	5	4	Supports for hydraulic presses
436	6	1	Movable bearing beam
436	7	1	Fixed bearing beam
440	8	1	Insert piece for the shaft support

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8.3 Rotor unit (replacement)

General

Extreme cleanliness is crucial during removal/installation. No grinding work may be performed in the same workshop.

Only carry out any repairs to the rotor unit after cooling fully to room temperature.



Caution



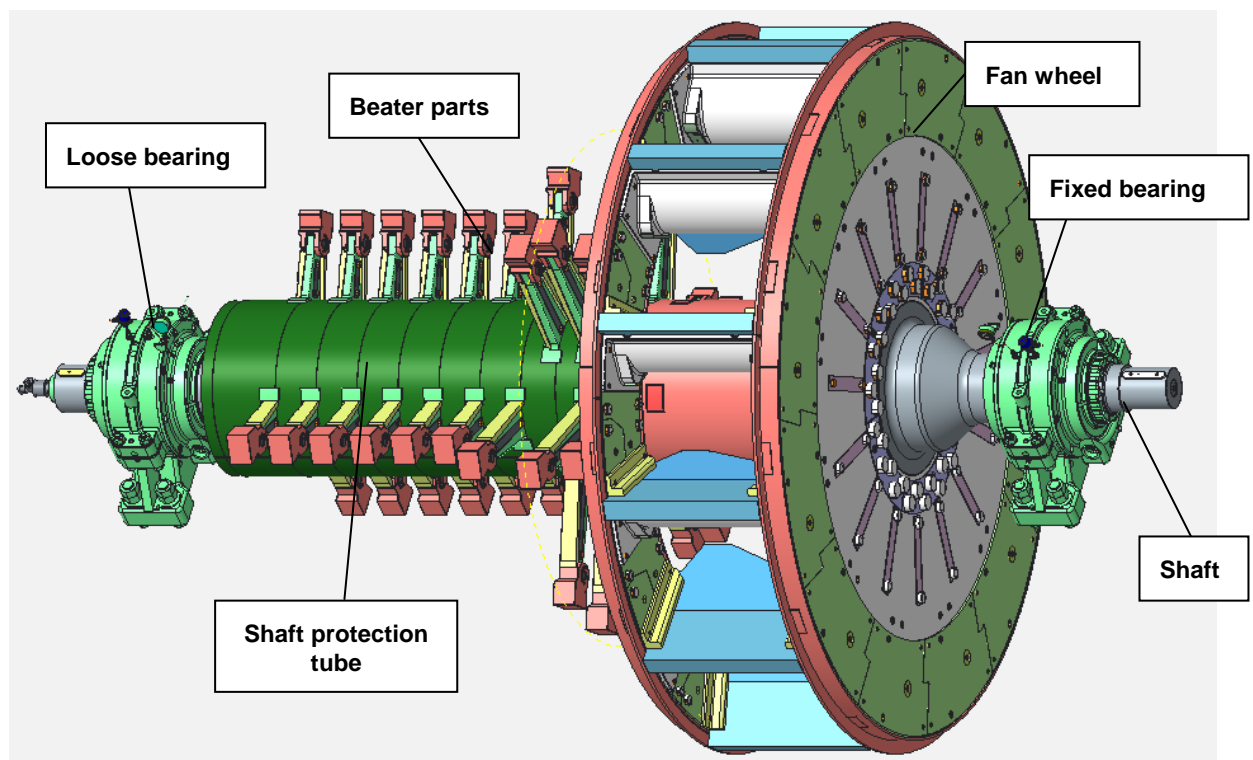
Hazard




**Danger of
falling objects**

The rotor unit must be handled
with extreme care!

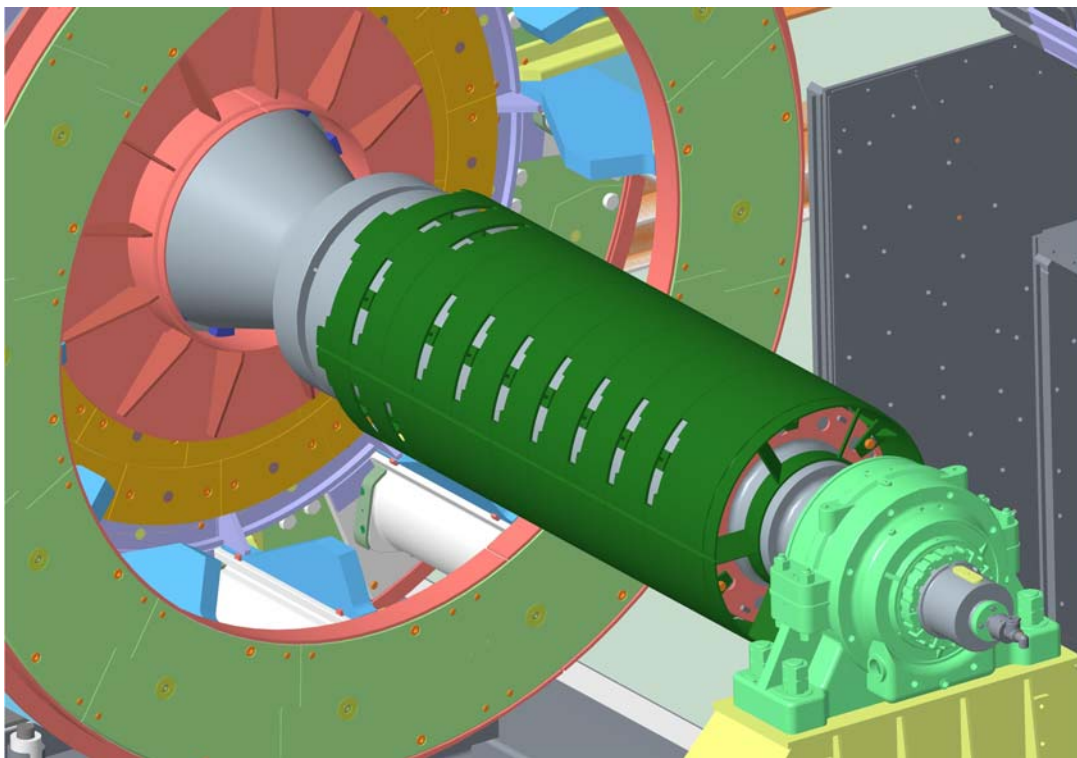
The rotor unit may only be dismantled transported and installed by using the original auxiliary equipment (rotor transport frame, rotor removal device and rotor transport truck) provided by the manufacturer for this purpose.



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Before the rotor unit replaced out of the mill the beater parts and parts of the shaft protection tube must be dismantled in the mill. Only then is it possible to pull the rotor unit out f the mill.



Rotor unit without beater parts and parts of the shaft protection tube


Rotor unit disassembly and assembly see also chapter 7.5.

Sequence of complete rotor unit disassembly from the mill

The specified items refer to item numbers in the drawing „Rotor installation“

1. Removal of all protection covers (see chapter 4.9)
2. Removal of coupling intermediate piece
3. Removal of cooling water connection of the shaft at loose bearing side
4. Removal of all thermometers on loose and fixed bearing
5. Drain of the oil out of the both circulating lubrication systems
6. Disconnect all hoses of the both circulating lubrication systems
7. Removal of oil circulating lubrication systems of the bearings
8. Opening and dismantling the fan housing door (see chapter 4.5)
9. Dismantling of lateral insert piece and shaft sealing of fan housing
10. Opening and dismantling the inlet housing door (see chapter 4.3)
11. Dismantling of intermediate piece for beater part

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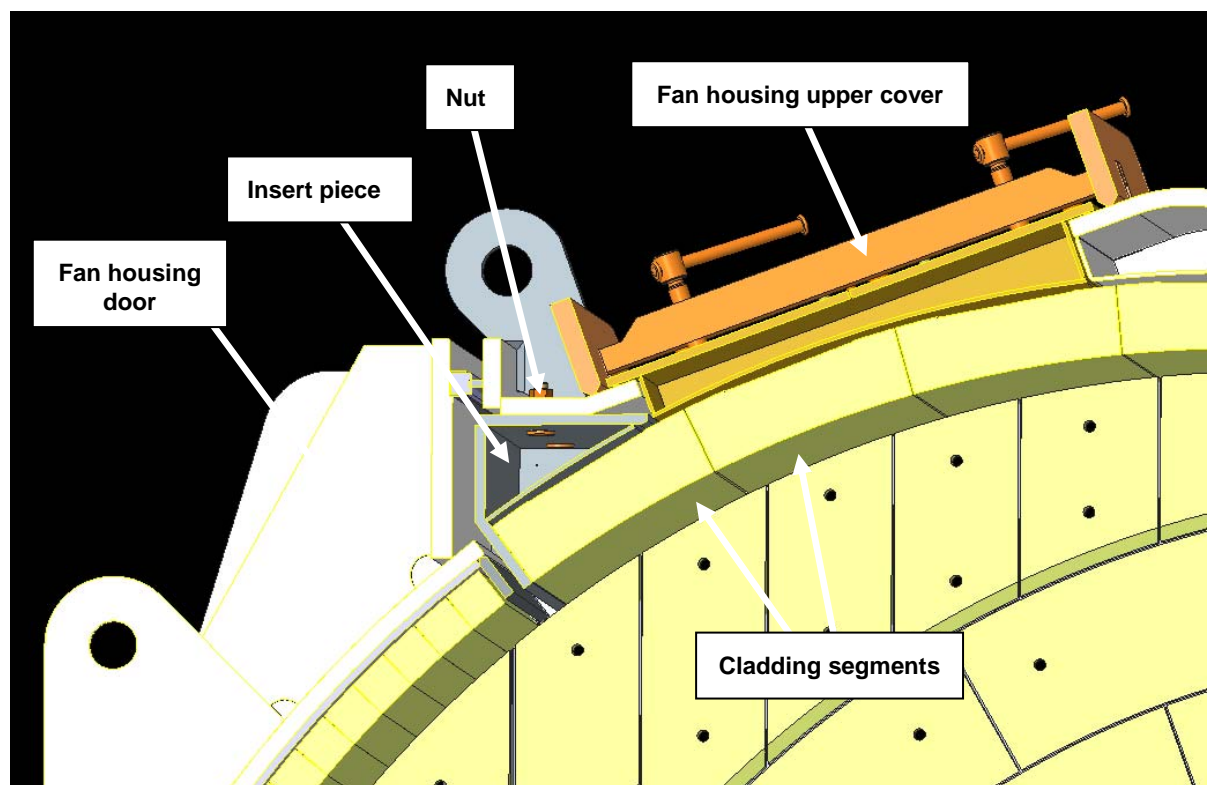
12. Dismantling of frontal insert piece of inlet housing
13. Dismantling of lateral insert piece and shaft sealing of inlet housing
14. Opening of the first cover next to the inlet housing door (see chapter 4.5 and the sketch on the next page)
15. Dismantling of 2 cladding segments (see the sketch on the next page)
16. Dismantling of the insert piece by loosening the nuts (see the sketch on the next page)
17. Dismantling of beater heads, beater arm protections and beater arms by using the erection device for hub bolts
18. Dismantling of shaft protection tube
19. Place the beam supports (items 4) as shown in the drawing on the loose bearing side
20. Connect the loose bearing sided beam (item 6) with the foundation frame and align it horizontal between support (item 4) and the beam (item 6) by using sheet metals
21. Place the rotor transport carriage (item 1) with mounted supports (items 2 and 3) in front of the mill
22.
 - Place the 4 supports (item 5) below the frame of the rotor transport carriage (see chapter 8.2.2) as shown in the drawing
 - Prepare the hydraulic equipment (see chapter 8.2.1) to lift up the rotor transport carriage and align it horizontal to the center of mill
 - Connect the fixed bearing sided beam with the fixed bearing sided foundation frame and align it horizontal between support (item 4) and the beam (item 7) by using sheet metals
 - Connect the fixed bearing sided beam (item 7) with the rotor transport carriage
 - Lift up the rotor transport carriage and align it to the center of mill
23. Unscrew the loose bearing support and lift it up with four presses (see chapter 8.2.1) about 10-15 mm, then put 4 for roller carriages (see chapter 8.2.2) into operation and lower the bearing support again
24. Repeat the described procedure with the fixed bearing support
25. Dismantle the insert piece (item 8) from loose bearing sided support (item 2)
26. Pull the rotor in a straight line out of the mill
27. Replace the insert piece (item 8) from loose bearing sided support (item 2)

Reinstall the rotor unit in reverse order.


Balancing instructions see chapter 11.

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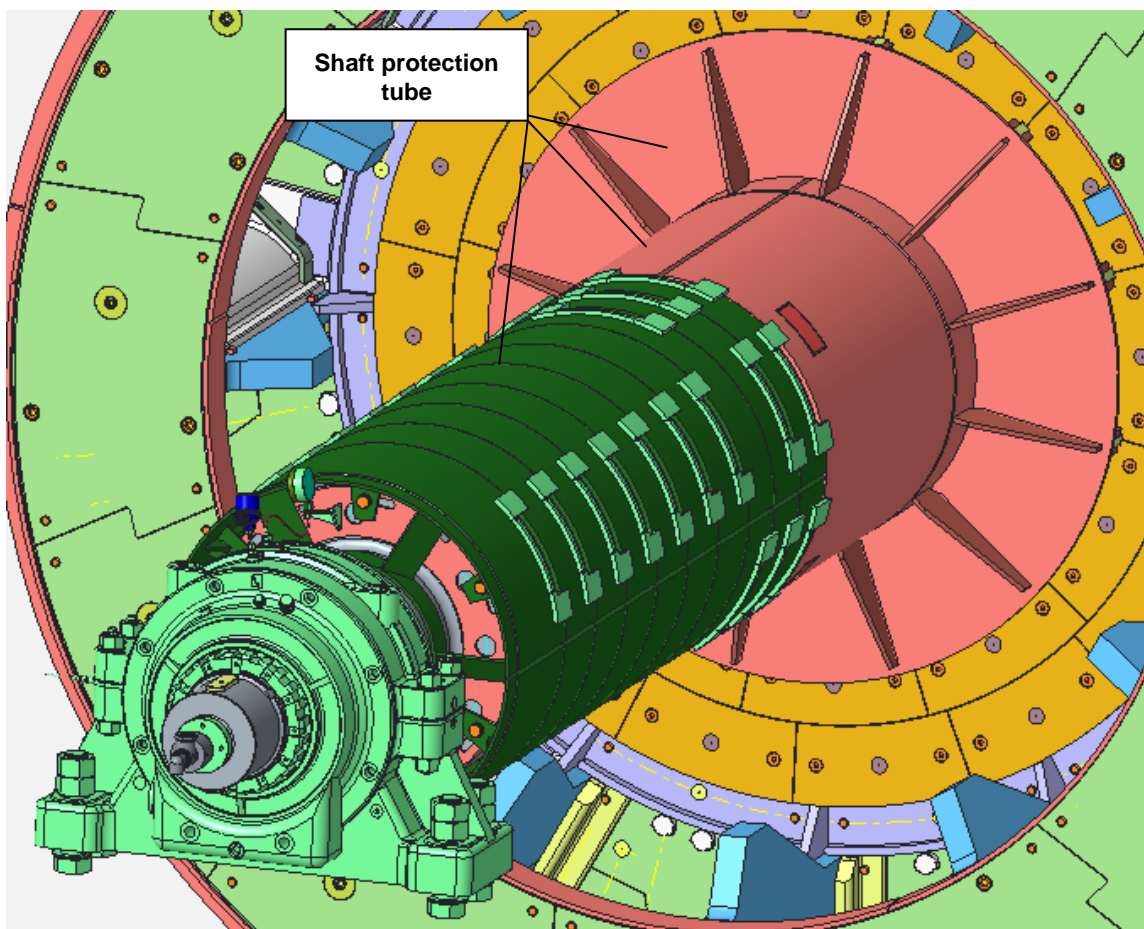
8.3.1 Replacement of self-aligning roller bearings (fixed and loose bearing side)

Replacement of self-aligning roller bearings see also chapters 4.7 (description), 6.12 and 7.6.

8.4 Repairing shaft protection tube




If wear on the shaft protection tube is detected during an inspection, the worn plates must be replaced. It is also possible to do this repair work in the mill!



Detail information about the shaft protection tube see in drawing "Armour plating for the mill rotor". See also chapters 4.6 (description) and 6.7.4.

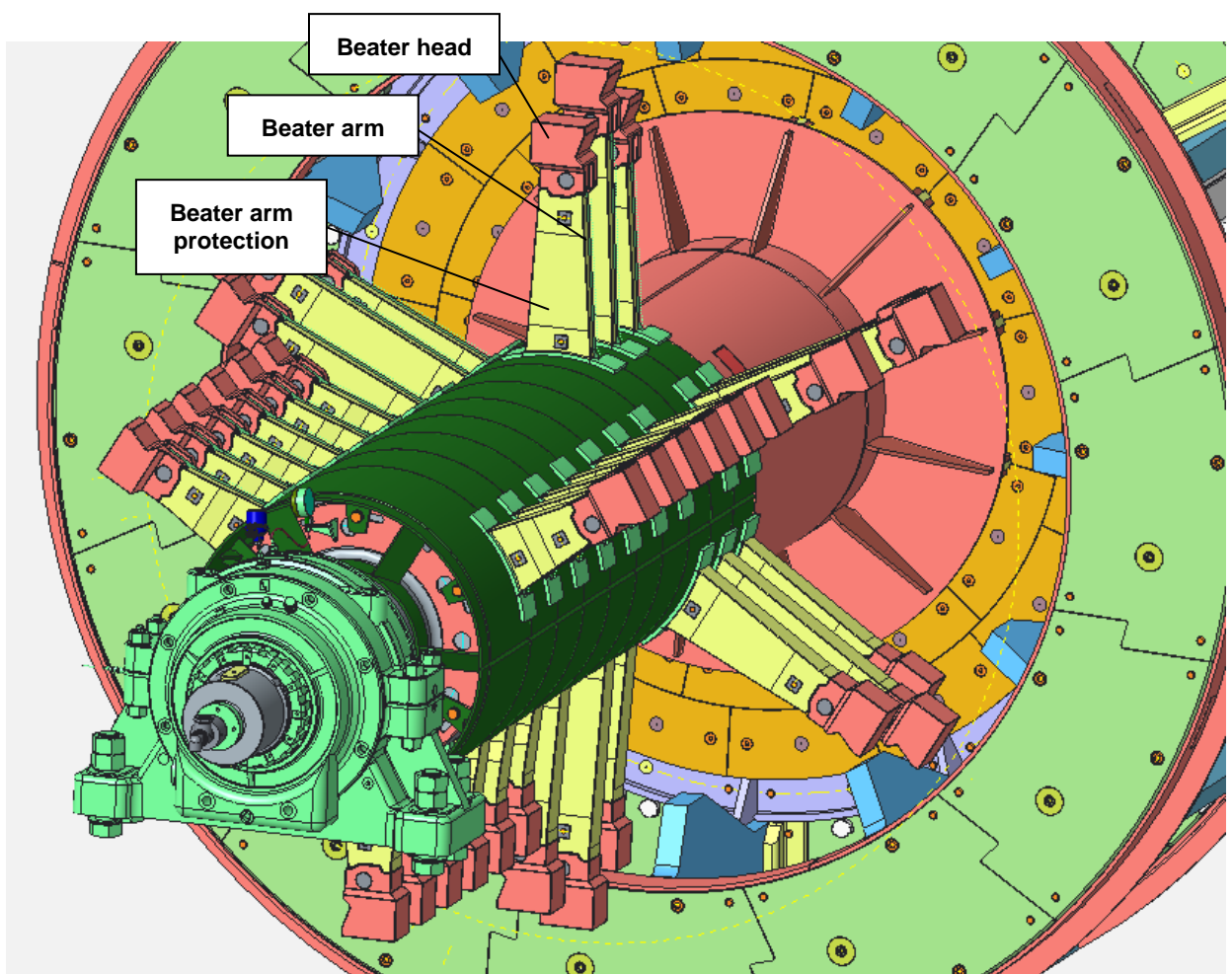
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8.5 Replacement rotating beater parts




If wear on the rotating beater parts are detected during an inspection, the worn parts must be replaced. It is only possible to do this repair work in the mill!



Detail information about the rotating beater parts see in drawing "Armour plating for the mill rotor"

Replacing beater parts see also chapters 4.6 (description), 6.6 and 7.4.1.
Balancing instructions see chapter 11.

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8.6 Replacement fan wheel blade and rod

Replacing blade and rod see also chapters 4.6 (description), 6.7.5 and 7.4.2 and balancing instructions see chapter 11.

8.7 Replacement inlet housing wear plates



If wear on the wear plates are detected during an inspection the worn plates with screws must be replaced.

Replacing wear plates see also chapters 4.3 (description), 6.7.1 and 7.3.1.


8.8 Replacement beater part cladding elements



If wear on the cladding elements are detected during an inspection the worn plates with screws must be replaced. The optimal coal grinding takes place with new cladding elements especially with new wear plates in the field of beater heads.

Replacing wear plates see also chapters 4.4 (description), 6.7.2 and 7.3.2.

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8.9 Replacement fan housing wear parts



If wear on the cladding elements are detected during an inspection the worn plates must be replaced.

Replacing cladding elements see also chapters 4.5 (description), 6.7.3 and 7.3.3.


8.10 Replacement wear plates housing after mill / transition piece / classifier



If wear on the wear plates detected during an inspection the worn plates must be replaced.

Replacing wear plates see also chapters 4.8 (description), 6.7.6 and 7.2.

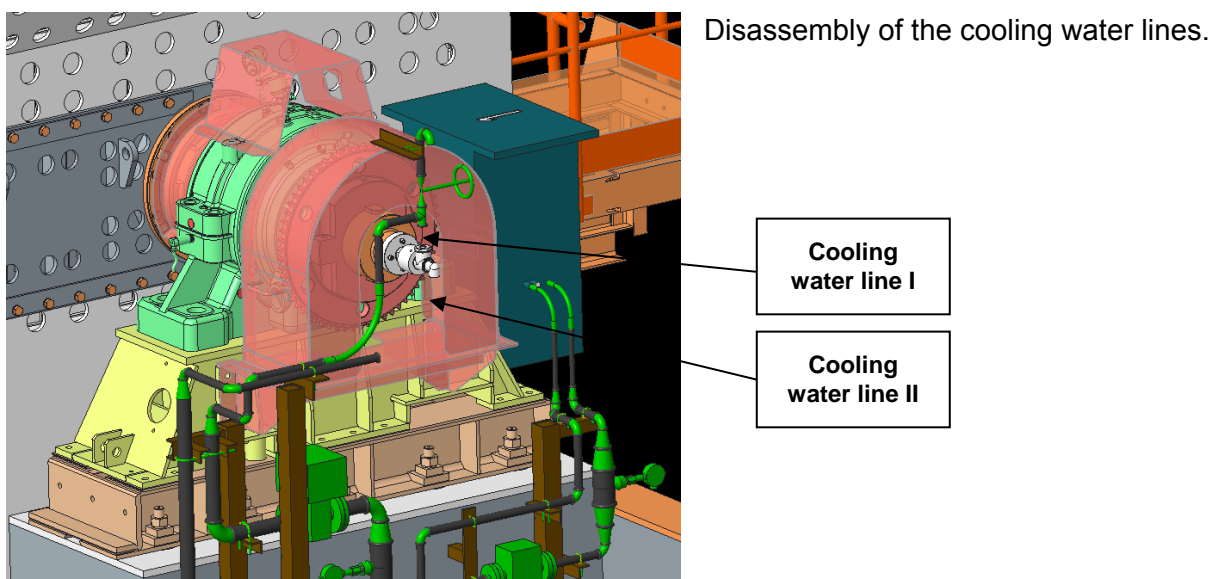
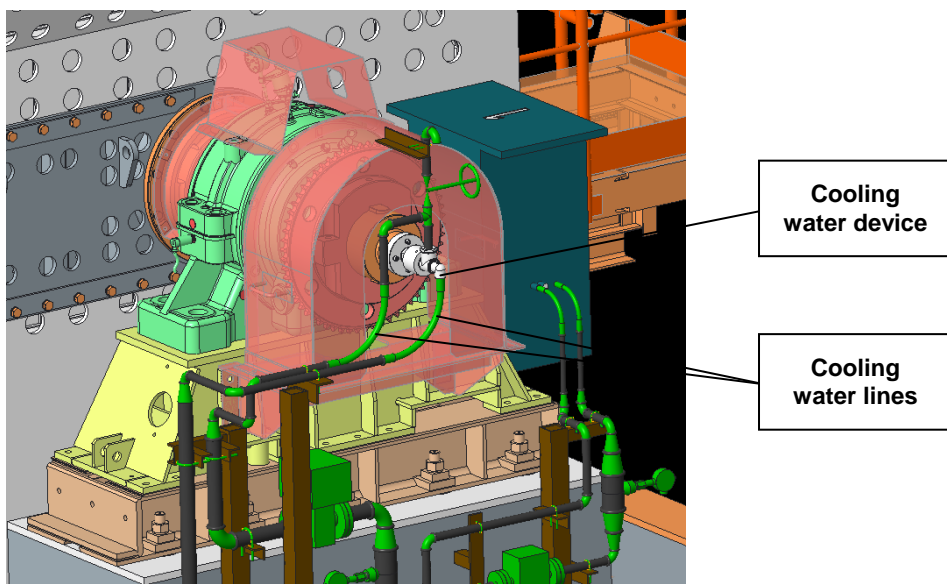
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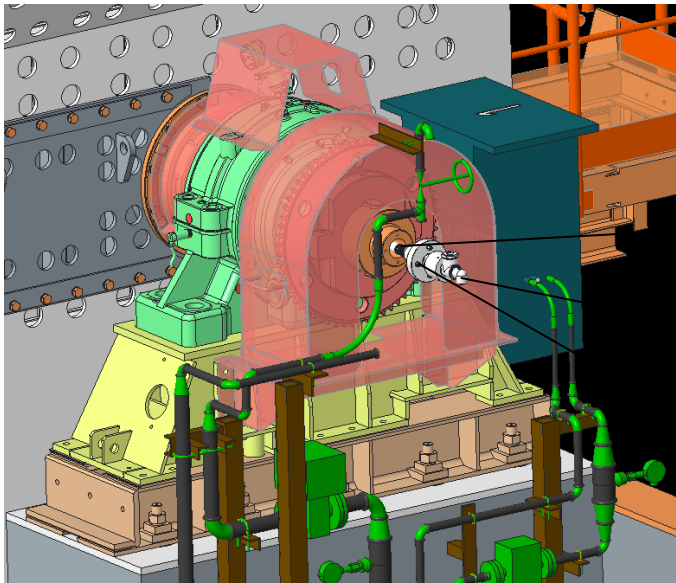
8.11 Replacement the cooling water device on the loose bearing side of the mill shaft



Replacing cooling water device see also chapter 6.8.



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Unscrew the fixing elements of the cooling water device.

Pull out the complete water device incl. hose and build in a new one.

Hose

Cooling water device

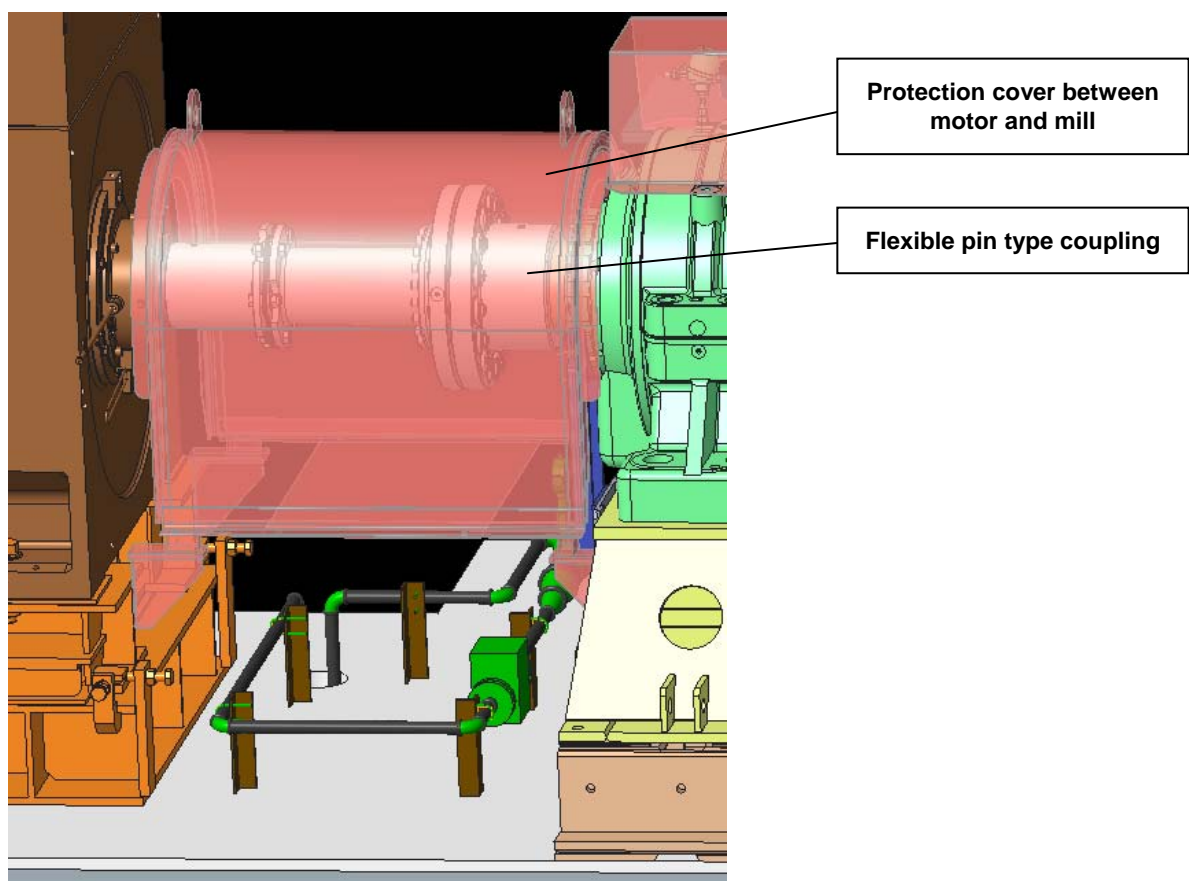
Fixing elements

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8.12 Replacement of the buffers of the flexible pin type coupling

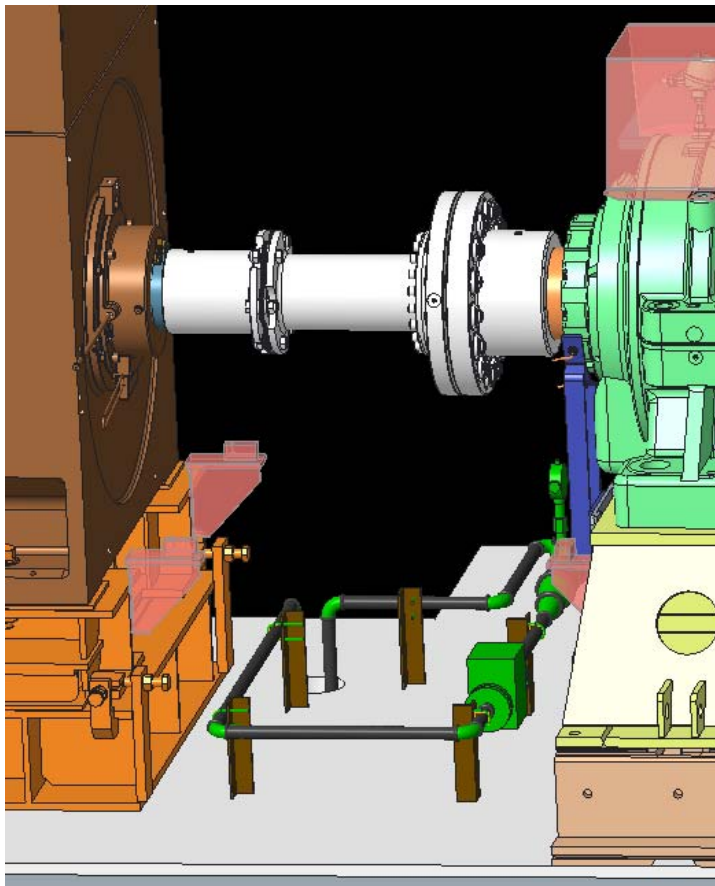


Replacing of the buffers of the flexible pin type coupling see also chapter 6.11.



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Demount the protection cover between motor and mill (assembly 351).

The further description of changing of the worn buffers of the coupling see OTD, 50HFC10...80 AJ001

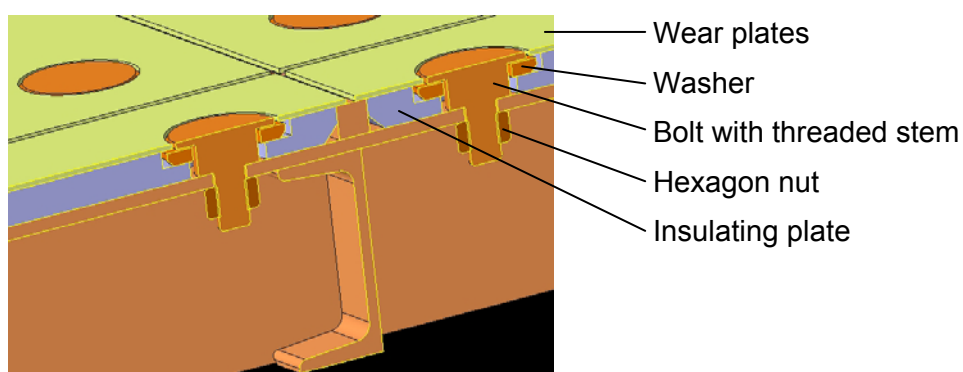
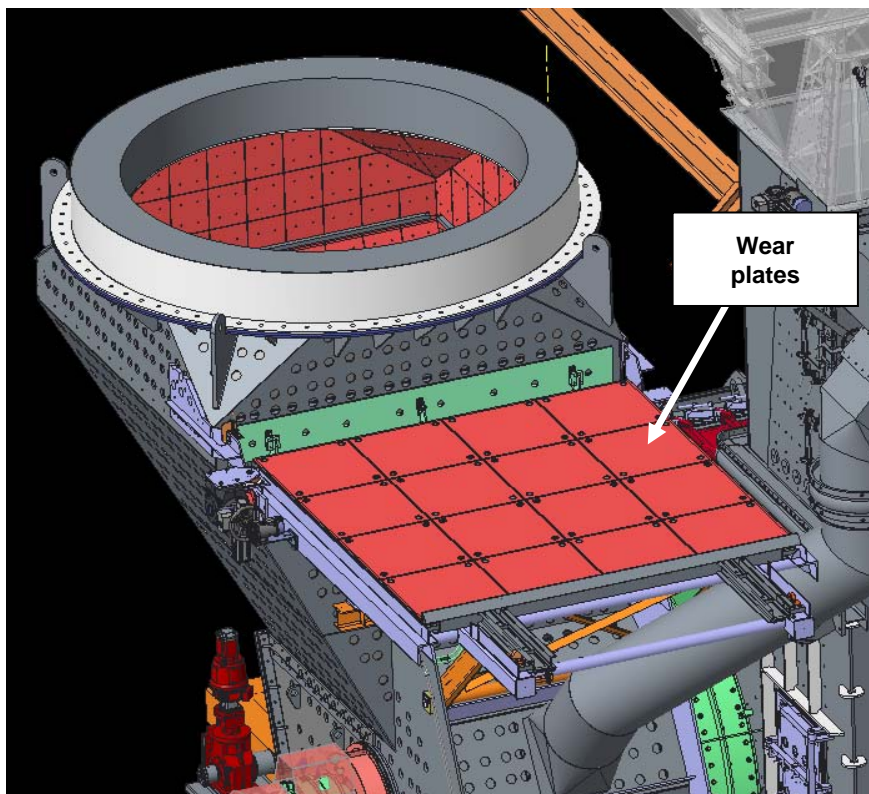
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8.13 Replacement wear plates repair gate valve



If wear on the wear plates detected during an inspection the worn plates must be replaced.
If it is necessary to replace the wear plates of the repair gate valve, this work must be done outside of the mill.



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9 Tools and devices




Attention!

The latest drawing index applies in each case.

Document no.	Ass.	Description	Qty. per unit
N-100170-M-D43-IG04-00001	430	Turning device for mill	1
N-100170-M-D43-IG04-00005	438	Blade maintenance device	1
N-100170-M-D43-IG04-00009	431	Erection device, basic frame	1
N-100170-M-D43-IG04-00015	431	Erection device, travelling mechanism frame	1
N-100170-M-D43-IG04-00020	442	Sliding frame for mill motor	1
N-100170-M-D43-IG04-00023	430	Erection device, arrangement mounting wheel	1
N-100170-M-D43-IG04-00025	430	Erection device, support girder for wheel support	1
N-100170-M-D43-IG04-00033	430	Erection device hub bolts	1
N-100170-M-D43-IG04-00045	430	Erection device, shaft turning gear	1
N-100170-M-D43-IG04-00046	431	Erection device, assembly sequence of wheel onto the drive shaft	1
N-100170-M-D43-IG04-00047	431	Erection device, assembly order of rotor onto transport cart	1
N-100170-M-D43-IG04-00048	431	Erection device, assembly spacer block 2 to the bearings	1
N-100170-M-D43-IG04-00049	431	Erection device, hydraulic sketch for mounting of wheel / shaft / rotor	1
N-100170-M-D43-IG04-00050	431	Erection device, assembly order of rotor onto transport frame	1
N-100170-M-D43-IG04-00051	438	Monorail beam for blade replacement	1
N-100170-M-D43-IG04-00057	431	Erection device, assembly order of rotor from the transport frame to the mill, sheet 1	1
N-100170-M-D43-IG04-00058	431	Erection device, assembly order of rotor from the transport frame to the mill, sheet 2	1
N-100170-M-D43-IG04-00059	431	Erection device, assembly order of rotor from the transport cart to the mill	1
N-100170-M-D43-IG04-00060	431	Erection device, assembly order of rotor from the transport cart to the mill	1
N-100170-M-D43-LT09-00001	430	Supply List - Erection devices	-
N-100170-M-D45-ID04-00002	462	Outline drawing, hydraulic power station	1
N-100170-M-D45-ID04-00007	462	Diagram, hydraulic power station	-
N-100170-M-D45-ID77-00001	462	Circuit diagram, hydraulic power station	-

Drawings/documents see chapter 15.

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10 Technical data for installation, operation and maintenance

1. Weights per mill
2. Tightening torques

10.1 Assemblies and assembly weights

Detail weights see “Assemblies and assembly weights” in chapter 5.

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10.2 Tightening torques

If there are no special instructions given in drawings, pre-tension forces and starting torques have to be used according to the following tables.

By application of MoS2-lubricants the suit moments are to be reduced around up to 20 %.


Screw material Materiał śruby	Nominal diameter Średnica nominalna mm	Tightening torque Moment dokręcania Nm
8.8	6	10
	8	25
	10	45
	12	85
	14	130
	16	200
	18	285
	20	400
	22	550
	24	690
	27	1.020
	30	1.400
	33	1.800
	36	2.400
	39	3.200
	42	3.900
	45	4.800
	48	5.900
	52	7.400
	56	9.300
	60	11.600
	64	13.900
	68	16.900
	72	20.300
	76	23.600
	80	28.200
	85	34.000
	90	40.900
	100	56.800
	110	76.400
	125	113.800
	140	160.000

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Screw material Materiał śruby	Nominal diameter Średnica nominalna mm	Tightening torque Moment dokręcania Nm
10.9	6	14
	8	35
	10	65
	12	115
	14	185
	16	280
	18	390
	20	560
	22	780
	24	970
	27	1.450
	30	1.900
	33	2.600
	36	3.400
	39	4.500
	42	5.500
	45	6.770
	48	8.400
	52	10.500
	56	13.100
	60	16.300
	64	19.600
	68	23.800
	72	28.500
	76	33.200
	80	39.700
	85	47.800
	90	57.500
	100	79.900
	110	107.400
	125	160.000
	140	226.000

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Screw material Materiał śruby	Nominal diameter Średnica nominalna mm	Tightening torque Moment dokręcania Nm	
		Hexagon head screws Śruba z łbem sześciokątnym	Hexagon head screws with reduced shank Śruby z łbem sześciokątnym ze zmniejszonym chwytem
1.7709	12	75	50
	16	180	130
	20	345	250
	24	595	420
	27	870	620
	30	1.200	880
	33	1.600	1.200
	36	2.100	1.500
	39	2.600	2.000
	42	3.300	2.400
	45	4.100	3.100

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11 Balancing instruction

Every time if worn beater parts and / or on the parts of the fan wheel have been replaced, the corresponding parts must be rebalanced.

11.1 Balancing instructions

It is to be pointed out that only specialists with appropriate training and sufficient practical experience in balancing are to be allowed to carry out the balancing. Moreover, there must be a suitable balancing mechanisms on hand.

11.2 Balancing in the case of inadmissible unsteadiness of running

Given observation of inadmissible instability of running or one detected from regular amplitude tests with a mill operating at the right operational temperature, then the mill is to taken out of operation and balanced.

Unsteadiness in running is inadmissible when there is a horizontal amplitude of 170 ... 200 µm on hand at the loose bearing monitoring point.

The balancing weights are fixed on the wear plates located on the insides of the wheel disks.


11.3 Particular Features

If balancing is not possible, then the reason can lie e.g. in slack, missing or improperly designed connecting elements or connecting points; or there might be incipient cracks or ruptures on hand. In such an eventuality, a thorough examination of all the suspected parts is to take place.

11.4 Further balancing documents

For more detail information see "Balancing instruction" and "Balancing protocol".

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12 Functional tests, checks after successful installation, repairs, inspections and lengthy shutdowns




Caution

The pulverizer must not be cleaned inside and outside with water.

1. Check the interior of the pulverizer for foreign materials - clean beater part, inlet and fan housing (remove foreign material).
2. Check the internal parts of the pulverizer.
3. Check the cooling water device for the mill shaft.
4. Check the oil circulation lubrication systems:
 - Check the oil levels
 - Check the pollution of the filters
 - Check the function and for smooth running
 - Check the tightness of the complete oil piping systems
5. Check the function/operational readiness of the oil systems.
6. Functional test / test run for the following:
 - Electric drive for the repair gate valve
 - Electric actuator for repair gate valve flap
7. Pulverizer openings closed, for example:
 - Inlet housing door
 - Iron collecting box door
 - Fan housing door
 - Corner cladding doors
 - Lateral access doors
 - Fan housing upper covers
8. All protective covers must be installed.
9. The chain of the turning device must not be installed.
10. Enable the pulverizer steam inerting system.
11. Check the locking criteria/alarm and switch-off points.

All settings and the notification of operational readiness must be documented!

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13 Spares recommendations/spare parts

1. General
2. Pulverizer

13.1 General

The spare part list is applicable to the pulverizer DGS® 180 with:

- Repair gate valve
- Oil supply systems
- Transition piece



Caution

It is advisable to keep a stock of the main spare parts not available at short notice in suitable quantities, as shown on the spares list, or to order them early.

Recommendation/information:




Caution

Please note that fitting spare parts that are not original MHPSE parts may affect the correct functioning and efficiency of the plant. They may also affect the scope of the contractual warranty.

Therefore we recommend to purchase only original MHPSE parts in order to guarantee full functioning and efficiency.

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To order spare parts following information are needed to identify the correct spare part:

- Plant : Ptolemais V
- Com. no. : N-100170
- Pulverizer machine no. : e.g. 368 (as per nameplate)
- No. : Part ID (as per spare part list)
- Ident no. : (as per spare part list)
- Item no. : (as per ident no.)
- Quantity : (as needed)


To order other parts of the pulverizer following information are needed to identify the correct spare part:

- Plant : Ptolemais V
- Com. no. : N-100170
- Pulverizer machine no. : e.g. 368 (as per nameplate)
- Ass.-no. : (as shown in the assembly drawing)
- Item no. : (as shown in the assembly drawing)
- Quantity : (as needed)

The spare parts recommendations of the ancillary equipment manufacturers as shown in the ODT with relevant KKS no. should also be observed.

For assembly drawings, see chapter 15 "Drawings".


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13.2 Recommended spare parts


No.	Quantity	Component name	Ass./Item No.
1	24 sets	Wearing parts for double wall IB incl. fastening elements	161/1, 2, 100-102
2	6 sets	Wearing parts for double wall I incl. fastening elements	162/1-12, 100-102
3	6 sets	Wearing parts for double wall II incl. fastening elements	163/1-13, 100-102
4	12 sets	Wearing parts for double wall IA/IIIA incl. fastening elements	164/1-7, 100-102
5	6 sets	Wearing parts for double wall IVA incl. fastening elements	165/1-8, 100-102
6	6 sets	Wearing parts for double wall III incl. fastening elements	166/1-13, 100-102
7	6 sets	Wearing parts for double wall IV incl. fastening elements	167/1-15, 100-102
8	6 sets	Wearing parts for double wall V incl. fastening elements	168/1-17, 100-102
9	6 sets	Wearing parts for double wall VI incl. fastening elements	169/1-3, 100-102
10	12 sets	Wearing parts for double wall VII incl. fastening elements	170/1-3, 100-102
11	6 sets	Wearing parts for double wall VIII incl. fastening elements	171/1-3, 100-102
12	6 sets	Wearing parts for double wall IX incl. fastening elements	172/1, 2, 100-102
13	6 sets	Wearing parts for double wall S1 incl. fastening elements	173/1-3, 100-102
14	6 sets	Wearing parts for double wall S2	174/1-3
15	6 sets	Wearing parts for double wall S4	174/1-3
16	12 sets	Fastening elements for wearing parts for double walls S2/S4	174/100-102

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No.	Quantity	Component name	Ass./Item No.
17	6 sets	Wearing parts for double wall S3 incl. fastening elements	175/1-12, 100-102
18	6 sets	Wearing parts for double wall S5 incl. fastening elements	176/1-3, 100-102
19	6 sets	Wearing plates frontal insert piece incl. fastening elements	177/1-7, 100-103
20	6 sets	Wearing parts for double wall IIA incl. fastening elements	178/1-8, 100-102
21	6 sets	Wearing plates lateral insert piece incl. fastening elements	179/1-3, 100-102
22	6 sets	Wearing plates inlet housing door incl. fastening elements	181/1-10, 100-108
23	6 sets	Wearing plates gate valve flap incl. fastening elements	182/1-3, 100-102
24	6 sets	Wearing plates for repair gate valve incl. fastening elements	183/4-7, 101, 102
25	6 sets	Armour plating for beater part incl. fastening elements	211/1-7, 10-12, 20- 27, 30-41, 50-52, 60-63, 101-108
26	12 sets	Fan housing, wearing parts side walls incl. fastening elements	251/1-74
27	6 sets	Fan housing, circumferential cladding	252/1-33
28	36 sets	Corner cladding to fan housing	253/1
29	6 sets	Shaft protection tube (loose bearing side)	275/6-9
30	6 sets	Shaft protection tube (beater section)	276/11, 12
31	6 sets	Armour plating for the mill rotor	281/1-6, 10-12, 15, 21-24
32	6 sets	Beater head bolts	282/1, 2
33	6 sets	Beater heads	283/1, 2
34	12 sets	Wearing parts for the fan wheel	314/1-8, 10-16,

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No.	Quantity	Component name	Ass./Item No.
35	18 sets	Wearing parts for the fan wheel, blade rod and plate	315/1, 2
36	12 sets	Wearing parts for the fan wheel, wearing plate incl. fastening elements	316/14-18
37	18 sets	Wearing parts for the fan wheel, baffle disc wearing plate incl. fastening elements	318/1-5
38	12 sets	Transition piece, wearing plates incl. fastening elements	338/1-22, 100-104
39	1 piece	Cooling water head RH incl. cooling water head	274/1
40	1 piece	Cooling water head LH incl. cooling water head	274/1
41	1 piece	Oil circulation lubrication system, gear pump with coupling and pumpcarrier without motor	295/1
42	6 sets	Oil circulation lubrication system, sealings gear pump	295/1
43	1 piece	Oil circulation lubrication system, E-Motor	295/1
44	48 pieces	Oil circulation lubrication system, Filter elements	295/1
45	48 sets	Oil circulation lubrication system, sealings	295/1
46	2 pieces	Oil circulation lubrication system, differential pressure indicators	295/1
47	1 piece	Oil circulation lubrication system, 5-fold distribution block	295/1
48	1 piece	Oil circulation lubrication system, low pressure ball valve	295/1
49	1 piece	Oil circulation lubrication system, shell and tube exchangers	295/1
50	2 sets	Oil circulation lubrication system, sealings for shell and tube	295/1

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No.	Quantity	Component name	Ass./Item No.
		exchangers	
51	2 pieces	Oil circulation lubrication system, thermal control valves	295/1
52	2 pieces	Oil circulation lubrication system, low pressure ball valves	295/1
53	1 piece	Oil circulation lubrication system, low pressure ball valve	295/1
54	4 pieces	Oil circulation lubrication system, thermometers with pointer indicator	295/1
55	2 pieces	Oil circulation lubrication system, manometers	295/1
56	1 piece	Oil circulation lubrication system, gauge valve	295/1
57	1 piece	Oil circulation lubrication system, throttle valve	295/1
58	1 piece	Oil circulation lubrication system, low pressure ball valve	295/1
59	1 piece	Oil circulation lubrication system, hose	295/1
60	1 piece	Oil circulation lubrication system, hose	295/1


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14 Troubleshooting

System troubleshooting: Pulverizer			
No.	Fault and/or report	Cause	Remedy
Mill out of operation			
1.	Repair slider in front of the mill cannot be closed	Drive defect	Check drive and repair if necessary
2.	Repair slider inside the mill cannot be opened	<ul style="list-style-type: none"> - Drive defect - Foreign particles on top of the repair slider 	<ul style="list-style-type: none"> - Check drive and repair if necessary - Removal of foreign matters
Mill in operation			
3.	Static pressure at the mill fan housing increases above -3 mbar An alarm is actuated	Mill is overloaded, coal storage in the fan housing	The mill speed should be increased or the coal feeder flow should be manually reduced
4.	Temperature at the mill housing decreases below 100 °C An alarm is actuated	Mill is overloaded, coal storage in the fan housing	The mill speed should be increased or the coal feeder flow should be manually reduced
5.	Temperature after mill too high > 200 °C, mill shut down after 10 min > 270 °C, Mill shut down (immediately)	No or too little coal, mill fire	Check feeder, extinguish fire by discharging extinguishing water
6.	Temperature after mill too low < 100 °C An alarm is actuated	Coal quantity too high, coal too wet, false air intrusion through open doors	Reduce quantity of coal, increase mill speed, eliminate the cause of the ingress of false air
7.	Bearing temperatures too high > 85 °C, alarm > 90 °C, mill shut down	Malfunction of circulating oil lubrication, bearing damage	<ul style="list-style-type: none"> - Leakage check - Checking of filter elements - Checking of oil cooler - Checking of the pump Exchange of bearing
8.	Differential pressure at the filter of the oil circulation lubrication too high > 1.2 bar, alarm	Filter element dirty	Switch the double filter, clean or replace the filter element (see the operating instructions of the filter manufacturer)
9.	Oil pressure before bearing too low < 0.25 bar, alarm < 0.20 bar, mill shut down after 4 minutes	Malfunction of the external oil cooling system, oil lines defective	<ul style="list-style-type: none"> - Leakage check - Checking of the pump
10.	Oil leaks on the oil circulation lubrication system	Damaged seals, loose screw connections	Replace the seals, tighten the screw connections
11.	Mill speed is too high > 625 rpm, alarm > 630 rpm, mill shut down	Malfunction of the frequency inverter	Check of the frequency inverter


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System troubleshooting: Pulverizer

No.	Fault and/or report	Cause	Remedy
Mill out of operation			
12.	Abnormal operating noises	<ul style="list-style-type: none"> - Damaged bearing - Misalignment of mill coupling - Foreign matters in the mill - Foreign matters between fan wheel and fan housing 	<ul style="list-style-type: none"> - Exchange of bearing - Alignment of coupling - Removal of foreign matters
13.	Inadmissible vibrations > 7,1 mm/s r.m.s, alarm > 9,0 mm/s r.m.s, accelerated shut down (delay 2 min) > 11,0 mm/s r.m.s, immediate shut down	Imbalance through: <ul style="list-style-type: none"> - uneven wear - loose wearing parts - missing wear parts - loose fastening screws in the drive train - bearing damage 	<ul style="list-style-type: none"> - Check the wear condition and the wear parts in the fan wheel - Rebalancing - Check the fastening screws - Bearing replacement
The troubleshooting table is not claimed to be complete.			

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15 Drawings




Attention!

The latest drawing index applies in each case.


Document no.	Ass.	Description
N-100170-M-D01-IB01-00001	016	P&ID DGS®-mill 180
N-100170-M-D01-IB01-00002	016	P&ID hydraulic system mill and diagram hydraulic station
N-100170-M-D01-IC06-00001	019	Location plan electrical consumers and measuring points at the mills
N-100170-M-D01-IC14-00001	014	Space requirements and load conditions- rotor transport
N-100170-M-D01-ID04-00001	012	Dimensional drawing DGS® 180
N-100170-M-D01-ID16-00001	021	Assembly drawing DGS® 180, sheet 1
N-100170-M-D01-ID16-00002	021	Assembly drawing DGS® 180, sheet 2
N-100170-M-D01-ID16-00003	021	Assembly drawing DGS® 180, sheet 3
N-100170-M-D01-ID16-00004	021	Assembly drawing DGS® 180, sheet 4
N-100170-M-D01-ID43-00001	011	Mounting description mill DGS® 180 (Basic) 1.7.2 - Mills
N-100170-M-D01-ID43-00002	011	Additional description to assembly instruction mill DGS® 180
N-100170-M-D01-IG04-00001	017	Rating and name plate
N-100170-M-D01-JQ02-00003	011	ITP - DGS® - Mill Erection
N-100170-M-D01-JQ07-00001	011	Balancing specification
N-100170-M-D01-IK26-00001	011	Lubrication list DGS® 180 mill
N-100170-M-D01-LT08-00001	020	Transport schedules and weights
N-100170-M-D01-LT08-00002	020	Transport schedules and weights, mill parts, sheet 2 (housing after mill)
N-100170-M-D01-LT08-00003	020	Transport schedules and weights, mill parts, sheet 3 (erection device and rotor transport carriage with supports)
N-100170-M-D01-LT09-00001	017	Supply List - Rating and name plate
N-100170-M-D01-LT09-00002	011	Supply List - Spare parts L1
N-100170-M-D01-LT09-00003	011	Supply List - Spare parts IBS
N-100170-M-D01-UA16-00003	011	Balancing protocol
N-100170-M-D05-IA45-00001	050	Building instructions, mill foundation
N-100170-M-D05-IC15-00001	050	Foundation arrangement plan, DGS® mills
N-100170-M-D05-IC16-00001	050	Foundation Mill DGS® 180
N-100170-M-D05-IC31-00001	050	Formwork plan mill foundation, right turning mill
N-100170-M-D05-IC31-00002	050	Formwork plan mill foundation, left turning mill
N-100170-M-D05-IC32-00001	050	Reinforcement plan mill foundation, 1. concrete step right turning mill
N-100170-M-D05-IC32-00002	050	Reinforcement plan mill foundation, 2. concrete step right turning mill, sheet 1

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	Techn. Documentation		Code Word:
	Doc-No.:		Ptolemais V
	N-100170-M-D01-GM03-00001-__		Job No.: N-100170


Document no.	Ass.	Description
N-100170-M-D05-IC32-00003	050	Reinforcement plan mill foundation, 2. concrete step right turning mill, sheet 2
N-100170-M-D05-IC32-00004	050	Reinforcement plan mill foundation, 2. concrete step right turning mill, sheet 3
N-100170-M-D05-IC32-00005	050	Reinforcement plan mill foundation, 1. concrete step left turning mill
N-100170-M-D05-IC32-00006	050	Reinforcement plan mill foundation, 2. concrete step left turning mill, sheet 1
N-100170-M-D05-IC32-00007	050	Reinforcement plan mill foundation, 2. concrete step left turning mill, sheet 2
N-100170-M-D05-IC32-00008	050	Reinforcement plan mill foundation, 2. concrete step left turning mill, sheet 3
N-100170-M-D05-ID04-00001	050	Dimension sheet, spring elements
N-100170-M-D05-IG04-00001	053	Anchor boxes
N-100170-M-D05-IG04-00002	050	Embedded parts strip foundation
N-100170-M-D05-IK05-00001	050	Steel amounts list - 1. concrete step (right)
N-100170-M-D05-IK05-00002	050	Steel amounts list - 2. concrete step (right)
N-100170-M-D05-IK05-00003	050	Steel amounts list - 1. concrete step (left)
N-100170-M-D05-IK05-00004	050	Steel amounts list - 2. concrete step (left)
N-100170-M-D05-LT09-00001	050	Supply List - Foundation parts
N-100170-M-D07-IG04-00001	071	Base frame, loose bearing
N-100170-M-D07-IG04-00002	072	Base frame, inlet housing
N-100170-M-D07-IG04-00003	074	Base frame, fixed bearing and fan housing
N-100170-M-D07-IG04-00004	076	Base frame for mill motor
N-100170-M-D07-IG04-00007	077	Base frames, aligning material
N-100170-M-D07-LT09-00001	070	Supply List - Base frames
N-100170-M-D09-IG04-00001	090	Loose and fixed bearing support
N-100170-M-D09-LT09-00001	090	Supply List - Bearing supports
N-100170-M-D11-IG04-00001	110	Inlet housing assembly drawing- main views
N-100170-M-D11-IG04-00002	110	Inlet housing, details and sections
N-100170-M-D11-IG04-00003	110	Inlet housing upper part, sheet 1
N-100170-M-D11-IG04-00012	110	Inlet housing (lower part) - sheet 1
N-100170-M-D11-IG04-00013	110	Inlet housing (lower part) - sheet 2
N-100170-M-D11-IG04-00027	130	Lateral insert piece with shaft sealing
N-100170-M-D11-IG04-00030	137	Repair gate valve before mill
N-100170-M-D11-IG04-00033	134	Repair gate valve before mill, frame
N-100170-M-D11-IG04-00035	135	Repair gate valve before mill, support
N-100170-M-D11-IG04-00037	133	Gate valve drive, assembly
N-100170-M-D11-IG04-00043	133	Repair gate valve before mill, Limit switches- Sheet 1
N-100170-M-D11-IG04-00044	133	Repair gate valve before mill, Limit switches- Sheet 2
N-100170-M-D11-LT09-00001	110	Supply List - Inlet housing
N-100170-M-D14-IG04-00001	140	Inlet housing door, sheet 1
N-100170-M-D14-IG04-00002	140	Inlet housing door, sheet 2
N-100170-M-D14-IG04-00012	147	Inlet housing door and flap, hydraulic
N-100170-M-D14-LT09-00001	140	Supply List - Inlet housing door
N-100170-M-D16-ID16-00001	160	Wearing parts for the inlet housing, sheet 1
N-100170-M-D16-ID16-00002	160	Wearing parts for the inlet housing, sheet 2
N-100170-M-D19-IG04-00001	190	Beater part, sheet 1
N-100170-M-D19-IG04-00002	190	Beater part, sheet 2

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	N-100170-M-D01-GM03-00001-__		Job No.: N-100170


Document no.	Ass.	Description
N-100170-M-D19-IG04-00005	190	Beater part, intermediate piece
N-100170-M-D19-IG04-00007	190	Beater part, iron collecting box door
N-100170-M-D19-LT09-00001	190	Supply List - Beater part
N-100170-M-D21-ID16-00001	210	Beater part cladding
N-100170-M-D23-IG04-00001	230	Fan housing, assembly-sheet 1
N-100170-M-D23-IG04-00002	231	Fan housing, housing- sheet 1
N-100170-M-D23-IG04-00003	231	Fan housing, housing sheet 2
N-100170-M-D23-IG04-00010	233	Fan housing, upper covers
N-100170-M-D23-IG04-00013	235	Fan housing, lateral access door
N-100170-M-D23-IG04-00015	236	Fan housing, Lateral insert piece with shaft sealing
N-100170-M-D23-IG04-00017	237	Fan housing, fan housing door- sheet 1
N-100170-M-D23-IG04-00018	237	Fan housing, fan housing door- sheet 2
N-100170-M-D23-IG04-00022	230	Fan housing, assembly-sheet 2
N-100170-M-D23-IG04-00024	241	Fan housing, ribbing
N-100170-M-D23-IG04-00026	242	Fan housing, pressure measuring connection
N-100170-M-D23-IG04-00028	230	Fan housing, beams for platforms
N-100170-M-D23-LT09-00001	230	Supply List - Fan housing
N-100170-M-D25-ID16-00001	250	Wearing parts for the fan housing, sheet 1
N-100170-M-D25-ID16-00002	250	Wearing parts for the fan housing, sheet 2
N-100170-M-D27-ID16-00001	270	Wearing parts for the mill rotor
N-100170-M-D27-IG04-00001	270	Assembly drawing mill rotor and housing, sheet 1
N-100170-M-D27-IG04-00006	274	Shaft cooling for the rotor shaft
N-100170-M-D27-IG04-00011	279	Hub bolt locking device
N-100170-M-D27-IG04-00015	270	Assembly beater head bolt
N-100170-M-D27-IG04-00017	275	Shaft protection tube - beater section, sheet 1
N-100170-M-D27-IG04-00018	275	Shaft protection tube - beater section, sheet 2
N-100170-M-D27-IG04-00019	275	Shaft protection tube cone
N-100170-M-D27-IG04-00023	286	Speed measuring at mill bearing
N-100170-M-D27-IG04-00024	270	Assembly drawing, mill rotor and housing, sheet 2
N-100170-M-D27-LT09-00001	270	Supply List - Rotor
N-100170-M-D27-LT09-00002	270	Supply List - Rotor shaft
N-100170-M-D29-ID04-00001	295	Oil lubrication unit for mill bearings, version 1
N-100170-M-D29-ID04-00002	295	Oil lubrication unit for mill bearings, version 2
N-100170-M-D29-ID04-00003	295	Hydraulic diagram for oil lubrication unit, version 1
N-100170-M-D29-ID04-00004	295	Hydraulic diagram for oil lubrication unit, version 2
N-100170-M-D29-IG04-00001	291	Fixed bearing, assembly
N-100170-M-D29-IG04-00002	292	Loose bearing assembly
N-100170-M-D29-IG04-00013	294	Mounting bush for bearing assembly
N-100170-M-D29-IG04-00014	294	Hook wrench for tension nut at mill bearing
N-100170-M-D29-IG04-00015	290	Arrangement oil circulation lubrication system right / left hand
N-100170-M-D29-LT09-00001	290	Supply List - Bearings and accessories
N-100170-M-D31-IG04-00001	310	Fan wheel, Assembly drawing
N-100170-M-D31-IG04-00003	310	Fan wheel, supplement
N-100170-M-D31-IG04-00019	317	Fan wheel, baffle disc - assembly drawing
N-100170-M-D31-LT09-00001	310	Supply List - Fan wheel
N-100170-M-D33-ID16-00001	330	Housing after mill, assembling overview
N-100170-M-D33-ID16-00002	338	Wearing parts for the housing after mill

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	Techn. Documentation		Code Word:
	Doc-No.: N-100170-M-D01-GM03-00001-__		Ptolemais V Job No.: N-100170


Document no.	Ass.	Description
N-100170-M-D33-IG04-00001	330	Housing after mill, assembly drawing
N-100170-M-D33-IG04-00002	330	Housing after mill, lower part
N-100170-M-D33-IG04-00004	330	Housing after mill, compensator
N-100170-M-D33-IG04-00005	330	Housing after mill, access door
N-100170-M-D33-IG04-00006	330	Housing after mill, cover
N-100170-M-D33-IG04-00007	330	Housing after mill, cap
N-100170-M-D33-IG04-00010	339	Air and flue gas duct system pulverized fuel ducts grid recirculation - assembling overview
N-100170-M-D33-IG04-00011	339	Housing after mill- grit recirculation box, overview, sheet 1 to 3
N-100170-M-D33-IG04-00012	339	Housing after mill- grit recirculation, flow limiter, sheet 1 to 2
N-100170-M-D33-IG04-00013	339	Housing after mill- grit recirculation pipe, sheet 1 to 2
N-100170-M-D33-LT09-00001	330	Supply List - Housing after mill
N-100170-M-D35-IG04-00001	353	Protection cover between fan housing and fixed bearing
N-100170-M-D35-IG04-00002	354	Protection cover between inlet housing and loose bearing
N-100170-M-D35-IG04-00003	355	Protection cover for shaft end at loose bearing side
N-100170-M-D35-IG04-00004	357	Protection cover above mill bearings
N-100170-M-D35-IG04-00005	351	Protection cover for coupling between mill and motor
N-100170-M-D35-LT09-00001	350	Supply List - Protection cover
N-100170-M-D37-IG04-00001	274	Connection firefighting water
N-100170-M-D41-IC20-00001	410	Platforms DGS® 180
N-100170-M-D41-IC20-00002	410	Platforms DGS® 180
N-100170-M-D41-IG06-00001	410	Platform +2,190, left turning mills
N-100170-M-D41-IG06-00002	410	Platform +4,830, left turning mills
N-100170-M-D41-IG06-00003	410	Platform +2,190, right turning mills
N-100170-M-D41-IG06-00004	410	Platform +4,830, right turning mills
N-100170-M-D43-ID04-00002	446	Outline drawing, rotor transport truck
N-100170-M-D43-IG04-00001	430	Turning device for mill
N-100170-M-D43-IG04-00005	438	Blade maintenance device
N-100170-M-D43-IG04-00009	431	Erection device, basic frame
N-100170-M-D43-IG04-00015	431	Erection device, travelling mechanism frame
N-100170-M-D43-IG04-00020	442	Sliding frame for mill motor
N-100170-M-D43-IG04-00023	430	Erection device, arrangement mounting wheel
N-100170-M-D43-IG04-00025	430	Erection device, support girder for wheel support
N-100170-M-D43-IG04-00033	430	Erection device hub bolts
N-100170-M-D43-IG04-00045	430	Erection device, shaft turning gear
N-100170-M-D43-IG04-00046	431	Erection device, assembly sequence of wheel onto the drive shaft
N-100170-M-D43-IG04-00047	431	Erection device, assembly order of rotor onto transport cart
N-100170-M-D43-IG04-00048	431	Erection device, assembly spacer block 2 to the bearings
N-100170-M-D43-IG04-00049	431	Erection device, hydraulic sketch for mounting of wheel / shaft / rotor
N-100170-M-D43-IG04-00050	431	Erection device, assembly order of rotor onto transport frame
N-100170-M-D43-IG04-00051	438	Monorail beam for blade replacement

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Document no.	Ass.	Description
N-100170-M-D43-IG04-00053	447	Coal chute for bunker emptying, sheet 1
N-100170-M-D43-IG04-00054	447	Coal chute for bunker emptying, sheet 2
N-100170-M-D43-IG04-00057	431	Erection device, assembly order of rotor from the transport frame to the mill, sheet 1
N-100170-M-D43-IG04-00058	431	Erection device, assembly order of rotor from the transport frame to the mill, sheet 2
N-100170-M-D43-IG04-00059	431	Erection device, assembly order of rotor from the transport cart to the mill
N-100170-M-D43-IG04-00060	431	Erection device, assembly order of rotor from the transport cart to the mill
N-100170-M-D43-LT09-00001	430	Supply List - Erection devices
N-100170-M-D43-LT09-00002	447	Supply List - Coal chute
N-100170-M-D45-ID04-00001	450	Outline drawing, gear coupling
N-100170-M-D45-ID04-00002	462	Outline drawing, hydraulic power station
N-100170-M-D45-ID04-00007	462	Diagram, hydraulic power station
N-100170-M-D45-ID77-00001	462	Circuit diagram, hydraulic power station
N-100170-M-D45-LT09-00001	450	Supply List - Accessories

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	Techn. Documentation	Code Word: Ptolemais V
	Doc-No.: N-100170-M-D01-GM03-00001-__	Job No.: N-100170


16 Annex

1. All drawings (sequence acc. to PGE-drawing-no.)

Operation and maintenance instruction for ancillary equipment

2. Spring elements
3. Mill coupling
4. Roller bearings (with accessories)
5. Breather filters
6. Nozzle in fire-fighting connection
7. Cooling water head
8. Cooling hoses
9. Roller skates
10. Wire rope pull hoist
11. Hydraulic manual pumps (with accessories)
12. Rotor transport cart
13. Wall-mounted slewing crane (without trolley)
14. Mill motor
15. Electrical actuator for repair gate valve
16. Flap for repair gate valve
17. Primary shut-off valve
18. Hydraulic cylinder
19. Hydraulic connection parts
20. Position switch
21. Inductive sensor
22. Pressure transmitter
23. Thermocouple with digital temperature transmitter
24. Oil circulation lubrication system
25. Hydraulic hoses
26. Socket test measuring points
27. Electrical turning drive
28. Throttle valve grit recirculation
29. Expansion joint grit recirculation
30. Expansion joint between mill and housing after mill
31. Turning device

Prepared by: Westphal	Checked by: Ulbrich	Date: 13.07.2020	Rev.: —
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	Techn. Documentation		Code Word: Ptolemais V
	Doc-No.: N-100170-M-D01-GM03-00001-__		Job No.: N-100170

- 32. Hydraulic connection box
- 33. Hydraulic power station

Part of the electrical documentation of the boiler

- 34. Speed measurement
- 35. Junction box instrumentation
- 36. Pressure transmitter
- 37. Sensor temperature measurement
- 38. Gas-actuated thermometer
- 39. Vibration measurement

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Electric actuator for repair gate valve before mill

Type rAB5 E 30 WER WEL CSC.V1.2 HART
RP4AF FU-FC280-0,37-400 ER SR KP
CSCZFU1 CSCK2 + IW5-160

Motor:

Power	0,37 kW
Voltage	3x 400V
Frequency	50Hz
Motor revolution	1370
Nominal current	1,1 A
Output torque motor	60 Nm

Rotary actuator:

Type	SEW SA97/A
Output torque	1790 Nm
Output revolution	9,7 r/min
Overall gear reduction	8,26
Output shaft end	Hollow shaft dia. 90 H7

Control unit

Type	Smartcon CSC.V1.2
Local control unit for wall mounting, CSCZFU1	

Heating resistor:

Power	5 W
Voltage	24 V

SCHIEBEL Antriebstechnik GmbH
Josef Benc Gasse 4
1230 Vienna / Austria
Tel: +43 1 66 108 - 0
email: info@schiebel-actuators.com

Electric actuator for repair gate valve before mill

Type **AB18 Q 80 DER DEL 2WER 2WEL CSC.V1.2**
CSZ1 CSZ2 mW4 RP4AF H + SA97/A

Motor:

Power **3,0 kW**
Voltage **690/400V**
Frequency **50Hz**
Motor revolution **2850 r/min**
Nominal current **3,83 A**
Output torque motor **249 Nm**

Rotary actuator:

Type **SEW SA97/A**
Output torque **1790 Nm**
Output revolution **9,7 r/min**
Overall gear reduction **8,26**
Output shaft end **Hollow shaft dia. 90 H7**

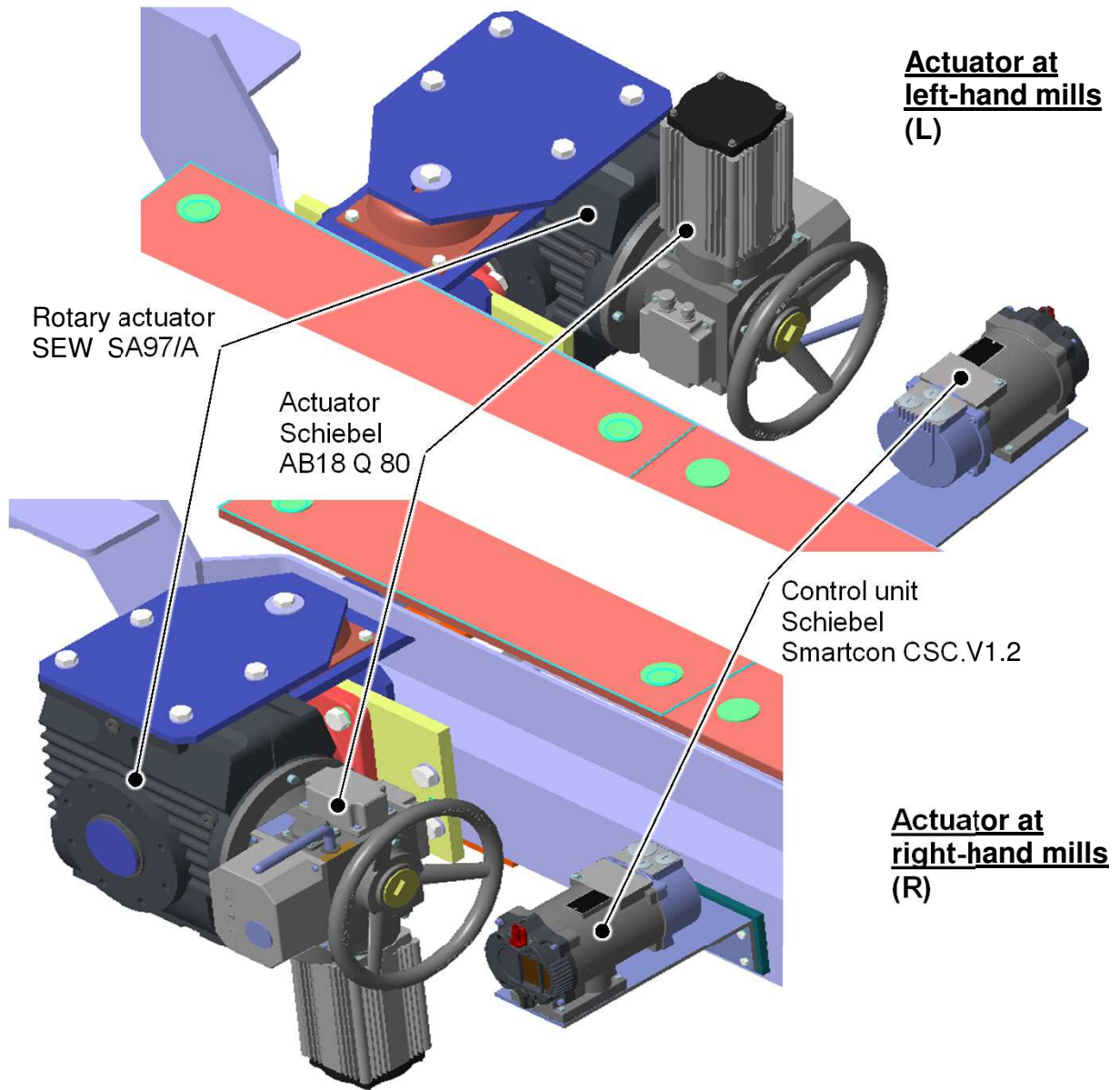
Control unit

Type **Smartcon CSC.V1.2**
Local control unit for wall mounting, CSZ1

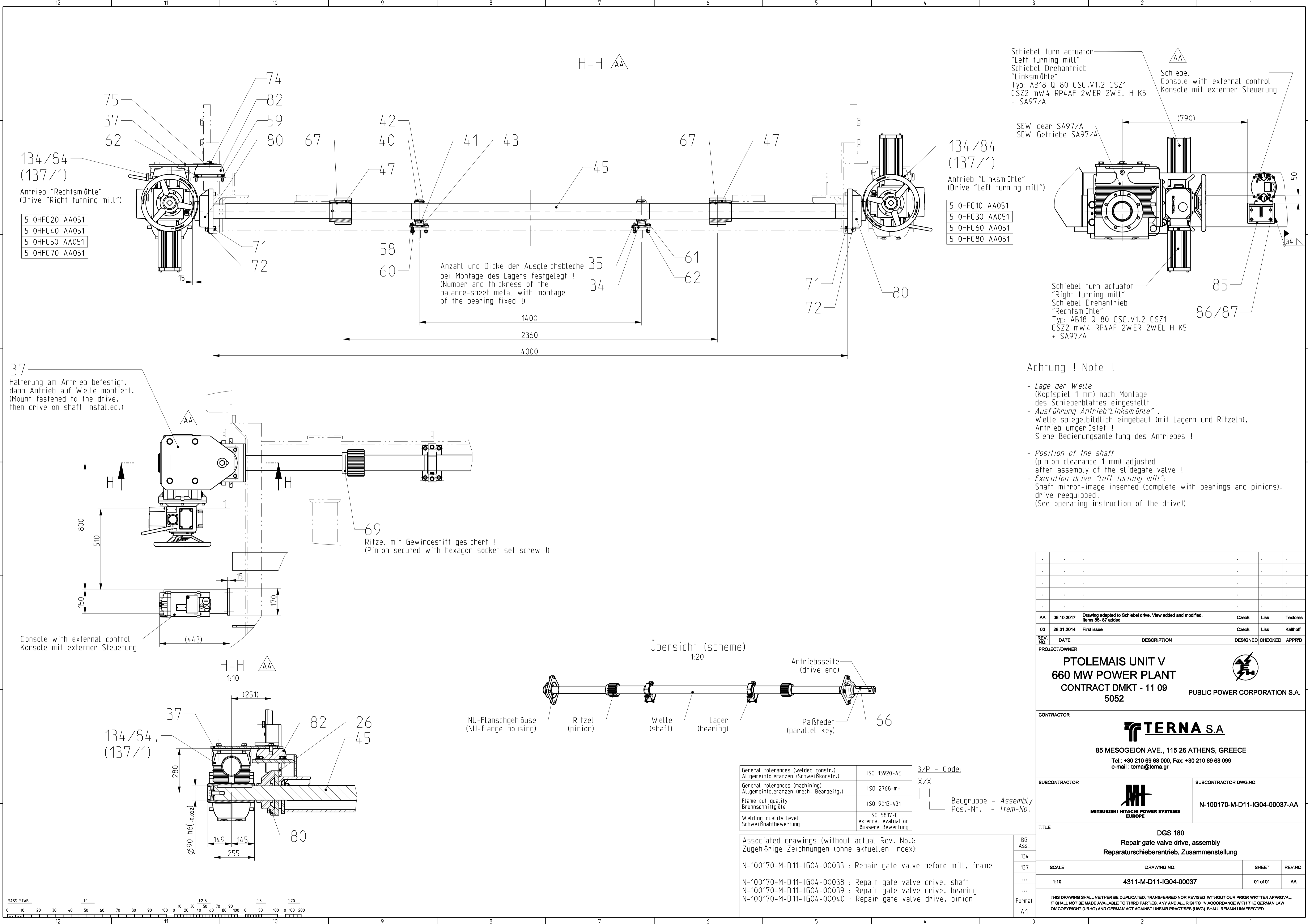
Heating resistor:

Power **5 W**
Voltage **24 V**

SCHIEBEL Antriebstechnik GmbH
Josef Benc Gasse 4
1230 Vienna / Austria
Tel: +43 1 66 108 - 0
email: info@schiebel-actuators.com



KKS No.		Serial no. drive + control unit	
5 0HFC10 AA051	(L)	1770 2513 + 1767 9922	
5 0HFC20 AA051	(R)	1770 2517 + 1767 9926	
5 0HFC30 AA051	(L)	1770 2514 + 1767 9923	
5 0HFC40 AA051	(R)	1770 2518 + 1767 9927	
5 0HFC50 AA051	(R)	1770 2519 + 1767 9928	
5 0HFC60 AA051	(L)	1770 2515 + 1767 9924	
5 0HFC70 AA051	(R)	1770 2520 + 1767 9929	
5 0HFC80 AA051	(L)	1770 2516 + 1767 9925	



Schiebel turn actuator
"Left turning mill"
Schiebel Drehantrieb
"Linksmühle"
Typ: AB18 Q 80 CSC.V1.2 CSZ1
CSZ2 mW4 RP4AF 2WER 2WEL H K5
+ SA97/A

AA
Schiebel
Console with external control
Konsole mit externer Steuerung

SEW gear SA97/A
SEW Getriebe SA97/A

134/84
(137/1)
Antrieb "Linksmühle"
(Drive "Left turning mill")

5 OHFC10	AA051
5 OHFC30	AA051
5 OHFC60	AA051
5 OHFC80	AA051

134/84
(137/1)
Antrieb "Rechtsmühle"
(Drive "Right turning mill")

5 OHFC20	AA051
5 OHFC40	AA051
5 OHFC50	AA051
5 OHFC70	AA051

Anzahl und Dicke der Ausgleichsbleche
bei Montage des Lagers festgelegt !
(Number and thickness of the
balance-sheet metal with montage
of the bearing fixed !)

37
Halierung am Antrieb befestigt,
dann Antrieb auf Welle montiert.
(Mount fastened to the drive,
then drive on shaft installed.)

69
Ritzel mit Gewindestift gesichert !
(Pinion secured with hexagon socket set screw !)

Console with external control
Konsole mit externer Steuerung

Übersicht (scheme)
1:20

NU-Flanschgehäuse
(NU-flange housing)

Ritzel
(pinion)

Welle
(shaft)

Lager
(bearing)

Paßfeder
(parallel key)

66

General tolerances (welded constr.) Allgemeintoleranzen (Schweißkonstr.)	ISO 13920-AE
General tolerances (machining) Allgemeintoleranzen (mech. Bearbeitg.)	ISO 2768-mH
Flame cut quality Brennschnittgüte	ISO 9013-431
Welding quality level Schweißnahtbewertung	ISO 5817-C external evaluation äußere Bewertung

B/P - Code:
X/X
Baugruppe - Assembly
Pos.-Nr. - Item-No.

Associated drawings (without actual Rev.-No.):
Zugehörige Zeichnungen (ohne aktuellen Index):

- N-100170-M-D11-IG04-00033 : Repair gate valve before mill, frame
- N-100170-M-D11-IG04-00038 : Repair gate valve drive, shaft
- N-100170-M-D11-IG04-00039 : Repair gate valve drive, bearing
- N-100170-M-D11-IG04-00040 : Repair gate valve drive, pinion

AA	06.10.2017	Drawing adapted to Schiebel drive, View added and modified, Items 65- 67 added	Czech.	Liss	Textores
00	28.01.2014	First issue	Czech.	Liss	Kalthoff
REV. NO.	DATE	DESCRIPTION	DESIGNED	CHECKED	APPROVED
PROJECT/OWNER					
PTOLEMAIS UNIT V 660 MW POWER PLANT CONTRACT DMKT - 11 09 5052			 PUBLIC POWER CORPORATION S.A.		
CONTRACTOR					
 85 MESOGEION AVE., 115 26 ATHENS, GREECE Tel.: +30 210 69 68 000, Fax: +30 210 69 68 099 e-mail : terna@terna.gr					
SUBCONTRACTOR			SUBCONTRACTOR DWG.NO.		
 MITSUBISHI HITACHI POWER SYSTEMS EUROPE			N-100170-M-D11-IG04-00037-AA		
TITLE					
DGS 180 Repair gate valve drive, assembly Reparaturschieberantrieb, Zusammenstellung					
SCALE	DRAWING NO.			SHEET	REV.NO.
1:10	4311-M-D11-IG04-00037			01 of 01	AA
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Documentation for actuators type AB with integrated SMARTCON control
unit - 200682

SCHIEBEL

delivered to:
Mitsubishi Hitachi Power Systems Europe GmbH

Your order no.:
4500329600/126

Schiebel Com. No.:
200682

Project:
Kom. 180686 Pj. Ptolemais

Contents

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1 datasheet for actuator with serial no.: 2080 1032

Customer:	Mitsubishi Hitachi Power Systems Europe GmbH
Project:	Kom. 180686 Pj. Ptolemais
order no.:	4500329600/126
job number:	200682
quantity:	1
type:	rAB5 E 30 WER WEL CSC.V1.2 HART RP4AF FU-FC280-0,37-400 ER SR KP CSCZFU1 CSCK2 + IW5-160
fab-no.:	2080 1032
painting:	K5 (300-400 μ m) RAL7001
protection class:	IP67
temperature range:	-25°C to 60°C
motor	power (kW): 0,37
	Voltage three phase: 3x400V / 50Hz (star connection)
	nominal current / starting current (A): 1,1 / 3,7
	nominal speed (rpm): 1370
	size / pols: 71 / 4
	mode of operation: S4-1200-40%
	motor protection: thermal sensor
	Ex-confirm: –
	Ex-confirm no.: –
actuator:	type: rAB5 E 30
	switch off torque OPEN / CLOSE (Nm): 60 / 60
	adjustable torque (Nm): 40,0 to 60
	max. continuous torque (Nm): 30,0
	output speed actuator (rpm): 30,0
	adjustable output speed actuator (rpm): 6,0 to 30,0
	adjusted travel (revs.): 40,0
	operation time for adjusted travel (see above) (sec): 80
	adjustable operation time for above travel (sec): 80 to 400
	actuator is self locking: yes
	output flange: F10 acc. ISO 5210 or ISO 5211
	output shaft: E with Ø20 mm
	Ex-confirm: –
	Ex-confirm no.: –
	dimension drawing(s): M-CSC08z2-4 V1.2 + iw52irsr2 (80:1+120:1+160:1 / I:F10+F14 / A:F16) + M80_1E30m
Wormgearbox	type: IW5-160
	gearbox switch off torque OPEN / CLOSE (Nm): 3900 / 3900
	max. torque S2 / max. torque S4 (Nm): 4447 / 2223
	adjusted travel (°): 90
	max. travel (°): 90
	factor: 65
	ratio: 160
	output flange: F16
	output shaft: drive sleeve with borehole and key acc. DIN with Ø60 mm
	gear unit is self locking: yes
control unit / additional components	wiring diagram(s): SCP 51.39.09_2 + SCC 10.19.07_6
	torque-unit with potentiometer 1000 Ohm F1000
	travel device WER WEL
	1 switch for cw and 1 switch for ccw
	position transmitter unit with potentiometer 1000 Ohm for CSC control unit
	control unit: CSC.V1.2
	bussystem: HART
	relay board: RP4AF
	position signal: ER
	positioner: SR
	parameterization: KP
	control unit designed for sepearte mounting: CSCZFU1
	connection cable: CSCK2
	fab-no.: 2067 2393
	Ex-confirm: –

Ex-confirm no.:

—

marking:

2080 1032: 5 0HFC10-80 AA001
S9 (6..30rpm/25Nm)

2 datasheet for actuator with serial no.: 2080 1033-1036

Customer:	Mitsubishi Hitachi Power Systems Europe GmbH
Project:	Kom. 180686 Pj. Ptolemais
order no.:	4500329600/126
job number:	200682
quantity:	4
type:	rAB5 E 30 WER WEL CSC.V1.2 HART RP4AF FU-FC280-0,37-400 ER SR KP CSCZFU1 CSCK2
fab-no.:	2080 1033-1036
painting:	K5 (300-400 μ m) RAL7001
protection class:	IP67
temperature range:	-25°C to 60°C
motor	power (kW): 0,37
	Voltage three phase: 3x400V / 50Hz (star connection)
	nominal current / starting current (A): 1,1 / 3,7
	nominal speed (rpm): 1370
	size / pols: 71 / 4
	mode of operation: S4-1200-40%
	motor protection: thermal sensor
	Ex-confirm: –
	Ex-confirm no.: –
actuator:	type: rAB5 E 30
	switch off torque OPEN / CLOSE (Nm): 60 / 60
	adjustable torque (Nm): 40,0 to 60
	max. continuous torque (Nm): 30,0
	output speed actuator (rpm): 30,0
	adjustable output speed actuator (rpm): 6,0 to 30,0
	adjusted travel (revs.): 40,0
	operation time for adjusted travel (see above) (sec): 80
	adjustable operation time for above travel (sec): 80 to 400
	actuator is self locking: yes
	output flange: F10 acc. ISO 5210 or ISO 5211
	output shaft: E with Ø20 mm
	Ex-confirm: –
	Ex-confirm no.: –
	dimension drawing(s): M-CSC08z2-4 V1.2 + M80_1E30m
control unit / additional components	wiring diagram(s): SCP 51.39.09_2 + SCC 10.19.07_6
	torque-unit with potentiometer 1000 Ohm F1000
	travel device WER WEL
	1 switch for cw and 1 switch for ccw
	position transmitter unit with potentiometer 1000 Ohm for CSC control unit
	control unit: CSC.V1.2
	bussystem: HART
	relay board: RP4AF
	position signal: ER
	positioner: SR
	parameterization: KP
	control unit designed for separate mounting: CSCZFU1
	connection cable: CSCK2
	fab-no.: 2067 2394-2397
	Ex-confirm: –
	Ex-confirm no.: –
marking:	2080 1033: 5 0HFC20 AA001 S9 (6..30rpm/25Nm)
	2080 1034: 5 0HFC40 AA001 S9 (6..30rpm/25Nm)
	2080 1035: 5 0HFC50 AA001 S9 (6..30rpm/25Nm)
	2080 1036: 5 0HFC70 AA001 S9 (6..30rpm/25Nm)

3 datasheet for actuator with serial no.: 2080 1037-1040

Customer:	Mitsubishi Hitachi Power Systems Europe GmbH
Project:	Kom. 180686 Pj. Ptolemais
order no.:	4500329600/126
job number:	200682
quantity:	4
type:	rAB5 E 30 WER WEL CSC.V1.2 HART RP4AF FU-FC280-0,37-400 ER SR KP CSCZFU1 CSCK2
fab-no.:	2080 1037-1040
painting:	K5 (300-400 μ m) RAL7001
protection class:	IP67
temperature range:	-25°C to 60°C
motor	power (kW): 0,37
	Voltage three phase: 3x400V / 50Hz (star connection)
	nominal current / starting current (A): 1,1 / 3,7
	nominal speed (rpm): 1370
	size / pols: 71 / 4
	mode of operation: S4-1200-40%
	motor protection: thermal sensor
	Ex-confirm: –
	Ex-confirm no.: –
actuator:	type: rAB5 E 30
	switch off torque OPEN / CLOSE (Nm): 47,0 / 47,0
	adjustable torque (Nm): 40,0 to 60
	max. continuous torque (Nm): 30,0
	output speed actuator (rpm): 30,0
	adjustable output speed actuator (rpm): 6,0 to 30,0
	adjusted travel (revs.): 40,0
	operation time for adjusted travel (see above) (sec): 80
	adjustable operation time for above travel (sec): 80 to 400
	actuator is self locking: yes
	output flange: F10 acc. ISO 5210 or ISO 5211
	output shaft: E with Ø20 mm
	Ex-confirm: –
	Ex-confirm no.: –
	dimension drawing(s): M-CSC08z2-4 V1.2 + M80_1E30m
control unit / additional components	wiring diagram(s): SCP 51.39.09_2 + SCC 10.19.07_6
	torque-unit with potentiometer 1000 Ohm F1000
	travel device WER WEL
	1 switch for cw and 1 switch for ccw
	position transmitter unit with potentiometer 1000 Ohm for CSC control unit
	control unit: CSC.V1.2
	bussystem: HART
	relay board: RP4AF
	position signal: ER
	positioner: SR
	parameterization: KP
	control unit designed for sepearte mounting: CSCZFU1
	connection cable: CSCK2
	fab-no.: 2067 2398-2401
	Ex-confirm: –
	Ex-confirm no.: –
marking:	2080 1037: 5 0HFC10 AA001 S9 (6..30rpm/25Nm)
	2080 1038: 5 0HFC30 AA001 S9 (6..30rpm/25Nm)
	2080 1039: 5 0HFC60 AA001 S9 (6..30rpm/25Nm)
	2080 1040: 5 0HFC80 AA001 S9 (6..30rpm/25Nm)

4 Operating instructions for actuators type AB with SMARTCON control unit Version 1.2

4.1 Introduction/Notes

These operating instructions apply to SCHIEBEL actuators of the type AB with integrated SMARTCON control unit Version V1.2..

The scope of application covers the operation of industrial valves, e.g., globe valves, gate valves, butterfly valves and ball valves. For other applications please consult with the factory.

The manufacturer shall not be liable for incorrect use and possible damage arising thereof. The risk shall be borne solely by the user.

Using the unit as intended also entails the observance of these operating instructions!



When operating electrical equipment, certain parts inevitably carry hazardous voltage levels. Work on the electrical system or equipment must be carried out only in accordance with electrical regulations by a qualified electrician himself or by specially instructed personnel under the control and supervision of a qualified electrician.

Maintenance instructions must be observed as otherwise the safe operation of the actuator cannot be guaranteed.

Failure to follow the warning information may result in serious bodily injury or property damage. Qualified personnel must be thoroughly familiar with all warnings contained in this operating manual.

Proper transport, storage, installation, assembly and careful commissioning are essential to proper and safe operation.

When working in potentially explosive areas, observe the European Standards EN 60079-14 "Electrical Installations in Hazardous Areas" and EN 60079-17 "Inspection and Maintenance of Electrical Installations in Hazardous Areas".



Maintenance work on open actuators may only be conducted if these are de-energized. Reconnection during maintenance is strictly prohibited.



4.2 General

4.2.1 Overview

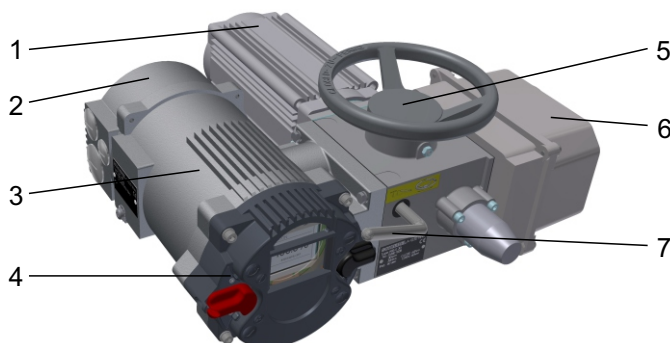


Figure 1: 1... Motor, 2... Connection compartment, 3... SMARTCON control unit, 4... Operating unit, 5... Handwheel, 6... Signalling lid, 7... Lever for manual operation

4.2.2 Serial number and nameplate

Each actuator and each SMARTCON control unit carries a serial number. The serial number is a 8-digit number that begins with the year and that can be read from the nameplate (see Figure 2 and 3)

The nameplate of the actuator is located under the hand lever and the nameplate of the SMARTCON control unit is located on the control unit (see Figure 4).

Using this serial number, SCHIEBEL can uniquely identify the actuator (type, size, design, options, technical data and test report).

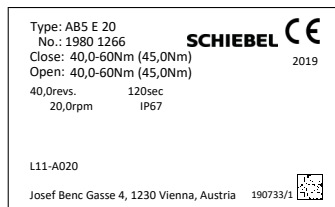


Figure 2: nameplate of the actuator



Figure 3: nameplate of the SMARTCON control unit



Figure 4: 1... nameplate of the SMARTCON control unit, 2... nameplate of the actuator

Actuators which are suitable for operation in explosive atmosphere (see EU-Richtlinie 2014/34/EU and EN60079-0 Standard) are separately designated by a special model plate (Ex, TÜV-Standard, see Figure 5 and 6).

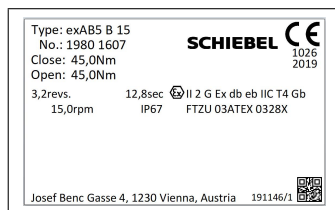


Figure 5: nameplate of the actuator for operation in explosive atmosphere

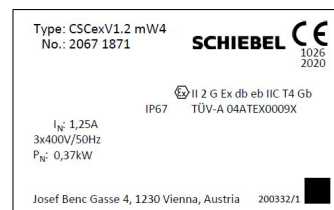


Figure 6: nameplate of the SMARTCON control unit for operation in explosive atmosphere

4.2.3 Operating mode

There are two distinct modes of operation: open-loop control operation (operational mode S2 for ON-OFF) and closed-loop control operation (operational mode S4) according to EN 60034-1. But since there is a great number of varying and special models made to order, it is recommended to consult the motor model plate for the mode of operation and the running time.

4.2.4 Protection class

Actuators with three-phase motors are standardly equipped with the IP 66 protection system (according to DIN-Standard 40050). **Explosion-proof** actuators and actuators with plugs are furnished with the IP 65 protection system. Exceptions are the AC, DC and brake-motor actuators as well as those for other protection systems made to special order.

CAUTION: The protection class specified on the nameplate is only effective when cable glands also provide the required protection class, the cover of the connection compartment is carefully screwed and the mounting position (see section 4.2.5, page 11) is observed.



We recommend metallic screwed cable glands with a metrical thread. Furthermore, cable inlets not be needed must be closed with screw plugs. On explosion-proof actuators cable glands with protection class **Ex e according EN60079-7** must be used. **After removing covers** for assembly purposes or adjustment work, take special care upon reassembly so that seals are not damaged and remain properly fastened. Improper assembly may lead to water entrances and to failures of the actuator.



Allow a certain sag in the connector cables before reaching the screwed cable glands so that water can drip off from the connector cables without running to the screwed cable glands. As a result, forces acting on the screwed cable glands are also reduced. (see section 4.2.5)

4.2.5 Mounting position

In principle, the installation position is irrelevant. However, based on practical experience, it is advisable to consider the following for outdoors use or in splash zones:

4.2 General

- Mount actuators with cable inlet facing downwards
- Do not arrange the motor so that it hangs downwards
- Ensure that sufficient cable slack is available

4.2.6 Direction of rotation

Unless specifically ordered otherwise, the standard direction is (see Figure 7 and Figure 8):

Clockwise rotation = Close

Counter-clockwise rotation = Open

Clockwise rotation of the actuator is given when the output shaft turns counter clockwise when looking on the output shaft.

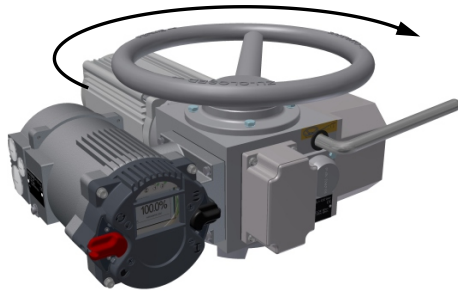


Figure 7: AB3 - AB80

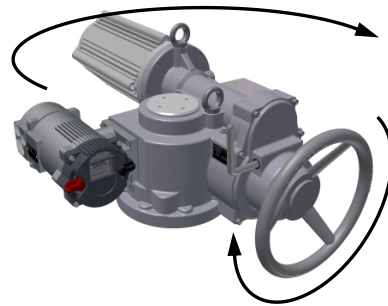


Figure 8: AB100 - AB500

All data in these operating instructions refer to the standard rotating direction.

4.2.7 Protection devices

4.2.7.1 Electromechanical protection devices (design potentiometer torque)

The torque protection of the actuators with integral SMARTCON control unit is controlled mechanically by plate springs which pass the current torque through a conductive plastic potentiometer to the control unit. The switch off torque can be changed in the menu of the control unit for the left and right direction. The factory default switch off torque is set to the ordered torque. If no torque was specified in the order, the actuator is supplied from the factory with the maximum adjustable torque.

See also section 4.7.2, page 32

4.2.7.2 Mechanical protection devices (design switch for torque)

All actuators have at least one torque switch for clockwise and counter-clockwise rotation. These can be separately adjusted and are preset ex works to the torque required

The adjusting screws are varnish-protected and must not be reset without prior consultation with the Schiebel Company.

However, the torque for the relevant rotating direction can be reduced by means of plastic cams on the torque switch. Counter-clockwise rotation torque is reduced as follows: Using a screwdriver, turn the plastic cam marked "L" in the direction of the decreasing scale markings (clockwise).

To reduce the clockwise rotation torque, turn the plastic cam marked "R" in the direction of the decreasing scale markings (clockwise). See Figure 9.

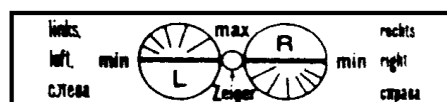


Figure 9

4.2.7.3 Electrical protection devices

All motors have temperature switches as standard equipment (temperature sensors upon special order), which are wired into the control and protect the motor from overheating.

In the housing of the connection plug super fast safety fuses are located to protect the integrated thyristors (electronic reversing contactors).

Further we recommend the installation of a motor protection circuit breaker on site as additional protection for rapid engine

warming up (block). The tripping current must be adjusted to 1.2 ... 1.5-times of the motor current, or at explosion-proof models proceed according to the corresponding guidelines of the National Explosion Protection Authority.

4.2.8 Ambient temperature

Unless otherwise defined according to special order, the following operational temperature generally applies:

- open-loop control actuators from -25°C to +70°C
- closed-loop control actuators from -25°C to +60°C
- Explosion-proof actuators (according to EN60079-0 Standard):

Type	min. Temp.	max. Temp
Standard	-20°C	+40°C
TT40	-40°C	+40°C
TT50	-50°C	+40°C
HT60	-20°C	+60°C
HT70	-20°C	+70°C

Warning: The maximum operational temperature also depends on the built-in components. Please observe the technical data sheets.

4.2.9 Delivery condition of the actuators

For each actuator, an inspection report is generated upon final inspection. In particular, this comprises a full visual inspection, calibration of the torque measurement in connection with an extensive run examination and a functional test of the micro controllers.

These inspections are conducted and documented according to the quality system and can be found in the document gag (mounted on the handwheel).

The basic setting of the end position must be performed after assembly on the actuator.

CAUTION: Commissioning instructions (see section 4.5, page 17) must be strictly observed!

During assembly of the supplied valves at the factory, end positions are set and documented by attaching a label (see Figure 10). During commissioning at the plant, these settings must be verified.



Einbaukomponenten sind voreingestellt. Stellantrieb darf weder demontiert noch in seiner Stellung zur Armatur verändert werden, andernfalls ist eine Neueinstellung erforderlich. Bei anlagenseitiger Inbetriebnahme können Neujustagen erforderlich werden.	Built-in components are preset. The actuator must not be removed or changed in its position to the valve, otherwise a re-adjustment is required. Also at commissioning re-adjustment may be required.
SCHIEBEL	
ID:7568	

Figure 10: Label

4.2.10 Information notice (tag)

Each actuator is provided with a bilingual tag containing key information, which is attached to the handwheel after final inspection. This tag also shows the internal commission registration number (see Figure 11)



Figure 11: tag

4.3 Packaging, transport and storage

You can order the actuators to be delivered with or without packing. Special packing requirements must be specified along with your order. Use extreme caution when unpacking or repacking the actuator.

Use soft belts for hoisting equipment. Do not attach hoisting belts to the handwheel.



4.3.1 General

The indicator lids of all actuators contain a minimum of 5 g of silica gel ex factory.

WARNING! Prior to start-up of the actuator (refer to section 4.5, page 17) all of the silica gel must be removed!



4.3.2 Storage

CAUTION

Observing the following precautions will help to avoid damage when storing actuators:

- Store actuators in well-ventilated, dry premises
- Protect against floor dampness by storing actuators on wooden grating, pallets, mesh boxes or shelves
- Protect the actuators against dust and dirt with plastic foil
- Actuators must be protected against mechanical damage. It is not necessary to open the controller of the actuator for servicing batteries or similar operations.
- The storage temperature must be between -20°C to +40°C

It is not necessary to open the controller of the actuator for servicing batteries or similar operations.

4.3.3 Long-term storage

CAUTION: If you intend to store the actuator for over 6 months, follow additionally the instructions below:



- **CAUTION:** The silica gel in the connection compartment must be replaced after 6 months of storage (from date of delivery from SCHIEBEL's factory in Vienna)
- After replacing the silica gel, brush with glycerine the connection cover seal. Then, carefully close again the connection compartment
- Coat screw heads and bare spots with neutral grease or long-term corrosion protection
- Renovate damaged paintwork arising from transport, improper storage, or mechanical influences.

CAUTION: For explosionproof actuators it is not allowed to overlacquer the actuator extensive. According to the standard, to avoid electrostatic charge, the maximal thickness of the varnish is limited with 200 μm .



- Wrap the motor (especially the brake motor) with oiled paper.
- Every 6 months. all measures and precautions for long term storage must be checked for effectiveness and corrosion protection and silica gel renewed.
 - Failure to follow the above instructions may lead to condensation which can damage to the actuator.



4.4 Installation Instructions

Installation work of any kind of actuator may only be performed by qualified personnel.

4.4.1 Mechanical Connection

Make sure that the fitting flanges and the actuator flanges match each other, and that the borehole matches the shaft or, in the case of actuator model "A"(threaded bushing), that the actuator and fitting threads match each other.

- Grease the spindle.
- Clean all exposed parts which have been coated with anti-corrosive.
- Thoroughly clean the bolting surfaces of the fittings.
- Lightly grease the connecting joints between the actuator and the fittings.
- Place the actuator on the fittings or the gear.
- Tighten the fastening screws crosswise (torque acc. below table).

size	torque [Nm] for screws 8.8
M6	10
M8	25
M10	48
M12	84
M16	206
M20	415

4.4.2 Mounting position of the control unit

The control unit can be rotated in 90° steps

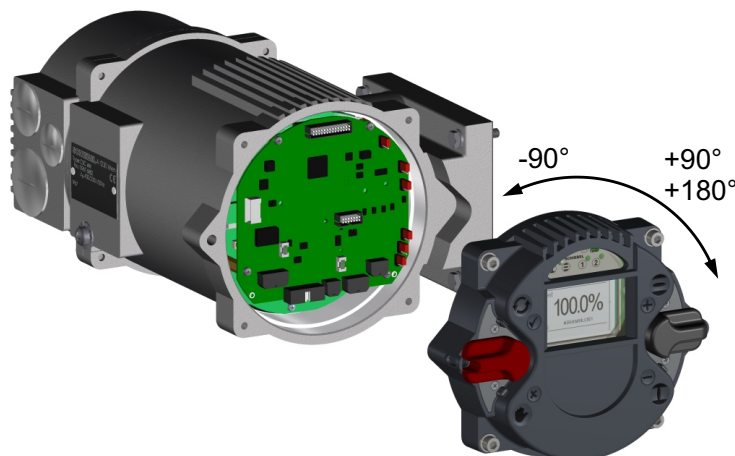


Figure 12

4.4 Installation Instructions

- Disconnect the actuator and control system from the power supply.
- To prevent damage to the electronic components, both the control system and the person have to be earthed!
- Undo the bolts for the interface surface and carefully remove the service cover.
- Turn service cover to new position and put back on.
 - Ensure correct position of the O-ring
 - Turn service cover by max. of 180°.
 - Put service cover on carefully so that no cables get wedged in.
- the bolts evenly in a crosswise sequence. IMPORTANT: max. torque 5 Nm



For output type A (unbored threaded bushing), you must sufficiently lubricate both needle bearings in the output form after processing and cleaning the spindle nut.

For this purpose, use the optional SCHIEBEL grease lubricant or a grease lubricant according to our recommendation (section 4.15, page 55).

4.4.3 Electrical connection

Electrical connections may only be carried out by qualified personnel.

Please observe all relevant national security requirements, guidelines, and regulations.

The equipment should be de-energized before working on electrical connections.

Furthermore, confirm the absence of electrostatic discharges during the connection.

First of all, connect the ground screw.



The line and short circuit protection must be done on the system side.

The ability to unlock the actuator is to be provided for maintenance purposes.

For the dimensioning the rated current is to be used (see Technical Data).



Check whether the power supply (voltage, frequency) is consistent with the connection data (see name plate of the motor)

The connection of electrical wiring must follow the circuit diagram.

This can be found in the appendix of the documentation. The circuit diagram can be ordered from SCHIEBEL by specifying the serial number.



The standard model can be ordered with the following connection options:

- size 1: connection of the control signals and power supply via plugs (see Figure 13) with screw connection.
- size 2: connection of the control signals is the same as size 1, the connection of the power supply is made by an additional plug (see Figure 14), both plugs aer with screw connection.
- **Explosion-proof actuators** or on special request the connection will be mady via terminals (see Figure 15).

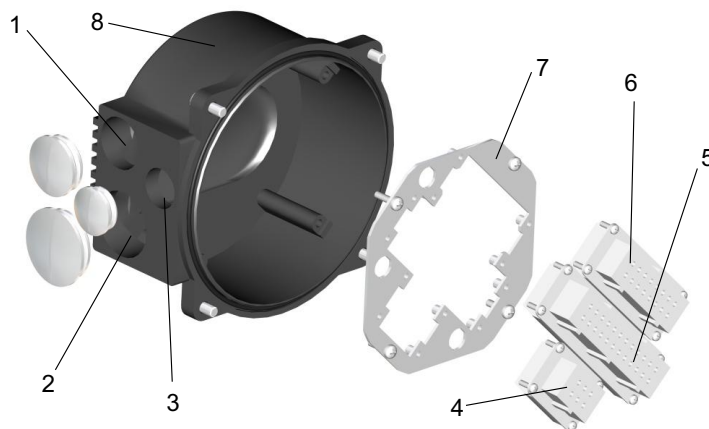


Figure 13: 1...metallic cable glands (closed with blind screw connections at delivery) M32x1,5, 2...M40x1,5, 3...M25x1,5, 4...plug (for power supply), 5...plug (for control signals), 6...plug for options, 7...connection plug plate, 8...connection plug housing

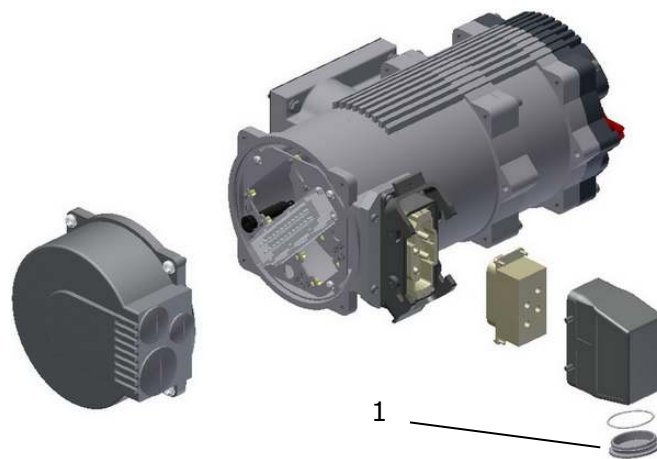


Figure 14: size 2 with the additional plug, 1... M40x1,5

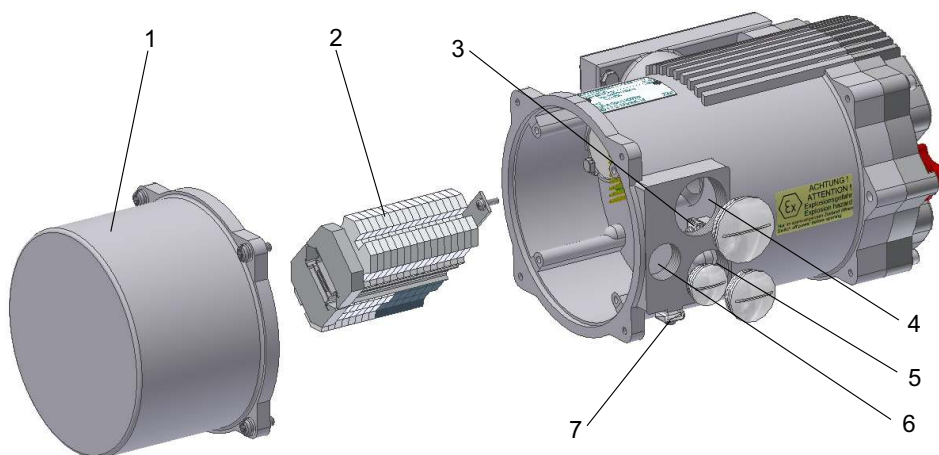


Figure 15: 1... connection plug housing, 2... terminal strip, 3... inside ground connection, 4... metallic cable glands (closed with blind screw connections at delivery) M40x1,5, 5... M32x1,5, 6... M25x1,5, 7... outside ground connection

3 phase power is applied in positive turning direction of the electric field on the connectors L1, L2, L3 according the wiring diagram.

Before starting the actuator the turning direction of the electronic field should be checked.

NOTE: If phase sequence of the three phase power supply system is wrong the integrated phase sequence monitoring generates an error and the actuator is blocked. (see section 4.7.1, page 30)



If you need a reverse rotation of the actuator (ccw) you must change this in the control unit (section 4.7.1, page 30).

Please also note the information about the installation of an external motor protection circuit breaker - see section 4.2.7.3, page 12.



If, during outdoor installation, commissioning is not carried out immediately after electrical connection, the power supply must be connected at a minimum to achieve a heating effect. In this case, the silica gel may remain in the connection compartment until commissioning.



CAUTION: see section 4.3.3, page 14

4.5 Commissioning

Before commissioning, please ensure the actuator is correctly assembled and electrically connected. (see section 4.4, page 15)

CAUTION: Remove silica gel from the connection compartment

4.5.1 General

4.5 Commissioning

CAUTION: During commissioning and after every disassembly of the actuator, you have to make the mechanical preadjustment (see section 4.5.3, page 19), adjust the mechanical position indication (see section 4.5.4, page 20), adjust the additional components (see section 4.5.5, page 20) and adjust the end positions (see section 4.5.7, page 20).

ATTENTION: The torque unit is adjusted at work and **must not** be changed.

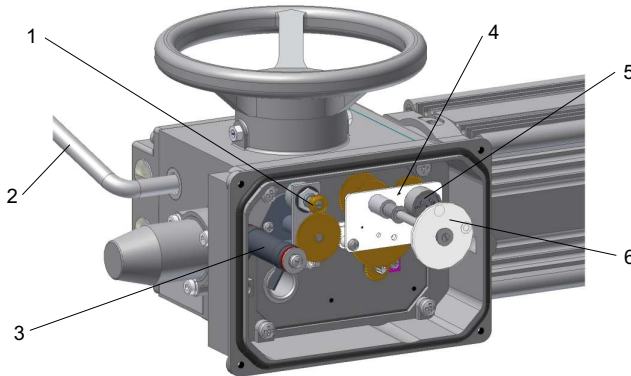


Figure 16: design potentiometer for travel: 1...torque unit, 2...hand lever, 3...heating resistor - **Attention: HOT!!!**, 4...gearing of travel unit, 5...potentiometer for travel sensing, 6...mech. position indicator (option)

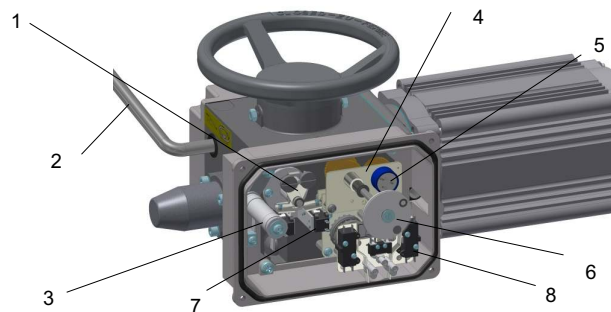


Figure 17: design switch for travel: 1...torque unit, 2...hand lever, 3...heating resistor - **Attention: HOT!!!**, 4...gearing of travel unit, 5...potentiometer for travel sensing, 6...mech. position indicator (option), 7...switch for torque, 8...switch for travel

4.5.2 Switching the actuator to manual operation

The actuator is switched to manual operation by moving the hand lever (see Figure 18 u. 19) by approximately 15°, and by simultaneously turning the hand wheel. The lever remains in this position and will be switched back automatically as the motor starts up.

WARNING:

- When switching to manual operation, the actuator's **automatic interlock is deactivated**, that means that the driven valve must not initiate reverse torque to the output shaft of the actuator!
- Switching back to motor operation is made **automatically** as the motor starts up. It **must not** be undertaken with the hand lever!
- Only switch to manual operation when the motor is idle!
- Hand lever has a slewing angle of approximately 15°, therefore release the hand lever immediately upon activation!



WARNING:

Special approach to switching to manual mode for actuator types AB100, AB200 and AB500!



1. Push the hand lever away from the handwheel and simultaneously move the handwheel in any direction to engage the clutch. The clutch is engaged when the hand lever don't move back automatically and the handwheel is stronger to move.
2. After the clutch is engaged, the hand lever must be pulled back to the handwheel one single time to fix the position of the clutch.
3. The actuator is now in manual operation mode. Switch back to normal operation mode happens automatically by starting the motor. **Switching back to the normal operation mode is not possible with the hand lever!**



Labels on the actuator:

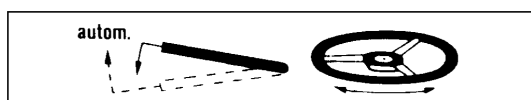


Figure 18: AB3, 5, 100, 200, 500



Figure 19: AB8, 18, 40, 80

4.5.3 Mechanical default settings, preparation (only for design potentiometer for travel)

Instructions:

- Switch with the hand lever to manual operation (see section 4.5.2, page 18) and turn the actuator with the handwheel to the next end position
- Remove cover of the signalling unit
- Switch with the control switch (black switch) to the status menu S4 (see section 4.8.1.4, page 48)
- For units without mechanical position indicator turn the slotted shaft (see Figure 20) with a screwdriver carefully until the below value is reached (see Figure 23)
 - when the actuator in in the closed position: Pos: 10.0
 - when the actuator is in the open position: Pos: 90.0
- For units with mechanical position indicator turn the wheel (see Figure 21 and Figure 22) until the below value is reached (see Figure 23)
 - when the actuator in in the closed position: Pos: 10.0
 - when the actuator is in the open position: Pos: 90.0
- Close cover of the signalling unit. Take special care upon reassembly so that seals are not damaged and remain properly fastened

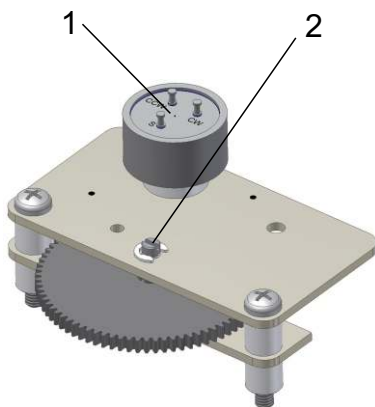


Figure 20: 1...potentiometer for position sensing, 2...slotted shaft for turning the potentiometer

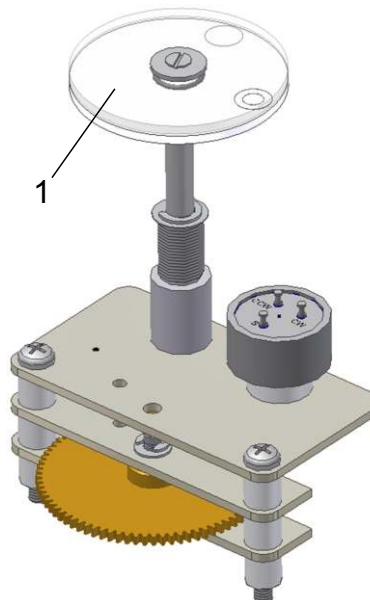


Figure 21: 1...mechanical position indicator

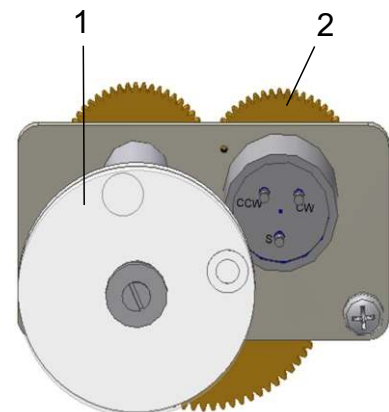


Figure 22: 1...mechanical position indicator, 2...wheel turning the potentiometer

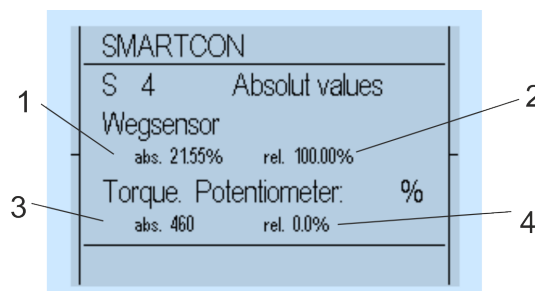


Figure 23: 1... absolute value of the position unit, 2... value for the torque unit (is factory adjusted)

For the set up of the end positionsl see section 4.5.7, page 20.

The abobe transmitter gear is made according to the customer's specifications. If another travel of the actuator is necessary, a new transmitter gearbox can be supplied.

4.5.4 Adjustment of the mechanical position indication (Option)

The adjustment of the mechanical position indication should be done together with the mechanical pre-setup.
Vorgehensweise:

- Switch with the hand lever to manual operation (see section 4.5.2, page 18) and turn the actuator to the next end position.
- Remove cover of the signalling unit
- turn Indicator slide according below end position:
 - when the actuator in in the closed position: Display with the filled circle
 - when the actuator is in the open position: Display with the circle
- move the actuator to the other end position and turn the other Indicator slide. It is necessary that you hold the second slide in its earlier set position.
- Check the clamping screw
- Close cover of the signalling unit. Take special care upon reassembly so that seals are not damaged and remain properly fastened

4.5.5 Additional components (Option)

Possibly installed additional components have to be set-up according their separately supplied technical descriptions.

4.5.6 Parameterize of the SMARTCON control unit

After finishing the pre-setup of teh actuator (see section 4.5.3, page 19) all further settings can be done via the SMARTCON interface.

WARNING: It is absolutely necessarily to control the torque settings of the actuator and to teach in the end positions of the travel.



4.5.7 End limit setting (design potentiometer for travel)

A detailed description of the operation of the SMARTCON control unit can be found in section 4.6.3, page 26.

4.5.7.1 End limit OPEN

Set the selector switch and control switch to the centre position.

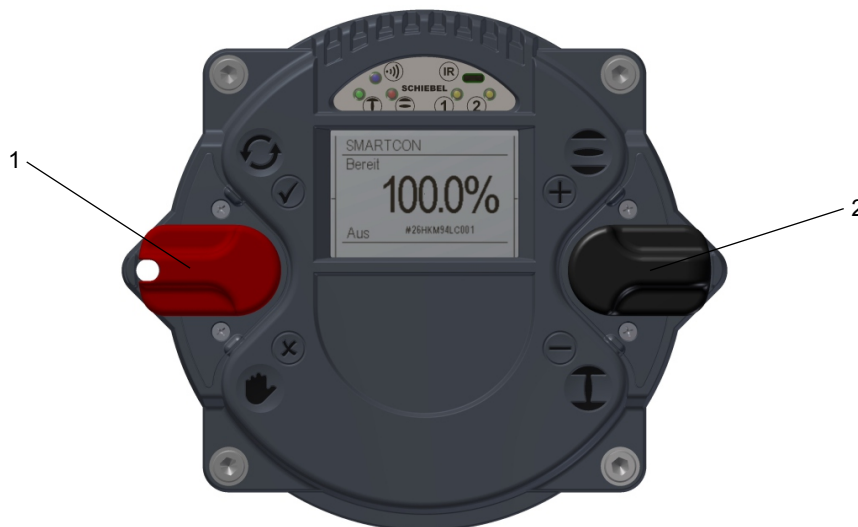


Figure 24: 1... selector switch (red), 2... control switch (black)

Scroll through the menu with the control switch. Move the control switch towards the first menu item \ominus „P 1.1 End limit – Open“.



Figure 25

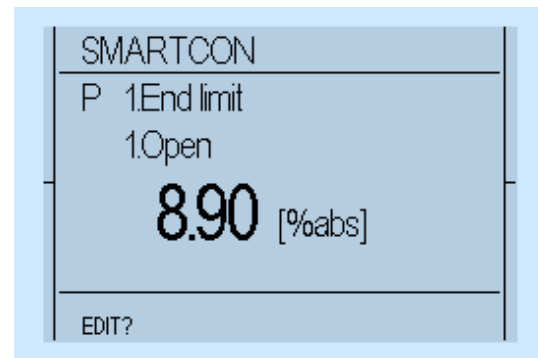


Figure 26

Afterwards, flip up the selector switch slightly and let it snap back to its neutral position ✓

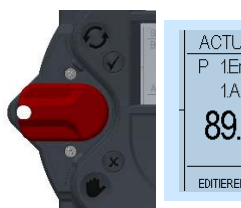


Figure 27

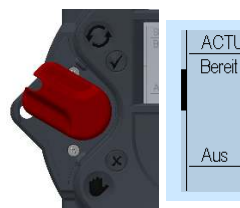


Figure 28



Figure 29

This changes the bottom line of the display from "EDIT?" to "SAVE?"

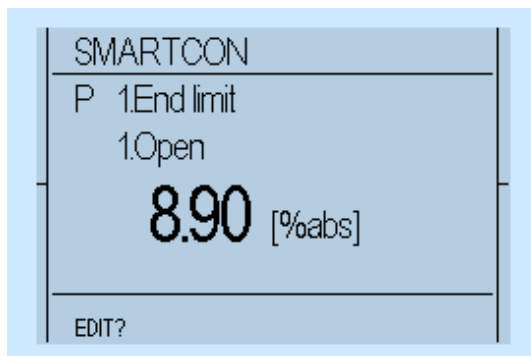


Figure 30

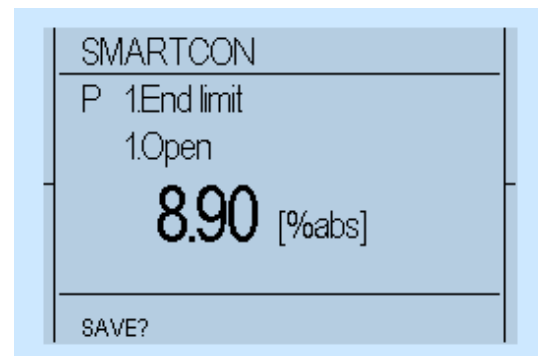


Figure 31

Then, push down the selector switch until it snaps into place. In doing so, the bottom right now on the display will show "TEACHIN" (✕)

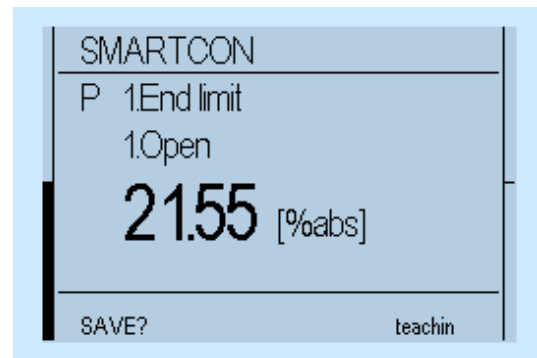
CAUTION: Once the display shows "TEACHIN", use the operating switch (black switch) to start the motorised operation of the actuator. In this mode, no travel-dependent switch off occurs in the end position.



CAUTION: Please note that, during motor operation, only torque monitoring remains active, as travel adjustment will happen subsequently. Therefore, please check beforehand whether the maximum torque has been already parameterised

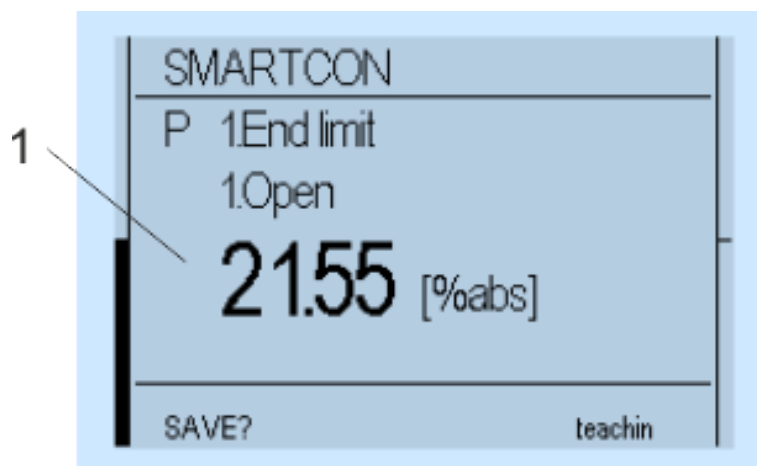


Absolute and relative values on the display will change continuously along with position changes.

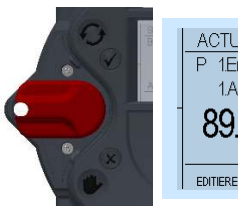
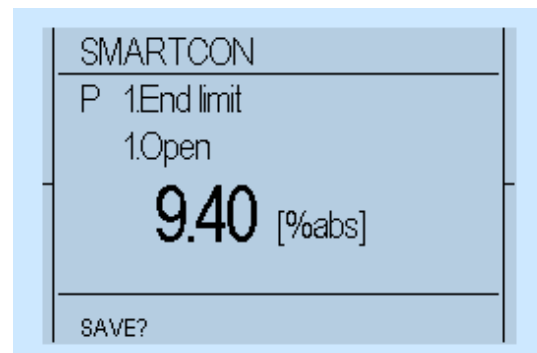
**Figure 32****Figure 33**

Manually move the actuator with the handwheel (see section 4.2.1, page 10 or 4.2.6, page 12) or by motor via the operating switch (black button) to the end position OPEN of the valve.

- Absolute value: Absolute value of the position feedback
- Relative value: the value to the other end position

**Figure 34:** 1... Absolute value, 2... Relative value

When the desired end position OPEN of the valve is reached, move the selector switch back to the middle position. Thus, the line "TEACHIN" disappears.

**Figure 35****Figure 36**

In order to confirm the end position (save), slightly flip up the selector switch and let it snap back to its neutral position ✓

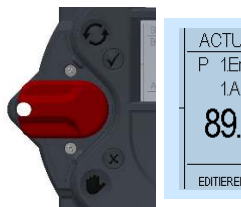


Figure 37

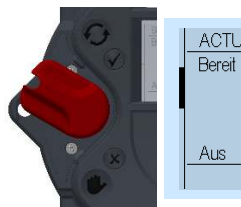


Figure 38

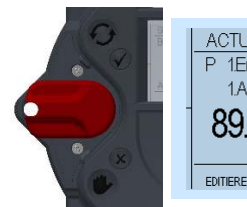


Figure 39

This changes the bottom line of the display for "SAVE?" to "EDIT?" and the end position is stored.

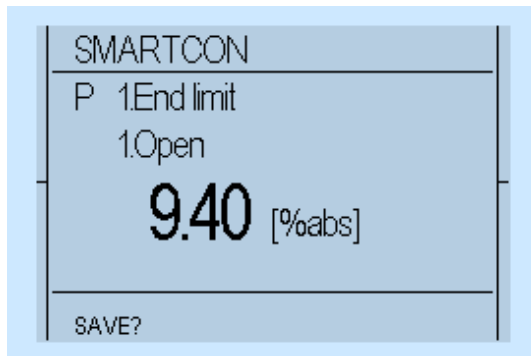


Figure 40

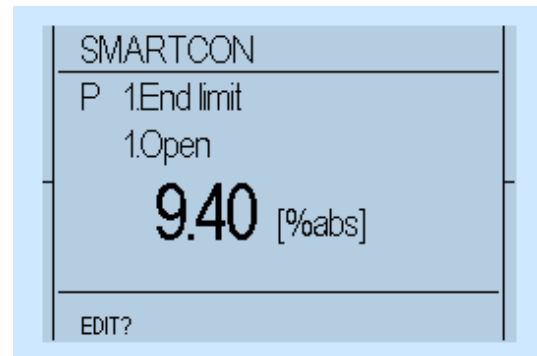


Figure 41

4.5.7.2 End limit CLOSE

Use menu item "P 1.2 End limit - End limit CLOSE" as for End limit OPEN

4.5.7.3 Setting of the end positions (design for switch for travel)

Caution: : Depending on the load intensity, special actuators with high output speed display a trailing effect when switched off. This must be taken into consideration accordingly when adjusting the travel switches. The actuator can use either a roller-type counter or a camshaft gear for travel determination, as need be.

Roller-type Counter (operational range starting at 1 rev. at the output)

- Setting the position „CLOSE“:
Move the actuator into the position „CLOSE“by hand. To set the final position, push the flasher shaft with square cam (see Figure 42) downwards with the finger. Using a screwdriver, turn the slotted shaft of the “R”rollers in the direction of the arrow, until the corresponding counter-clockwise trip cam activates the travel switch (see Figure 43). Release flasher shaft and be sure that the toothed roller locks in.

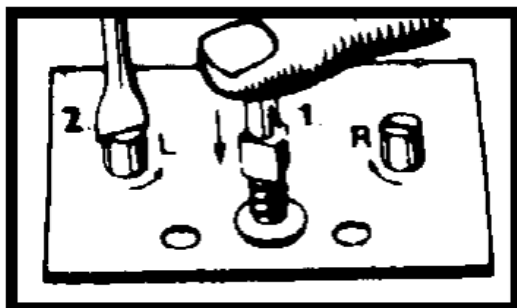


Figure 42

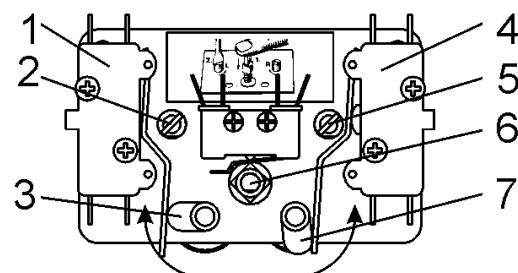


Figure 43: 1... switch S4, 2... L, 3... trip cam for counter-clockwise (OPEN), 4... switch S3, 5... R, 6... flasher shaft, 7... trip cam for counter-clockwise (CLOSE)

- Setting the position „OPEN“:
Move the actuator into the position „OPEN“by hand. To set the final position, push the flasher shaft with square cam (see Figure 42) downwards with the finger. Using a screwdriver, turn the slotted shaft of the “L”rollers in the direction of the arrow, until the corresponding clockwise trip cam activates the travel switch (see Figure 43). Release flasher shaft and be sure that the toothed roller locks in.

4.5.7.4 Final works

Following commissioning, check for proper sealing the covers to be closed and cable inlets. (see section 4.2.4, page 11)
Check actuator for paint damage (by transport or installation) and repair if necessary.

4.6 Control Unit

The controller is intended to monitor and control the actuator and provides the interface between the operator, the control system and the actuator.

4.6.1 Operating unit

Operation relies on two switches: the control switch and a padlock-protected selector switch.
Information visualization is provided by 4 integrated indicator lights, as well as the graphic display.
For better visibility, switch symbols (✓, ✗, ⊕, ⊖) are on the cover

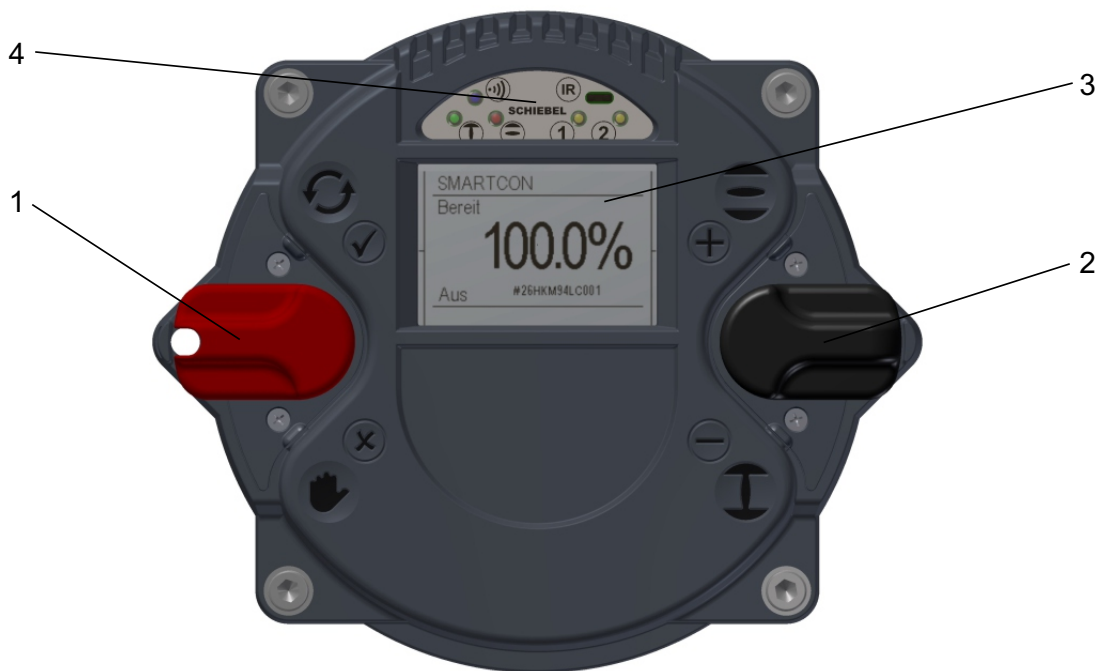


Figure 44: 1... Selector switch, 2... Control switch, 3... Graphic display, 4... LED display

The controller switches serve on the one hand for electric-motor operation of the actuator and, on the other hand, to configure and view various menu items.

The controller cover may be wiped clean with a damp cloth.

The mounting position of the control unit can be turned in 90° steps (see section 4.4.2, page 15).

4.6.2 Display elements

4.6.2.1 Graphic display

The graphic display used in the controller allows text display in different languages.

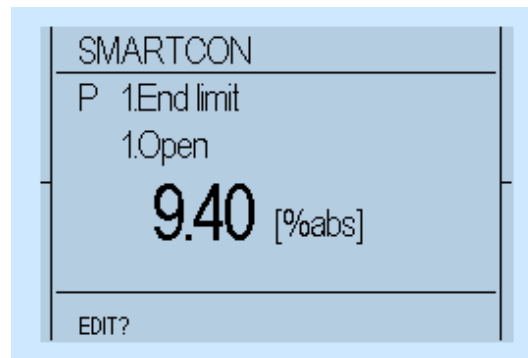


Figure 45

During operation, the displays shows the position of the actuator as a percentage, operation mode and status. When using the option "identification", a customer-specific label is shown at the bottom of the display (e.g., PPS Number).

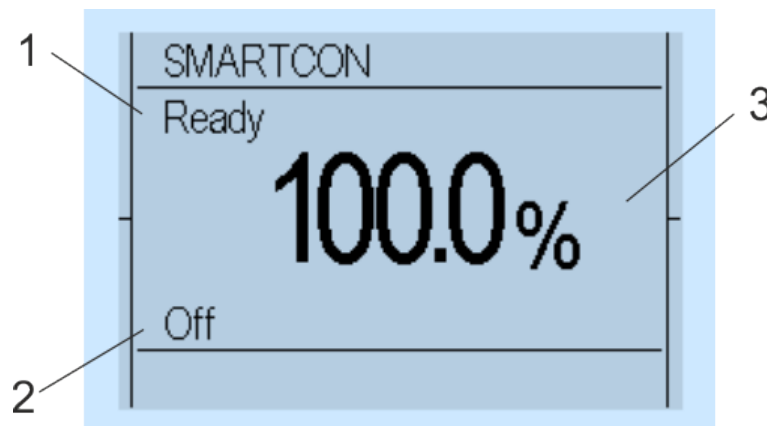


Figure 46: 1... Status, 2... Operation mode, 3... Position

4.6.2.2 LED Display

To provide users with better status information, basic status data is displayed using 4-colour LEDs. As the device powers up, it undertakes a self-test whereby all 4 LEDs briefly lit up simultaneously.

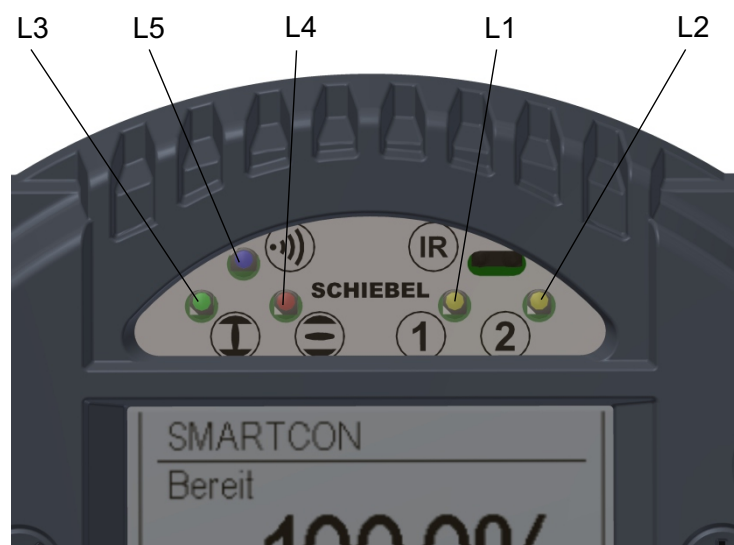


Figure 47

4.6 Control Unit

Description	Colour	Lits up	Flashes quickly	Flashes slowly	Does not light up
L1	Yellow	No torque error	Torque fault	—	¹⁾
L2	Yellow	Ready (operational readiness)	Travel fault (no operational readiness!)	—	Error (no operational readiness) motor temperature, supply voltage absent, internal error ¹⁾
L3	Green ²⁾	CLOSE ³⁾	Moving to CLOSE position	Applies upon torque-dependent closing: Occurs when the end position CLOSE is reached but the cut-out torque has not yet been reached	Actuator is not in the CLOSE position.
L4	Red ²⁾	OPEN ³⁾	Moving to OPEN position	Applies upon torque-dependent opening: Occurs when the end position OPEN is reached but the cut-out torque has not yet been reached	Actuator is not in the OPEN position.
L5	Blue	Bluetooth connected	Bluetooth data transmission	Bluetooth ON, not connected	Bluetooth/Infrared OFF
	Red	Infrared connected	Infrared data transmission	Infrared ON, not connected	

4.6.3 Operation

The actuator is operated via the switches located on the controller (selection- and control switch). All actuator settings can be entered with these switches. Furthermore, configuration is also possible via the IR interface or the Bluetooth Interface (see section 4.9, page 50). Flip the switch up or down to regulate the parameter menu scrolling speed.

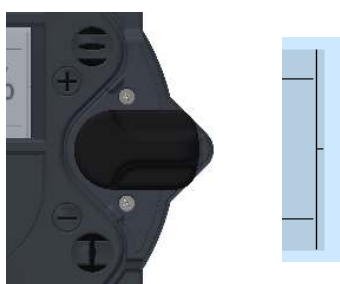


Figure 48: Neutral position

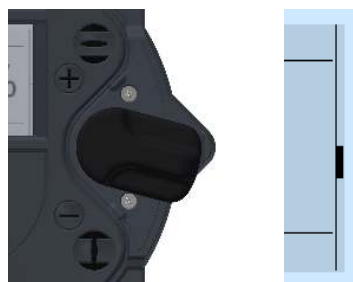


Figure 49: Slight switch flip (it will move to the next parameter)

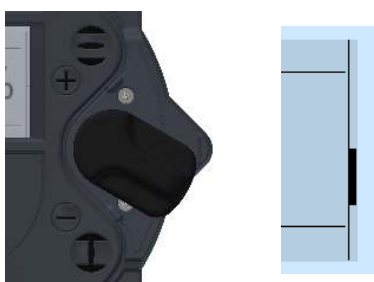


Figure 50: halfway switch flip (it will jump to the next parameter category)



Figure 51: Full switch flip (it will jump to the end of the menu)

4.6.3.1 Operation mode



Use the selector switch (red) to determine the various operating states of the actuator. In each of these positions, it is possible to block the switch by means of a padlock and thus protect the actuator against unauthorized access.

¹⁾ LED L1 and L2 are turned off as long as an infrared connection is active.

²⁾ Colour of LED L3 and L4 can be changed by parameter P1.7 - see section 4.7.1, page 50.







³⁾ A travel fault is indicated by a lit L3 and L4

The selector switch has the following positions:

OFF	The actuator can be neither operated via the remote control nor via the control switches of the controller.
Local 	It is possible to operate the actuator by motor via the control switch. Control via the remote inputs may be possible with appropriate configuration (superimposed control commands, emergency commands)
Remote 	The actuator is ready to process control commands via input signals. The control switch for the motor operation of the actuator is not enabled.

Besides defining the operational status, the selector switch is used in configuration mode to confirm or cancel parameter inputs.

Depending on the selector switch position, the control switch performs different functions:

Selector switch in the OFF position:	The control switch is used to scroll up or down the menu according to internal symbolism. From the neutral position towards  you reach the status and history data areas. Towards the  symbols you reach the parameter menu. Here, the selection switch either confirms  or rejects  the current input according to associated symbolism.
Selector switch in the REMOTE position  :	The control switch gives you access to status, history data and parameter area.
Selector switch in the LOCAL position  :	With the control switch, the actuator can be operated by motor. You may also operate the actuator in inching and self-hold mode. Switches are spring-loaded to snap back automatically into their neutral position. (To confirm a control command, the control switch must be pushed all the way into its mechanical locking position.)

4.6.3.2 Configuration

In principle, all parameters are shown as numbers in the corresponding parameter point. From the actuator menu, use the control switch to access different menu points. The lower left corner of the display shows the "EDIT" option.

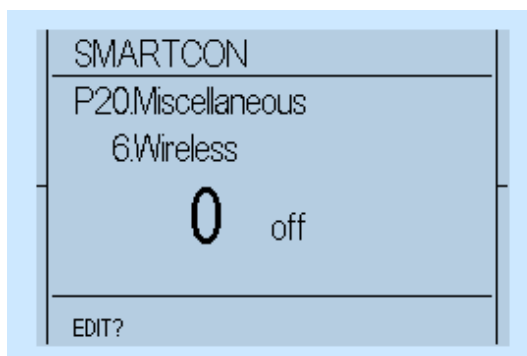



Figure 52

Confirm the selector switch (with a slight flip towards , (see Figure 37, page 23 to Figure 39, page 23) to change the selected parameter. To confirm this input readiness, the display changes from "EDIT" to "SAVE".

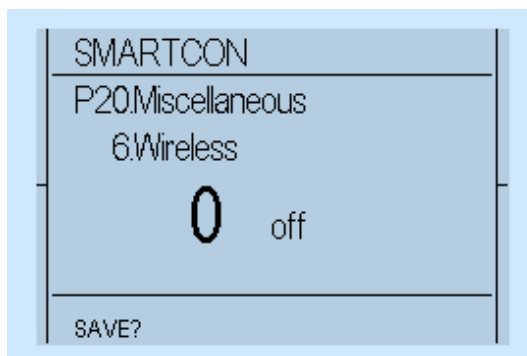





Figure 53

Use the control switch towards to the characters to change the parameter.  or  (see Figure 48 til Figure 51, page 26) After reaching the desired parameter value, confirm the value with the selector switch (again, flip it slightly towards , (see Figure 37, page 23 til Figure 39, page 23).

4.6.3.3 Configuration example

By way of example, we will change parameter P20.6 (wireless) from 0 (wireless off) to 2 (Bluetooth communication on). Thus, the Bluetooth connection is activated for a short time and then deactivated again automatically:

The operating and control switch must be in the neutral position



Figure 54: 1... Selector switch (red) , 2... Control switch (black)

Now, move the control switch down (towards) until the menu item "P 20.6 Miscellaneous - Wireless" is displayed.



Figure 55

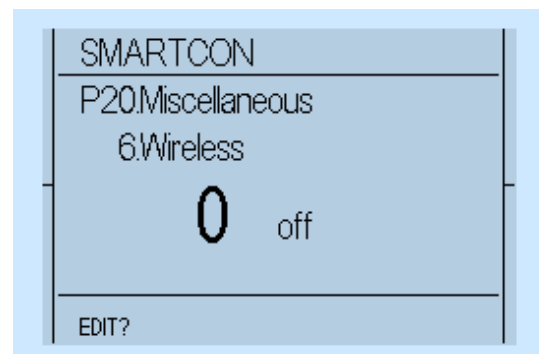


Figure 56

Afterwards, flip up slightly the selector switch (towards) and let it snap back to its neutral position

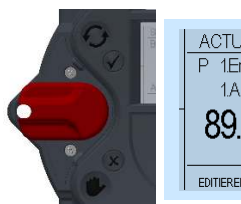


Figure 57

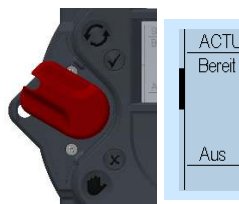


Figure 58



Figure 59

This changes the bottom line of the display from "EDIT?" to "SAVE?"

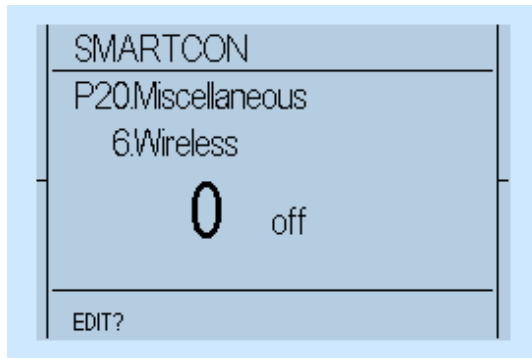


Figure 60

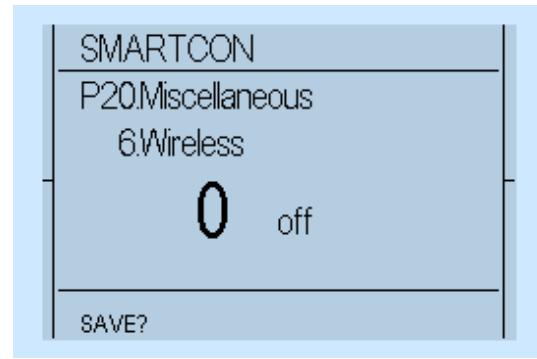


Figure 61

Thereafter, flip up the control switch (toward) to change the value from 0 (off) to 2 (Bluetooth)



Figure 62

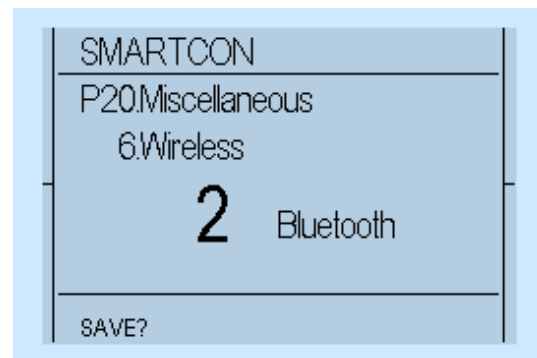


Figure 63

If the value changes to 1, confirm the selection by flipping halfway up the selector switch (towards) and letting it snap back to its neutral position (see Figure 57 til Figure 59).

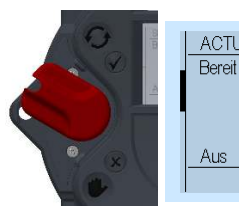


Figure 64

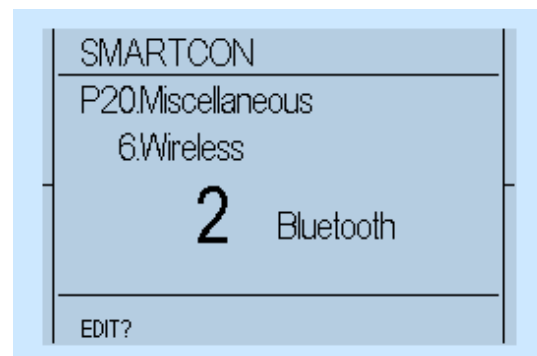


Figure 65

This changes the bottom line of the display from "SAVE?" to "EDIT?" and the parameter is stored.

4.6.3.4 "TEACHIN" (only for design potentiometer for travel)

Furthermore, certain parameters (end positions, intermediate positions).can be set using "TEACHIN". Thus, their configuration is greatly simplified.

After selecting the appropriate menu item (for example: End position) and changing the the input type from "EDIT?" to "SAVE?", move the selector switch (red) to "manual mode" and lock it into place. As you do so, the display will show the message "TEACHIN" and the current position value will be applied continuously to the parameter value. In this mode, further to manual operation by hand wheel, the actuator can be motor-driven with the control switch to the desired position. (see section 33, Figure 33, page 22)

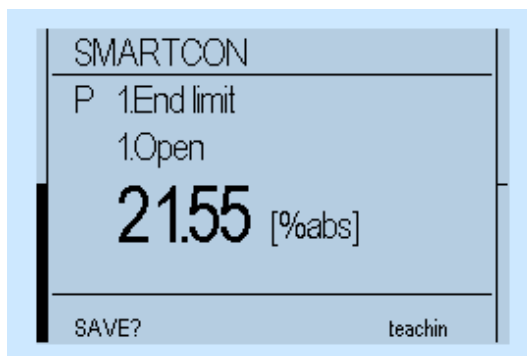


Figure 66

CAUTION: Please note that, during motor operation, only torque monitoring remains active, as travel adjustment will happen subsequently. Therefore, please check beforehand whether the maximum torque has been already set.



After reaching the desired, to-be-defined position, move the selector switch back to the neutral position. Finally, the parameter value must still be saved by flipping the selector switch halfway up and letting it snap back to the neutral position (see Figure 57 til Figure 59, page 28).

4.7 Parameter menu

For each parameter group, you can find a description, tabular overview of the menu items and possible configurations. The parameter list below also includes all possible options per menu item. Please note that some of the menu items listed and described may not be delivered with your configuration.

4.7.1 Parameter group: End limit

These parameters are used to configure the end position and switch off behavior of the actuator. In this regards, it is important to ensure that the basic mechanical configuration described in section ??, page ?? has already been made.

Ensure that these parameters are set during commissioning before operating the actuator. In addition, the settings in the "Torque" menu (see section 4.7.2, page 32 must be compared with the permissible values of the valve and corrected as appropriate)



CAUTION: Generally, 100% stands for fully open and 0% for fully closed. Please note that these values cannot be changed. The end position range is reached as soon as 0% or 100% is shown on display.



	Menu item	Sub-menu item	poss. setting	Notes / comments
P1.1	End limit	Open	TEACHIN; 0...100 U ¹⁾	The parameter value can be set using TEACHIN. With a known travel, the second end position can be entered after setting the first end position.
P1.2	End limit	Close	TEACHIN; 0...100 U ¹⁾	The parameter value can be set using TEACHIN. With a known travel, the second end position can be entered after setting the first end position.
P1.3	End limit	Switch-off Open	0: travel	The actuator uses end-position signals to switch off and report the end position. Attention: For failsafe-actuators in failsafe-direction not applicable. End limit by travel in failsafe-position only possible by changing the mechanical connection to the valve.
			1: torque	The actuator signals the end position or stops the motor only after reaching the specified torque in the end position. If the torque is reached and end position signal not, the actuator reports an error. If the end position is reached and the control command drops off during the build-up of the torque, the motor stops and the required torque is not reached. Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force

¹⁾representative for CM03; U...number of revolutions

continued on next page

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	Menu item	Sub-menu item	poss. setting	Notes / Comments
			2: torque1	Like „torque“, but in the end position range, the torque is also increased when the control command drops off during the build-up of the torque, until the required torque is reached. Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force
			3: torque2	Like „torque1“, but in the end position range automatically an additional control command is generated to reach and hold the torque. If the torque decrease and the actuator is in the end position it will be restored automatically. e.g.: Changes due to temperature differences, settlement. Attention: For failsafe-actuators in failsafe-direction not applicable. Torque/Force in failsafe-position depends on residual spring torque/force
			4: travel1	Like „travel“, however, the actuator still continues to drive the set Overrun time after reaching the end position, even when the positioning command is released. Only relevant if Overrun time (P1.10, P1.11) is greater than 0. Attention: For failsafe-actuators in failsafe-direction not applicable.
P1.4	End limit	Switch-off Close	1: travel	see P1.3
			1: torque	see P1.3
			2: torque1	see P1.3
			3: torque2	see P1.3
			4: travel1	see P1.3
P1.5	End limit	Closing direction	right (0)	Actuator is designed for clockwise = closing.
			left (1)	Reverse direction of rotation! Counterclockwise = closing. The crossing of all signals and commands is performed by the controller.
P1.6	End limit	Rot. sense pos.	0	Rotation sense of the Potentiometer. No function in ACTUSMART CM series.
			1	
P1.7	End limit	LED function	Close = green (0)	Definition of the LED colour of the CLOSED or OPEN end position signalization.
			Close = red (1)	
P1.8	End limit	End limit hyst.	0.1... 10.0%	Hysteresis range for end position signals: Example: End position hysteresis 1% means that the End position OFF is reached when closing 0%, and will be left when opening only at 1%, i.e., a re-closing can only take place after leaving this hysteresis.
P1.9	End limit	Ramp	0.1... 100%	When approaching the end position, the speed is reduced.
P1.10	End limit	Range	0... 100%	End position range for torque (P1.3, P1.4). Permissible range in which the torque is to be achieved. If the actuator comes to the end of the end position range, the motor shuts off even if the torque has not been reached.
P1.11	End limit	Overrun Open	0... 60 s	Switch-off delay after reaching the end position see travel1 (P1.3, P1.4)
P1.12	End limit	Overrun Close	0... 60 s	Switch-off delay after reaching the end position travel1 (P1.3, P1.4)

CAUTION: When installing the actuator on an gear or a thrust unit, please take into account the limits and factors of the gear / thrust unit at parametrization.

When using end limit switch off by torque, the end position limit must be set before reaching the torque limit. Accordingly, the actuator will only signal the final end position if the configured torque and the associated end position are reached. If the end position is not reached, a torque error is reported (see section 4.6.2.2, page 25)



4.7.2 Parameter group: Torque

If no torque was specified with the order, the actuator is supplied from the factory with the maximum configurable torque.

	menue item	sub menue item	poss. setting	notes / comments
P2.1	Torque	Open	40 - 100%	Switch off torque in OPEN direction CAUTION: The range can be restricted via the menu item P2.3
P2.2	Torque	Close	40 - 100%	As P2.1 but in CLOSED direction
P2.3	Torque	Torque limit	40 - 100%	Torque to protect the valve, the transmission or the thrust unit. This value limits the setting of the Parameters P2.1 and P2.2 and to prevent an erroneous increase above the allowed value of these two parameters.
P2.4	Torque	latching	{off (0)}	For self locking actuators
			on (1)	If the adjusted torque is reached the actuator cannot drive into the same direction. You must first drive the actuator in the other direction. That means that a reduction of the torque after a torque switch off, the actuator will not drive into the same direction. That is necessary for non self locking actuators
P2.5	Torque	Boost Open	0 – 120% {0%}	Increase the torque during motor start (approx. 0.5 sec) in direction OPEN. On large flywheel masses a unwanted shut off can be avoided. Furthermore, break free effect can thus be achieved. When setting values are less than the switch off torque in OPEN direction (P2.1) there will be no torque increasing during motor start. The torque increase should occur only if the valve is designed for it!
P2.6	Torque	Boost Close	0 – 120% {0%}	As P2.5 but in CLOSED direction.
P2.7	Torque	Hysteresis	{0: 50%}	After a torque shut off the current torque must be reduced by at least the hysteresis to enable the actuator to drive in the switch off direction.
			1: 25%	
			2: 12%	
			3: 6%	
			4: 3%	
			5: 1%	

When installing the actuator on an additional gear, please take into account the corresponding values of the gear / thrust unit as you enter the actuator parameters. To achieve an effective output torque (incl. gear) / output power (including thrust unit) ratio, the factor gear/thrust unit must be considered.



4.7.3 Parameter group: Speed (option)

	Menu item	Sub-menu item	poss. setting	Notes / Comments
P4.1	Speed	Local Open	5 – 100%	Output speed for local operation in direction OPEN
P4.2	Speed	Local Close	5 – 100%	As P4.1 but in direction CLOSE
P4.3	Speed	Remote Open	5 – 100%	Output speed for remote operation in direction OPEN
P4.4	Speed	Remote Close	5 – 100%	As P4.3 but in direction CLOSE
P4.5	Speed	Emergency Open	5 – 100%	Output speed for emergency operation in direction OPEN
P4.6	Speed	Emergency Close	5 – 100%	As P4.5 but in direction CLOSE
P4.7	Speed	Torque-dependent.	5 – 100%	seal-tight speed. Speed at which the actuator runs near the end position at torque-dependent switch off (see P1.3 u. P1.4)
P4.8	Speed	Minimum	5 – 100%	Minimum speed

CAUTION: 50% means nominal output speed (50Hz) and 100% means that the output speed is 2 times faster (100Hz)



4.7.4 Parameter group: Ramp (optional)

The start ramp can be set separately for each operation mode. Thus, a 100% start ramp means that the motor attains its maximum speed in about a second. Higher speeds (see section 4.7.3) lead to shorter runtimes. If the ramp is set below 100%, the starting time increases in an inversely proportional fashion.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P5.1	Ramp	Local	1... 100%	Start ramp for local operation
P5.2	Ramp	Remote	1... 100%	Start ramp for remote operation
P5.3	Ramp	Emergency	1... 100%	Start ramp for emergency operation

4.7.5 Parameter group: Control

	Menu item	Sub-menu item	poss. setting	Notes / Comments
P6.1	Control	Phase sequence	0: off	Phase sequence detection is deactivated. A wrong phase sequence will not be shown on the display and also not corrected. In case of wrong phase sequence the actuator will drive in the wrong direction.
			1: on	Phase sequence detection is activated. A wrong phase sequence will be shown on the display but not corrected. In case of wrong phase sequence the actuator cannot be driven electrical.
			2: auto	The phase sequence will be corrected automatically. The actuator will always drive in the right direction.
P6.2	Control	Ready delay	0 - 10 sec.	Drop-out delay for the ready signal (Bin. outputs)
P6.5 ²⁾	Control	24V output	0	24V auxiliary output is deactivated (chapter 4.20.5, page 64). The function of the auxiliary input is still activated.
			{1}	24V auxiliary output is activated (chapter 4.20.5, page 64).
P6.6	Control	Min. Impuls	0,1 - 2,0s	minimum switch-on time of the motor

4.7.6 Parameter group: Password

The actuator control can be password-protected to prevent access at different levels. It is possible to prevent entry by unauthorized personnel or to entirely lock motor operation.

Default password is set to "000" and thus deactivated.

You can use both numbers and capital letters in your password. After entering a password, password protection is activated. To remove password protection, enter an empty password (000).

When accessing a password-protected parameter, the user is automatically prompted for its introduction. Only after correctly entering the password, it is possible to change the corresponding parameters.

	Menu item	Sub-menu item	poss. setting	Notes / Comments
P7.1	Password	Reading PWD	3-digit	Status display and history data are still viewable; access to the parameter menu is locked until this password is introduced. Parameter menu scrolling is only enabled after entering the password. Electric motor operation is unlocked.
P7.2	Password	Writing PWD	3-digit	Status display, history data and parameter menu can be viewed. However, parameters become read-only.
P7.3	Password	Bluetooth PWD	15-digit	password for the Bluetooth connection, empty password deactivates the password request.

4.7.7 Parameter group: Position

In addition to OPEN and CLOSED end positions, you may define intermediate positions. These can be used as feedback signals for the binary outputs or as target value for fix position approach.

CAUTION: If you change the end positions (see section 4.7.1, page 30), intermediate positions are retained percentage-wise, i.e., the absolute positions of the intermediate positions change.



²⁾since firmware 1.303

4.7 Parameter menu

	Menu item	Sub-menu item	Poss. setting	Notes / comments
P8.1	Position	Intermed.pos.1	TEACHIN 0... 100%	Position value of intermediate position 1
P8.2	Position	Intermed.pos.2	TEACHIN 0... 100%	see above
P8.3	Position	Intermed.pos.3	TEACHIN 0... 100%	see above
P8.4	Position	Intermed.pos.4	TEACHIN 0... 100%	see above
P8.5	Position	Emerg.position	TEACHIN 0... 100%	Position value of the emergency position.
P8.6	Position	Hysteresis	0.1... 10.0%	Hysteresis range of intermediate positions. Within this hysteresis, no repositioning occurs upon reaching the intermediate positions (option: fix position approach). Furthermore, the output functions for position = intermediate position are active within this range (see P10.1 ...).

4.7.8 Parameter group: Binary inputs

The controller is equipped with 5 freely configurable binary inputs. Please find further information on technical data of the binary inputs in section 4.20.2, page 61. Binary inputs are also effective during actuator control via Profibus (option).

Default binary inputs are as follows:

Input 1: OPEN

Input 3: STOP

Input 5: EMERGENCY Closed

Input 2: CLOSED

Input 4: EMERGENCY OPEN

	Menu item	Sub-menu item	poss. setting	Notes / comments
P9.1	Bin. Input	Input 1	0: no function	this input has no function
			1: Open	OPEN command in REMOTE mode (selector switch in position REMOTE).
			2: Closed	CLOSED command in REMOTE mode (selector switch in position REMOTE).
			3: Stop	STOP command in REMOTE mode (selector switch in position REMOTE).
			4: Open Self-hold	Self-hold for OPEN, i.e., a short pulse is sufficient and the actuator moves then into the end position. Use the STOP command to stop the actuator.
			5: Closed Self hold	Self-hold for CLOSED, see OPEN SELF-HOLD
			6: Emergency Open	Superimposed run command; run the actuator in direction OPEN regardless of whether the selection switch is set to REMOTE or LOCAL operation
			7: Emergency Closed	Superimposed run command; run the actuator in direction CLOSED regardless of whether the selection switch is set to REMOTE or LOCAL
			8: Release	The actuator may be operated only with a switched signal. Both in local and remote operation
			9: Open/Closed	The actuator moves towards OPEN if input is active and towards CLOSED otherwise
			10: Close/Open	The actuator moves towards CLOSED if input is active and towards OPEN otherwise
			11: Positioner	Release of the positioner
			12: Open inv.	As open but active low
			13: Close inv.	As CLOSED but active low
			14: Stop inv.	As STOP but active low
			15: Open Self-Hold.inv	As Open Self-Hold but active low
			16: Closed Self-Hold inv	As Closed Self-Hold. but active low
			17: Emergency-Open inv.	As Emergency-Open but active low
			18: Emergency-Closed inv.	As Emergency-Closed but active low

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			19: Block	with activated (switched) signal, the actuator is locked for operation also in local mode
			20: Contoller lock	Positioner lock
			21: Release Local	The actuator may be operated only with a switched signal.
			22: Block Local	as Release Local but active low
			23: Lock Open	Trigger lock OPEN (in LOCAL and REMOTE mode). Actuator moves with the highest priority to OPEN; command continues internally active after reaching the end position OPEN. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			24: Lock Closed	Trigger lock CLOSED (in LOCAL and REMOTE mode). Actuator moves with the highest priority to CLOSED; command continues internally active after reaching the end position CLOSED. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			25: Lock Off	Drop the lock
			26: Failsafe	Trigger the failsafe function in all operating modes (only functional in Failsafe actuators).
			27: Failsafe inv.	As Failsafe, but active low
			28: Lock Open inv.	As Lock Open, but active low
			29: Lock Closed inv	As Lock Closed, but active low
			30: Lock Off inv.	As Lock Off, but active low
			31: Intermediate position1	Approach intermediate position 1 (P8.1) in REMOTE mode (fix position approach). There is no repositioning upon reaching the intermediate position within the hysteresis (see P8.6). Higher priority than intermediate position 2, 3 and 4
			32: Intermediate position2	As intermediate position 1, but with higher priority than intermediate positions 3 and 4
			33: Intermediate position3	As intermediate position 1, but with higher priority than intermediate position 4
			34: Intermediate position4	As intermediate position 1, but with lowest priority.
			35: Emergency position	Approach emergency position (P 8.5). As intermediate position 1, but with higher priority than intermediate positions 1, 2
			36: Intermediate position1 inv.	As Intermediate position 1, but active low
			37: Intermediate position2 inv.	As Intermediate position 2, but active low
			38: Intermediate position3 inv.	As Intermediate position 3, but active low
			39: Intermediate position4 inv.	As Intermediate position 4, but active low
			40: Emergency position inv.	As Emergency position, but active low
			41: Travel Open	reserved for future use
			42: Travel Close	reserved for future use
			43: Travel Open inv.	reserved for future use
			44: Travel Close inv.	reserved for future use
			45: Failsafe lock	reserved for future use (only for Failsafe actuators)
			46: Failsafe lock inv.	reserved for future use (only for Failsafe actuators)
P9.2	Bin. Input	Input 2	see Input 1	
P9.3	Bin. Input	Input 3	see Input 1	
P9.4	Bin. Input	Input 4	see Input 1	
P9.5	Bin. Input	Input 5	see Input 1	

4.7.9 Parameter group: Binary outputs

The controller is equipped with 8 freely configurable binary outputs. Please find further information on technical data of the binary outputs in section 4.20.1, page 61. Provided with external supply, binary outputs are optically isolated from the rest of the controller.

Default binary outputs are as follows:

Output 1: Ready	Output 2: End position OPEN
Output 3: End position CLOSED	Output 4: Run OPEN
Output 5: Run CLOSED	Output 6: Torque
Output 7: LOCAL	Output 8: REMOTE

	Menu item	Sub-menu item	poss. setting	Notes / comments
P10.1	Bin. Output	Output 1	0: User defined	Optional
			1: Ready	Actuator is ready
			2: Fault	General fault; actuator is not ready
			3: Open	Actuator is in open position
			4: Closed	Actuator is in closed position
			5: Running Open	Actuators runs in direction Open
			6: Running Closed	Actuators runs in direction Closed
			7: Running	Actuator is running in either Open or Closed
			8: Torque Open	Switch-off torque was reached in Open direction, actuator has been switched off
			9: Torque Closed	Switch-off torque was reached in Closed direction, actuator has been switched off
			10: Torque	Switch-off torque was reached in either Closed or Open direction
			11: Travel Open	The Open end position has been reached
			12: Travel Closed	The Closed end position has been reached
			13: Pos. > Int.1	Position > Intermediate position 1
			14: Pos. < Int.1	Position < Intermediate position 1
			15: Pos. > Int.2	Position > Intermediate position 2
			16: Pos. < Int.2	Position < Intermediate position 2
			17: Pos. > Int.3	Position > Intermediate position 3
			18: Pos. < Int.3	Position < Intermediate position 3
			19: Pos. > Int.4	Position > Intermediate position 4
			20: Pos. < Int.4	Position < Intermediate position 4
			21: Local	Local operating mode (selector switch in position)
			22: Remote	Remote operating mode (selector switch in position Remote)
			23: Off	Off operating mode (selector switch in the Off position)
			24: no function	no function
			25: motor error	The motor temperature sensor has reported an error
			26: Always	Signal is always on
			27: Never	Signal is always off
			28: Bin. Input 1	Forwarding of binary input to output
			29: Bin. Input 2	Forwarding of binary input to output
			30: Bin. Input 3	Forwarding of binary input to output
			31: Bin. Input 4	Forwarding of binary input to output
			32: Bin. Input 5	Forwarding of binary input to output
			33: Torque Open ma.	As Torque OPEN, but it will suppress (mask) this signal in the end position upon torque-dependent switch-off.
			34: Torque Closed ma.	As Torque CLOSED, but it will suppress (mask) this signal in the end position upon torque-dependent switch-off.
			35: Ready Remote	Ready and Remote operating mode
			36: Ready Local	Ready and Local operating mode
			37: Ready Local/remote	Ready and Local or Remote mode
			38: Lock Open	Lock OPEN is enabled. OPEN command is internally queued with the highest priority and will not be dropped even in the end position.
			39: Lock Closed	Lock CLOSED is enabled. CLOSED command is internally queued with the highest priority and will not be dropped even in the end position.
			40: Failsafe OK1	Failsafe OK (only for Failsafe actuators)
			41: Failsafe OK2	Failsafe OK and Ready (only for Failsafe actuators)

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			42: Failsafe OK3	Failsafe OK, Ready and Remote (only for Failsafe actuators)
			43: Lock	Lock Open or Lock Closed is enabled.
			44: Ready/TorqueOK	Actuator is ready and no torque switch-off
			45: Ready / Remote / TorqueOK	Actuator is ready for operation in REMOTE mode and no torque switch-off
			46: Pos.=Int1	Position = Intermediate position 1. The width of the interval is set with the parameter P8.6.
			47: Pos.=Int2	Position = Intermediate position 2. The width of the interval is set in parameter P8.6.
			48: Pos.=Int3	Position = Intermediate position 3. The width of the interval is set in parameter P8.6.
			49: Pos.=Int4	Position = Intermediate position 4. The width of the interval is set in parameter P8.6.
			50: Pos.=EmergPos	Position = emergency position. The width of the interval is set in parameter P8.6.
			51: Bus Bit 1	In existing bus interface (hardware option), the output is set according to the selected bit bus. ³⁾
			52: Bus Bit 2	
			53: Bus Bit 3	
			54: Bus Bit 4	
			55: Bus Bit 5	
			56: Bus Bit 6	
			57: Bus Bit 7	
			58: Bus Bit 8	
			59: Virtual 1	Configurable output function
			60: Virtual 2	
			61: Virtual 3	
			62: Virtual 4	
			63: Line voltage OK	Supply voltage for the motor is OK
			64: Control voltage OK	The auxiliary voltage for the SMARTCON control is OK. This function is only available if the auxiliary voltage output is not switched on (P6.5 to 0).
			65: Oil pressure OK	The oil pressure is higher than the minimum pressure (P6.10).
			66: Oil level OK	The oil level is OK.
			67: pump OK	The temperature sensor in the pump motor and the external motor protection have not tripped.
4-5 P10.2	Bin. Output	Output conf. 1	0: normal	Output 1 is set to normal, i.e. if the condition in point P10.1 is met, Output 1 is set to HIGH (active HIGH).
			1: inverted	If the condition in point P10.1 is met, Output 1 is set to LOW (active LOW).
			2: norm. flashing	If the condition in point P10.1 is met, Output 1 starts blinking (active HIGH).
			3: inv. flashing	If the condition in point P10.1 is not met, Output 1 starts blinking (otherwise it is set to HIGH).
P10.3	Bin. Output	Output 2	see Output 1	
P10.4	Bin. Output	Output 2 Konf.	see Output 1 conf.	
P10.5	Bin. Output	Output 3	see Output 1	
P10.6	Bin. Output	Output 3 Konf.	see Output 1 conf.	
P10.7	Bin. Output	Output 4	see Output 1	
P10.8	Bin. Output	Output 4 Konf.	see Output 1 conf.	
P10.9	Bin. Output	Output 5	see Output 1	
P10.10	Bin. Output	Output 5 Konf.	see Output 1 conf.	
P10.11	Bin. Output	Output 6	see Output 1	
P10.12	Bin. Output	Output 6 Konf.	see Output 1 conf.	
P10.13	Bin. Output	Output 7	see Output 1	
P10.14	Bin. Output	Output 7 Konf.	see Output 1 conf.	
P10.15	Bin. Output	Output 8	see Output 1	

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³⁾from Firmware 1.323

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P10.16	Bin. Output	Output 8 Konf.	see Output 1 conf.	

CAUTION: When using the parameters torque-dependent OPEN or torque-dependent CLOSED (see section 4.7.1, page 30, items P1.3 and P1.4), the actuator will only be open or closed when the set torque and the associated end position is reached. If the end position is not reached, a torque error is reported (see section 4.6.2.2, page 25).



4.7.10 Parameter group: Position output (optional)

Position output is used to indicate the current position of the actuator using 0/4...20 mA; it can be retrofitted using a Smart-code.

If this option is not enabled, the menu point shows the message "inactive".

No adjustment to the end positions or the travel is required. Adjustment is automatically performed during the configuration of travel limit positions (see section 4.7.1, page 30).

No further settings are necessary for torque-dependent switch-off, because the controller exclusively uses travel limit positions for the calculation, regardless of whether this is defined by the torque or the travel limit positions.

The factory default setting is:

4 mA at 0% position

20 mA at 100% position

	Menu item	Sub-menu item	poss. setting	Notes / comments
P11.1	PositionOutput	Function 1	0: off	mA output disabled
			1: Position	mA output corresponds to the actual position value.
			2: Pos. Valvechar.	mA output corresponds to the actual position value taking into account the valve characteristic.
			3: Torque 1	mA output corresponds to the actual torque value.
				torque = 100% Close: mA output = start
				torque = 0%: mA output = center
				torque = 100% Open: mA output = end
			4: Torque 2	mA output corresponds to the actual torque value.
				torque = 100% Close: mA output = end
				torque = 0%: mA output = start
				torque = 100% Open: mA output = end
			5: Torque 3	mA output corresponds to the actual torque value.
				torque = 150% Close: mA output = start
				torque = 0%: mA output = center
				torque = 150% Open: mA output = end
			6: Torque 4	mA output corresponds to the actual torque value.
				torque = 150% Close: mA output = end
				torque = 0%: mA output = start
				torque = 150% Open: mA output = end
P11.2	Position output	Begin 1 (at 0%)	0...20.5 mA {4 mA}	mA value for the Closed (0%) position
P11.3	Position output	End 1 (at 100%)	0...20.5 mA {20 mA}	mA value for the On (100%) position
P11.4	Position output	Calib. 20 mA 1	-10%...+10%	Calibrating the output position during the setting of this parameter will output a 20 mA (100%) signal. Use this parameter to calibrate accurately the 20 mA output signal (e.g., if you measure 19.8 mA at the output, just add 1% (0.2 mA...1% of 20 mA) to the displayed value).
P11.5	Analog output	Function 2	see Function 1	
P11.6	Analog output	Begin 2 (at 0%)	see Begin 1	
P11.7	Analog output	End 2 (at 100%)	see End 1	
P11.8	Analog output	Calib. 20 mA 2	see Calib. 20 mA 1	

4.7.11 Parameter group: Step mode

Step mode operation can be used to extend the operating time in certain ranges or for the whole travel; it is available in local, remote and emergency mode.

Step mode operation can be activated individually for the directions OPEN and CLOSED.

Cycle start, cycle end, cycle duration and interval time can be set separately for both directions (see Figure 67, page 40).

	Menu item	Sub-menu item	poss. setting	Notes / comments
P12.1	Step mode function	Mode	0: disabled	Step mode operation is disabled
			1: enabled	Step mode operation is enabled in LOCAL, REMOTE and EMERGENCY operation
			2: Local only	Step mode mode is only enabled in LOCAL mode
			3: Remote only	Step mode mode is only enabled in REMOTE mode
			4: Local + Remote only	Step mode mode is enabled in REMOTE and LOCAL mode
P12.2	Step mode function	Start Open	0...100%	In OPEN direction, position in % from which the step mode operation should start.
P12.3	Step mode function	End Open	0...100%	In OPEN direction, position in % of which the step mode operation should end.
P12.4	Step mode function	Runtime Open	0.1...60	Runtime in OPEN direction
P12.5	Step mode function	Pause time Open	0.2...60	Pause time in OPEN direction
P12.6	Step mode function	Start Closed	0...100%	In CLOSED direction, position in % from which the step mode operation should start.
P12.7	Step mode function	End Closed	0...100%	In CLOSED direction, position in % of which the step mode operation should end.
P12.8	Step mode function	Run time Closed	0.1...60	Runtime in Closed direction
P12.9	Step mode function	Pause time	0.2...60	Pause time in Closed direction
P12.10	Step mode function	Timebase	0: Seconds	Time basis for run and pause times
			1: Minutes	
P12.11	Step mode function	Speed adaption	0:	Speed adaption not activated. Normal step mode function.
			1:	Speed adaption is activated. The speed is reduced according to the runtime and pause time in the step mode range. (Example: Running time 1 sec and pause time 1 sec results in half the speed). If the minimum speed is undershot, the actuator clocks in the converted ratio with the minimum speed. The speed adjustment is only applicable to actuators of the type CM and AB CSC.

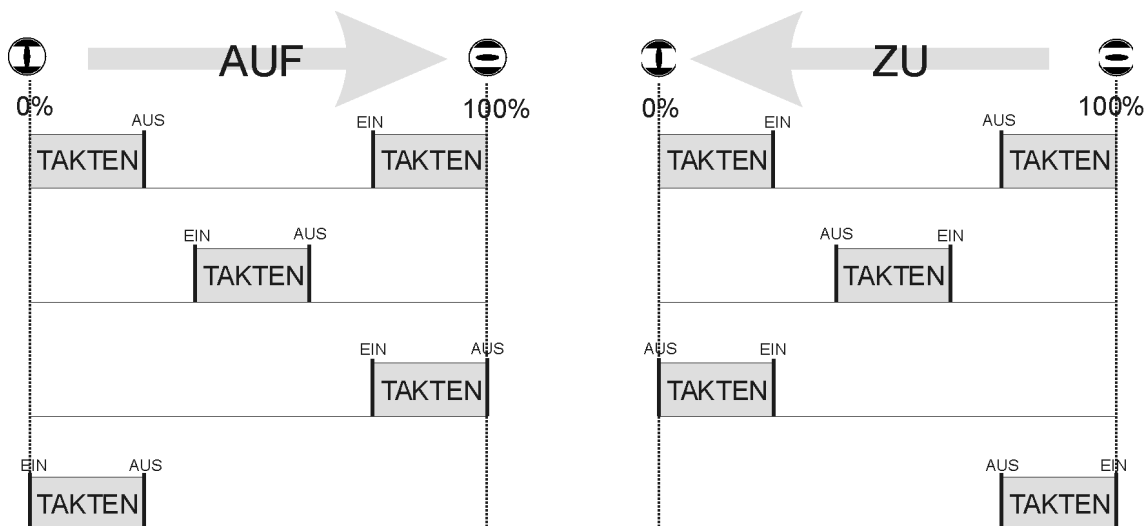


Figure 67

NOTE: It is important to ensure that the mode of operation is not exceeded!
The running info on the actuator (see section 4.6.2.2, page 25) only flashes while the drive is running, i.e. during the break, no flash!



4.7.12 Parameter group: Positioner (optional)

The positioner SR option is used to control the electric actuator by means of a set point input 0/4...20 mA signal. The SR helps control the position of the actuator, i.e. the positioner ensures that the actual value and thus the position of the actuator matches the desired set point.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P13.1	Positioner	Function	off	Positioner disabled
			1: Position	mA input for the position setpoint
			2: Pos. valvechar.	mA input for the position setpoint, taking into account the valve characteristic
P13.2	Positioner	Begin (at 0%)	0...20.5 mA {4.0 mA}	mA value of the setpoint for the CLOSED (0%) position
P13.3	Positioner	End (at 100%)	0...20.5 mA {20.0 mA}	mA value of the setpoint for the OPEN (100%) position
P13.4	Positioner	Dead band	0.1...10.0% {1.0%}	Tolerance range for the control deviation (set point position – actual position) where no adjustment occurs. The deadband should not be set too low to prevent actuator oscillation.
P13.5	Positioner	Gain	1...100% {100%}	The gain (gradient) affects the positioning close to the target position. The smaller the gain selected (e.g. 20%), the earlier the actuator starts reducing its speed in case of speed variable actuators on approaching the target position. In case of actuators with fixed speed (reversing starters), the speed reduction is done by pulsing (also see params P13.9 and P13.10). This leads to better positioning (smaller reachable deadband). A 100% setting disables this gradient.
P13.6	Positioner	Live zero detect.	Ignore	The setpoint monitoring (monitoring the setpoint to below approximately 2 mA = loss of signal) is disabled.
			1: Stop	Actuator stops on signal failure.
			2: Open	On signal failure, actuator moves the OPEN position.
			3: Close	Actuator moves on signal failure to the CLOSED position.
			4: Emerg.pos.	On signal failure, the actuator moves the defined emergency position (see parameter P13.7).
			5: Emerg. PID	reserved for future use
P13.7	Positioner	Emergency pos.	0...100% {50,0%}	Determination of the emergency position (Can also be set in the menu P8.5)
P13.8	Positioner	Calib. setpoint	-10%...+10%	Calibration value for the mA setpoint. Calibration process: By applying 20 mA on the setpoint input, this parameter is corrected until the readout matches 20 mA.

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P13.9	Positioner	Min. impulse	{0,2 s}	Variable speed actuators (Actusmart CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): Minimum activation time of the reversing contactors. For very small activation times (<0.3...0.5 s), the motor will be switched off during start-up process, which significantly increases mechanical wear on reversing contactors. With frequent periods of very small activation times (restless loop, small dead zone, clocking near to the target value), we therefore recommend electronic reversing contactors.
P13.10	Positioner	Period	{2.0 s}	Variable speed actuators (Actusmart CM and Smartcon CSC FU): Without function Fixed speed actuators (Smartcon CSC): This parameter is only relevant in Step mode when approaching the target position (parameter gain smaller than 100%) and determines the period of a run / pause cycle.
P13.11	Positioner	Begin pos. (a0)	0.0...25.0% {2.0%}	Smallest controllable position other than the end position CLOSED. The range 0% ... a0 will be just passed through. Use the parameter a0 to define the beginning of the allowable control range of the valve (e.g., blind spot for ball segment valves, etc.).
P13.12	Positioner	End pos. (e0)	75.0...100.0% {98.0%}	Largest controllable position other than the end position OPEN. The area e0 ... 100% is just passed through. Use the parameter e0 to define the end of the allowable control range of the valve.
P13.13	Positioner	Begin setp. (a1)	0.0...25.0% {2.0%}	Below this value, the end position CLOSED is controlled. In the range 0% ... a1 cannot be controlled (end position tolerance). The initial setpoint a1 is associated with a small hysteresis (1/4 of the deadband).
P13.14	Positioner	End setp. (e1)	75.0...100.0% {98.0%}	Above this value, the end position OPEN is controlled. The range e1 ... 100% cannot be controlled (end position tolerance). The final setpoint e1 is associated with a small hysteresis (1/4 of the deadband).
P13.15	Positioner	Calib.setpoint offset	-10% ... +10%	Calibration of zero for the input setpoint. 1% = 0.2 mA

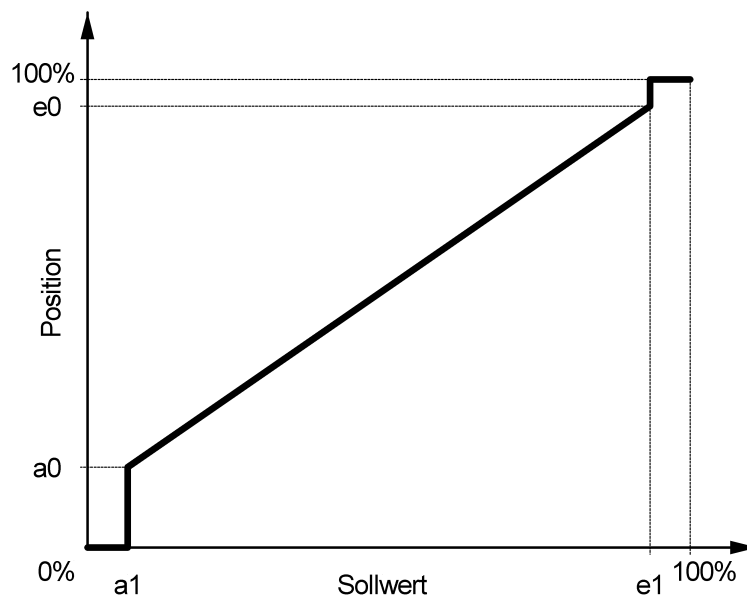


Figure 68: Assigning the position to the setpoint

4.7.13 Parameter group: PID controller (optional)

The optional PID controller is used for controlling an external actual value (process variable) to a setpoint using 0/4...20 mA signal by readjusting the actuator.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P14.1	PID-controller	Function	0: disabled	PID controller disabled
			1: Position	The output of the PID controller corresponds to the position setpoint of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see section 4.7.12).
			2: Speed	The output of the PID controller corresponds to the speed of the actuator (speed mode is only possible for Actusmart CM and Smartcon CSC FU!). There is no adjustment with the positioner. ⁴⁾
			3: Speed	The output of the PID controller corresponds to the change of the position setpoint (speed) of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see section 4.7.12). Hence a control mode similar to the Speed mode (see Setting 2, above) is possible also for actuators with constant speed. ⁵⁾
P14.2	PID-controller	External Setpoint	0: fixed	The PID controller uses an internal, fixed setpoint (see param P14.3).
			1: external	The PID controller uses the external setpoint. Adjust this setpoint with the params P13.2 and P13.3 (see section 4.7.12).
P14.3	PID-controller	Fixed setpoint	0...100%	Specification of the internal fixed setpoint
P14.4	PID-controller	Start (at 0%)	0...20.5 mA	mA value at 0% of the external actual value
P14.5	PID-controller	End (at 100%)	0...20.5 mA	mA value at 100% of the external actual value
P14.6	PID-controller	Gain (P)	-50.0...+50.0	Gain (proportional value) of the PID-controller. A negative value reverses the effective direction of the PID-controller, e.g.: Positive gain: The actuator opens when the desired value is greater than the external actual value. Negative gain: The actuator closes when the desired value is greater than the external actual value.
P14.7	PID-controller	Reset time (I)	0...100.0 s	The shorter the reset time (integral time, integral value), the stronger the effect of the integral component of the PID-controller. Values below 1.0 will disable the integral component.
P14.8	PID-controller	Lead time (D)	0...100.0 s	The larger the lead time (differential/derivative value), the stronger the effect of the derivative component of the PID-controller. To reduce the influence of noise, a first-order lag element with 1 sec time constant is added (DT ₁).
P14.9	PID-controller	Offset	-200...+200%	The offset value will be added to the output value of the PID controller.
P14.12	PID-controller	Live zero detect.	0: Ignore	The monitoring of the external actual value is disabled.
			1: Stop	Actuator stops on signal failure of external. actual value
			2: Open	On signal failure of external actual values, actuator moves to the OPEN position.
			3: Closed	On signal failure of external actual values, actuator moves to the CLOSED position.
			4: Emergency position	On signal failure of external actual values, actuator moves to the EMERGENCY position (see param P13.7).
			5: Emergency PID	reserved for future use
P14.13	PID-controller	Calibration of ext. actual value	-10.0...+10.0%	Calibration process: By applying 20 mA to the external actual value input, this parameter is corrected until the readout matches 20 mA.
P14.14	PID-controller	Process begin	-32768...+32767	Mantissa of the real process variable (begin of external actual value)

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⁴⁾from firmware 1.338

⁵⁾from firmware 1.338

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	Menu item	Sub-menu item	poss. setting	Notes / comments
P14.15	PID-controller	Process end	-32768...+32767	Mantissa of the real process variable (end of external actual value)
P14.16	PID-controller	Process comma shift	-3...+3	Position of the comma for process begin/end (P14.14, P14.15), e.g.: mantissa = 200, comma shift = -2/2, process value = 2.00/20000
P14.17	PID-controller	Process unit	—	Unit of the real process variable
P14.18	PID-controller	Dead band	0.1...10.0% {1.0%}	Tolerance range for the control deviation (set point – external actual value) where no adjustment occurs. ⁶⁾

4.7.14 Parametergruppe: Bus-Systems (Option)

The manuals for the Bus-Systems are available in the download area on our homepage www.schiebel-actuators.com under the tab **Quality & Service**

4.7.15 Parameter group: Characteristic curves (optional)

With this option, customers can enable travel-dependent torque, speed and valve characteristic curves.

4.7.15.1 Torque characteristic

With this characteristic curve, torque limits already set under menu item **P2-torque** (see section 4.7.2, page 32) can be further **reduced** depending on travel. Characteristics can be configured via the SMARTTOOL software (see Figure 69, page 44).



⁶⁾from firmware 1.340

4.7 Parameter menu

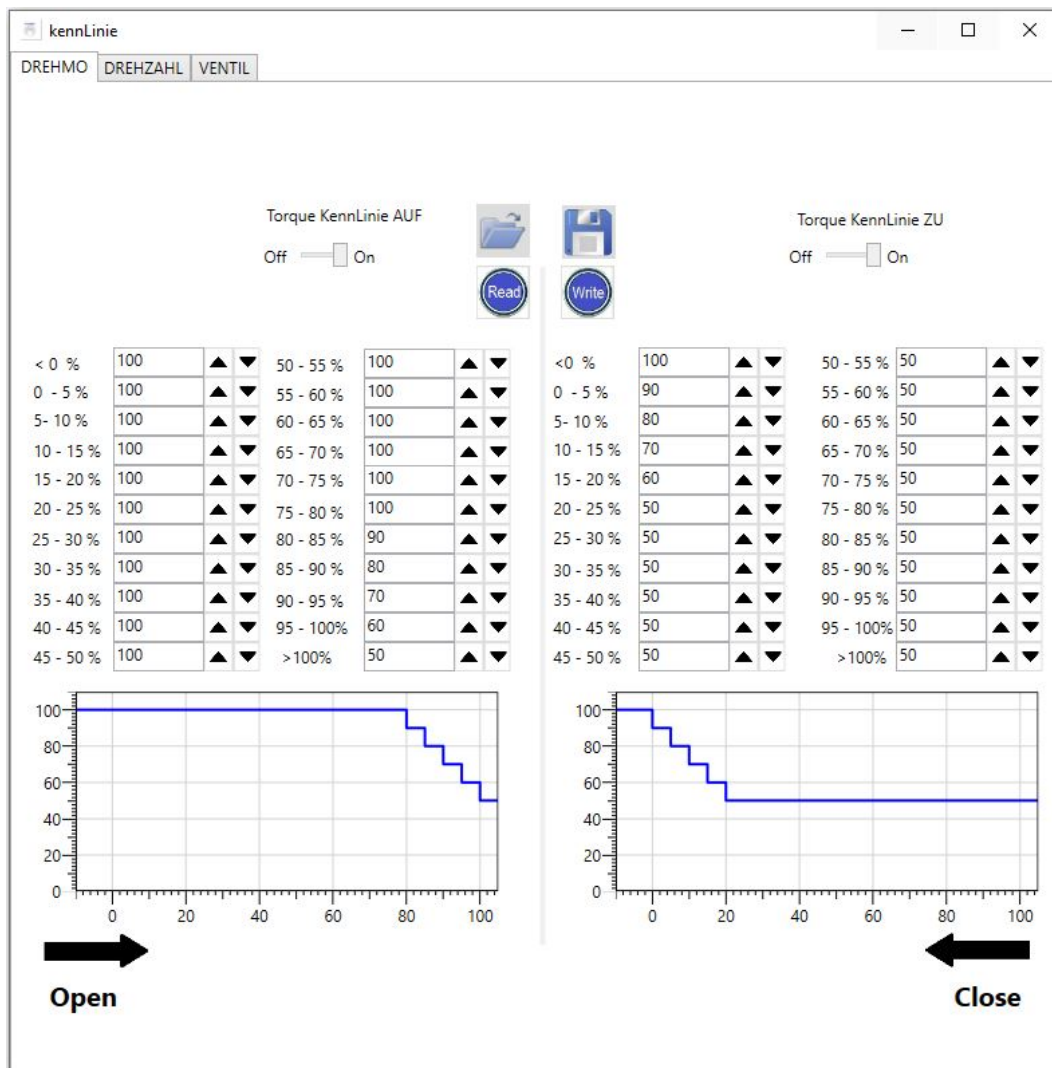


Figure 69: Torque characteristic

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.1	Characteristic	Torque Open	0: Off	The torque characteristic curve is disabled for the OPEN direction.
			1: On	The torque characteristic curve is enabled for the OPEN direction.
			2: Local + Remote only	The torque characteristic curve is enabled for the OPEN direction only in LOCAL and REMOTE mode (while disabled in the EMERGENCY mode).
P17.2	Characteristic	Torque Closed	0: Off	The torque characteristic curve is disabled for the CLOSED direction.
			1: On	The torque characteristic curve is enabled for the CLOSED direction.
			2: Local + Remote only	The torque characteristic curve is enabled for the CLOSED direction only in LOCAL and REMOTE mode (while disabled in the EMERGENCY mode).

4.7.15.2 Speed characteristic

With this characteristic curve, speed limits already set under menu item **P4-speed** (see section 4.7.3, page 32) can be further **reduced** depending on travel. Characteristics can be configured via the SMARTTOOL software (see Figure 70, page 45).



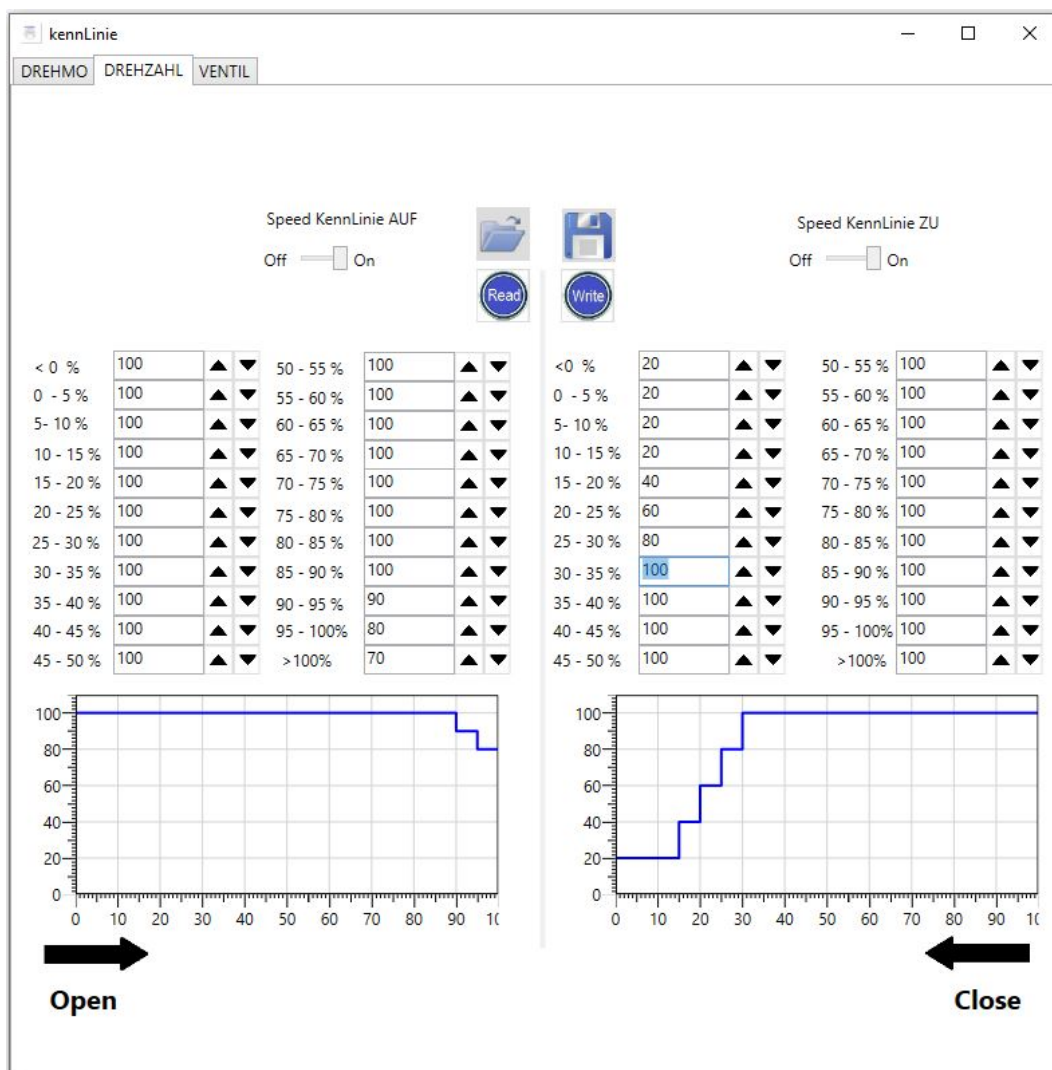


Figure 70: Speed characteristic

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.3	Characteristic	Speed Open	0: Off	The speed characteristic curve is disabled for the OPEN direction.
			1: On	The speed characteristic curve is enabled for the OPEN direction.
P17.4	Characteristic	Speed Closed	0: Off	The speed characteristic curve is disabled for the CLOSED direction.
			1: On	The speed characteristic curve is enabled for the CLOSED direction.

4.7.15.3 Valve characteristic

With this characteristic curve the mapping between the actuator position and the setpoint of the valve can be adjusted. Hence it is possible to compensate and linearize the general nonlinear characteristic curves of valves. Characteristics can be configured via the SMARTTOOL software (see Figure 71, page 46).



4.7 Parameter menu

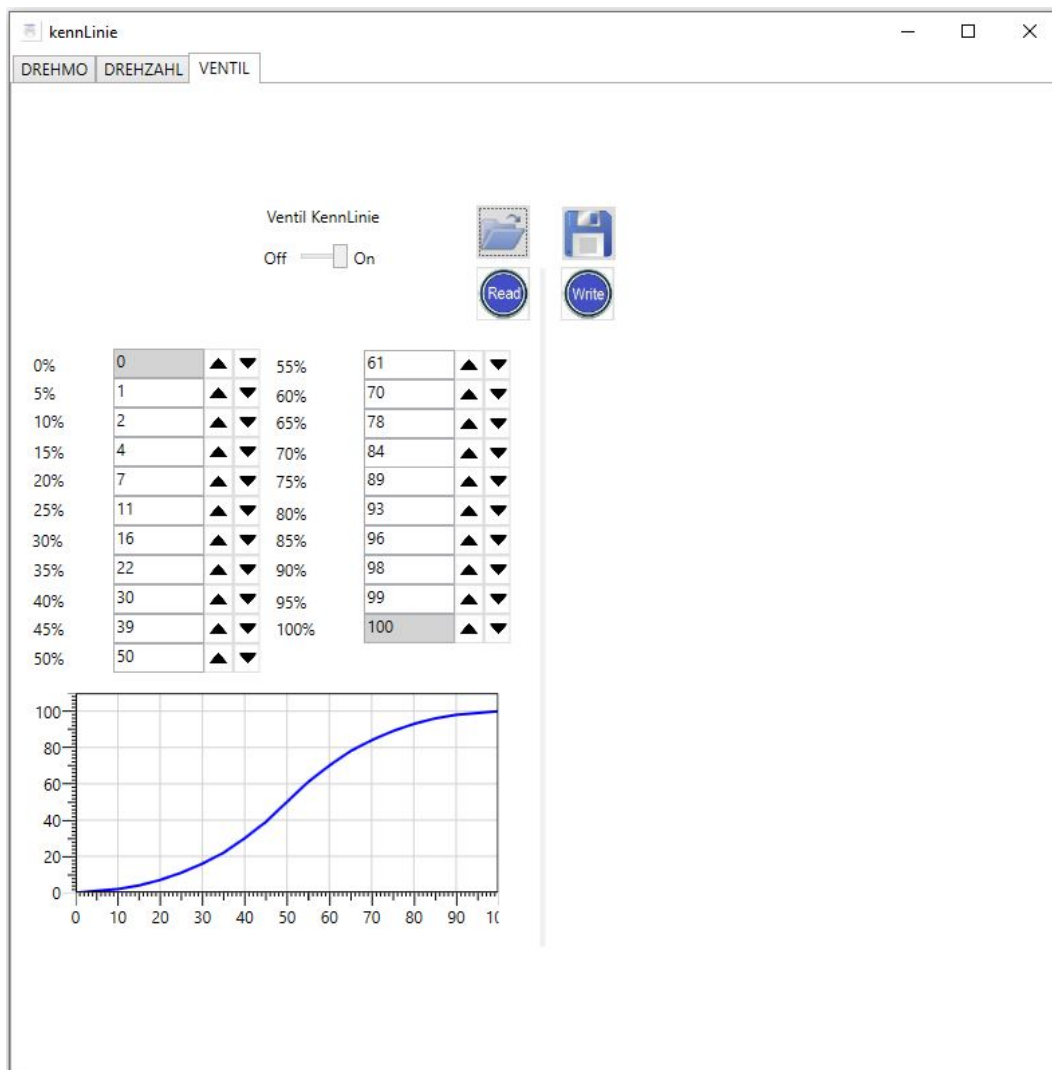


Figure 71: Valve characteristic

	Menu item	Sub-menu item	poss. setting	Notes / comments
P17.5	Characteristic	Valve	0: Off	The valve characteristic curve is disabled.
			1: user defined	The valve characteristic curve is enabled as configured in the SMARTTOOL.

4.7.16 Parameter group: Identification (optional)

This option allows entering further custom-identification parameters.

	Menu item	Sub-menu item	poss. setting	Notes / comments
P18.1	Identification	PPS number	15 digits	Used to enter a PPS number. This is displayed in the bottom line. CAUTION: Param P20.5 must be set to 0.

4.7.17 Parameter group: System parameters (locked)

Used for actuator configuration and not available for customers.

4.7.18 Parameter group: Miscellaneous

	Menu item	Sub-menu item	poss. setting	Notes / comment
P20.1	Miscellaneous	Language	0: German	Defines the menu language
			1: English	
			2: Russian	
			3: Czech	
			4: Spanish	

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	Menu item	Sub-menu item	poss. setting	Notes / comments
			5: French	
			6: Italian	
			7: Danish	
			8: Hungarian	
			9: Turkish	
			10: Greek	
			11: Polish	
			12: Serbian	
			13: Croatian	
P20.2	Miscellaneous	Smartcode		Enables additional features by entering a Smartcode
P20.3	Miscellaneous	Restore para	0:	no action
			1: Custpara -	By saving this setting, all parameters except the end positions are reset to the customer parameters.
			2: Custpara +	By saving this setting, all parameters are reset to the customer parameters.
			3: Backuppara -	By saving this setting, all parameters except the end positions are reset to the factory settings.
			4: Backuppara +	By saving this setting, all parameters are reset to the factory settings.
P20.4	Miscellaneous	Backup para	0:	no action
			1: Custpara	By saving this setting, the currently set parameters are adopted as customer parameters.
P20.5	Miscellaneous	Info line	0...31	The fourth line of the display shows various diagnostic values.
P20.6	Miscellaneous	Infrared	0: Off	The infrared connection is disabled.
			1: Infrarot	The infrared connection is active for about 3 minutes unless communication is detected.
			2: Bluetooth	The Bluetooth connection is active for about 3 minutes unless communication is detected.
			3: Infrarot+	The infrared connection is activated.
			4: Bluetooth+	The Bluetooth connection is activated.
P20.7	Miscellaneous	Menu style	0...2	different menu styles
P20.11	Miscellaneous	Daylight saving time	0: off	Normal time is activated
			1: on	Daylight saving time is activated.
			2: auto	The actuator switches automatically between Daylight saving time and Normal time.

4.8 Status area

The status area presents current process and diagnostic data. There data is read-only. To access the status area, move the control switch in the direction where the selector switch should be in the neutral position or in the remote position.

The status area is divided into 2 sub-areas:

- Status
- History

4.8.1 Status

4.8.1.1 Status – Bin. Outputs

Display of binary outputs: The display shows output control as opposed to output status, i.e. the supply of the binary outputs is ignored. A switched output is represented by 1.

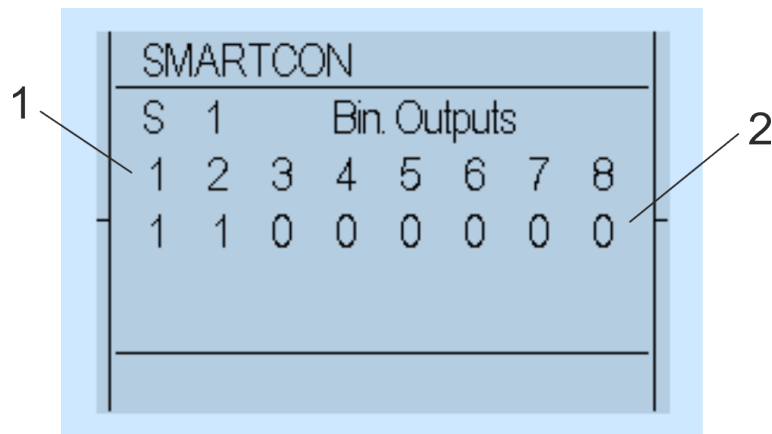


Figure 72: 1... Output Number, 2... Signal (0 = LOW; 1 = HIGH)

4.8.1.2 Status – Bin. Inputs

Display of binary inputs: A set input is represented by 1.

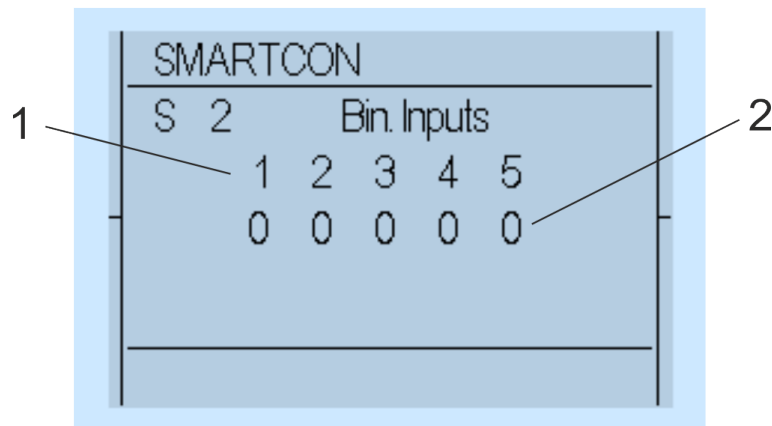


Figure 73: 1... Input number, 2... Signal (0 = LOW; 1 = HIGH)

4.8.1.3 Status – Analogue values

Display of analogue values: Input 1 (In1) is used by the positioner as the setpoint; Input 2 (In2) serves as an external value for the optional PID controller. In the analogue output (out), only the control signal is shown, regardless of whether the output current actually flows or not (interruption of the current loop).

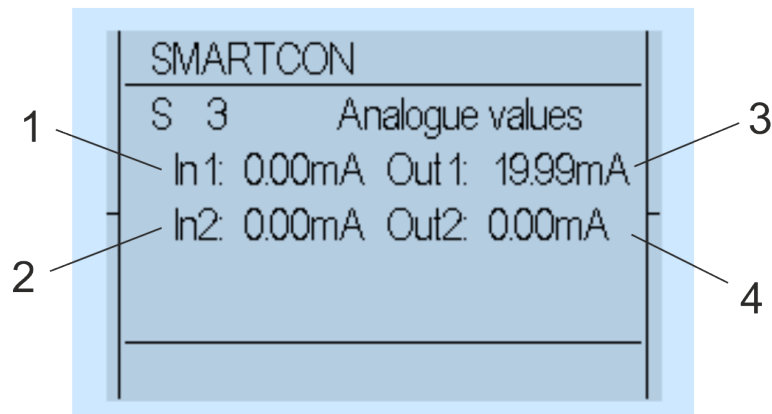


Figure 74: 1... Input 1, 2... Input 2, 3... Output, 4... all values in mA

4.8.1.4 Status – Absolute values

This is used for the mechanical pre-adjustment of the position unit. (see section 4.5.3, page 19)

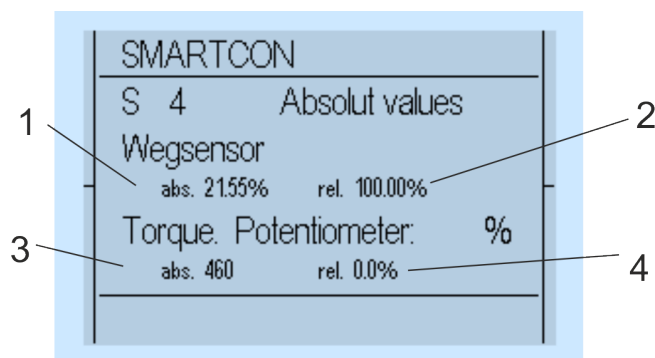


Figure 75: 1... absolute value of the position unit, 2... value for the torque unit (is factory adjusted)

4.8.1.5 Status – Firmware

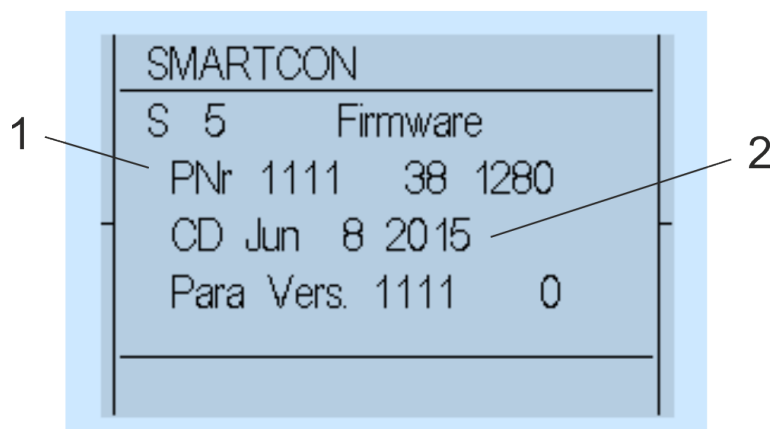


Figure 76: 1... Firmware, 2... Firmware date

4.8.1.6 Status – Serial number

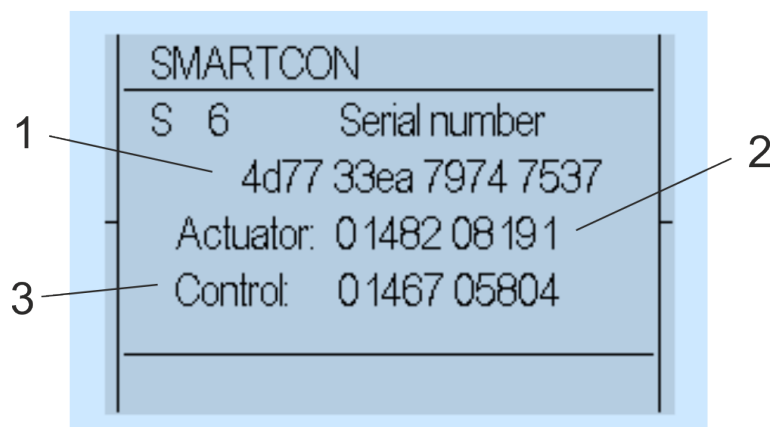


Figure 77: 1... serial number of the control unit, 2... Serial number of the actuator, 3... Serial number of electronics

4.8.1.7 Status - meter readings

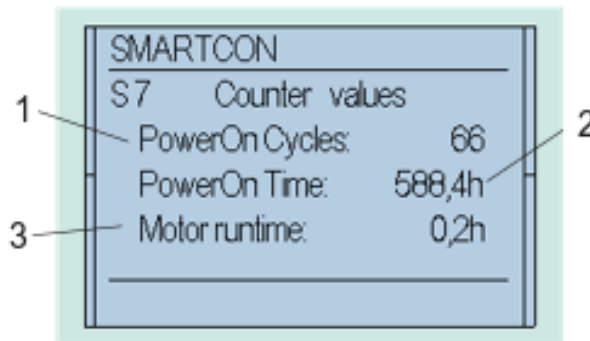


Figure 78: 1... power-on cycles, 2... operating hours, 3... engine duration

4.8.2 History

History shows the last 20 history entries. In addition to the plain text entry, the time since the last history entry is also provided.

Please note that the actuator can only calculate time if energised. For error analysis, please refer to section 4.12.1, page 52.

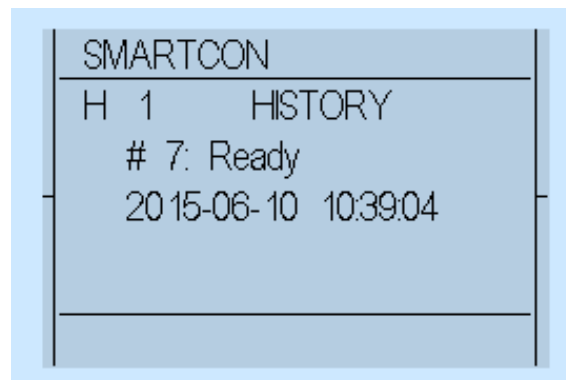


Figure 79: History

4.9 Infrared connection

For easier communication and better visualization of the menu options, the unit provides an infrared port for connection to a PC.

The required hardware (connection cable to the PC's RS-232 or USB connectors) and the corresponding software are available as options.

The SMARTTOOL software, in addition to communication with the actuator, allows the management of multiple actuators to transfer the configuration to different actuators.

This approach can greatly simplify operation.

Please refer to the SMARTTOOL software operating instructions manual for further information.

During operation, it must be ensured that the IR interface surface is protected from strong disturbances -which may otherwise compromise the communication.

Before mounting the infrared adapter, clean the surface of the infrared interface with a damp cloth.

When the infrared interface is enabled, it is indicated by Light-emitting Diode L5 (see Figure 80 section 4.6.2.2, page 25). The infrared interface can be enabled in the menu item P20.6.

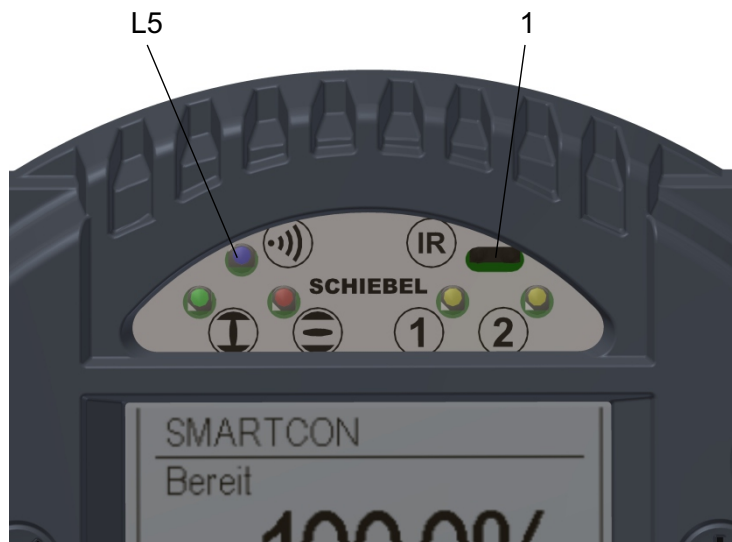


Figure 80: 1... Infrared connection

4.10 Bluetooth Link

In addition to the infrared interface, it is also possible to configure the Control System using a Bluetooth interface. Software required for Android equipment is available as an option.

In addition to communication with the actuator, the Android software also enables management of multiple actuators, allowing easy transfer of parameter sets to various actuators. This approach can simplify commissioning significantly.

When the Bluetooth interface is enabled, this is indicated by the light-emitting diode L5 (see Figure 80 or chapter 4.6.2.2, page 25). The Bluetooth interface can be enabled in menu item P20.6.

4.11 Maintenance

Maintenance work on open actuators may only be conducted if these are de-energized. Reconnection during maintenance is strictly prohibited.

Work on the electrical system or equipment must be carried out only in accordance with electrical regulations by a qualified electrician himself or by specially instructed personnel under the control and supervision of a qualified electrician.



Actuators are ready for use after installation. By default, the actuator is delivered filled with grease.

On-going monitoring:

- Beware of increased running noise. During long downtime periods, operate the actuator at least every 3 months.
- For actuators with output types A, B and C according to DIN 3210-A, B1, B2 and C according to DIN ISO 5210, re-lubricate at least every 6 months on existing grease fittings (see section 4.15.3, page 55)

Actuators are designed for installation in any position (see section 4.2.5, page 11). Therefore, the main body is not equipped with a level indication or a drain plug.

The replacement of the lubricant from the main body must be performed via the handwheel.

Every approx. 10,000-20,000 hours (about 5 years - section 4.15, page 55), depending on the workload, you must:

- Change oil/grease
- Replace seals

Check all roller bearings and the worm-wheel assembly and replace if necessary.

Check our lubricants table for recommended oils and greases. (4.15, page 55)

Check the cable glands at regular intervals (annually) for tightness of the cables and retighten if necessary.



If the visual inspection (eg. dust or water penetration) indicates that the effectiveness of the Sealing elements of the cable entry has suffered damage or aging, such elements have to be replaced preferably by using the original spare parts from the manufacturer of the equipment or through cable entries of comparable quality as well as the same ex- or IP protection class.

4.12 Troubleshooting

The electrical actuation is inhibited by the actuator, if an error occurs. Upon warning or error, The bottom line of the display will show the corresponding, plain text description. This event will also be entered into the history (see section 4.8.2, page 50).

4.12.1 Error list

CAUTION: Each error has a unique error number. Each error also has its separate “OK” message in the history after the fault has gone.



Error	Description
#3: Mot. temp. warn. #19: Mot. temp. warn. OK	The motor temperature is in the critical range although the actuator remains fully functional.
#4: Mot. temp. trip. #20: Mot. temp. OK	Overtemp in motor, fault on Basis or BLDC, On Basis: loss of main power (3x400V) or cable break between CSC and motor; on BLDC: cable break between BLDC and motor.
#5: Phase sequ. error #6: Phase sequ. OK	Cause on Basis: Active phase sequence detection on single phase actuators, loss of main power while connected to external 24 VDC auxiliary voltage, or loss of phase L2.
#7: Ready	Written to the history after all errors are gone.
#8: Power On	Is written to the history after power on the actuator, even if there are some errors.
#9: Power supply error #21: Power supply OK	No power supply to the power electronics (when the controller is powered from the auxiliary power input). Defect of power electronics – please contact the manufacturer.
#11: Failsafe error #12: Failsafe OK	Communication error between Failsafe board and Logic, loss of external 24 V Failsafe Voltage, or overtemp. on Failsafe brake.
#13: Manual override #14: Manual override off	Manual override on Failsafe activate (visible in status S4), cable/switch broken.
#17: Travel error #18: Travel OK	The travel unit is outside the permitted range (potentiometer fault on Basis), cable broken, or multitransducer calibration lost on CM – please contact the manufacturer.
#22: Torque error #23: Torque OK	Potentiometer fault on Basis, or cable broken.
#24: Bus error #25: Bus OK	No communication with the optional bus system.
#26: Bus Watchdog #27: Bus Watchdog OK	Watchdog for bus communication has reacted.
#28: Undervoltage> Warning #29: Voltage OK	The input voltage is below the regular voltage range, but motor operation is still possible.
#32: Internal Comm.L> error #33 Internal Comm.L> OK	Communication error between Logik and Basis/BLDC, cable broken between boards, or board defect.
#34: Internal Comm.D> error #35: Internal Comm.D> OK	Communication error between Display and Logik, cable broken between boards, boards defect, or firmware update on Logik not properly done.
#36: Failsafe not ready #37: Failsafe ready	Failsafe voltage OK and Failsafe not initialized (LUS not tensioned).
#38: Battery low #39: Battery OK	Battery on Display board is empty, loss of time/date or counter values possible.
#44: Inverter error Para #45 Inverter OK Para	BLDC parameter error.
#46: Analog Input 1 Failure #47: Analog Input 1 OK	SRG active, Positioner live zero detection activated, no setpoint value recognized.
#48: Analog Input 2 Failure #49: Analog Input 2 OK	Ext. setpoint active, Ext. setpoint live zero detection activated, no Ext. setpoint value recognized

Error	Description
#56: Internal Comm.E> error #57: Internal Comm.E> OK	Communication error between Logik and Failsafe (external connection) – please contact the manufacturer.
#58: Undervoltage> Warning	The input voltage is too low. The motor is switched off, until the input voltage is in the regular voltage range.
#59: Undervoltage> Switchoff	The input voltage dropped below the lower threshold multiple times. The motor is turned off for 5 minutes. This error can be acknowledged by switching the selector switch to OFF or by turning the actuator off and on.
#60: Overvoltage> Warning	The input voltage is over the regular voltage range, but motor operation is still possible.

Errors in case of special types

Error	Description
#30: Oil level low #31: Oil level OK	Binary input on Basis board or switch faulty.
#40: Oil pressure low #41: Oil pressure OK	Analog input (4...20 mA) on Basis board faulty.
#42: Motor protection #43 Motor protection OK	Binary input on Basis board or switch faulty.

4.13 Fuses

Depending on the version of the SMARTCON control unit, there are fuses located in the terminal area, the dimension of the fuse is indicated next to the fuse holder.

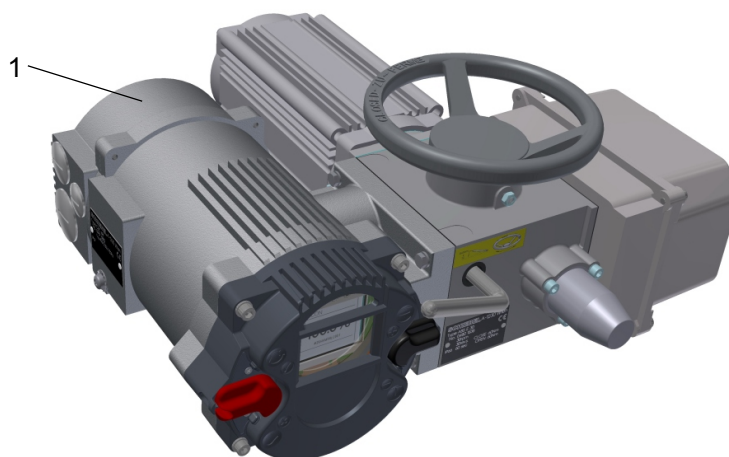


Figure 81: 1... Connection compartment

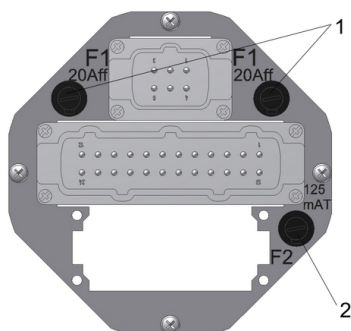


Figure 82: size 1, electronic reversing starters
(1... main fuses, 2... control fuse)

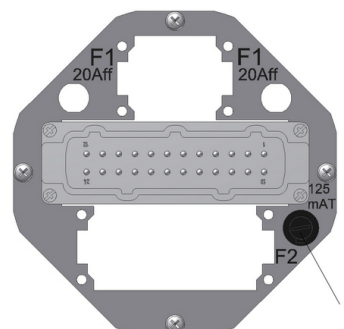


Figure 83: size 2 (1... control fuse)

4.14 Spare parts

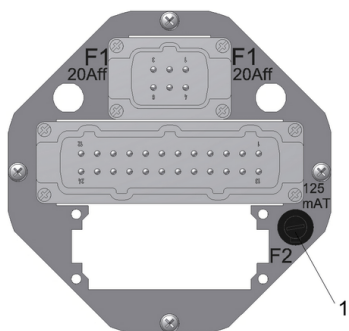


Figure 84: size 1, up to 440VAC
(1... control fuse)

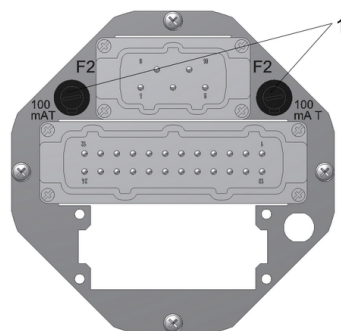


Figure 85: size 1, larger than 440VAC
(1... control fuse)

fuse F1: main fuse before the electronic reversing starter (eW, see Figure 82)			
power of the motor	value	Recommended Type	Spare part designation
up to 1,5kW	20A FF (2 pcs)	G-fuse, brand SIBA, type 195100, ceramic 6,3 x 32mm; 20AFF,very fast acting, 500V, $I^2t = 46A^2$	C606d
3kW	12,5A T (2 pcs)	G-fuse, brand SIBA, type 189140, ceramic 6,3 x 32mm; 12,5AT; time lag, 500V, $I^2t = 1300A^2s$	C606e
fuse F2: control fuse before the control transformer			
supplyvoltage	value	Recommended Type	Spare part designation
$\leq 440VAC$	125mA T	G-fuse, brand SIBA, type 189140, ceramic 6,3 x 32mm; 125mA; time lag, 500V, $I^2t = 0,08A^2s$	C606g
$> 440VAC$	100mA T (2 Stück)	G-fuse, brand SIBA, type 189140, ceramic 6,3 x 32mm; 100mA; time lag, 500V, $I^2t = 0,05A^2s$	C606f

Actuators which are suitable for operation in explosive atmosphere, no fuses are located in the connection compartment! The control fuse is installed in the flameproof area of SMARTCON control unit and is not accessible to the user!



The logic board of the controller cover (see Figure 86, page 54) features two miniature fuses for the control lines

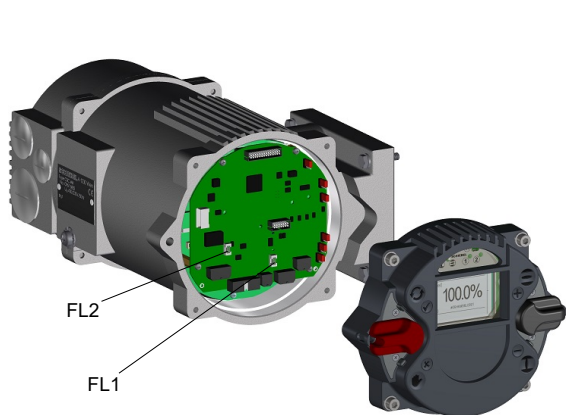


Figure 86: FL1... Fuse for auxiliary supply, FL2... Fuse for the binary outputs

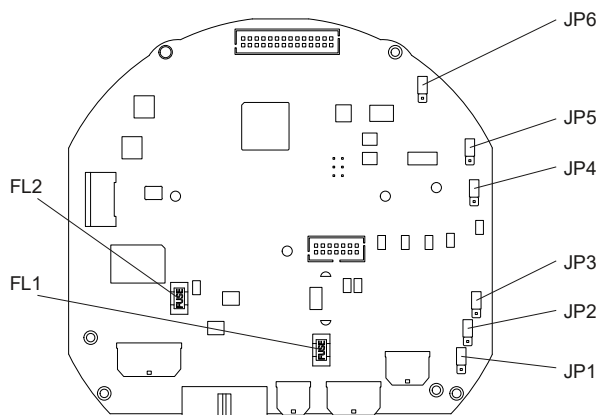


Figure 87: Logic-Board

Fuses on the logic board			
Fuse	Value	Manufacturer	List of spare parts
FL1	1AT	Littelfuse 454 NANO ² Slo-Blo [®] träge	FUSE-F1
FL2	4AT	Littelfuse 454 NANO ² Slo-Blo [®] träge	FUSE-F2

4.14 Spare parts

When ordering spare parts, please provide us with the serial number of the (see section 4.2.2, page 10). Check the separate break-down image and separate list of spare parts.

4.15 Recommendations of Lubricants (for all manufactures)

Please note, that safety precautions such as the use of personal protective equipment (PPA) may have to be followed! Please consult the safety datasheet (in section 8) of the product in question.



4.15.1 Main Casing

4.15.1.1 Application temperature from -35°C to +100°C

Lubricating grease DIN 51826 - GP 00 P-30

i.e. High pressure (EP), complex grease on Li soap basis:
 work penetration 0.1 mm: 355 - 430
 Dripping temperature: about 200°C
 NLGI grade: 00
 Acid-free, not or only marginally reacting with water

4.15.1.2 Application temperature from -50 to +100 °C

Lubricating oil CLP DIN 51517-3

i.e. fully synthetic high-performance industrial gear oil based on poly alpha olefins (PAOs):
 Viscosity class: ISO VG 68
 Pour point: <-55°C
 Compatibility with conventional coatings and sealants

4.15.1.3 Application temperature from -60 to +100 °C

Lubricating oil CLP DIN 51517-3

i.e. fully synthetic high-performance industrial gear oil based on poly alpha olefins (PAOs):
 Viscosity class: min ISO VG 32
 Pour point: <-60°C
 Compatibility with conventional coatings and sealants

4.15.2 Spur Gears (actuator size AB8 - AB80)

Lubricating grease DIN 51825 - KPF -1/2 G-20

i.e. High-graphite, bitumen-free permanent lubricant with outstanding EP properties:
 Work penetration 0.1mm: 265 - 340.
 Observe operating temperature range!

4.15.3 Output Drive Type A and Spindle Drive (Linear Actuators) plus Failsafe units

Lubricating grease DIN 51825-K(P) R -40

i.e. Water-repellent complex grease based on Al-soap with high resistance to acids and alkalis:

Ambient temperature:	-40 to +85 °C
Worked penetration 0,1 mm:	310-340
Dripping point:	approximately 260 °C
NLGI-Class:	1
acid-free, not or only slightly reactive with water	
Observe operating temperature range!	

4.15.4 Precision Components

Lubricating grease (or spray) DIN 58396- S1

i.e. High-creeping, water-displacing, low-viscosity grease chemically neutral to copper and plastics:
 Work penetration 0.1mm: 175 - 385
 Dripping temperature: over 150°C
 Evaporation loss: max. 1%
 Water resistance: Evaluation grade DIN 51807-1-40
 Observe operating temperature range!

4.15.5 Basic Lubricant Service Interval

On actuator maintenance, the old grease must be removed completely and replaced by a new one.

The service interval for Schiebel actuators is 10 years from the date of delivery by Fa. SCHIEBEL Antriebstechnik Gesellschaft m.b.H, A-1230 Vienna

The functionality and operating life of the lubricants is, however, dependent upon operational conditions. It may be necessary to take reduction factors into account.



Operational condition(s)	Definition	Reduction Factor(Multiplier)
On-period (OP)	(Total of motor running time)	
Extremely high OP	over 1,250 hours/year	0,5
High OP	over 500 hours/year	0,7
Extremely low OP	less than 0.5 hours/year	0,8
Ambient temperature	(Permanent or long-term)	
Extremely changing	between -10 and +50°C	0,5
Extremely high	over +50°C	0,7
Extremely low	below -25°C	0,9
Output speed	(at main shaft of actuator)	
High revolution	over 80 rev./min	0,8
Utilization factor	(with respect to nominal performance)	
Very high	over 90%	0,8
High	between 80 and 90%	0,9

Example:

Extremely low OP + extremely low ambient temperature + high revolution + utilization factor 87%

⇒ 0.8 x 0.9 x 0.8 x 0.9 = 0.51 reduction factor.

Lubricant maintenance interval ⇒ 10 years x 0.51 = 5.1 years (62 months).

WARNING: A thusly calculated maintenance interval does not apply to the maintenance of the output type A (threaded bushing), nor to the maintenance of the linear and spindle actuator units. These must be regularly re-greased (at least once every six months) at the lubricating nipples (see section 4.15.3, page 55)!



During actuator maintenance, the old lubricants must be thoroughly removed and replaced by fresh ones. **No mixing of different makes of lubricant is permitted!**

The quantities needed for lubricant service can be seen from the table below.

4.15.6 Lubricant Requirements

Type of actuator	Main gear	Spur gears	Output form A (Threaded bushing)	Output form B (Plug bushing)	Output form C (Claw coupling)
AB3/5	1kg (1l oil)	—	5cm ³	3cm ³	3cm ³
AB8	1kg (1l oil)	1cm ³	5cm ³	3cm ³	3cm ³
AB18	1kg (1l oil)	1cm ³	8cm ³	5cm ³	5cm ³
AB40/80	1,5kg (1,5l oil)	1,5cm ³	9cm ³	6cm ³	6cm ³
AB100/200	3,5kg (3,5l oil)	1,5 kg (1,5l oil)	23cm ³	20cm ³	20cm ³

When lubricating precision components, such quantities of lubricant are to be used as to ensure fine moistening of the sliding surfaces.

4.16 Training

Warning: Should problems arise on site in connection with assembly or adjustment, please contact the SCHIEBEL Antriebstechnik Gesellschaft m.b.H, Josef-Benc Gasse 4, A-1230 Vienna, Telephone +43 (1) 66 108 or by internet www.schiebel-actuators.com, in order to avoid any incorrect operations or damage to the actuators. The Schiebel Company recommends to recruit only qualified personnel for assembly of Schiebel actuators. Upon special request by the ordering party, personnel can be trained on the premises of the Schiebel Company according to the operations listed in the instructions for use.



4.17 Original Declaration of Incorporation of Partly Completed Machinery

Accordinging Machinery Directive 2006/42/EC, (Annex II, sub. B)

The maufacturer, the company:

SCHIEBEL Antriebstechnik Gesellschaft m.b.H.
Josef-Benc-Gasse 4
A-1230 Vienna

hereby declares that the partly completed machinery described below:

Electric actuators series:

AB rAB exAB exrAB

with optional additional components:

Smartcon CSC Smartcon exCSC

the following basic requirements of the Machinery Directive (2006/42/EC) are applied and fulfilled:

Annex I, articles 1.1.2, 1.1.3, 1.1.5; 1.2.1, 1.2.1, 1.2.2, 1.2.6; 1.3.1, 1.3.2, 1.3.7; 1.5.1;
1.6.3; 1.7.1, 1.7.3, 1.7.4

The following European harmonized standards have been applied:

EN12100:2010 EN ISO 5210:1996 EN ISO 5211:2001 DIN 3358:1982

The relevant technical documentation for partly completed machinery referred to in Annex VII, Part B has been prepared. The manufactor commits to submitting the documents for the incomplete machine the competent national authority electronically upon request.

For the preparation of the technical documents is authorized:

Head of mechanical Engineering
Schiebel Antriebstechnik Gesellschaft m.b.H.
Josef-Benc-Gasse 4
A-1230 Vienna

This partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive 2006/42/EC, where appropriate.


The electric actuators as partly completed machinery is in conformity with the relevant regulations of the EU directives:

Directive 2014/30/EU ("EMV-Directive")
Directive 2014/35/EU ("Low voltage directive")
Directive 2014/34/EU ("ATEX-Directive") for correspondingly marked devices

The corresponding separate EC Declarations of Conformity are valid.

Vienna,
(location)

den **14.12.2016**
(date)


.....
(Klaus Schiebel, general manager)

4.18 Declaration of Conformity**(EMV- and Low voltage-directive)**

The producer:

SCHIEBEL Antriebstechnik Gesellschaft m.b.H.
Josef-Benc-Gasse 4
A-1230 Wien

herewith confirms, that the equipment

electric actuators with control unit and following types

(r)AB ... CSC

meets the requirement of the EC-directive:

2014/30/EU („EMV-directive“)

in consideration of the respective operating instructions, and the fulfilment of the Directive has been demonstrated by the following standards:

EN 61000-6-2:2005

EN 61000-6-3:2007-01 + A1:2011-03

and are also consistent with the EC-directive:

2014/35/EU („Low-voltage-directive“)

in consideration of the respective operating instructions, and the fulfilment of the Directive has been demonstrated by the following standards:

IEC 60204-1:2005 + A1:2008

EN 60529:1991 + A1:2000

Vienna,
(location)

14.12.2016
(date)



.....
(Klaus Schiebel, general manager)

4.19 Declaration of Conformity

(Ex-, EMV- and Low voltage-directive)

The producer:

SCHIEBEL Antriebstechnik Gesellschaft m.b.H.
Josef-Benc-Gasse 4
A-1230 Wien

herewith confirms, that the equipment

Description	Type	Marking	Certificate-No.
Electric Actuator	ex (r) AB	⊕II2G Ex db eb II C T4(T6) Gb	FTZU03ATEX0328X
Control Unit	CSCex	⊕II2G Ex db eb II C T4(T6) Gb	TÜV-A04ATEX0009X
Control Unit	CSCexFU	⊕II2G Ex db eb II B T4(T6)	TÜV-A08ATEX0006
Flameproof Induction Motor	D(.)FUY63/..-	⊕II2G Ex db II C T4 Gb	FTZU03ATEX0330X
Flameproof Induction Motor	D(.)FUY80/..-	⊕II2G Ex db II C T4 Gb	FTZU03ATEX0333X
Flameproof Induction Motor	ex DKF .. .X. ..	⊕II2G Ex db II C T4 Gb	TÜV-A03ATEX0016X
Microswitch	d 515U	⊕II2G Ex db II C Gb	FTZU03ATEX0332U
Flameproof Potentiometer	dP1 / dP2	⊕II2G Ex db II C Gb	FTZU03ATEX0387U
Flameproof capacitor	dK .	⊕II2G Ex db II B Gb	FTZU07ATEX0009U

meets the requirement of the EC-directive:

2014/34/EU

EC-Directive for Operation of Equipment in Potentially Explosive Atmospheres

and complies with the following harmonised standards in the version valid at signature date:

EN60079-0:2014	Electrical apparatus for explosive gas atmospheres – General requirements
EN60079-1:2014	Electrical apparatus for explosive gas atmospheres – Flameproof enclosures "d"
EN60079-7:2016	Electrical apparatus for explosive gas atmospheres – Increased safety "e"
EN60079-11:2012	Electrical apparatus for explosive gas atmospheres – Intrinsic safety "i"

Following notified bodies certificate the conform design of the equipment:

FTZU	CZ-716 07 Ostrava Radvanice	NB 1026: Quality system FTZU03ATEXQ019, Type examination certificates
TÜV Austria Services GMBH	A-1230 Wien	NB 0408: Type examination certificates

Furthermore they consistent with the EC-directive:

2014/30/EU („EMV-directive“)

in consideration of the respective operating instructions, and the fulfilment of the Directive has been demonstrated by the following standards:

EN 61000-6-2:2005

EN 61000-6-3:2007-01 + A1:2011-03

and are also consistent with the EC-directive:

2014/35/EU („Low-voltage-directive“)

in consideration of the respective operating instructions, and the fulfilment of the Directive has been demonstrated by the following standards:

IEC 60204-1:2005 + A1:2008

EN 60529:1991 + A1:2000

Vienna,
(location)

25.03.2019
(date)



.....
(Klaus Schiebel, general manager)

4.20 Technical data

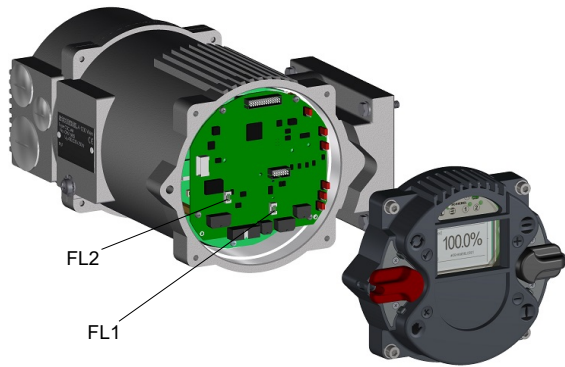


Figure 88: Control unit

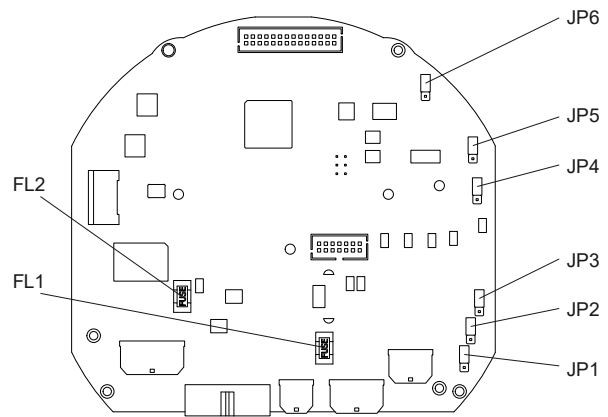


Figure 89: Logic-board

4.20.1 Binary outputs

Count:	8
Power supply:	24 VDC nominal range: 11...35 VDC (either from internal or external)
Max voltage drop at set output:	1 V
Output voltage at non-set output:	<1 V
Maximum current per output:	500 mA (short circuit proof)
Maximum permissible total current for all outputs:	4 A
Fuse (Fuse FL2, see Figure 89, page 61):	4 A slow (Littelfuse 454 NANO ² Slo-Blo [®])

Binary outputs with external supply are separated from other controllers via optocouplers.

4.20.2 Binary inputs

Count:	5
Nominal voltage:	24 VDC towards common ground
Voltage for input set:	>10 V (8.5 V typ.)
Voltage for input not set:	<7 V (8.5 V typ.)
Maximum voltage:	30 VDC
Current consumption at 24 VDC:	10.5 mA typ.

Binary inputs are separated from other controllers via optocouplers.

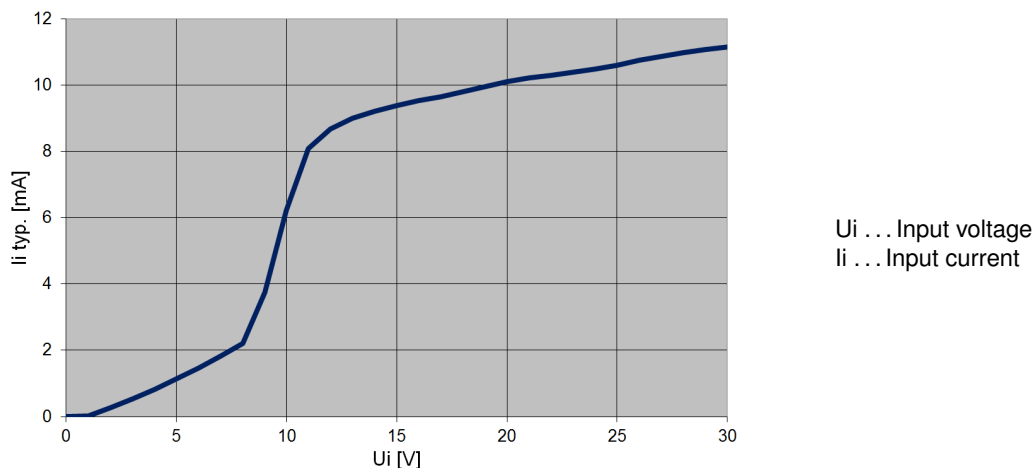


Figure 90: Binary inputs, input characteristic

4.20 Technical data

Jumpers JP1 ... JP3 can be used to interconnect the binary inputs to groups with separate earths:

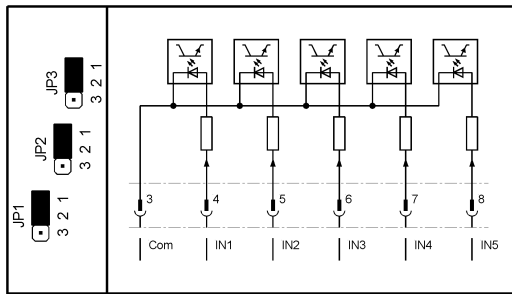


Figure 91: 5 inputs with same common

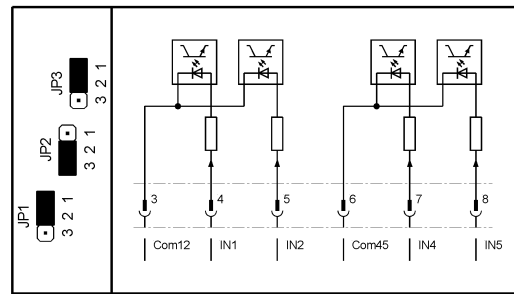


Figure 92: 2 separated groups of 2 inputs with same ground
Input IN3 is disabled.

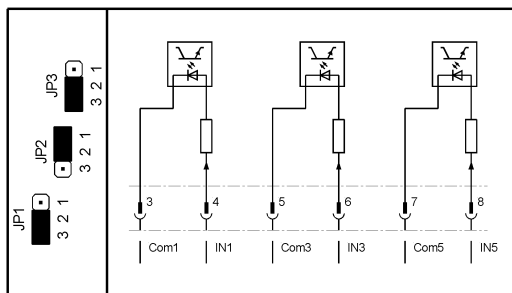


Figure 93: 3 separated inputs
Inputs IN2 and IN4 are disabled.

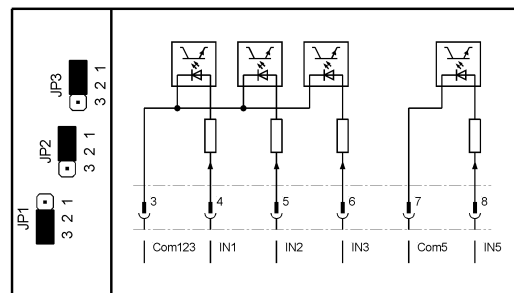


Figure 94: 3 inputs with same common and 1 separated input.
Input IN4 is disabled.

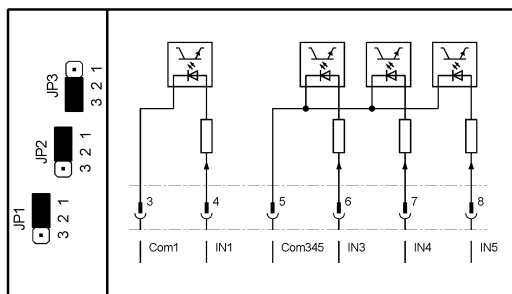


Figure 95: 1 separated input and 3 inputs with same common.
Input IN2 is disabled.

Examples:

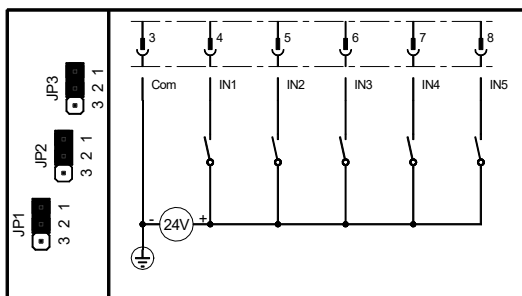


Figure 96: 5 inputs with common = "-" using external 24V

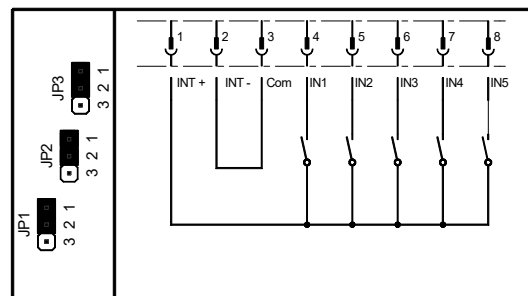


Figure 97: 5 inputs with common = "-" using internal 24V
(e.g. for dry contacts)

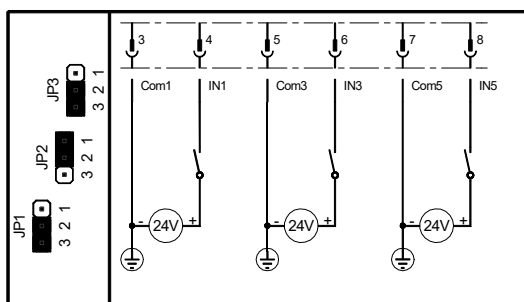


Figure 98: 3 separated inputs using 3 separated external 24V

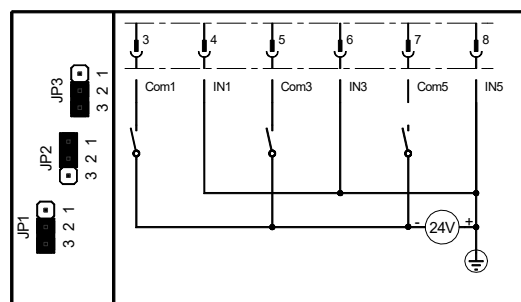


Figure 99: 3 separated inputs with common = "+" using external 24V

4.20.3 Analog inputs

Input 1: setpoint value

Current range:0... 25 mA
Resolution: 14 bit
Accuracy: 0.5%
Input resistance:60 Ω

Analog input 1 is electrically isolated from the rest of the electronic system.

Input 2: External actual value (only in combination with PID controller)

Current range:0... 20.8 mA
Resolution: 12 bit
Accuracy: 0.5%
Input resistance:120 Ω

Jumper JP6 can be used to switch analog input 2 from a passive input (default) to an input with internal 24 V power supply (for 4... 20 mA, two-wire transmitters).

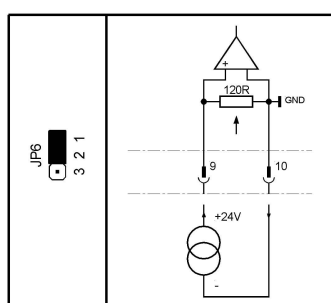


Figure 100: Passive input (default)

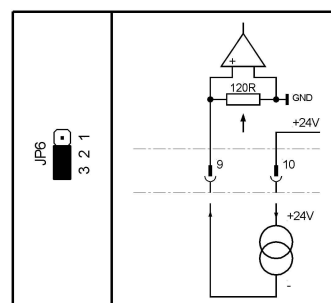


Figure 101: Input with internal supply (active input)

IMPORTANT: The analog input 2 is referenced to common of the electronic system and the auxiliary power supply (see section 4.20.5).



4.20.4 Analog output

Current range:0... 20.8 mA
Resolution: 12 bit
Accuracy: 0.5%
Max load: 600 Ω

The analog output is galvanically isolated from the rest of the electronic system.

Jumper JP4 can be used to switch the analog output from an active power source (default) to a current sink, allowing the output to simulate a 4... 20 mA, two-wire transmitter.

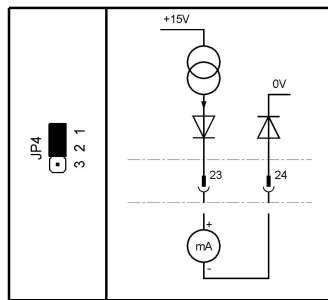


Figure 102: Current source

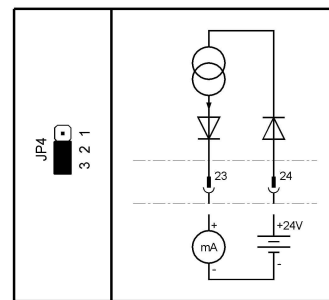


Figure 103: Current sink

Ground potential is the potential of the control unit and the auxiliary supply (see chapter 4.20.5).

4.20.5 Auxiliary voltage input and output

Input voltage range (auxiliary voltage input): 20... 30 VDC
Maximum current consumption (auxiliary voltage input): 500 mA
Maximum current consumption in power-save mode 120 mA
(auxiliary voltage input):
Output voltage (auxiliary voltage output): typ. 23 V
Maximum output current (auxiliary voltage output): 200 mA
Resistance of common ground vs. earth: typ. 330 kΩ
Resistance of common ground vs. earth (floating version): > 10 MΩ
Capacitance of common ground vs. earth: typ. 100 nF
Maximum allowed voltage of common ground vs. earth: max. 40 Vs
Fuse (Fuse FL1, see picture 89, page 61): 1 A slow
(Littelfuse 454 NANO² Slo-Blo[®])

Ground potential is the common ground of the controller and the analog inputs and outputs.
The auxiliary voltage output can be set in menu P6.5 (see section 4.7.5, page 33).

The power-save mode is defined as follows:

- No power supply (the controller is powered exclusively through the 24 V auxiliary voltage input).
- The backlight of the LCD display switches off automatically.
- No additional hardware options included (Profibus Interface, DeviceNet interface, relay board, etc. ...).
- Binary outputs and the mA output are not enabled; when activating, the respective currents must be added to the total current consumption.

4.20.6 Mechanical reversing starter

By default all phases of the motor are switched by a mechanical reversing contactor. The mechanical reversing contactor is both electrically and mechanically interlocked to prevent unintended cross circuits.
Depending on the engine size results in the following assignments:

size	Typ	power of the motor (with 400V 3-phase current)	
		open-loop control (operational mode S2)	closed-loop control (operational mode S4)
mW4	K09	3kW	1,5kW
mW5	K12	5,5kW	3kW
mW7	D18	7,5kW	5,5kW
mW11	D25	11kW	7,5kW
mW22	D38	22kW	11kW

The mechanical life (switching cycles) of the reversing starter can be roughly estimated with the help of the following diagram and the rated current (motor current):

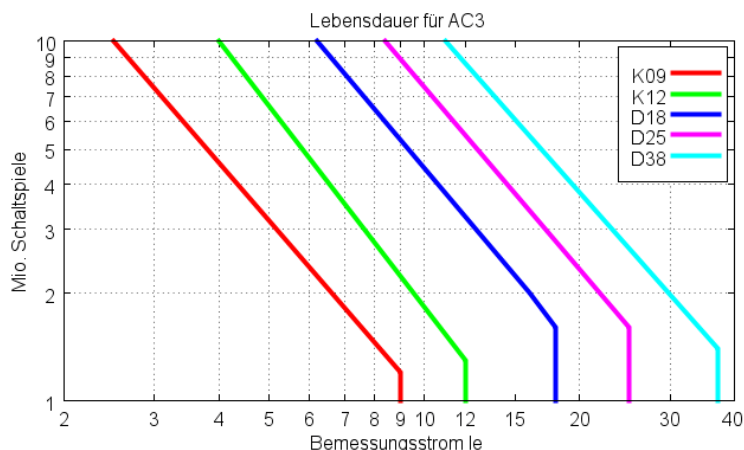


Figure 104

IMPORTANT: These values apply to utilization category AC-3 (switching off during motor run) and not to utilization category AC-4 (inching)! With AC-4, stressing by the high breaking current is substantially higher, so the service life is considerably shorter. For this reason, inching (switch-off during motor start-up) should be avoided with mechanical reversing contactors.



4.20.7 Electronical reversing starter

Optionally, the motor of the actuator is controlled by an electronic reversing contactor (thyristors). The electronic reversing contactor switches two of the three motor phases. The control of the two directions of rotation is locked by hardware in the electronic reversing contactor. Compared to conventional mechanical contactors there is no mechanical wear through contact burning; in case of electronic reversing starters this feature increases the life and reliability of modulating actuators with high switching frequency.

Attention: The third phase is not switched in the electronic reversing contactor and is therefore constantly on the motor winding.



voltage range: 48... 480Vrms
current range: 0,1... 50Arms
transient overvoltage: 720Vpk
max. I^2t of the fuse: 2320A²s
lock time when changing direction:: min. 100msec

4.20.8 Micro switch

Standard switch

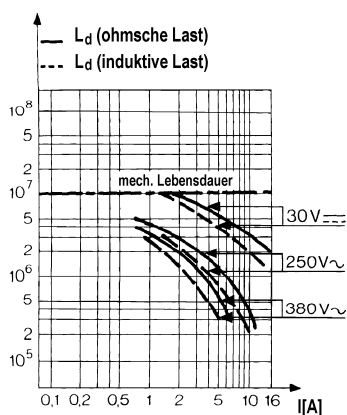


Figure 105: Load capacity diagram (83106)

Flashing switch and Explosion-proof micro-switch:

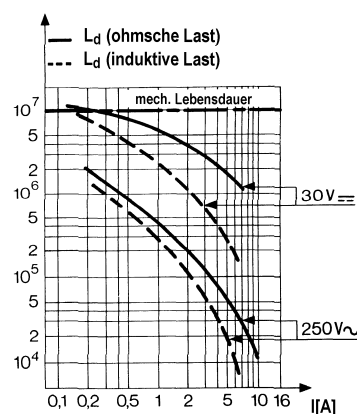


Figure 106: Load capacity diagram (83133)

Mech. service life L_d 10^7 switching cycles
Permissible ambient temp -20...+85°C
Special models -40...+125°C

Mech. service life L_d 10^7 switching cycles
Permissible ambient temp -20...+125°C

For the ohmic load capacity, $\cos\varphi=1$ shall apply. The inductive load capacity given is $\cos\varphi=0,8$ and/or $L/R=5\text{ms}$.

WARNING: the maximum switching current for micro switches with gold-plated contacts is 40 mA a voltage of 24 V (ohmic load). If switching currents are too high, the goldplating will be destroyed.



4.20.9 Power supply

The internal supply of the SMARTCON control unit is made via the power connection. At 3-phase current a neutral phase is not required. The following table shows the possible different voltage ranges of the control.

voltage (3-phase, standard range):	3 x 380, 400, 415, 440 VAC +/-10%
voltage (3-phase, on request):	3 x 110, 115, 120 VAC +/-10%
voltage (3-phase, on request):	3 x 220, 230, 240 VAC +/-10%
voltage (3-phase, on request):	3 x 460, 480, 500, 525 VAC +/-10%
voltage (3-phase, on request):	3 x 575, 660, 690 VAC +/-10%
voltage (single-phase, on request):	110, 115, 120 VAC +/-10%
voltage (single-phase, on request):	220, 230, 240 VAC +/-10%
frequency:	50/60Hz, +/-3Hz
idle power consumption:	max. 24W

For the supply voltage of the complete system (control unit and actuator) also the motor voltage must still be considered (see actuator data and name plate)!



4.20.10 Connections

Size 1 (mechanical reversing starter mW4, mW5, mW7K and electronical reversing starter):

Power / motor:	till 440V: Industrial plug with 6 pins, screw connection 16A, max. 2,5mm ² , AWG14 from 460V: Industrial plug with 3+2 pins, screw connection 16A, max. 2,5mm ² , AWG14
Control signals:	Industrial plug with 24 pins, screw connection 16A, max. 2,5mm ² , AWG14

optional crimp contacts are available

Size 2 (mechanic reversing starters mW7, mW11 and mW22):

Power / motor:	Industrial plug with 4 pins, screw connection 80A, 1,5...16mm ²
Control signals:	Industrial plug with 24 pins, screw connection 16A, max. 2,5mm ² , AWG14

optional crimp contacts for the control unit are available

Explosion-proof version:

Power / motor:	terminals with screw connection 16A, 0,5...4mm ² , AWG20...AWG12
Control signals:	terminals with screw connection 4A, 0,5...2,5mm ² , AWG20...AWG14

4.20.11 Miscellaneous

Ambient temperature:

On/Off Actuators:	-25 to +70°C
Modulating actuators:	-25 to +60°C
explosion-proof version:	-20 to +40°C (acc. EN60079-0)

protection class:

standard actuators, size 1 1:	IP67
standard actuators, size 2:	IP65
explosion-proof version:	IP65

colour: RAL7030 (other colors on request)

5 Additional instructions - SMARTCON control with frequency converter

5.1 General

The SMARTCON control unit with frequency converter is used for monitoring and controlling an actuator and provides the interface between the operator, the control system and the actuator.

This version of the control unit is only available in control cassette design for separate mounting of the actuator.

There are 2 different versions, the standard **CSC FU** and explosion-proof **CSCex FU** control unit.

5.2 Dimensions, Mounting

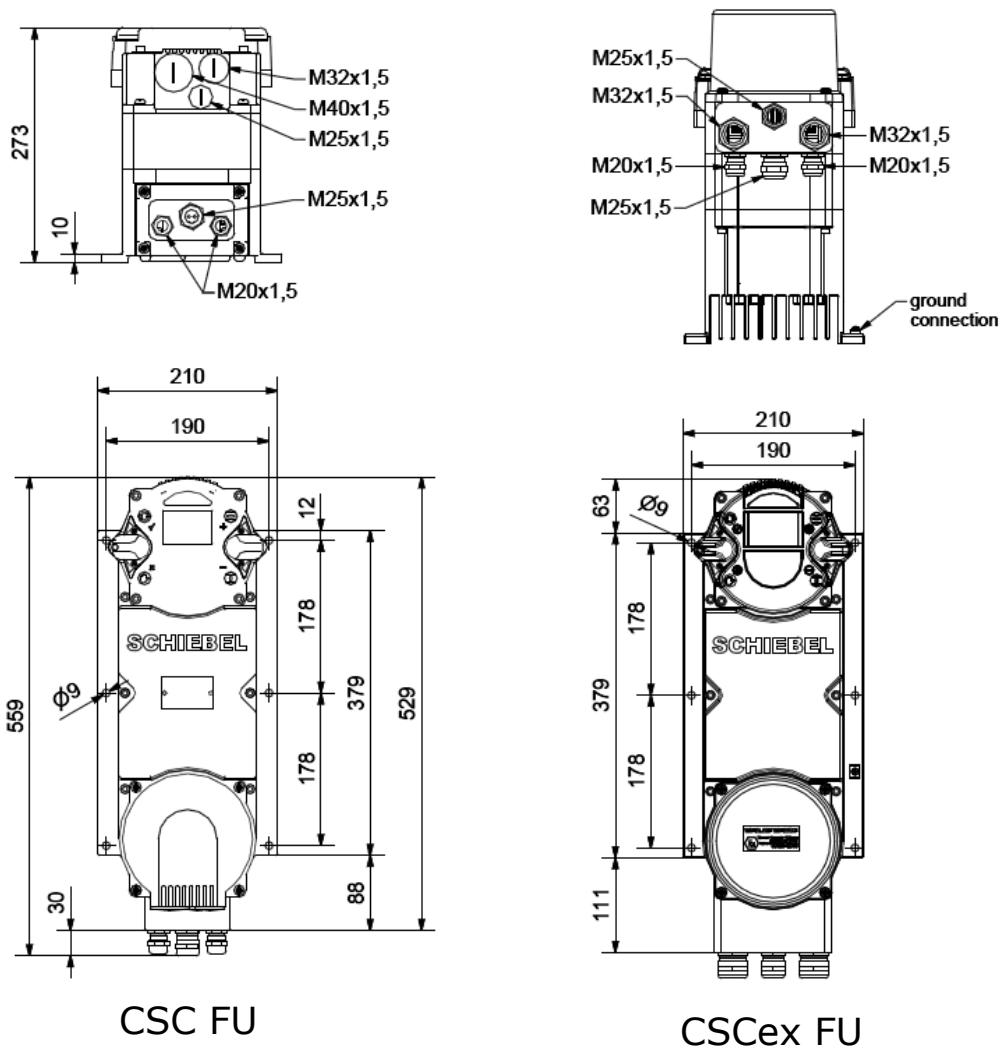


Figure 107: Dimensions

The control unit is designed to be mounted on a flat vertical wall in which a vertical orientation in accordance with the Figure 107. For mounting 6 boreholes (holes Ø9mm) are available at least the outer 4 must be used.

With the explosion-proof version CSCexFU is to make sure that the cooling fins are not covered on the top and bottom of the unit and allow air circulation is impeded.

5.3 Electrical connection

5.3 Electrical connection

Work on the electrical system or equipment must be made in accordance with the applicable electrical engineering rules only by a qualified electrician or by instructed persons under the direction and supervision of a qualified electrician.

Relevant safety regulations (OVE EN 1).

Electric supply in a powered down state.



When working in hazardous areas the European Standards EN 60079-14 "Electrical installations in hazardous areas" and EN 60079-17 must be observed "Inspection and maintenance of electrical installations in hazardous areas".



Warnings located on the control unit:



Check whether the system-side supply (voltage, frequency) with the motor data (refer to motor type plate) matches.



The connection of the electrical wiring must be in accordance with the operating instructions for actuators including Smart-consteuerung and the relevant connection diagram. This is in reporting or connection housing. The diagram can be ordered quoting the serial number at SCHIEBEL.

Indicated on the nameplate of protection is only ensured if suitable cable glands are used, ie the protection of the cable glands must be at least equal to the protection of his control, and the cable gland must be suitable for the corresponding cable diameter. Unused cable entries must be fitted with suitable blanking screws may or supplied blind screws can not be removed.

For controllers in EX version, the cable glands must additionally have an Ex "e" approval!

General it should be observed when mounting that not only the tightness of the cable gland for cable, but also the tightness of the housing or cover part is guaranteed.

The corresponding manufacturer's instructions must be observed!



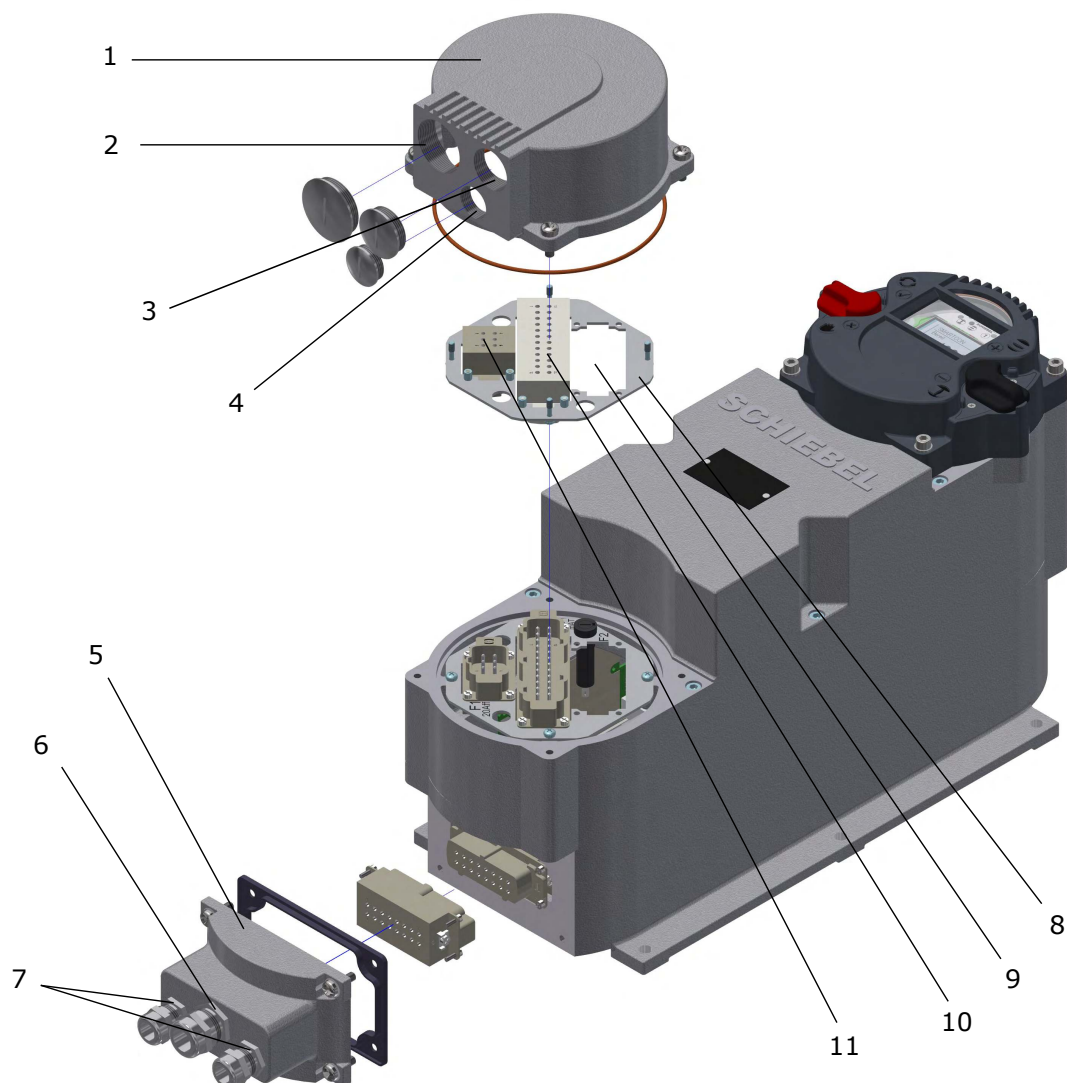


Figure 108: Connection normal version

1... Connection cover customer connection, 2... metric screw (are sealed delivered with blind screws) M40x1,5, 3... M32x1,5, 4... M25x1,5, 5... Connector cover joint actuator, 6... M25x1,5, 7... M20x1,5, 8... connector plate, 9... plug insert (for relay and bus board - option), 10... plug insert (for control cables), 11... plug insert (for power supply)

5.3 Electrical connection

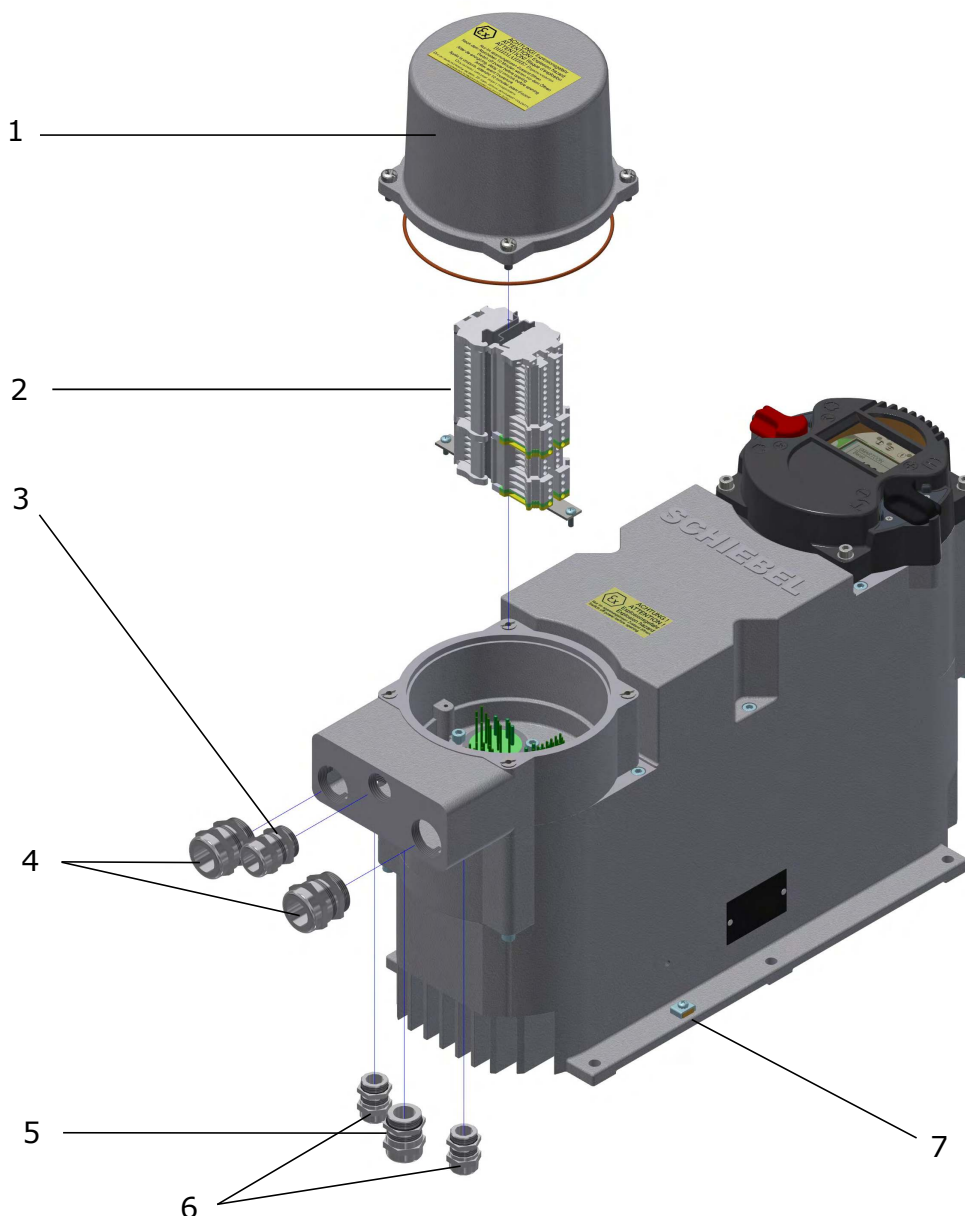


Figure 109: Connection Ex-version

1 ...connecting lid, 2 ...Terminal, 3 ...metric screw for customer connection (are delivered with blind screws closed) M25x1.5, 4... M32x1.5, 5... metric screw for connection to the actuator M25x1.5, 6... M20x1.5, 7... external grounding

Depending on the order the following connection are possible:

- In standard design then connection of control signal and motor are made via plug (see Figure 108) with screw (In = 16A): The maximum conductor cross-section is 2,5mm²
- For (ex-design) or on sepcial order, the connection is made with terminals (see Figure 109): The maximum conductor cross-section for the control signals is 2.5 mm and 4mm² for the power connection
On order (or if required due to high currents) also larger terminals are used for the motor connection.

Furthermore, make sure it comes to no electrostatic discharges during follow-up. Please connect the grounding screw first.

For controllers in explosion-proof design both the outer grounding (connection cross section 4 mm²) and the ground lying in the terminal box must be connected.

On request there are additional pre-assembled connecting cable to the actuator available.

When using options such as Profibus the additional guidelines must be observed.



5.3.1 Technical data, Fuses

Site, fuses and disconnect switches are required for short-circuit protection and for disconnecting the actuator. According to the following tables, the following current values are valid and accordingly fuses must be dimensioned. The fuses must be of the type gG for installation according to IEC.

Also the name plate data and the job documentation must be observed!



Power supply 1x 230V 50Hz

Type Frequency		PK37	PK55	PK75	P1K1	P1K5	P2K2
Typische shaft power	$P_{M,N}$ [kW]	0,37	0,55	0,75	1,1	1,5	2,2
Input current	$I_{L,N}$ [A]	2,9	4,4	5,5	7,7	10,4	14,4
	$I_{L,MAX}$ (60s) [A]	4,6	7,0	8,8	12,3	16,6	23,0
Max. Fuses	IEC Typ gG [A]	20	20	20	20	20	20

power supply 3x 400V 50Hz

Type Frequency		PK37	PK55	PK75	P1K1	P1K5
Typische shaft power	$P_{M,N}$ [kW]	0,55	0,75	1,1	2,2	4,0
Input current	$I_{L,N}$ [A]	1,2	1,7	2,2	3,0	3,7
	$I_{L,MAX}$ (60s) [A]	1,9	2,7	3,5	4,8	5,9
Max. Fuses	IEC Typ gG [A]	10	10	10	20	20

Type Frequency		P2K2	P3K0	P4K0	P5K5
Typische shaft power	$P_{M,N}$ [kW]	2,2	3	4	5,5
Input current	$I_{L,N}$ [A]	5,3	7,2	9,0	12
	$I_{L,MAX}$ (60s) [A]	8,5	11,5	14,4	19,2
Max. Fuses	IEC Typ gG [A]	20	25	25	25

5.4 Settings and parameters

The setting and parameters are set in the context of the actuator according to the operating instructions for actuators with SMARTCON control units.

5.5 Malfunctions

In case of a malfunction of the CSC FU or CSCex FU, please perform following checks:

Error Description	Action
smartcon supplied with main power: dark display	Check the main power supply. If supply voltage is OK, check fuse C606f
Smartcon supplied with 24V: dark display	Check the control voltage supply (terminal 1 (+) and 2 (-) on the control plug or control terminals if the 24V DC are present If OK check fuse C302b.
No binary outputs	Check the voltage (terminal 13 (+) and 14 (-) on the control plug or control terminals if the 24V DC are present If OK check fuse C302a.
No power to the heating resistor in the actuator	Check the fuse C408

fuses can be changed as follows:
Note section 5.3, page 67!
Perform work only when the power is off!



5.5.1 Fuse replacement for standard version CSC FU

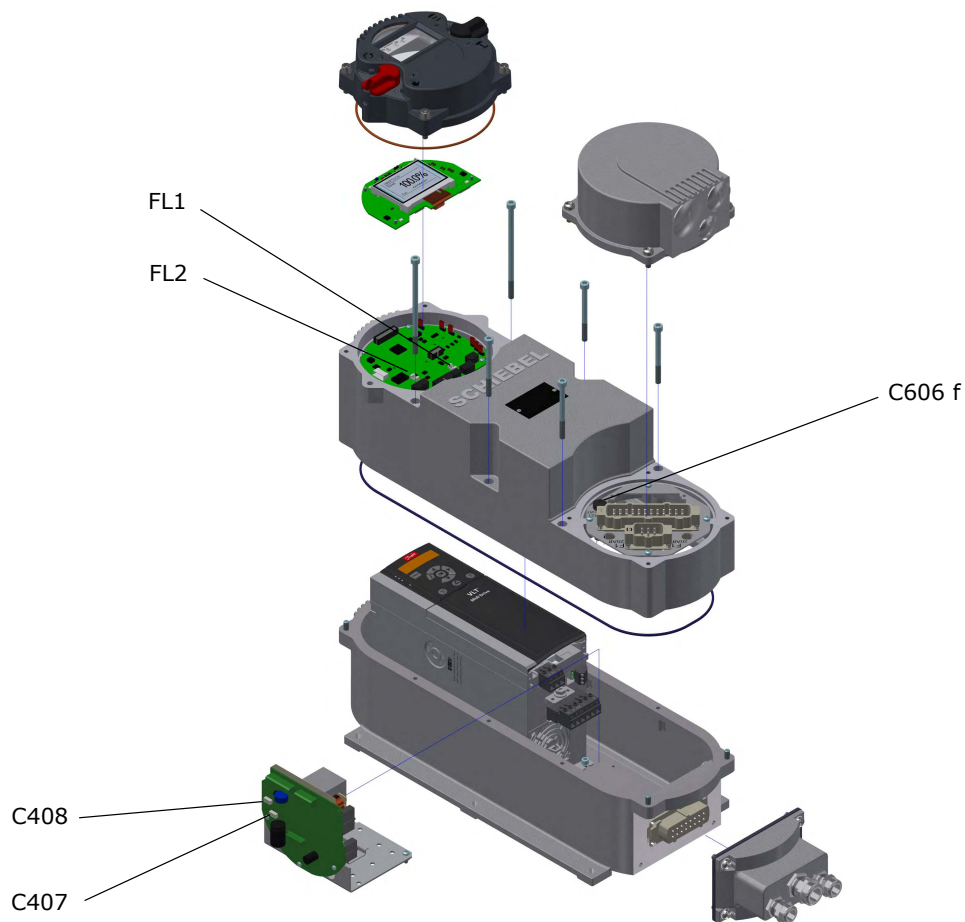


Figure 110: Insurance-standard version

Description	Position	application	Type	trigger value
FL1	Logic	24V auxiliary supply	Littelfuse 454 NANO ² Slo-Blo [®] träge	1 AT
FL2	Logic	binary outputs	Littelfuse 454 NANO ² Slo-Blo [®] träge	4 AT
C407	supply	safeguarding supply	Littelfuse 454 NANO ² Slo-Blo [®] träge	1 AT
C408	supply	safeguarding heating	Littelfuse 454 NANO ² Slo-Blo [®] träge	500 mAT
C606 f	connection compartment	tax insurance	finely insurance 6,3x32	125 mAT

For the access to the internal fuses (C407 and C408) the housing upper part must be removed. Therefore it is necessary to remove the actuator connector in order to access the underlying screw.

Furthermore, it should be noted that between the upper and lower part there is a cable connection which must not be removed. For the work the upper part gently tilt to the side!

When refitting check seals and sealing surfaces. Seal the surfaces lightly with acid-free grease (eg Vaseline). Replace cover and make sure that no wires are pinched.

Tighten screws evenly crosswise.

5.5.2 Fuse replacement for explosion-proof CSCex FU

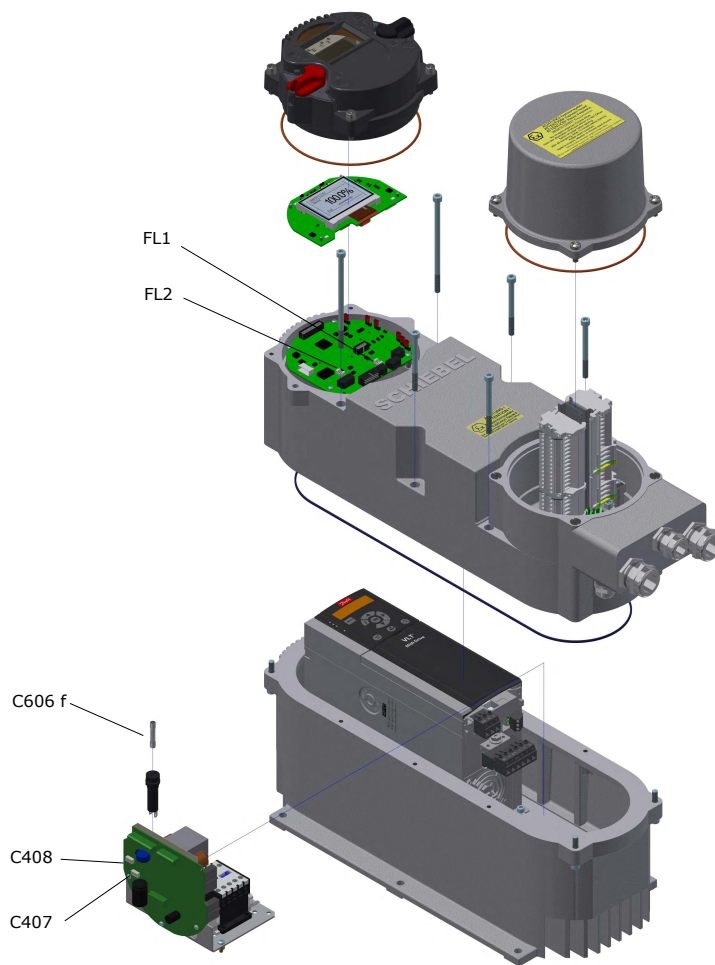


Figure 111: Fuse Ex-Version

Attention:

- **Pressure proof encapsulation! Before opening, check the absence of gas and if the unit is de-energized.**
- **Note signs on the device!**
- **Handle cover and housing parts carefully.**
- **Cleavage surfaces must not show any damage or contamination.**
- **Do not tilt the cover during assembly.**



For the access to the internal fuses (C407 and C408 and C606f) the housing upper part must be removed. Furthermore, it should be noted that between the upper and lower part there is a cable connection which must not be removed. For the work the upper part gently tilt to the side! When refitting check seals and sealing surfaces. Seal the surfaces lightly with acid-free grease (eg Vaseline). Replace cover and make sure that no wires are pinched. Tighten screws evenly crosswise.

5.5.3 Maintenance

Generally the unit is maintenance-free. Should be opened in the course of repair work cover the sealing surfaces and seals for damage or condition to check and if necessary replace. It is recommended to annually conduct a visual inspection of the unit for mechanical damage that could affect the degree of protection. Specifically, the cable entries must be checked for tightness of the cable and condition of the seals. At least every 5 years to check the seal of the connection cover on condition.

5.5.4 Technical data

Product	CSC FU	CSCex FU
Housing and cover	Aluminium, painted	
Weight	max. 18 kg	max. 22 kg
Supply voltage (range)	3phasig 380-440VAC +/-10%; 50, 60Hz	
.....	-1phasig: 220-240VAC +/-10%; 50, 60Hz	
Rated power (typical wave power)	0,37 - 5,5 kW (1,5kW 1phasig)	
frequency range (Output)	5-50Hz (Speed ratio 1:10)	
Binary In/Outputs	see instructions for actuators with SMARTCON control	
Analog In/Outputs	see instructions for actuators with SMARTCON control	
Auxiliary voltage input	see instructions for actuators with SMARTCON control	
Protection (EN 60529)	IP67	IP65 (IP67)
ambient temperature	- 10° to + 60°C	- 10° to + 40°C
Type of protection	-	Ex II2G EX de IIBT4
certificate number	-	TÜV-A 08ATEX0006

6 Operating instructions for gears IW, MOW, MTW, IB and IS range

This manual contains important safety information. Please ensure it is thoroughly read and understood before installing the gearbox.



This manual is produced to enable a competent person to install, operate, adjust and inspect Rotork gearboxes. Only persons competent by virtue of their training or experience should install, maintain and repair Rotork gearboxes.



WARNING: Gearbox may present an unbalanced load.



WARNING: With respect to handwheel operation of Rotork gearboxes, under no circumstances should any additional lever device such as a wheel-key or wrench be applied to the handwheel in order to develop more force when closing or opening the valve as this may cause damage to the valve and/or gearbox or may cause the valve to become stuck in the seated/backseated position.



WARNING: Damage to protective coatings should be correctly rectified and may invalidate warranty.



6.1 Introduction

Unless otherwise specified the gearbox is supplied assembled. In the case of $\frac{1}{4}$ turn gearboxes, the gearbox stops have been set to a nominal 90° open and close position.

The IW gearbox stops must be re-set for the stroke of the valve after combination installation.



6.2 Health and safety

Work undertaken must be carried out in accordance with the instructions in this and any other relevant manuals. The user and those persons working on this equipment should be familiar with their responsibilities under any statutory provisions relating to the Health and Safety of their workplace. Due consideration of additional hazards should be taken when using the gearbox with other equipment. Should further information and guidance relating to the safe use of the Rotork products be required, it will be provided on request.

The mechanical installation should be carried out as outlined in this manual and also in accordance with relevant standards such as British Standard Codes of Practice. No inspection or repair should be undertaken unless it conforms to the specific hazardous area certification requirements. For maintenance of the actuator, refer to the actuator installation and maintenance manual.

WARNING: The gearbox enclosure materials may include cast iron, SG iron, carbon steel or stainless steel.



6.3 Storage

If your gearbox cannot be installed immediately store it in a clean dry place until you are ready to install in situ. Recommended storage temperature range: 0°C to 40°C (32°F – 104°F).

6.4 Unpacking

Gearboxes are packed in a variety of configurations depending on size, type and quantity of the consignment.

It is the responsibility of the individual unpacking and handling the combination to carry out a risk assessment for the supplied arrangement to ensure safe working. Refer to Section 6.5, page 76.

Packaging material used may include wood, cardboard, polyethylene and steel. Packaging should be recycled according to local regulations.

6.5 Handling

Individual weights for gearboxes are recorded on their respective nameplates

Only trained and experienced personnel should carry out handling. At all times, safe handling must be ensured.



Each combination must be assessed to identify all risks associated with handling.

The gearboxes must be fully supported until full valve shaft/stem engagement is achieved and the gearbox is secured to the valve flange.

Once connected to the valve, each assembly must be assessed on an individual basis for safe handling/lifting. Never lift the complete combination-valve assembly via the gearbox.

If it is necessary to lift the gearbox using lifting equipment, certified soft slings are recommended. Damage to protective coatings should be correctly rectified and may invalidate warranty.

6.6 Installation & maintenance of worm combinations

6.6.1 Output sleeve removal, machining and refitting

Gearbox sizes IW12 to IW16 have an output which is directly machined as specified with the order. All other worm gearbox combinations have a removable output sleeve (1) (see Figure 112).

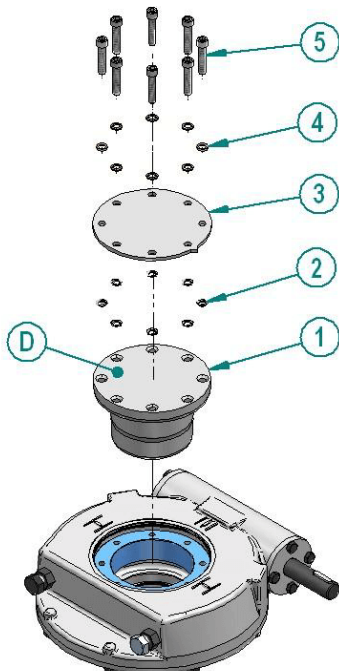


Figure 112: 1... Output Sleeve, 2... O-rings, 3... Indicator cover, 4... Serrated Washers, 5... Retaining Screws

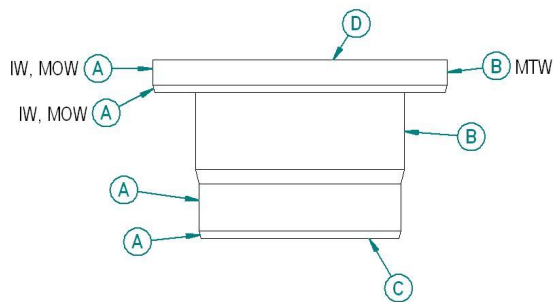


Figure 113

Important Notes for figurename 113

A: The surfaces marked „A“ are sealing faces and must not be damaged.

B: The surfaces marked „B“ can be used for chucking the output sleeve for machining.

C: To remove the output sleeve from the gearbox, a force may have to be applied to the face marked „C“ of the output sleeve.

D: It is recommended to apply silicon sealant to the face marked „D“ when fitting the indicator plate.



Unless specifically requested at the ordering stage, the output sleeve will be supplied blank and must be machined to suit the valve shaft. The sleeve can be easily removed from the top of the gearbox by first removing the output sleeve retaining screws (5) The screws are either serrated under their heads or are fitted with serrated washers (4) then remove the indicator/cover plate (3)

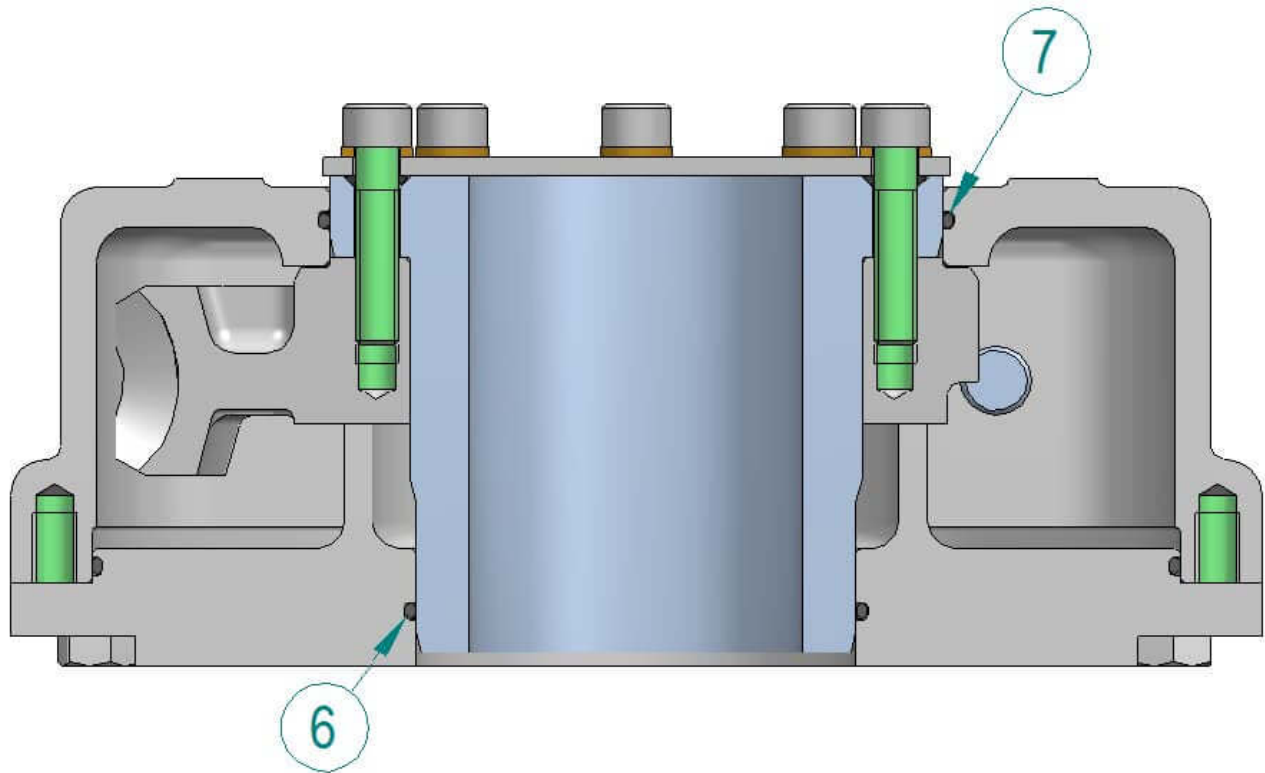


Figure 114: 6... O-Ring, 7... O-RING

O-rings (6) and (7) are to be inspected for damage, greased and properly seated before refitting the output sleeve. If the O-ring is damaged then it should be replaced prior to fitting the output sleeve.

WARNING: Removing the retaining screws will result in the loss of control of the valve.



O rings (2) are used to seal the indicator plate, output sleeve and retaining screws. Upon final installation on the valve, screws (5) must be tightened to the correct torque figures as shown on the label on the underside of the indicator/cover plate.

Figure 112 shows the removal of the output sleeve from the gearbox. See Figure 112 for removing the output sleeve without damaging the sealing faces.

Before refitting the output sleeve after machining, check that the surfaces marked 'A' in Figure 113 are not damaged. Damaged surfaces can break the gearbox seals and cause water ingress or grease leakage. Applying a thin layer of grease to the faces marked 'A' will make refitting of the sleeve easier.

As detailed in Figure 112 and Figure 113, it is recommended that silicon sealant is applied to face 'D' to seal the indicator/cover plate to the output sleeve. Taking care not to apply sealant to the o rings (2) or the sealing faces of the o rings.

Before re-assembly, clean and de-grease the top face of the output sleeve, underside of the indicator/cover plate, and the socket head cap screws. Make a note of the tightening torque required for the output sleeve screws on the label on the underside of the indicator plate. Insert the screws and washers into the holes in the indicator/cover plate, as per Figure 112.

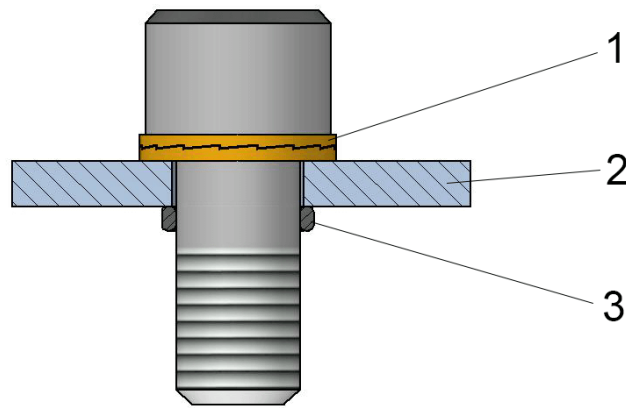


Figure 115: 1... 2 PART WASHER, 2... INDICATOR PLATE, 3... O-RING

It is essential to fit the two part washers the correct way round with the cam faces of the washers joining. Place the o rings over the screw threads and against the indicator plate.

Apply a thin coat of silicon sealant to the top face of the output sleeve. Place the indicator on the output sleeve, with the indicator pointer in the correct orientation if applicable. Engage each screw through the indicator and output sleeve into the tappings in the gear quadrant. Fasten the screws evenly. As the screws start to tighten, press down on the indicator plate to extrude any excess sealant. Wipe away the excess. Tighten each screw to the recommended torque previously noted.

WARNING: It is absolutely essential to assemble and torque tighten the screws immediately after the sealant is applied to the indicator/cover plate and screws. Any delay will allow the sealant to start to cure. This will result in a flexible joint being formed between the output sleeve and indicator/cover plate. This joint would relax over time, allowing the screws to loosen.



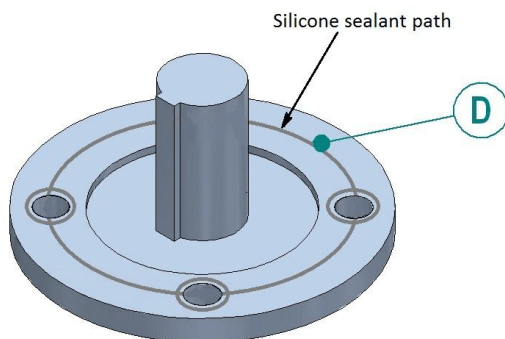
6.6.2 Mounting to the valve

WARNING: Ensure the valve is fully supported and capable of accepting increased weight and change of centre of gravity resulting from the addition of the gearbox combination.



If the gearbox has been supplied with a handwheel, it is recommended that this be fitted to the gearbox before mounting onto the valve. This will make it easier to rotate the gearing to pick up on the valve stem, either key, flats or square.

1. Ensure gearbox output is in the same relative position as the valve shaft (open or closed). Gearbox output position can be moved by rotating the input shaft or turning the actuator handwheel.
2. Apply a ring of silicone sealant around the mounting face of the flange, the ring should be at the same radius from the shaft as the bolt holes. Apply small rings of sealant around each of the bolt holes to completely seal the faces (see Figure 116).



Important Note for Figure 116

D: It is recommended that the flanges be sealed on assembly with silicon sealant. The face marked „D“ on Figure 116 shows where sealant can be applied to the valve mounting flange



Figure 116: Valve Mounting Flange

3. Align gearbox baseplate flange square and parallel to valve flange (see Figure 116). It is recommended that flanges be sealed on assembly with silicon sealant. Grease the output sleeve and the valve shaft.
4. Engage gearbox output sleeve on to valve shaft ensuring valve shaft keyway, square etc is in alignment (if necessary rotate output sleeve— refer to 1)
5. It is essential that the gearbox baseplate is flush with the valve bonnet flange before the mounting screws are tightened. Mounting screws or studs/nuts must be high tensile steel (grade 8.8 or higher). Firmly tighten down fixings onto the valve flange to the torque required. See chapter 6.9.1, page 86.

6.6.3 Baseplate Thread Depths

Gearbox	Base	Min Tap Depth	Max Drill Depth
IW3 / MOW3	F/FA10, F/FA12	18	21
	F/FA14	18	21
	F/FA16	24	27
IW4 / MOW4	F/FA12, F/FA14	16	18
	F/FA16	30	34
IW5 / IW52 / MOW5	F/FA14, F/FA16	16	20
	F/FA25	16	20
	F/FA25	30	34
IW6 / IW62 / IW63 / MOW6	F/FA16, F/FA25	16	26
	F/FA16, F/FA25, F/FA30	20	26
	F/FA30	30	34
IW7 / IW72 / MOW7	F/FA16, F/FA30	24	28
	F/FA30	24	28
	F/FA35	30	40
IW8 / IW82 / MOW8	F/FA25, F/FA30, F/FA35, F/FA40	30	36
	F/FA25, F/FA30, F/FA35	30	36
	F/FA40, F/FA48	36	46
IW9 / MOW9	F/FA30, F/FA35, F/FA40	30-36	44
	F/FA30, F/FA35, F/FA40	25-36	46
	F/FA40, F/FA48	36	44
IW10 / MOW10	F/FA35, F/FA40	30-36	41-46
	F/FA48	36	46
	F/FA60	36	46
IW11 / IW11BB / IW115 / IW115BB / MOW11	F/FA35, F/FA40, F/FA48	36	39
	F/FA60	36	39
IW12 / IW13	F/FA40, F/FA48, F/FA60	38	48
	F/FA48, F/FA60	38	48

6.6.4 Setting the gearbox stops to suit the valve (IW and MOW Only)

This procedure should be carried out by the valvemakersupplier and should be done when the valve opening and closing operations can be visibly checked. Once installed within the pipe the stops should not be altered without the authorisation of the valvemakersupplier.

The gearbox stops are factory set but require adjusting for optimum valve performance. If an actuator is to be used to operate the gearbox, then the mating faces between the gearbox input flange and the actuator output must be sealed prior to assembly using a ring of silicone sealant applied at the same radius as the bolt holes, a small ring of sealant should be applied around each bolt hole to completely seal the faces (see Figure 116). The actuator limit and torque switch settings should be set up according to the actuator manufacturer's recommendations. The gearbox open & closed stop screws should then be set. (see Figure 117).

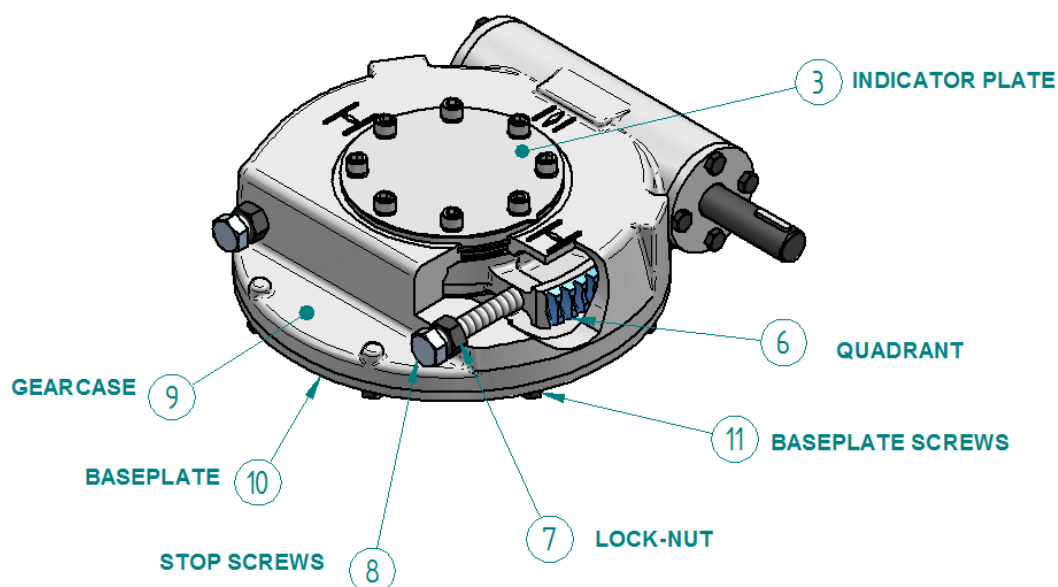


Figure 117: Setting stop bolts

Close the valve, using the actuator where applicable. Use the indicator plate (3) pointer as an indication of position. Loosen the lock nuts (7) and turn the stop screws out approximately 3 complete turns, apply a small amount of silicone sealant to the threads where the screws meet the gearcase. Wind the gearbox closed position stop screw (8) into the gearbox quadrant (6). Back the screw off one turn, then tighten the lock-nut (7) to secure the stop screw. Open the valve with the actuator, and then repeat the process with the open position stop screw. If the stop screws are re-adjusted at a later date then silicone sealant must be re-applied.

Note – movement between baseplate (10) and gearcase (9) can occur when operating at near rated torques. It is recommended that regular maintenance occurs to verify baseplate screws (11) are correctly torqued.

6.6.5 Worm combination maintenance

Under normal operating conditions, no maintenance is required for the gearbox. Should the valve be taken out of service for overhaul, the gearbox baseplate may be removed and the lubricant changed using one of the following greases. The baseplate must be sealed using silicone sealant on re-assembly, unless fitted with o-rings. All o rings should be renewed.

Gearbox	Manufacturer	Name	Temperature Range
IW	Fuchs	Renolit CL-X2	-60°C bis + 120°C
MOW	Fuchs	Renolit LST 0	-20°C bis + 120°C
MTW	Fuchs	Renolit EPLITH 00	-10°C bis + 120°C

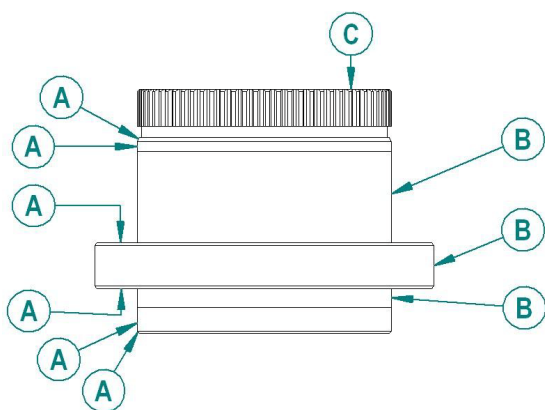
An equivalent extreme pressure lubricant may be used. For extreme temperature applications, please consult Rotork Gears

6.7 Installation & maintenance for multi-turn IB & IS combinations

6.7.1 Output sleeve removal, machining and refitting

IB and IS range of gearboxes have a removable output sleeve. Unless specifically requested at the ordering stage, the output sleeve will be supplied blank and must be machined to suit the valve stem/shaft. Before refitting the output sleeve after machining, check that the surfaces marked 'A' in Figure 118 are not damaged.

Damaged surfaces can break the gearbox seals or bearings and cause water ingress or grease leakage.



Important notes for Figure 118

A: The surfaces marked „A“ are sealing faces and must not be damaged.

B: The surfaces marked „B“ can be used for chucking the output sleeve for machining.

C: To remove the output sleeve from the gearbox, a force may have to be applied to the face marked „C“ of the output sleeve.



Figure 118: Ventilbefestigungsflansch

Applying a thin layer of grease to the faces marked 'A' will make refitting of the sleeve easier.

See Figure 119: Note that the output sleeve arrangement is identical for IB and IS gearboxes. The sleeve (14) can be easily removed from the gearbox by first removing the loose piece spigot ring (15) from the baseplate (16). A slight force may have to be applied to the face marked 'C' to assist in removing the sleeve.

WARNING: It is imperative that the thrust bearings in the output are fitted correctly, along with the output sleeve and the spigot ring. That is: the needle thrust bearings **MUST** have a thrust washer (12) at each side of the needle race (13). A bearing / washer assembly **MUST** be fitted at each side of the output sleeve thrust shoulder. All thrust elements and bearing cavities must be packed with grease of the correct specification.



The output sleeves are splined and may have to be rotated slightly to engage with the mating spline in the output gear.

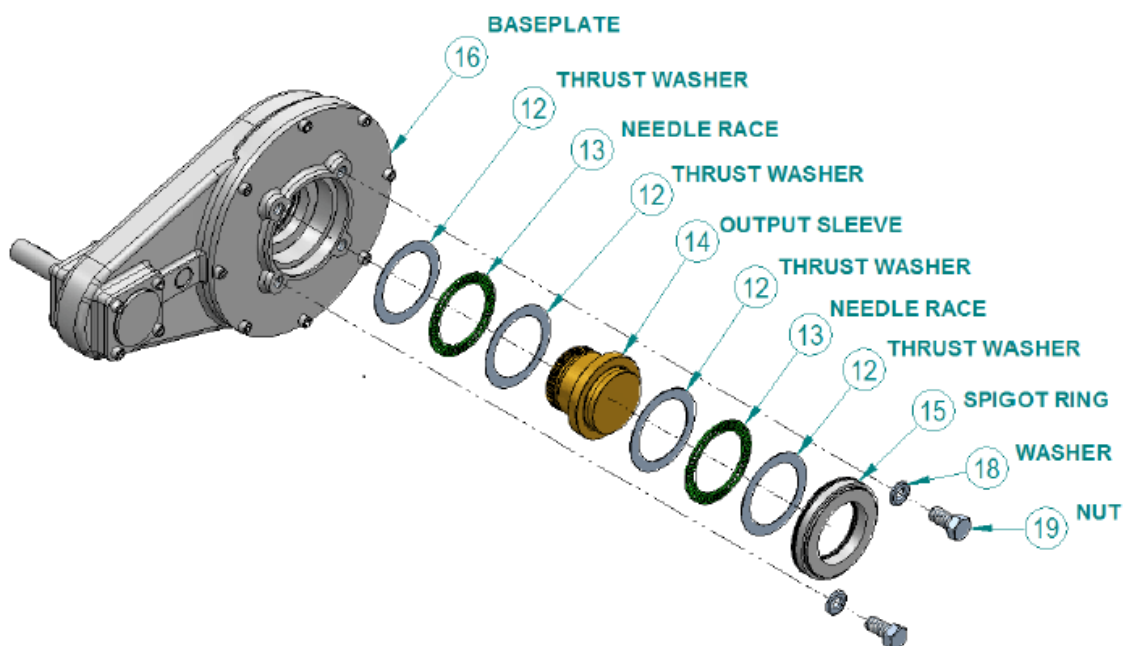


Figure 119: IS Gearbox Output Sleeve Assembly

6.7.2 Mounting to the valve

WARNING: Ensure the valve is fully supported and capable of accepting increased weight and change of centre of gravity resulting from the addition of the actuator-gearbox combination. The recommended maximum unsupported length for cover tubes is shown in table A.



WARNING: We recommend fitting a nut (19) and washer (18) fixture into the base of the gearbox as demonstrated in Fig 6 and Fig 6A. Note that the washers must overlap the spigot ring (15). This will stop the output sleeve assembly from becoming detached from the main body. The bolts and washers are not supplied by Rotork Gears.

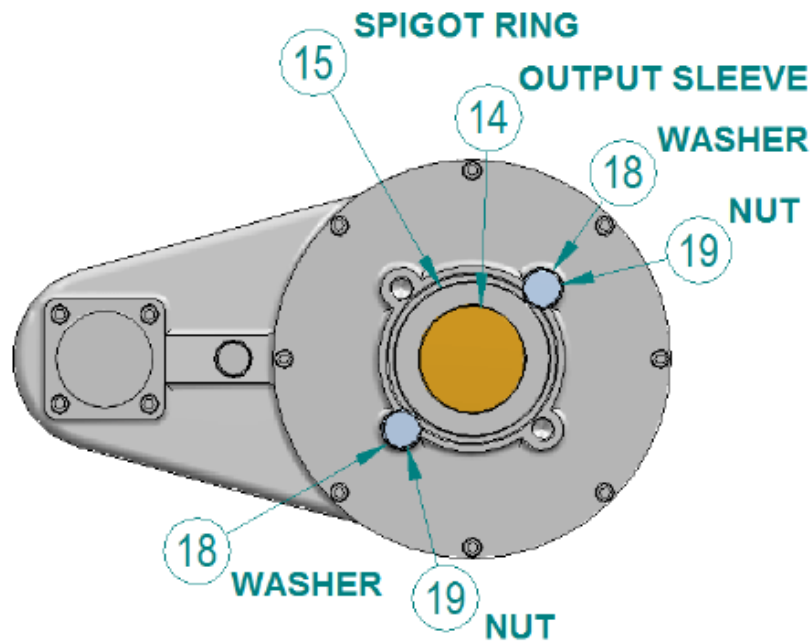


Figure 120: IS Gearbox With Nut and Washer Fixture

If the gearbox has been supplied with a handwheel, it is recommended that this be fitted to the gearbox before mounting onto the valve. This will make it easier to rotate the gearing to pick up the valve stem, key, thread or spline location.

WARNING: Threaded stems should be thoroughly greased before fitting the output sleeve.



Gearboxes IB2 to IB7 and IS2 to IS6

1. Ensure the machined output sleeve assembly is correctly assembled into the gearbox (see Figure 119).
2. Align combination gearbox baseplate flange square and parallel to valve flange. It is recommended that flanges be sealed on assembly with silicon sealant (see Figure 116).
3. Line up the machined output sleeve to the valve shaft. For non-rising stem valves (keyed shaft etc) engage fully (if necessary rotate output sleeve to align keyways). Lower the gearbox onto the valve flange, align mounting holes and secure using screws or studs with a minimum tensile strength of 800 N/mm². Firmly tighten down fixings onto the valve flange to the torque required. See chapter 6.9.1, page 86.
4. For rising stem valves (threaded stem) rotate handwheel in the direction required to screw the output sleeve onto the threaded valve stem (anticlockwise for a left hand stem thread). Continue to rotate the actuator handwheel to ensure combination gearbox assembly is fully screwed down on to the valve flange and the valve is partially open. Align mounting base holes and secure using screws or studs with a minimum tensile strength of 800 N/mm². Firmly tighten down fixings onto the valve flange to the torque required. See chapter 6.9.1, Seite 86.
5. For rising stem valves, a cover tube to protect the stem must be fitted. **WARNING: Do not pack the cover tube with grease as this can lead to pressure build up in the cover.** or bolt the tube into the gearbox with a suitable sealant to prevent water ingress.

6. Cover tubes are extensions to the gearcasing and damage to the cover tubes can cause damage to the gearcase. It is essential that cover tubes are protected or supported to avoid side loads due to the environment or the application. See Table A below.
7. When an actuator is being installed to the input of the gearbox, it is important to apply a ring of silicone sealant between the mating faces prior to assembly (see Figure 116).

Gearboxes IB8 to IB13 and IS7 to IS13, IS15 and IS17

It is recommended that the machined output sleeve assembly is assembled on the valve stem/shaft first and then the actuator-gearbox combination lowered to locate on the output sleeve assembly (see Figure 121 and 122 for assembly details).

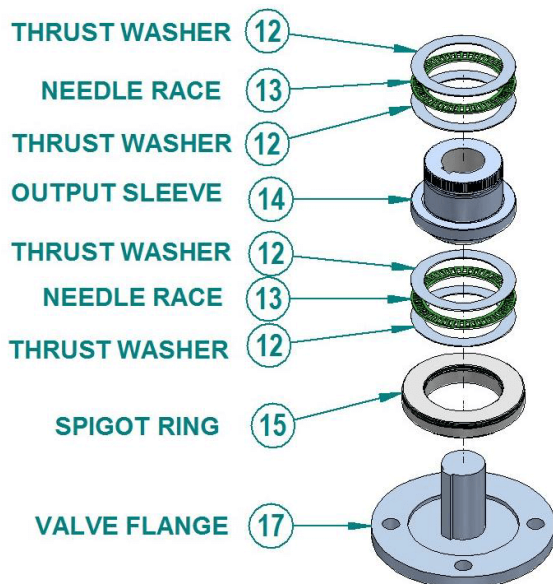


Figure 121: Valve Stem Assembly

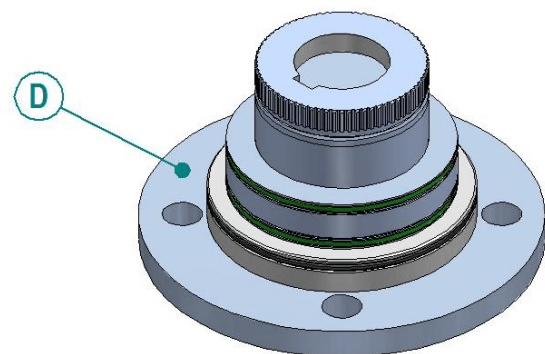


Figure 122: Valve Stem Assembled

1. Fit the machined output sleeve (14), thrust bearings (12 and 13) and baseplate spigot ring (15) on the valve shaft as shown in the Figure 121. Bearings should be greased with the appropriate grease. Grease the output sleeve and valve stem/shaft. Note that the spigot ring has an internal and external seal that should also be greased. See step 2 for further instructions.

Gearboxes IB14 and IS14, IS16, and IS18-IS21

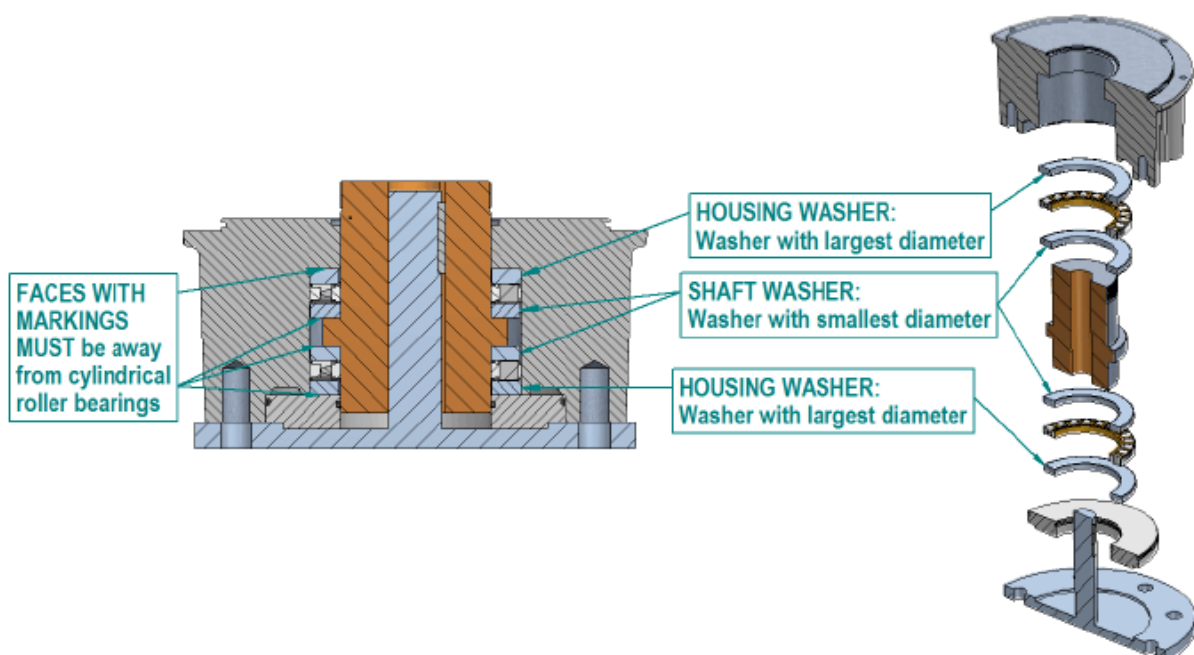


Figure 123: Valve Stem Assembled

For gearboxes with cylindrical roller bearings or gearboxes IB14 and IS14, IS16, and IS18-IS21 It is recommended that the machined output sleeve assembly is assembled on the valve stem/shaft first and then the actuator-gearbox combination lowered to locate on the output sleeve assembly. See Figure 123 for assembly details.

1. Fit as follows; Spigot ring, housing washer (largest outside diameter), bearing, shaft washer (smallest outside diameter), output sleeve, shaft waster (smallest outside diameter), bearing then finally the housing washer (largest outside diameter) on to the valve shaft as shown in the Figure 123 below. The washer faces that are either chamfered or have markings **MUST** face **AWAY** from the bearings to decrease wear on the bearing. Bearings should be greased with the appropriate grease. Grease the output sleeve and valve stem/shaft. Note that the spigot ring has an internal and external seal that should also be greased. See step 2 for further instructions.

For IB8 to IB14 and IS7 to IS21 Gearboxes

2. It is recommended that flanges be sealed on assembly with silicon sealant. The face marked 'D' on Figure 122 and Figure 116 shows where sealant can be applied.
Lower the gearbox onto the assembled output sleeve assembly, taking care that the splines do not get damaged.
3. For valves with keyed shafts (non-rising as shown in Figure 121 and 122), align base mounting holes and secure using screws or studs with a minimum tensile strength of 800 N/mm².
For valves with screwed stems (rising stem), rotate the handwheel to ensure gearbox assembly is fully screwed down on to the valve flange. Continue to turn to partially open the valve. Align mounting base holes and secure using screws or studs with a minimum tensile strength of 800 N/mm². Firmly tighten down fixings onto the valve flange to the torque required. See chapter 6.9.1, page 86.
4. For rising stem valves, a cover tube to protect the stem must be fitted. **WARNING: Do not pack the cover tube with grease as this can lead to pressure build up in the cover.** Screw or bolt the tube into the gearbox with a suitable sealant to prevent water ingress.
5. Cover tubes are extensions to the gearcasing and damage to the cover tubes can cause damage to the gearcase. It is essential that cover tubes are protected or supported to avoid side loads due to the environment or the application. See Table A below.

Table A

Gearbox	Maximum unsupported tube length
IB2 bis IB5, IS2 bis IS5	2,0 m (6.6ft)
IB6 bis IB7, IS6 bis IS7	2,8m (9.2ft)
IB8 bis IB9, IS8 bis IS9	3,0m (9.8ft)
IB10 bis IB14, IS10 bis IS20	5,0m (16.4ft)

Maintenance instructions for IB & IS gear operators

All gear cavities are lubricated for life with Fuchs Renolit CL-X2 grease. Under normal operating conditions, no maintenance is required for the gearbox but should the valve be taken out of service for overhaul, the gearbox baseplate may be removed and the grease changed using the following recommended lubricant. The baseplate must be sealed using silicone sealant on re-assembly, unless fitted with an O ring. All O rings should be renewed.

NB.: All thrust elements and bearing cavities must be re-greased and refitted in the correct order.

Manufacturer	Name	Temperature Range
Fuchs	Renolit CL-X2	-60°C bis + 120°C

An equivalent extreme pressure lubricant may be used. For extreme temperature applications, please consult the factory.

6.8 Paint repair procedure

If paint repair is required, the following procedure should be followed:

1. Clean surface using solvent if necessary.
2. Rinse surface with clean fresh water to remove any foreign matter and traces of solvent.
3. Abrade area using wet and dry sandpaper, or power sander, feather edges of sound intact paint around damaged area by 2.5 cm
4. Apply paint system as per originally applied to unit ensuring that dft limits are met and time is allowed for each coat to cure. All as per the paint manufacturer's data sheets.

Ambient Conditions - No cleaning or coating application shall be undertaken if:

- The relative humidity is more than 85%
- The metal temperature is less than 3°C above the dew point.
- The ambient conditions are outside those stated in the paint manufacturer's data sheet for each coating.
- Coatings shall only be applied or cured at ambient and steel temperatures above 10°C or otherwise recommended by paint supplier.

6.9 Reference**6.9.1 Recommended tightening torques for mounting the gearbox to the valve**

Gearbox to valve fixing must conform to Material Specification ISO Class 8.8, yield strength 628N/mm² to use Table below.

Britisches Maß (Sechskant)	Drehmoment		Metrisches Maß (Sechskant)	Drehmoment	
	Nm	lbs/ft		Nm	lbs/ft
3/8"	34	25	M5	5	4
7/16"	55	40	M6	9	6
1/2"	83	61	M8	21	15
9/16"	120	89	M10	41	30
5/8"	166	122	M12	71	53
3/4"	291	215	M16	177	131
7/8"	469	346	M20	346	255
1	702	518	M24	598	441
1 1/4"	1403	1035	M30	1189	877
1 1/2"	2441	1800	M36	2079	1533

6.10 Handwheel Types

Size in mm	Handwheel Type - weight Kgs (lbs)				
	CD (casted)	PS (pressed steel)	SG (Steel welded)	S (Stainless steel)	F (Steel welded)
50	0.11 (0.24)	-	-	-	-
75	0.21 (0.46)	-	-	-	-
100	0.32 (0.71)	0.15 (0.33)	-	-	-
125	0.54 (1.19)	0.2 (0.44)	-	-	-
150	-	-	1 (2.20)	0.4 (0.88)	-
160	-	0.35 (0.77)	-	-	-
200	1 (2.20)	0.75 (1.65)	1.35 (2.98)	1 (2.20)	1 (2.20)
250	-	1.5 (3.31)	1.4 (3.09)	-	-
300	-	-	1.8 (3.97)	-	1.5 (3.31)
315	-	2 (4.41)	-	-	-
350	-	-	2.3 (5.07)	1.5 (3.31)	-
400	-	3.5 (7.72)	2.8 (6.17)	-	2.2 (4.85)
450	-	-	3 (6.61)	-	-
500	-	-	3.5 (7.72)	-	3 (6.61)
600	-	-	4.5 (9.92)	-	3.2 (7.05)
700	-	-	5 (11.02)	-	5.5 (12.13)
800	-	-	5.5 (12.13)	-	6.6 (14.55)
900	-	-	6 (13.23)	-	7.2 (15.87)
1000	-	-	-	-	8.4 (18.52)
1100	-	-	-	-	9.4 (20.72)
1200	-	-	-	-	10.27 (22.64)

7 Data sheet for the 83106 and 83133 Micro-Switches

SEC-DS-GERMAN-MIKROSCH-V2.00-2012.07.17

7.1 Underlying principle

The switch is a dual interrupting change-over switch.

WARNING: The two switching circuits of the micro-switch can only be used for switching identical potential!!!

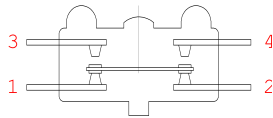


Figure 124: Underlying principle

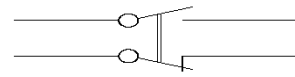


Figure 125: Switch symbol

7.2 Dimensions:

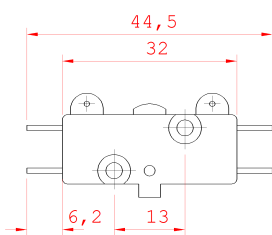


Figure 126: Standard switch (83106)

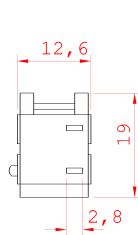


Figure 127: Flashing switch (83133)

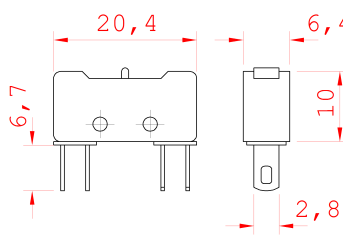


Figure 128: Explosion-proof switch (83133)

7.3 Load Capacity

Standard switch

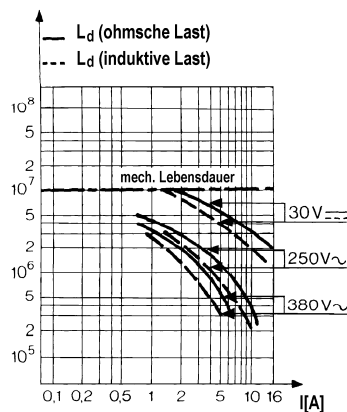


Figure 129: Load capacity diagram (83106)

Flashing switch and Explosion-proof micro-switch:

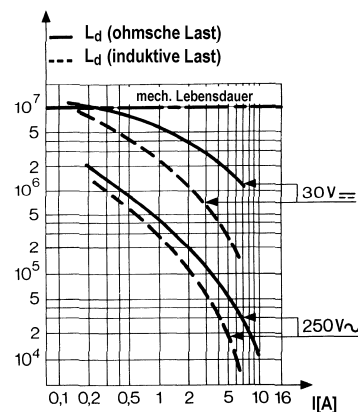


Figure 130: Load capacity diagram (83133)

Mech. service life L_d 10^7 switching cycles
Permissible ambient temp $-20...+85^\circ\text{C}$
Special models $-40...+125^\circ\text{C}$

Mech. service life L_d 10^7 switching cycles
Permissible ambient temp $-20...+125^\circ\text{C}$

For the ohmic load capacity, $\cos\varphi=1$ shall apply. The inductive load capacity given is $\cos\varphi=0,8$ and/or $L/R=5\text{ms}$.

WARNING: the maximum switching current for micro switches with gold-plated contacts is 40 mA a voltage of 24 V (ohmic load). If switching currents are too high, the goldplating will be destroyed.



8 Technical Data Sheet for the Temperature Sensors (PTC-Sensors)

8.1 General

The temperature sensors can be built into the windings of the actuator motor (according to DIN 44081/82 Standard). The individual temperature sensors are serially and internally connected within the motor. The temperature sensors require a tripping unit for evaluation. If the winding temperature of the motor exceeds a certain value, as determined by its insulation class, the resistance of the temperature sensor will increase markedly (see Figure 131, at ϑ_{NAT}). This increase in resistance is evaluated by the tripping unit. By incorporating the tripping unit into the motor drive, the motor will be protected from an excessive increase in temperature due to overload.

8.2 Characteristic Line

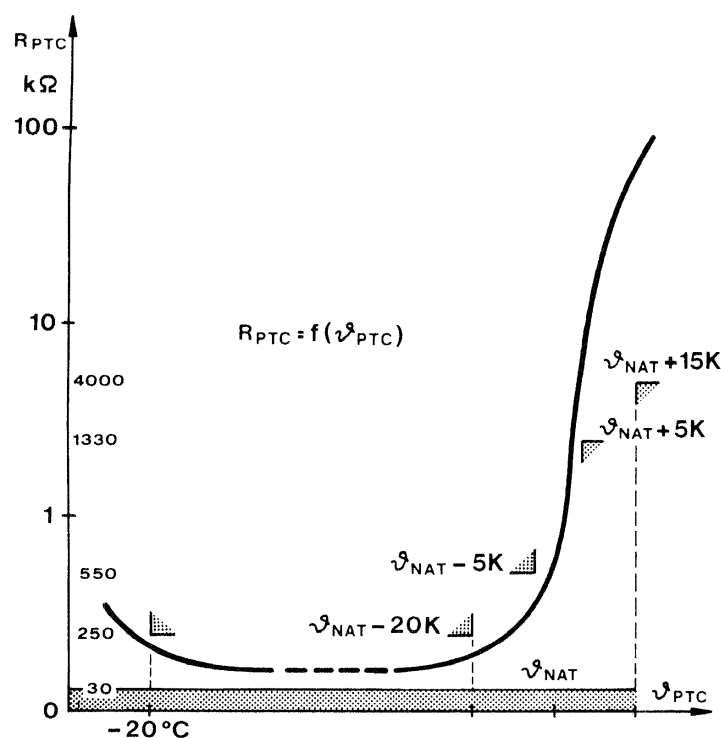


Figure 131: Characteristic line of the temperature sensor (PTC)

The characteristic line of the temperature sensor refers to a maximum testing voltage of 2,5V!

8.3 Technical Data

Highest permissible voltage	25V
recommended operation voltage	690mW
Testing voltage (litz wire against insulation)	2,5kV

CAUTION: The temperature sensor's own increase in temperature influences the thermal response. This is why only high-impedance measuring devices with a low power loss in the measuring circuit should be used for evaluation and monitoring purposes.

NOTE: At room temperature, the resistance of the temperature sensors in use with a three-phase motor (three sensors in series) usually amounts to about 200Ω.

9 HART Additional Board for SMARTCON Control

9.1 General

When ordering an actuator, HART (Highway Addressable Remote Transducer) is one of many possible fieldbus interfaces available for SCHIEBEL actuators of the ACTUSMART and SMARTCON series. The decision about the communication interface of the actuator should be decided before setting an order for an actuator. Although retro fitting is possible, it might require a series of costly adjustments and should only be performed by SCHIEBEL service technicians or equally skilled third parties.

HART is a bi-directional communication protocol that provides data access between intelligent field instruments and host systems. Standard 4-20mA wiring practices assure reliable communication. (for further information visit <https://fieldcommgroup.org/techno>)

The setpoint connection is also for the HART communication. The setpoint can be either changed analog or over the HART communication.

A DTM (Devices Type Manager) for the PACTware™ will be provided.

9.2 Commissioning

The HART interface of a SCHIEBEL actuator is already placed upon delivery, no further actions are required.

All necessary files for the Master-Set up can be downloaded at <http://actuators.schiebel.com>.

If HART is activated the following menu points will be added to your control unit (ACTUSMART, SMARTCON).

	Menu Item	Subitem	Options	Explanation/Comments
P15.1	HART	HART	0: disabled	HART disabled
			1: enabled	HART is enabled
			2: enabled +	HART is enabled, regular writing on command and setpoint is monitored.
P15.2	HART	Watchdogtime	0,0-60,0s {0,0s}	Monitoring of the toggle bit transmitted from the master (bit 7 in the command). With a bus watchdog time set, this bit has to toggle within that time; otherwise there is a bus watchdog error. At 0.0 s the watchdog function is disabled, in which case toggling of the toggle bit may be omitted
P15.3	HART	Setpoint Source	0: Standard	The setpoint is specified via HART (only relevant when the positioner is enabled)
			1: Analog	The setpoint is specified by the analogue signal (only relevant when the positioner is enabled)
			2: Bus/Analog	With a fault-free bus, the setpoint is specified via the HART. With a bus error, the analogue value is switched to (only relevant when the positioner is enabled)

The setpoint is specified via HART (only relevant when the positioner is enabled)

9.3 Description of the Input and Output Data

9.3.1 Output data (slave to master)

9.3.1.1 Primary Value:

Setpoint input value: 0,0...100,0%
The readback of the setpoint value

9.3.1.2 Secondary Value:

Actual position: 0,0...100,0%

9.3.1.3 Tertiary Value:

Actual torque value: -200,0% ... +200,0%

9.3.1.4 Quaternary Value:

Actual external value: 0,0 ... 100,0%

9.3.1.5 Extended Status:

Status: Bitfield

Structure:

Bitnr.:	Funktion:	Beschreibung:	
		Bit = 0	Bit = 1
0	READY	-	Actuator is ready
1	END LIMIT OPEN	-	End position OPEN reached (taking into account the type of command termination (torque-or travel-dependent))
2	END LIMIT CLOSE	-	End position CLOSED reached (taking into account the type of command termination (torque-or travel-dependent))
3	TRAVEL OPEN	-	Travel end position OPEN reached (not taking into account the type of command termination (only straightforward travel information))
4	TRAVEL CLOSE	-	Travel end position CLOSE reached (not taking into account the type of command termination (only straightforward travel information))
5	TORQUE OPEN	-	Cut-out torque in OPEN direction has been exceeded
6	TORQUE CLOSE	-	Cut-out torque in CLOSE direction has been exceeded
7	MOTORTEMP.	-	Motor temperature sensor has responded (overtemp.)
8	OPENING	-	The actuator is operating by motor OPEN
9	CLOSING	-	The actuator is operating by motor CLOSE
10	LOCAL	-	Selector switch in position LOCAL
11	REMOTE	-	Selector switch in position REMOTE
12	LOCK OPEN	-	Locking OPEN is active. OPEN command is queued with the highest priority and will not be locked even in the end POSITION (see command for bits 10 and 12)
13	LOCK CLOSE	-	Locking CLOSE is active. CLOSE command is queued with the highest priority and will not be locked even in the end Position (see command for bits 10 and 12)
14	LIVEBIT 1	Livebit 1 toggles every second	
15	LIVEBIT 2	Livebit 2 is the copy from the watchdog toggle bit (see command bit 7)	

9.3.2 Modules for the input data (data from master to slave)**9.3.2.1 Command:**

Command: Bitfield

Structure:

Bit no.:	Function:	Description:	
		Bit = 0	Bit = 1
0	OPEN	-	OPEN command in REMOTE mode
1	CLOSE	-	CLOSE command in REMOTE mode
2	STOP	-	STOP command in REMOTE mode
3	NOT-AUF	-	EMERGENCY OPEN command in LOCAL & REMOTE modes
4	NOT-ZU	-	EMERGENCY CLOSE command in LOCAL & REMOTE modes
5	BLOCK	-	BLOCK drive in LOCAL & REMOTE modes. The drive is not operable either via the selector switch locally nor via commands by REMOTE nor HART.
6	CONTROL INHIBIT	-	CONTROL INHIBIT in REMOTE mode Engagement of the positioner is suppressed
7	WATCHDOG	Toggle bit from the master for bus watchdog monitoring With bus watchdog time set, the bit has to toggle within this time; otherwise there is a bus error.	

8	OPEN-SH	-	OPEN command with self-retention in REMOTE mode jettison with STOP
9	CLOSE-SH	-	CLOSE command with self-retention in REMOTE mode jettison with STOP
10	LOCKING- OPEN	-	Trigger locking OPEN (in LOCAL and REMOTE modes) the drive runs OPEN with highest priority, the command continues to queue internally even after reaching the OPEN end position. Jettison only with LOCKING OFF, supply off or OFF mode
11	LOCKING- CLOSE	-	Trigger locking CLOSED (in LOCAL and REMOTE modes) the drive runs CLOSED with highest priority, the command continues to queue internally even after reaching the CLOSED end position. Jettison only with LOCKING OFF, supply off or OFF mode
12	LOCKING OFF	-	Jettison locking
13	BLOCK LOCAL	-	BLOCK drive in LOCAL mode The drive is not operable via the selector switch locally
14	FAILSAFE	-	Trigger the failsafe unit (if there is one)
15	OVERRIDE	-	Binary inputs are not processed

9.3.2.2 Setpoint:

Setpoint: 0,0...100,0%

The setpoint value will only be used if the parameter P15.3 (Setpoint source) is set to 0 or 2.

If the mentioned parameter is set to 1 or 2 during a malfunction the analogsignal will be used as setpoint.

10 Relay board RP4A for SMARTCON control

10.1 General

The additional relay board RP4A extends the SMARTCON control unit with 4 output relays.

The additional relay board RP4A is a hardware option and should be ordered in combination with the SMARTCON control unit.

A later installation is possible.

The additional relay board RP4A is mounted below the logic board of the SMARTCON control unit.

10.2 Relay configuration

The outputs contacts of the four relays are separated from each other. the relays R1 and R2 have changeover contacts, the relays R3 and R4 have normally open contacts.

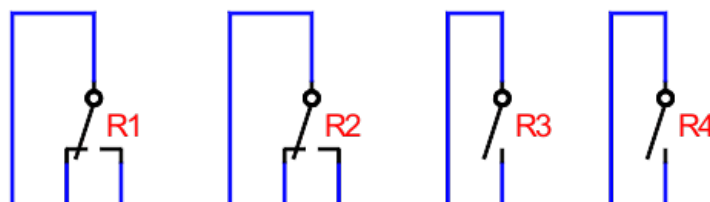


Figure 132: Relay configuration

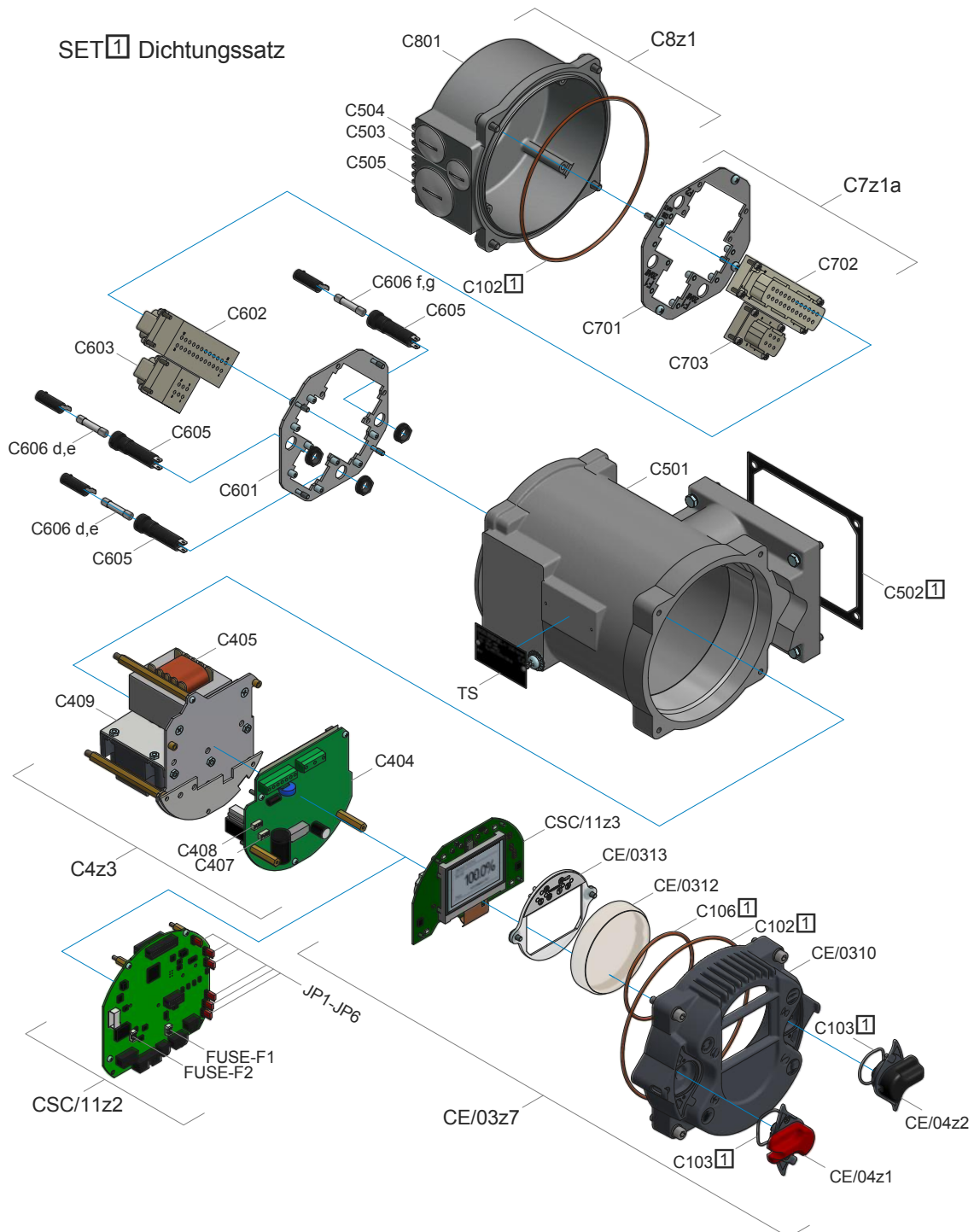
10.3 Technical data

Relais:

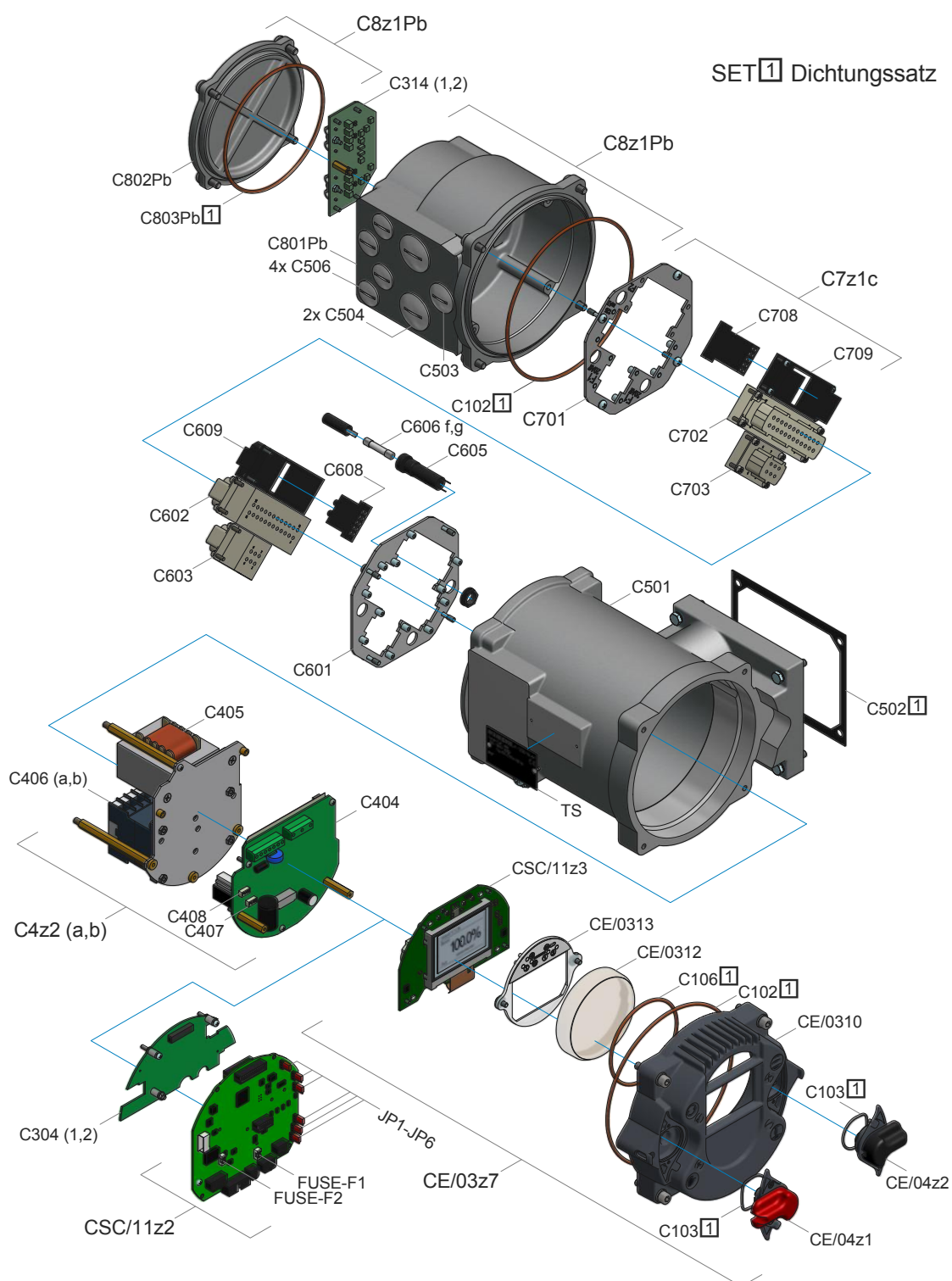
Max. switching voltage:.....230V AC/DC

Max. switching current:.....2A resistive

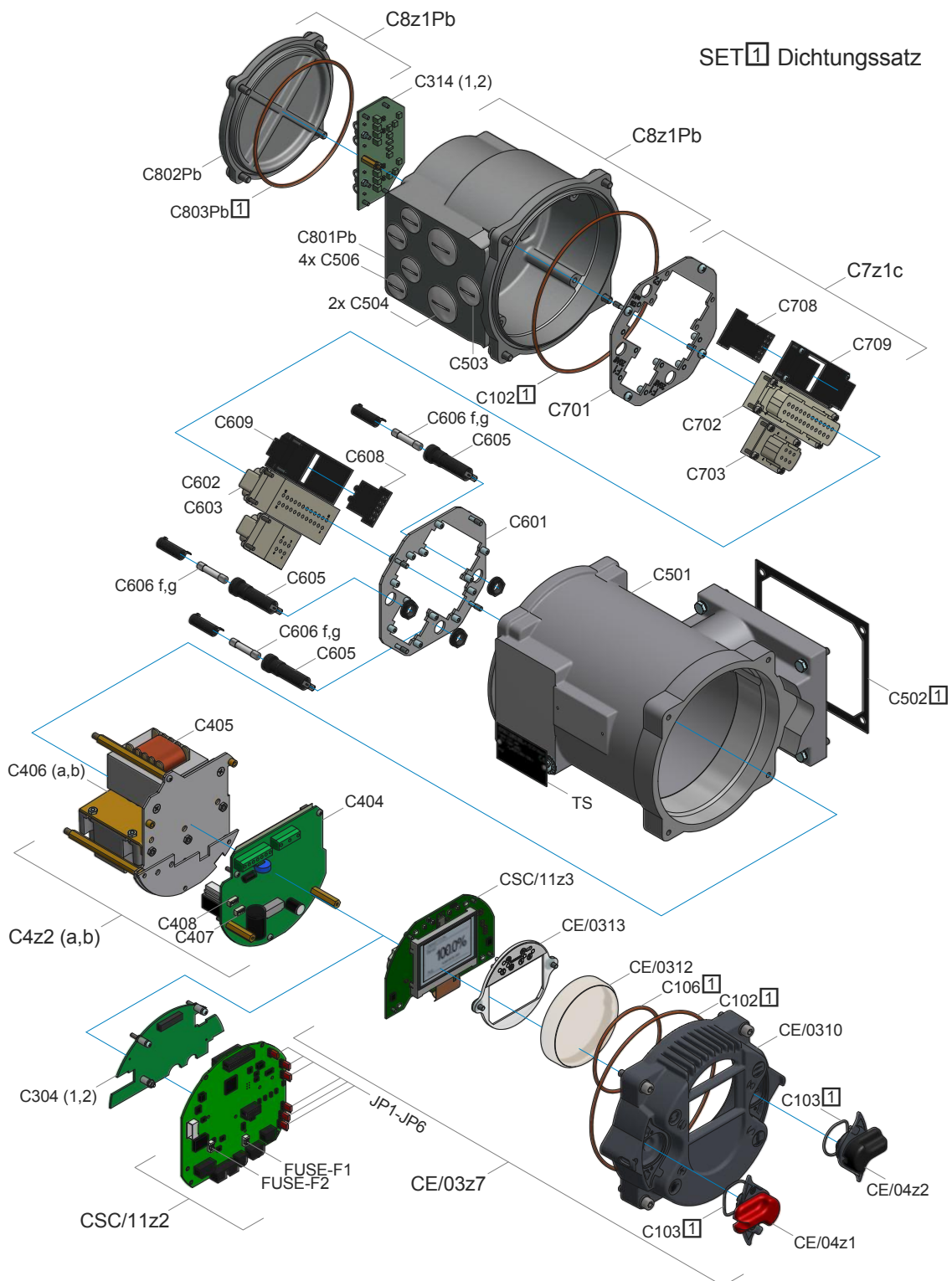
11.2 Version with thyristor reversing contactors



11.3 Version with Profibus and mechanical reversing contactors



11.4 Version with Profibus and thyristor reversing contactors



11.5 Spare part list

Part-Nr.	Description
C102	O-Ring
C103	O-Ring for operating switch red/back
C104	Operating switch black
C105	Operating switch red
C106	O-Ring inspection glass
C1z1	Cover E synthetic material complete
C302a	Fuse 375mA for Logic board
C302b	Fuse 500mA for Logic board
C304-1	Profibusprint DP1 1-channel
C304-2	Profibusprint DP2 2-channels
C314-1	Profibus connection board DP1 1-channel
C314-2	Profibus connection board DP2 2-channels
C3z2	Logic board with parametrisation accord to actuator fabrication number
C404	Basic board
C405	Transformer
C406a	mechanical reversing contactors mW4 for motor power up to 3.0kW(S2)/1.5kW(S4)
C406b	mechanical reversing contactors mW7K for motor power 3.0-5.5kW(S2)/1.5-3.0kW(S4)
C407	Fuse 1AT for Basic Board
C408	Fuse 500mAT for Basic Board
C409	Thyristor reversing contactors eW for motor power power up to 3.0kW
C4z2a	power supply unit mW4 for motor power up to 3.0kW(S2)/1.5kW(S4)
C4z2b	power supply unit mW7K for motor power 3.0-5.5kW(S2)/1.5-3.0kW(S4)
C4z3	power supply unit eW for motor power power up to 3.0kW
C501	Housing
C502	Flat gasket
C503	Nose cap M25x1.5
C504	Nose cap M32x1.5
C505	Nose cap M40x1.5
C506	Nose cap M20x1.5
C601	Mounting plate for plugs control unit
C602	Plug Han24E male for signals control unit
C603	Plug Han6E male for power supply control unit
C605	Fuse holder
C606d	Fuse 20Aff at motor power smaller 3,0kW (2.pcs per control unit)
C606e	Fuse 12,5 At at motor power =3kW (2.pcs per control unit)
C606f	Fuse 100mAT for control unit with mechanical/thyristor reversing contactors for motor power higher than 3x400V;50Hz
C606g	Fuse 125mAT for control unit with mechanical/thyristor reversing contactors for motor power up to 3x400V;50Hz
C608	Plug Profibus male control unit
C609	Frame for Plug Profibus control unit
C701	Mounting plate for plug customer site
C702	Plug Han24E female for signals customer site
C703	Plug Han6E female for power supply customer site
C708	Plug Profibus female customer site

Nr.	Bezeichnung
C709	Frame for Plug Profibus customer site
C7z1a	Mounting plate with plugs Han24E+Han6E customer site
C7z1c	Mounting plate with plugs Han24E+Han6E+Profibus customer site
C8z1	Customer cover A for connection room complete
C8z1Pb	Customer cover A type Profibus for connection room complete
C8003Pb	O-Ring A-cover PB
CSCI-USB	SMART Interface for backup of customer datas consists of infrared dongle with cable and software

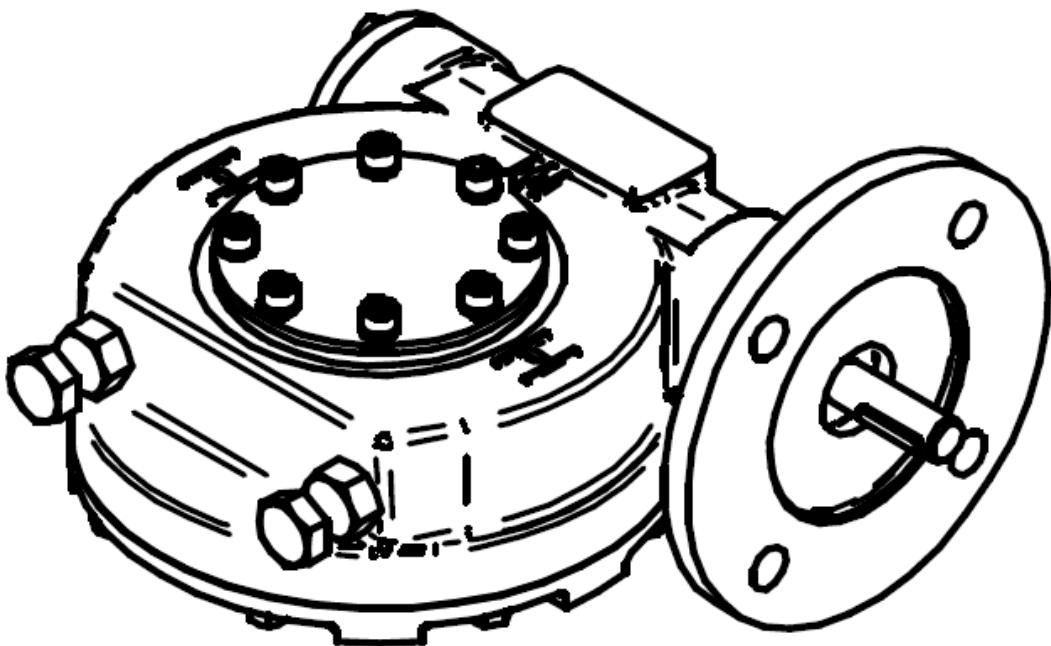
CAUTION: When ordering spare parts, you **must** provide the **serial number** (look type shield near the hand lever).

Use only original spare parts supplied by SCHIEBEL. Using other parts will render the warranty void.
Illustrations may differ from actual spare parts.

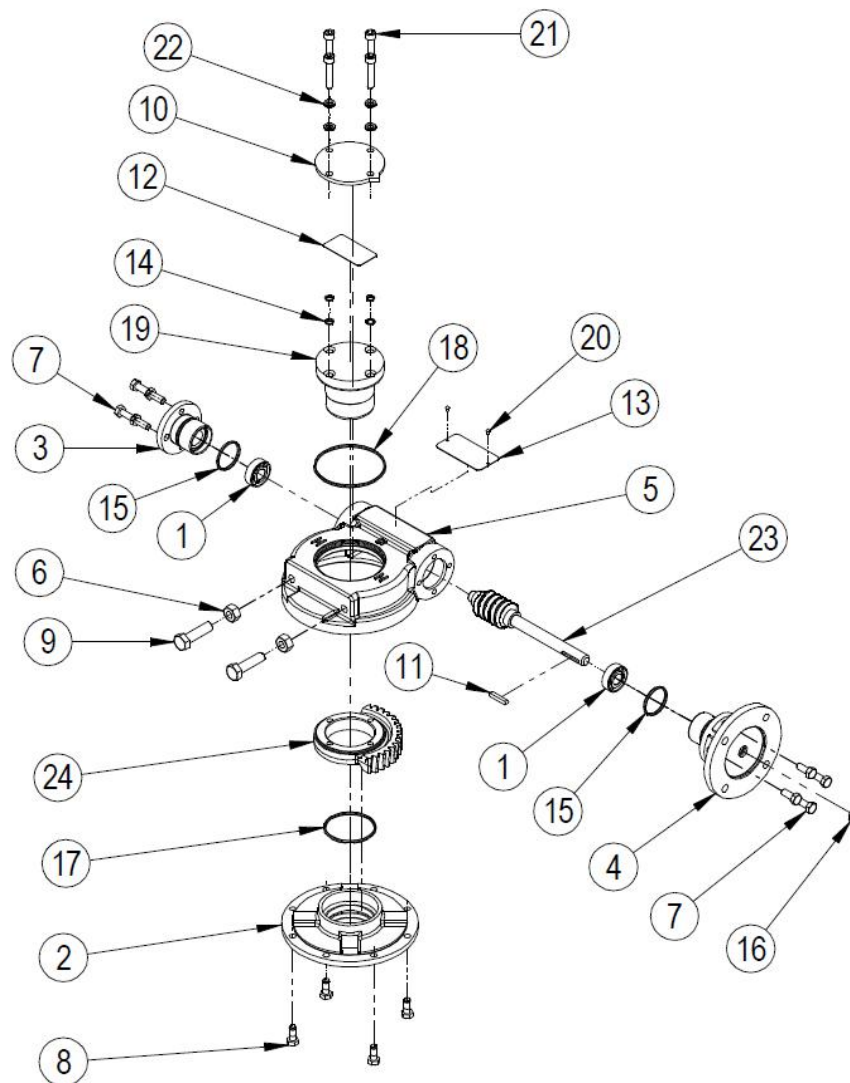


12 Spareparts for IW worm gearbox

SEC-DS-ENGLISH-GETRIEBE-IW-SPARE-V3.00-2017.07.05



SPARE PARTS LIST FOR IW/MOW 3 RANGE OF WORM GEAR ACTUATORS



IW 3 WORM GEARBOX

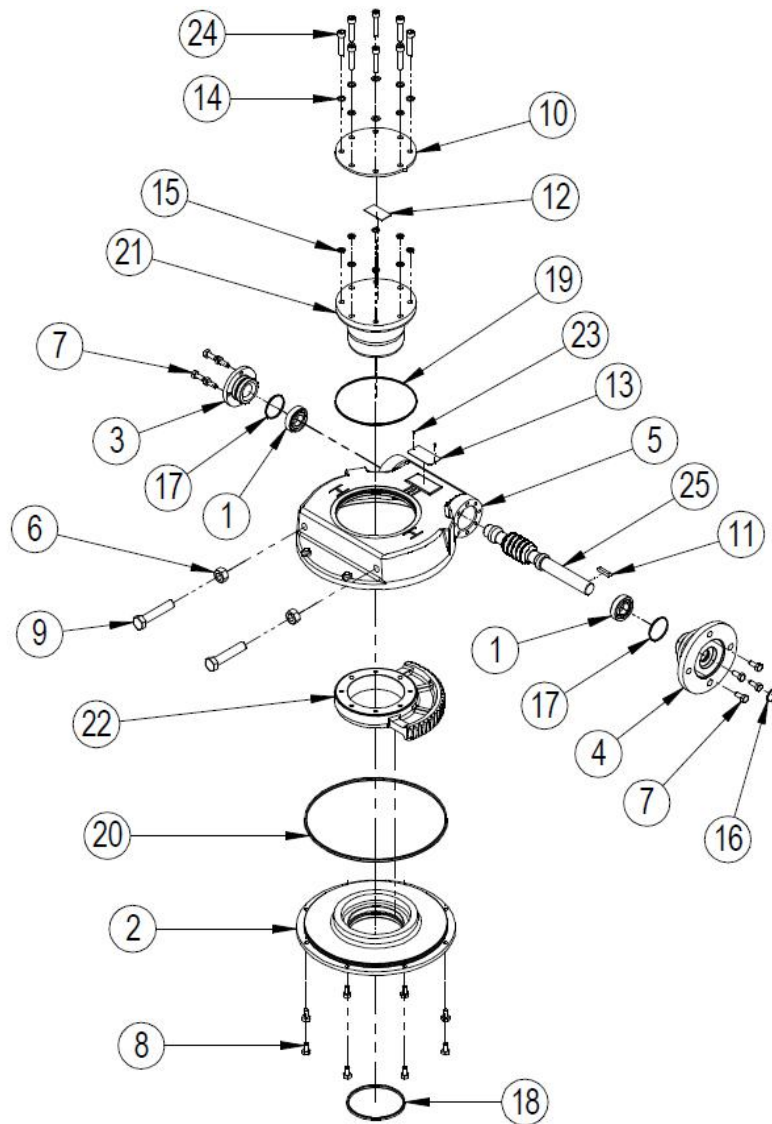
ITEM	DESCRIPTION	QUANTITY
*1	BALL BEARING	2
2	BASEPLATE	1
3	ENDCAP	1
4	INPUT FLANGE	1
5	GEARCASE	1
6	HEXAGON HEAD NUT	2
7	SCREW	8
8	SCREW	4
9	SCREW	2
10	INDICATOR PLATE	1
11	KEY	1
12	LABEL	1

13	NAMEPLATE	1
*14	O RING	4
*15	O RING	2
*16	O RING	1
*17	O RING	1
*18	O RING	1
19	OUTPUT SLEEVE	1
20	RIVET	2
21	SCREW	4
22	NORDLOCK WASHER	4
23	WORM SHAFT	1
24	WORM WHEEL	1
*25	GREASE	

Note: Items marked * are the recommended spares holding for 5 years operation

Special solid worm wheels do not have output sleeves and screws but do have the same gearbox rating

SPARE PARTS LIST FOR IW/MOW 4-8 RANGE OF WORM GEAR ACTUATORS



IW 4-8 WORM GEARBOX

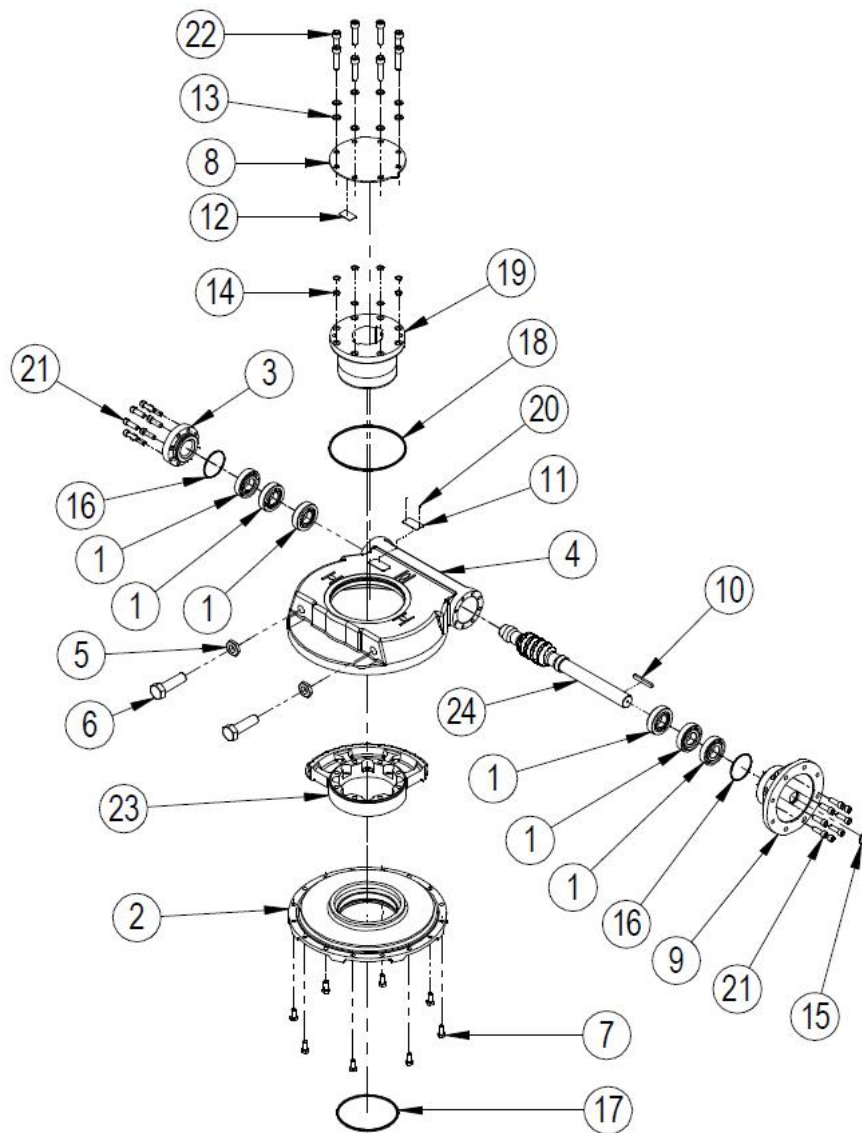
ITEM	DESCRIPTION	QUANTITY
*1	BALL BEARING	2
2	BASEPLATE	1
3	ENDCAP	1
4	INPUT FLANGE	1
5	GEARCASE	1
6	HEXAGON NUT	2
7	SCREW	8
7	SCREWS	8(IW7/8, IW72 & 82)
8	SCREW	8
9	SCREW	2
10	INDICATOR PLATE	1
11	KEY	1

12	LABEL	1
13	NAMEPLATE	1
14	NORDLOCK WASHER	8
*15	O RING	1
*16	O RING	1
*17	O RING	1
*18	O RING	1
*19	O RING	1
*20	O RING	1
21	OUTPUT SLEEVE	1
22	QUADRANT	1
23	RIVET	2
24	SCREW	8
25	WORM SHAFT	1
*26	GREASE	

Note: Items marked * are the recommended spares holding for 5 years operation

Special solid worm wheels do not have output sleeves and screws but do have the same gearbox rating

SPARE PARTS LIST FOR IW/MOW 9-11 RANGE OF WORM GEAR ACTUATORS



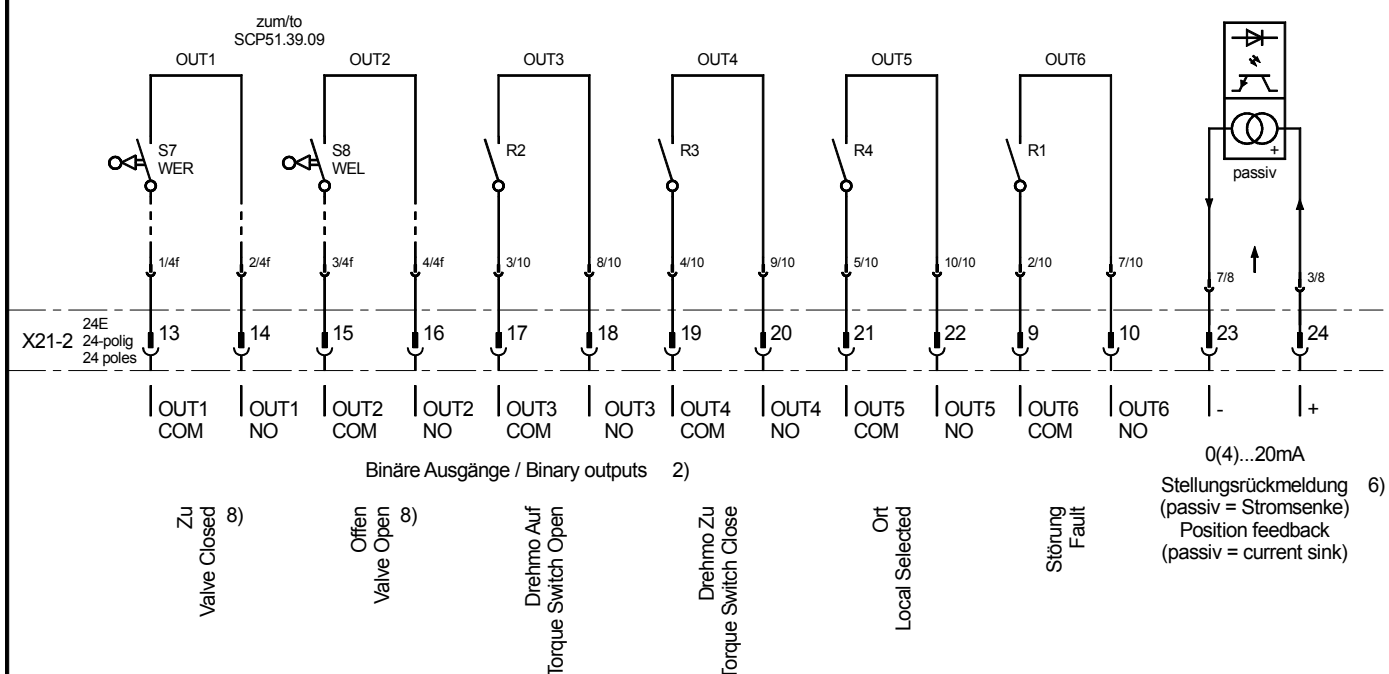
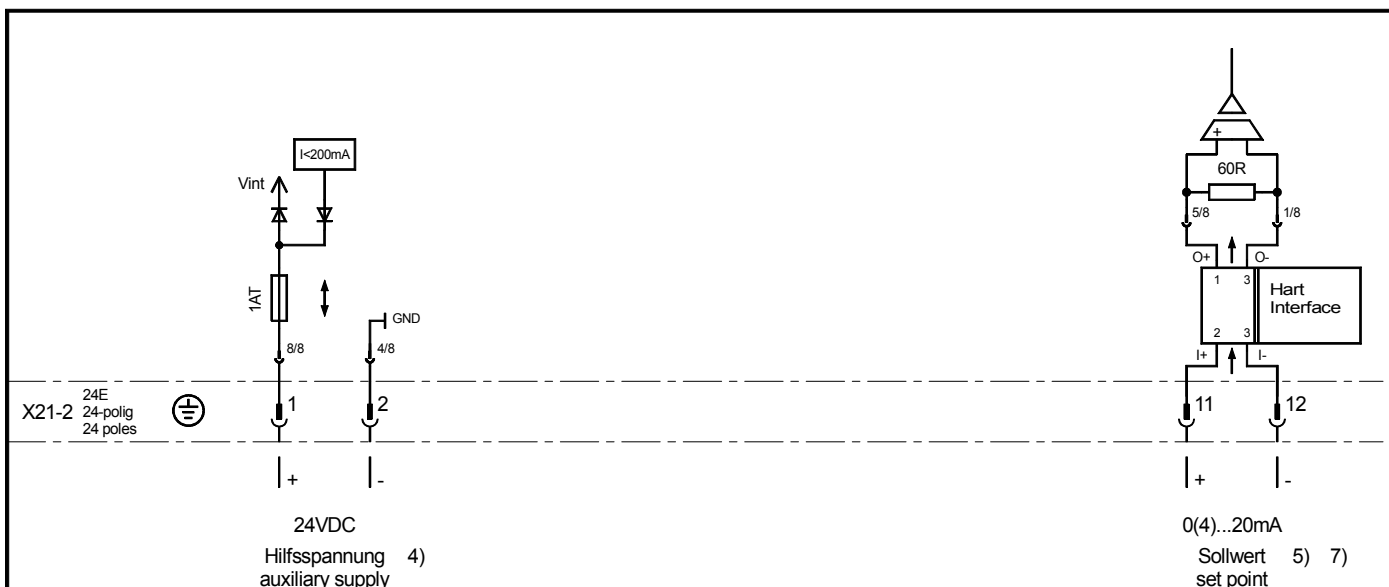
IW 9-11 GEARBOX

ITEM	DESCRIPTION	QUANTITY
*1	BALL BEARING	6
2	BASEPLATE	1
3	ENDCAP	1
4	GEARCASE	1
5	HEXAGON NUT	2
6	SCREW	2
7	SCREW	8
8	INDICATOR PLATE	1
9	INPUT FLANGE	1
10	KEY	1
11	NAMEPLATE	1
12	LABEL	1
13	NORDLOCK WASHER	8
*14	O RING	8

*15	O RING	1
*16	O RING	2
*17	O RING	1
*18	O RING	1
19	OUTPUT SLEEVE	1
20	RIVET	2
21	SCREW	16
22	SCREW	8
23	WORM QUADRANT	1
24	WORM SHAFT	1
*25	GREASE	

Note: Items marked * are the recommended spares holding for 5 years operation

Special solid worm wheels do not have output sleeves and screws but do have the same gearbox rating

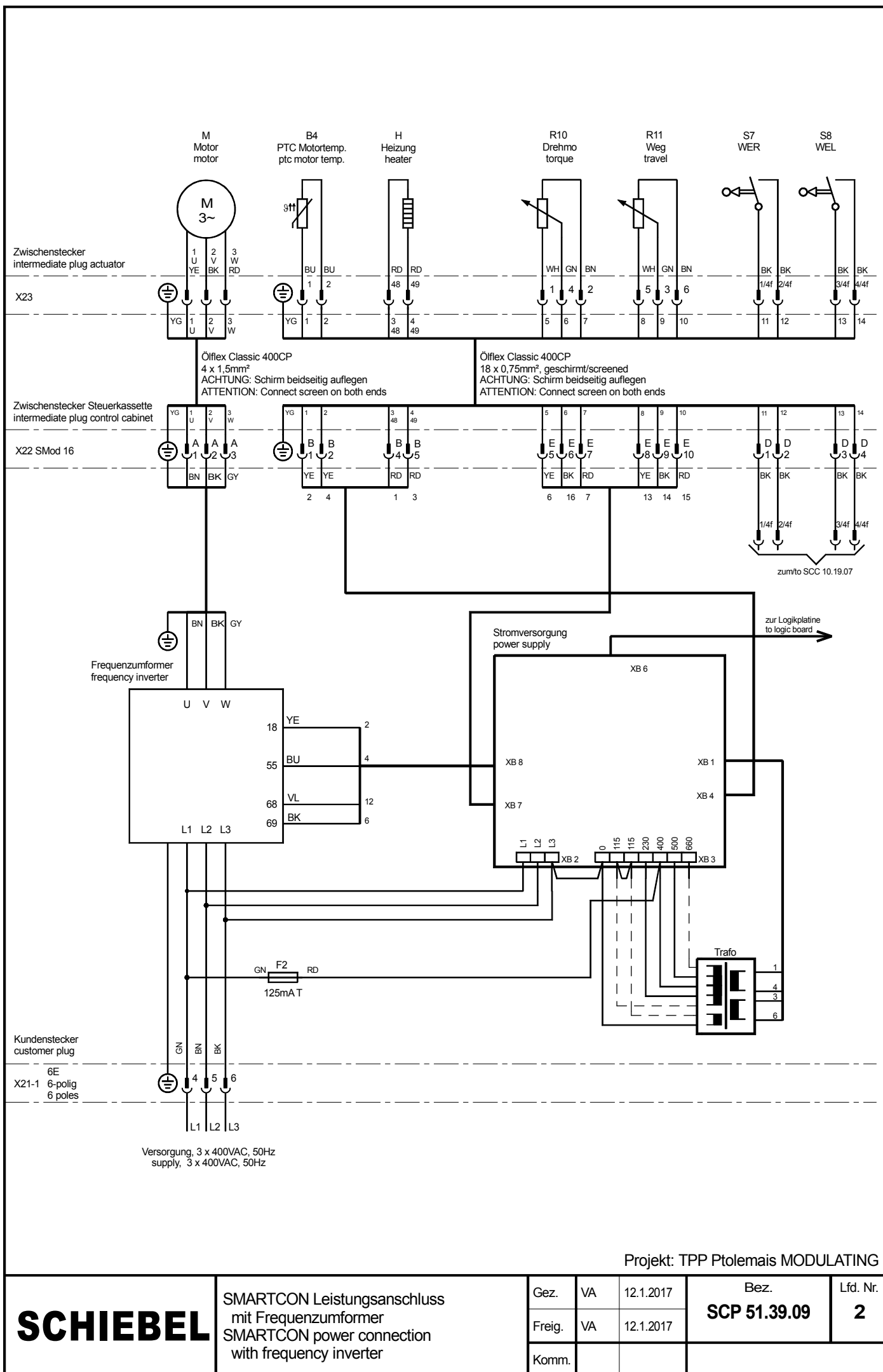


- 2) Binäre Ausgänge: Maximale Schaltspannung 30V AC/DC, max. Schaltstrom 1A ohmsch
Binary outputs: Max. switching voltage 30V AC/DC, max. switching current 1A resistive load
- 4) Hilfsspannungseingang/-ausgang 24VDC, max Belastbarkeit 200mA
Auxiliary input/output supply 24VDC, max. loading 200mA
- 5) Sollwerteingang: (0)4...20mA, passiv, potentialgetrennt von der restlichen Antriebselektronik.
Setpoint input: (0)4...20mA, passive, potential isolation from the remaining actuator electronic.
- 6) Stellungsrückmeldung: (0)4...20mA, Stromsenke (konfigurierbar als aktive Stromquelle, siehe Betriebsanleitung),
potentialgetrennt von der restlichen Antriebselektronik.
Position feedback: (0)4...20mA, current sink (configurable as active current source, see manual),
potential isolation from the remaining actuator electronic.
- 7) Eingangswiderstand >250Ohm gemäß HART Spezifikation.
Input resistance >250 ohms acc. HART specification.
- 8) Die Meldungen "Zu" und "Offen" beziehen sich auf eine rechtdrehende Schließrichtung.
The signals "Valve Closed" and "Valve Open" refers to clockwise closing direction.

An nicht gezeichneten Anschlüssen darf nichts angeschlossen werden!
Not depicted pins must be unconnected!

Projekt TPP Ptolemais MODULATING

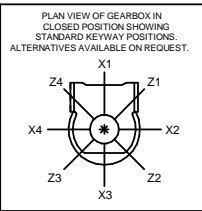
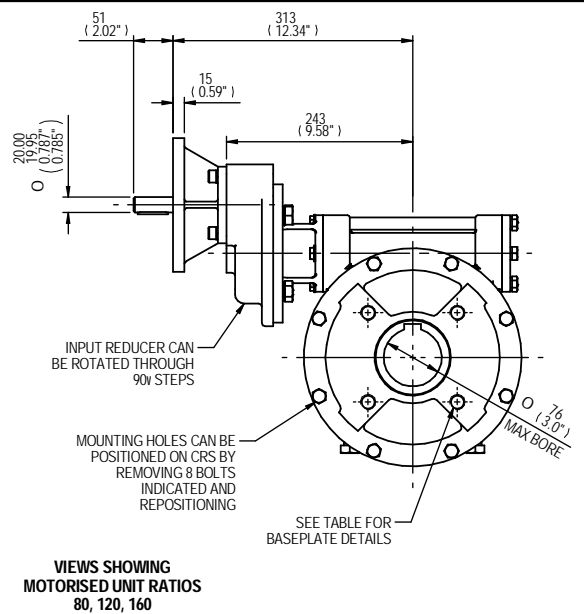
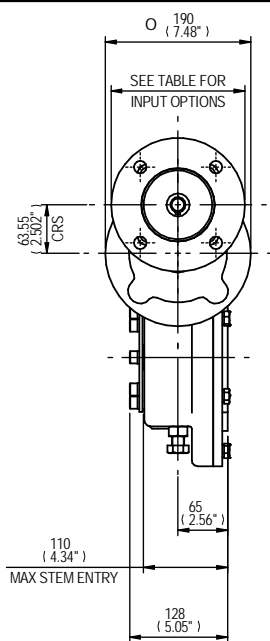
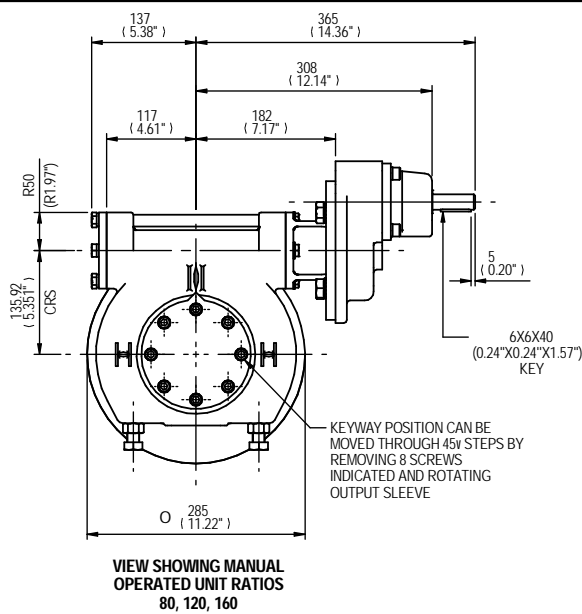
SCHIEBEL	C-Serie: Steueranschluss mit HART-Interface C-series: Control connection with HART-interface	Gez.	VA	9.7.2017	Bez. SCC 10.19.07	Lfd. Nr. 6
		Freig.	VA	9.7.2017		
		Komm.				V .2



SCHIEBEL

SMARTCON Leistungsanschluss
mit Frequenzumformer
SMARTCON power connection
with frequency inverter

Gez.	VA	12.1.2017	Bez.	Lfd. Nr.
Freig.	VA	12.1.2017	SCP 51.39.09	2
Komm.				



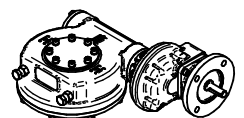
MAX BORE SQ KEY			MAX BORE RECTANGULAR KEY		
S/D	BORE	KEY	S/D	BORE	KEY
BS4235	-	-	BS4235	76.0	22X4
BS46	2.75	3/4" SQ	BS46	3.00	3/4"X1/2"
ANSI B17.1	2.75	5/8" SQ	ANSI B17.1	3.00	3/4"X1/2"

INPUT FLANGE DETAILS (RATIO 80 TO 160)					
FLANGE	SHAFT	RECESS	RECESS	HOLE DETAILS	KEY
O/DIA.	DIA.	DIA.	DEPTH	(OFF CENTRES)	DETAILS
ISO F10	Ø125 (Ø4.92)	Ø20.00±0.05 (Ø0.787±0.002)	Ø70.05±0.15 (Ø2.758±0.006)	4 HOLES Ø10.5 (Ø0.41) (0.16")	ON Ø102.0 (Ø4.02") P.C. (0.24"X0.24"X1.57") 6X6X40
FA10	Ø125 (Ø4.92)	Ø20.00±0.05 (Ø0.787±0.002)	Ø68.70±0.15 (Ø2.705±0.006)	4 HOLES Ø10.5 (Ø0.41) (0.16")	ON Ø102.0 (Ø4.02") P.C. (0.24"X0.24"X1.57") 6X6X40
ISO F14	Ø181 (Ø7.13)	Ø20.00±0.05 (Ø0.787±0.002)	Ø100.05±0.15 (Ø3.939±0.006)	4 HOLES Ø16.5 (Ø0.65) (0.20")	ON Ø140.0 (Ø5.51") P.C. (0.24"X0.24"X1.57") 6X6X40
FA14	Ø181 (Ø7.13)	Ø20.00±0.05 (Ø0.787±0.002)	Ø95.25±0.15 (Ø3.750±0.006)	4 HOLES Ø16.5 (Ø0.65) (0.20")	ON Ø140.0 (Ø5.51") P.C. (0.24"X0.24"X1.57") 6X6X40

BASEPLATE DETAILS (ALL RATIOS)	
(ALTERNATIVES AVAILABLE ON REQUEST)	
ISO	FA
F16	F16
4 HOLES Ø165.0 (Ø6.50") P.C. 4 HOLES 3/4"UNCx16 (Ø0.63") DEEP ON Ø165.0 (Ø6.50") P.C.	



MANUAL INPUT



MOTORISED INPUT

APPROX WEIGHT: 49.5 kg

**rotork
gears**

IW/MOW52IRS QUARTER TURN GEARBOX, 80/ 120/ 160:1 RATIOS
MANUAL F10/ FA10/ F14/ FA14:1 INPUT: F16/ FA16 BASEPLATE

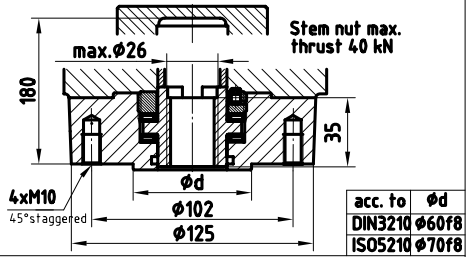
DETAILS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

FOR UP TO DATE DETAILS VISIT www.rotork.com

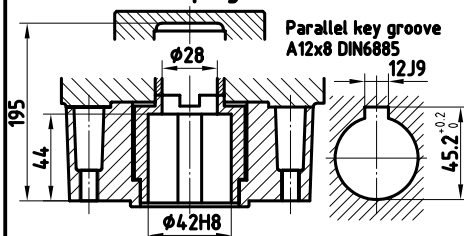
DRAWING No	PUB/IW52IRS	Regina House Ring Road Bramley Leeds LS134ET United Kingdom
ISSUE	2	
DATE	15/01/2013	

Output Drives
Mounting Dimension F10 acc. to ISO5210
or. G0 acc. to DIN3210

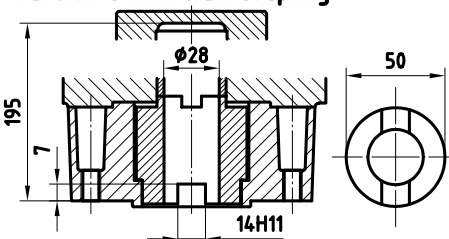
Version A with stem nut



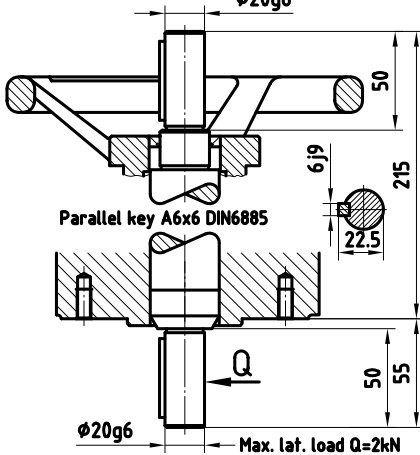
Version B with plug sleeve



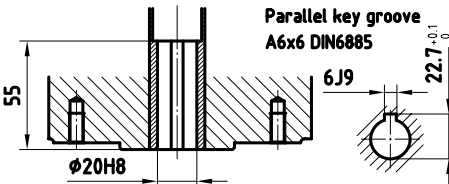
Version C with claw coupling



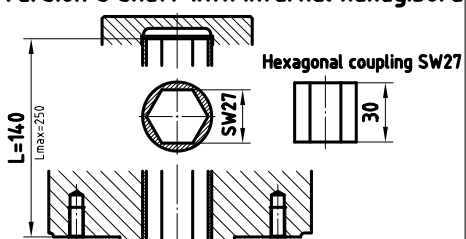
Version D with one shaft end
resp. D0 with two shaft end
Ø20g6



Version E with bore

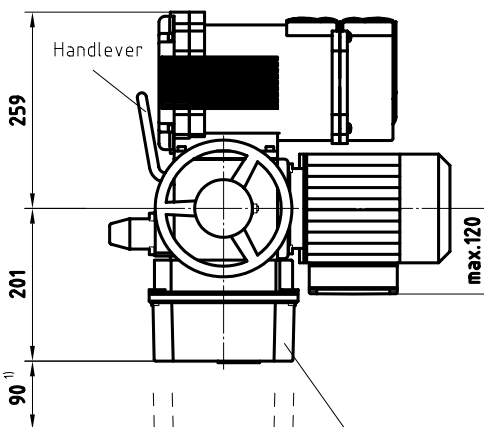
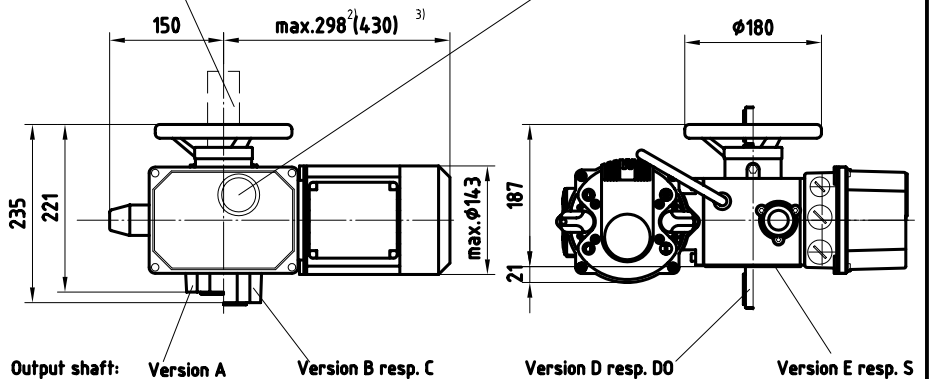


Version S shaft with internal hexag. bore



Stem protection tube SpA
 (optional for "A", "B", "C")

Mech. position indicator (opt.)



Electrical Connection

Model series: (r)AB CSC
 Plug Version (with threaded terminal ends)
 Screw plugs (cable gland): M25x1,5, M32x1,5, M40x1,5

- 1) Space required for removing cover (plug)
- 2) Standard motor without brake
- 3) Pole change motor with brake

SCHIEBEL

Antriebstechnik
 Gesellschaft m.b.H
 Josef Benc-Gasse 4
 A-1230 Wien

Maßbild / Dimensions

Rotaty Actuator

Smartcon
 Type AB3/AB5 CSC

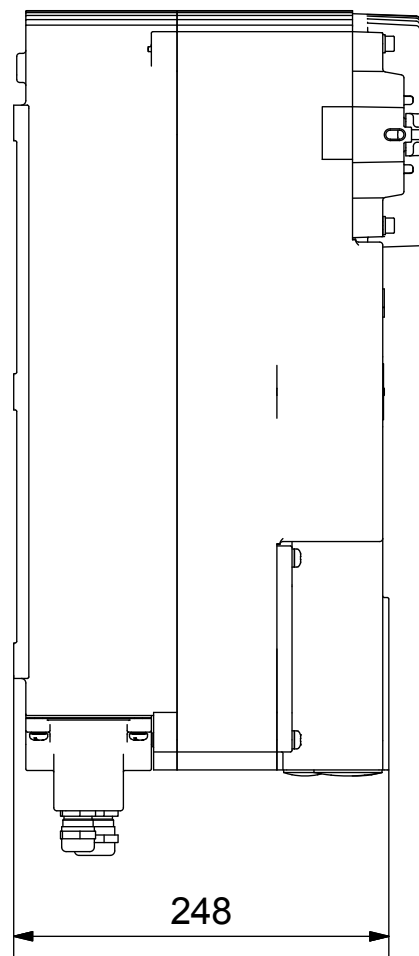
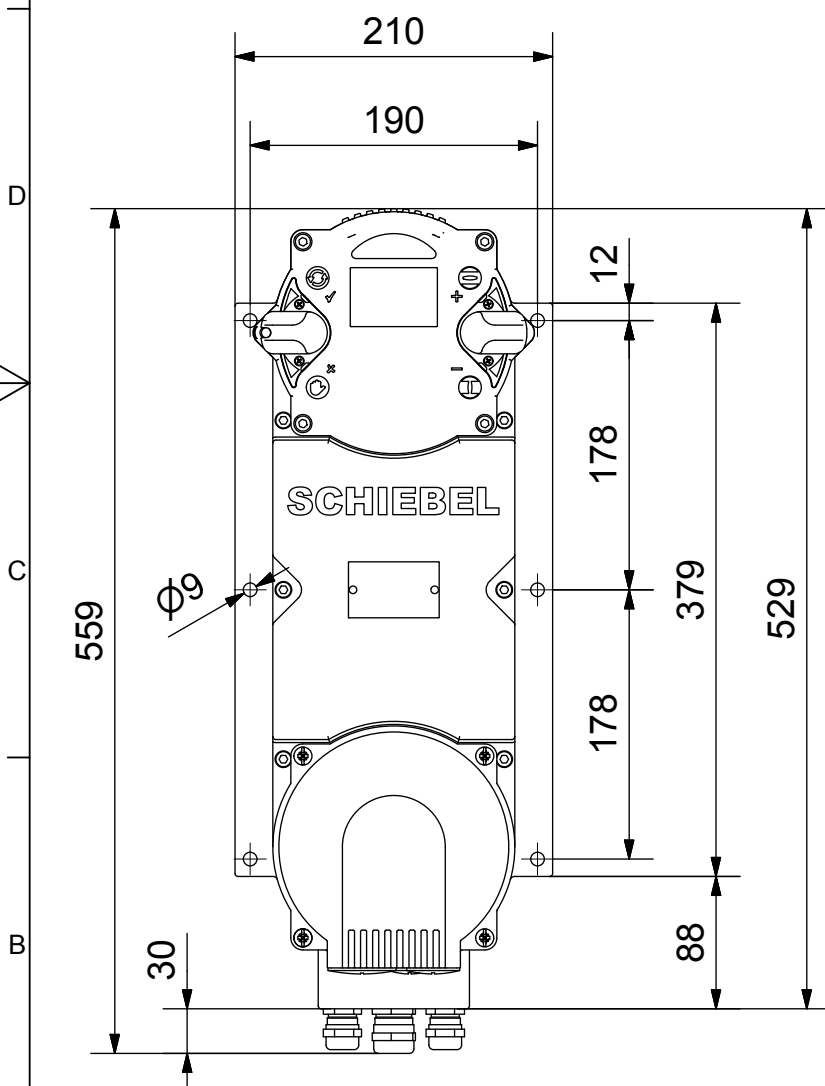
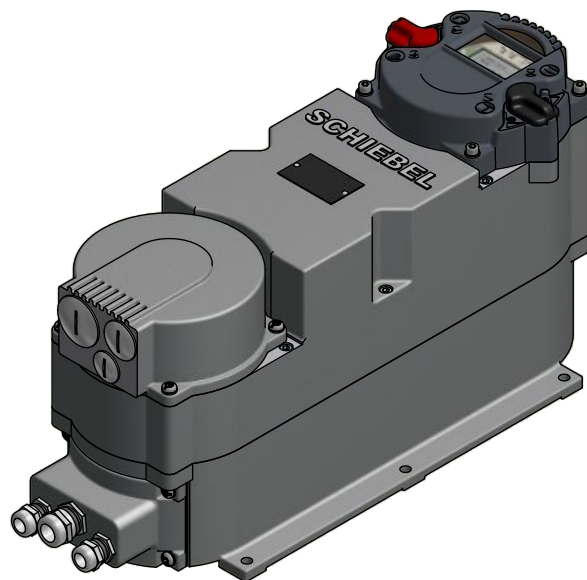
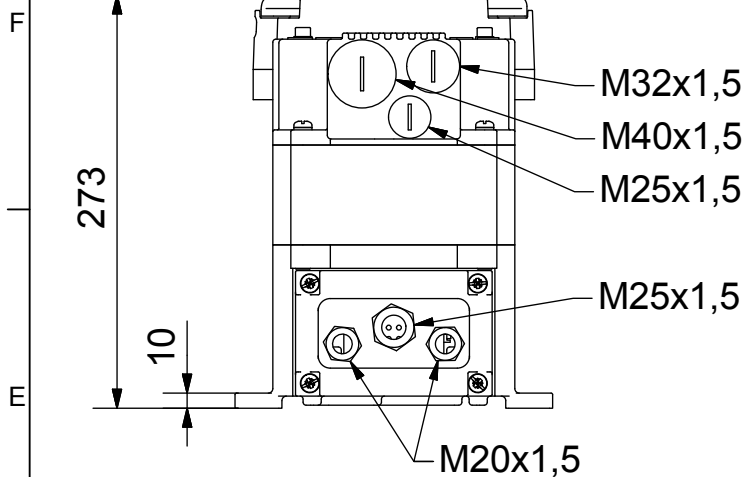
Gez.:	Ra	27.01.09	K.Nr.:
Gepr.:			Maßbildnummer:
	Name:	Datum:	M80_1E30m

4

3

2

1


SCHIEBEL

Dimensions

All dimensions in mm

M-CSC08z2-4 V1.2

Smartcon FU

Control unit V1.2

 Antriebstechnik
Gesellschaft m.b.H.
Josef Benc Gasse 4
A - 1230 Vienna

	Dated	Name
drawn	26.01.2017	H.Mayer
checked		

G:\Inventor\C\Smartcon\CSC 08 Steuerkassette FU\CSC08z2-4\M-CSC08z2-4 V1.2.idw



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SEW
EURODRIVE

Assembly and Operating Instructions



Gear unit series R..7, F..7, K..7, K..9, S..7, SPIROPLAN® W



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1 General information

1.1 About this documentation

This documentation is an integral part of the product. The documentation is intended for all employees who perform assembly, installation, startup, and service work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation or require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
▲ DANGER	Imminent hazard	Severe or fatal injuries.
▲ WARNING	Possible dangerous situation	Severe or fatal injuries.
▲ CAUTION	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment.
INFORMATION	Useful information or tip: Simplifies handling of the drive system.	

1.2.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



SIGNAL WORD







Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard
	Warning of dangerous electrical voltage
	Warning of hot surfaces
	Warning of risk of crushing
	Warning of suspended load
	Warning of automatic restart

1.2.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

- **▲ SIGNAL WORD** Type and source of hazard.
Possible consequence(s) if disregarded.
– Measure(s) to prevent the hazard.

1.3 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the unit!

1.4 Exclusion of liability

Read the information in this documentation, otherwise safe operation is impossible. You must comply with the information contained in this documentation to achieve the specified product characteristics and performance features. SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, SEW-EURODRIVE assumes no liability for defects.

1.5 Product names and trademarks

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.6 Copyright notice

© 2015 SEW-EURODRIVE. All rights reserved.

Copyright law prohibits the unauthorized reproduction, modification, distribution, and use of this document, in whole or in part.

2 Safety notes

2.1 Preliminary information

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The user must ensure that the basic safety notes are read and observed. Ensure that persons responsible for the machinery and its operation as well as persons who work on the unit independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

The following safety notes are primarily concerned with the use of the unit described in these operating instructions. If you use other components from SEW-EURODRIVE, also refer to the safety notes for these particular components in the corresponding documentation.

Also observe the additional safety notes provided in the individual chapters of this document.

2.2 General information



⚠ WARNING

Danger of fatal injury or risk of injury during the operation of motors or gearmotors caused by live, bare (in the event of open connectors/terminal boxes) and movable or rotating parts.

Danger of fatal injury.

- All work related to transport, storage, installation, assembly, connection, startup, maintenance and repair may only be carried out by qualified personnel.
- For transport, storage, installation, assembly, connection, startup, maintenance and repair note the following documents:
 - Warning and safety signs on the motor/gearmotor
 - All the project planning documents, startup instructions and wiring diagrams related to the drive
 - System-specific regulations and requirements
 - National/regional regulations governing safety and the prevention of accidents.
- Never install damaged products.
- Never operate or energize the unit without the necessary protection covers or housing.
- Use the unit only for its intended purpose.
- Make sure installation and operation are correct.



INFORMATION

Submit any complaint to the shipping company immediately in the event of transportation damage.

2.3 Target group

Any mechanical work may only be performed by adequately qualified personnel. Qualified personnel in the context of this documentation are persons familiar with the design, mechanical installation, troubleshooting and servicing of the product, who possess the following qualifications:

- Training in mechanical engineering, e.g. as a mechanic or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

Any electronic work may only be performed by adequately skilled person (electrically). Skilled person (electrically) in the context of this documentation are persons familiar with electrical installation, startup, troubleshooting and servicing of the product, who possess the following qualifications:

- Training in electrical engineering, e.g. as an electrician, electronics or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately.

All qualified personnel must wear appropriate protective clothing.

2.4 Designated use

The gear unit series R..7, F..7, K..7, K..9, S..7, SPIROPLAN® W is intended for use in industrial systems.

The gear units may only be used according to the specifications in the technical documentation from SEW-EURODRIVE as well as the specifications on the nameplate. They fulfill the applicable standards and regulations.

When installed in machines, startup (i.e. start of designated operation) is prohibited until it is determined that the machine complies with the local laws and directives. In the individual area of application, you must especially observe the Machinery Directive 2006/42/EC as well as the EMC Directive 2004/108/EC. The EMC test specifications EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6 and EN 61000-6-2 must be taken into account during startup.

Using these products in potentially explosive atmospheres is prohibited, unless specifically designated otherwise.

2.5 Other applicable documentation

Observe the corresponding documentation for all connected devices.

2.6 Transportation/storage

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If necessary postpone motor startup.

Tighten attached lifting eyes securely. The lifting eyes are designed to carry only the weight of the motor/gear unit/gearmotor. Do not apply any additional loads.

The installed lifting eyebolts are in accordance with DIN 580. Observe the loads and regulations specified there. If the motor/gear unit/gearmotor has 2 lifting eye lugs or lifting eyebolts, then you should also use both lifting eye lugs for attaching transport ropes. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment, that can be used for further transport.

In case the motor/gear unit/gearmotor is not installed immediately store it dry, free of dust and not outdoors. Do not store the motor/gearmotor on the fan guard. The motor/gear unit/gearmotor can be stored for up to 9 months without requiring any special measures before startup.

2.7 Installation



NOTICE

Danger due to static overdetermination if gear units with foot (e.g. KA19/29B, KA127/157B or FA127/157B) are mounted both via the torque arm and via the foot plate.

Risk of injuries and damage to property.

- Especially with the KA.9B/T design, it is not permitted to use the foot plates and the torque arm at the same time.
- Attach the KA 9B/T design only via the torque arm.
- Attach the K.9 or KA.9B design only via the foot plate.
- If you want to use foot plates and torque arms for mounting, contact SEW-EURODRIVE.

Observe the notes in chapter "Mechanical installation (→ 22)".

2.8 Startup/operation

Check the oil level before startup as described in chapter Inspection/Maintenance (→ 88).

Check for proper direction of rotation in **decoupled** state. Listen out for unusual grinding noises as the shaft rotates.

Secure the key for the test run without output elements. Do not deactivate monitoring and protection devices even for a test run.

Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, unusual noise, vibration). Determine the cause. It may be necessary to contact SEW-EURODRIVE.

2.9 Inspection/maintenance

Observe the notes in chapter "Inspection/Maintenance"!

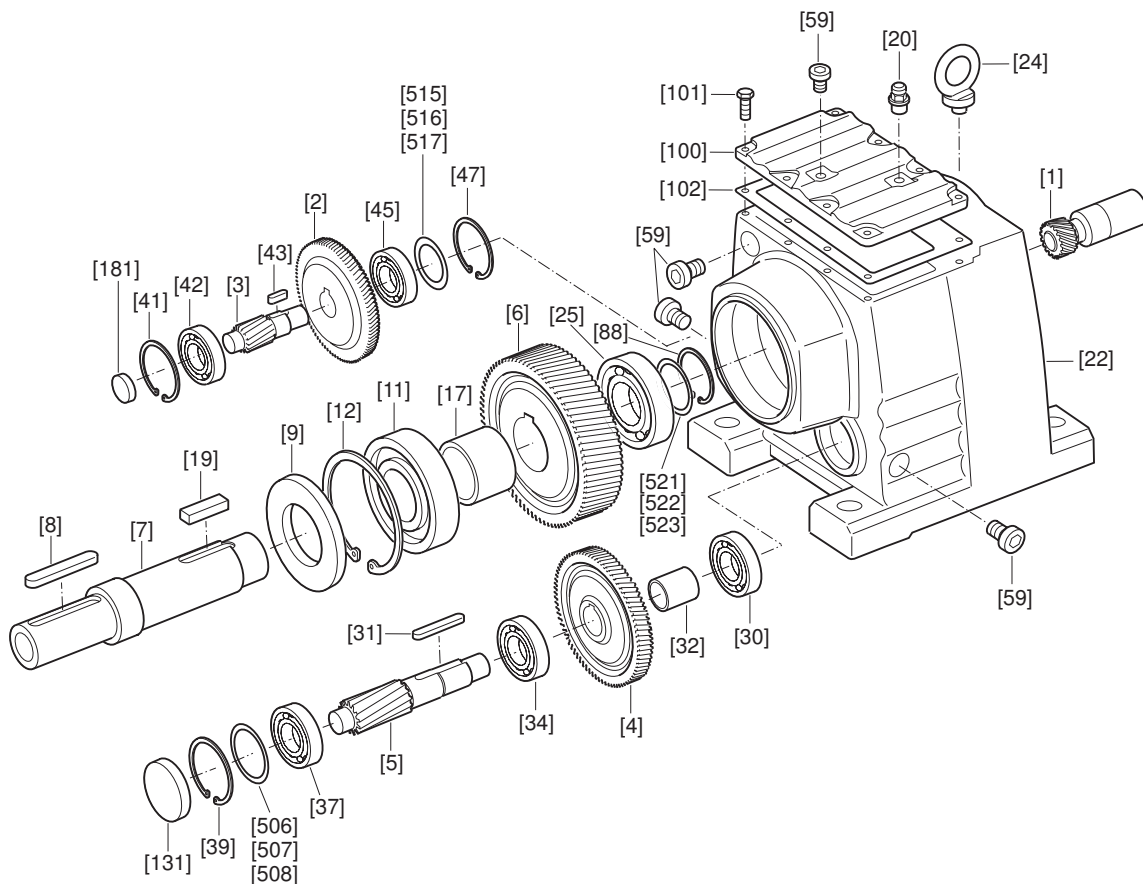
3 Gear unit structure

INFORMATION



The following figures are block diagrams. Their purpose is only to make it easier to assign components to the spare parts lists. Discrepancies may occur depending on the gear unit size and version.

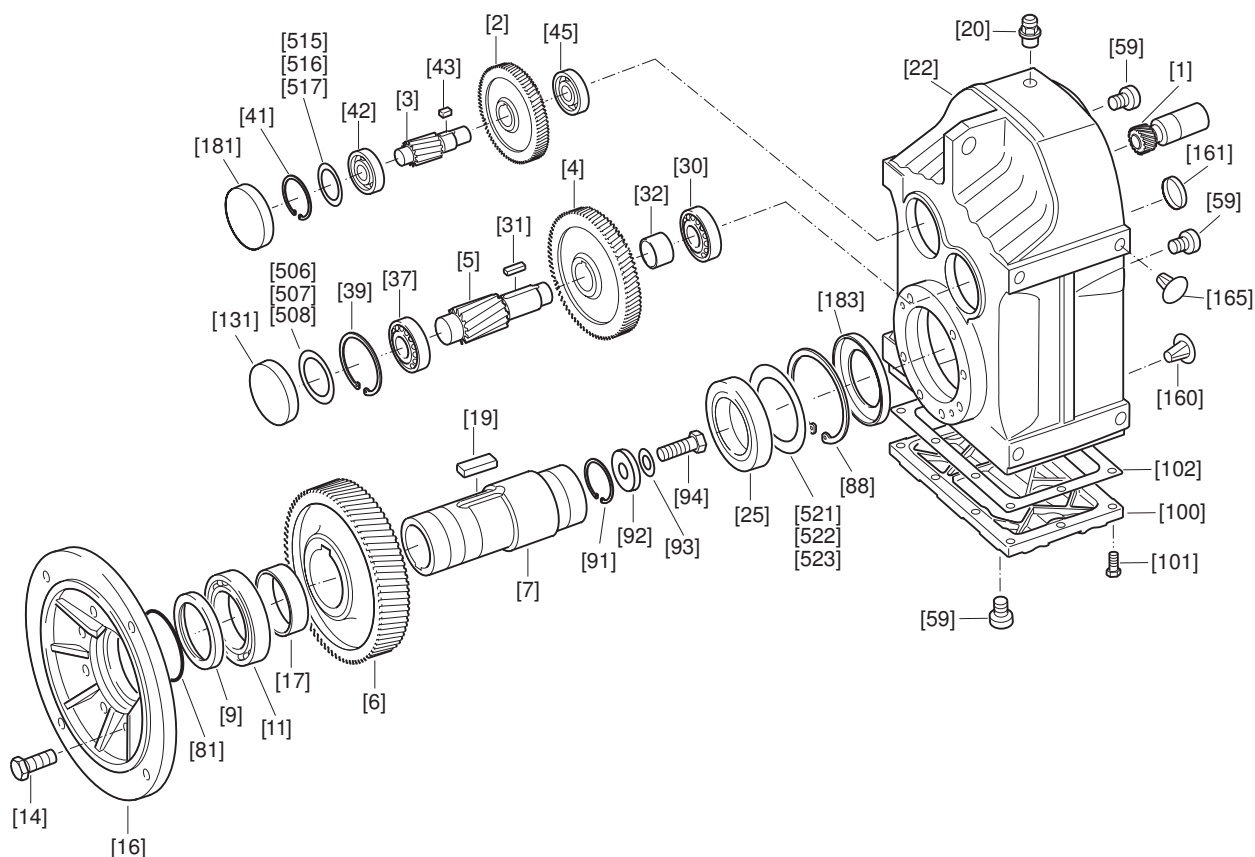
3.1 Basic structure of helical gear units



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[1] Pinion	[19] Key	[42] Rolling bearing	[507] Shim
[2] Gear	[20] Breather valve	[43] Key	[508] Shim
[3] Pinion shaft	[22] Gear unit housing	[45] Rolling bearing	[515] Shim
[4] Gear	[24] Eyebolt	[47] Retaining ring	[516] Shim
[5] Pinion shaft	[25] Rolling bearing	[59] Screw plug	[517] Shim
[6] Gear	[30] Rolling bearing	[88] Retaining ring	[521] Shim
[7] Output shaft	[31] Key	[100] Inspection cover	[522] Shim
[8] Key	[32] Spacer tube	[101] Hex head screw	[523] Shim
[9] Oil seal	[34] Rolling bearing	[102] Gasket	
[11] Rolling bearing	[37] Rolling bearing	[131] Closing cap	
[12] Retaining ring	[39] Retaining ring	[181] Closing cap	
[17] Spacer tube	[41] Retaining ring	[506] Shim	

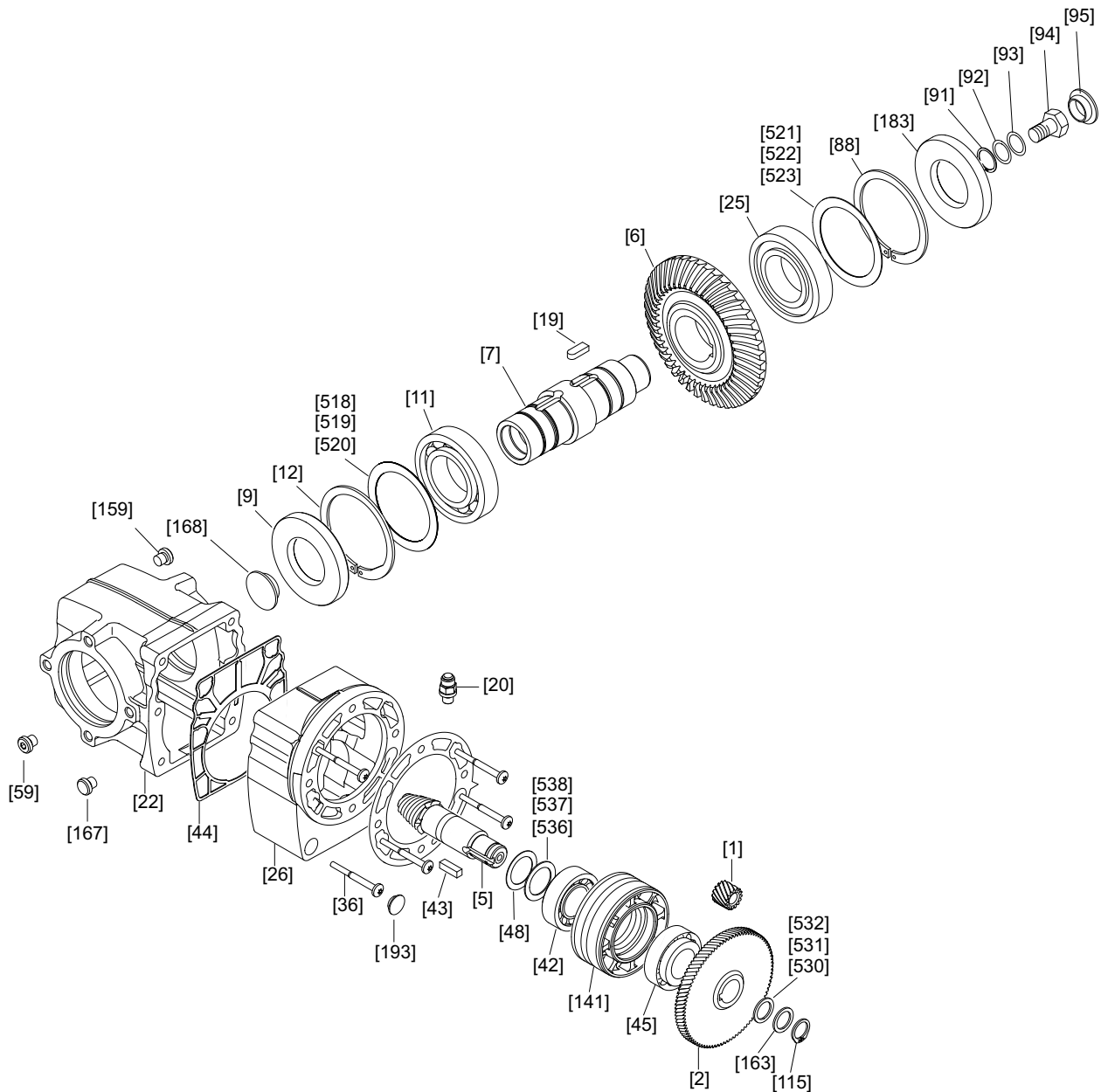
3.2 Basic structure of parallel-shaft helical gear units



9007199274039051

[1] Pinion	[22] Gear unit housing	[91] Retaining ring	[506] Shim
[2] Gear	[25] Rolling bearing	[92] Washer	[507] Shim
[3] Pinion shaft	[30] Rolling bearing	[93] Lock washer	[508] Shim
[4] Gear	[31] Key	[94] Hex head screw	[515] Shim
[5] Pinion shaft	[32] Spacer tube	[100] Inspection cover	[516] Shim
[6] Gear	[37] Rolling bearing	[101] Hex head screw	[517] Shim
[7] Hollow shaft	[39] Retaining ring	[102] Gasket	[521] Shim
[9] Oil seal	[41] Retaining ring	[131] Closing cap	[522] Shim
[11] Rolling bearing	[42] Rolling bearing	[160] Closing plug	[523] Shim
[14] Hex head screw	[43] Key	[161] Closing cap	
[16] Output flange	[45] Rolling bearing	[165] Closing plug	
[17] Spacer tube	[59] Screw plug	[181] Closing cap	
[19] Key	[81] Shield ring	[183] Oil seal	
[20] Breather valve	[88] Retaining ring		

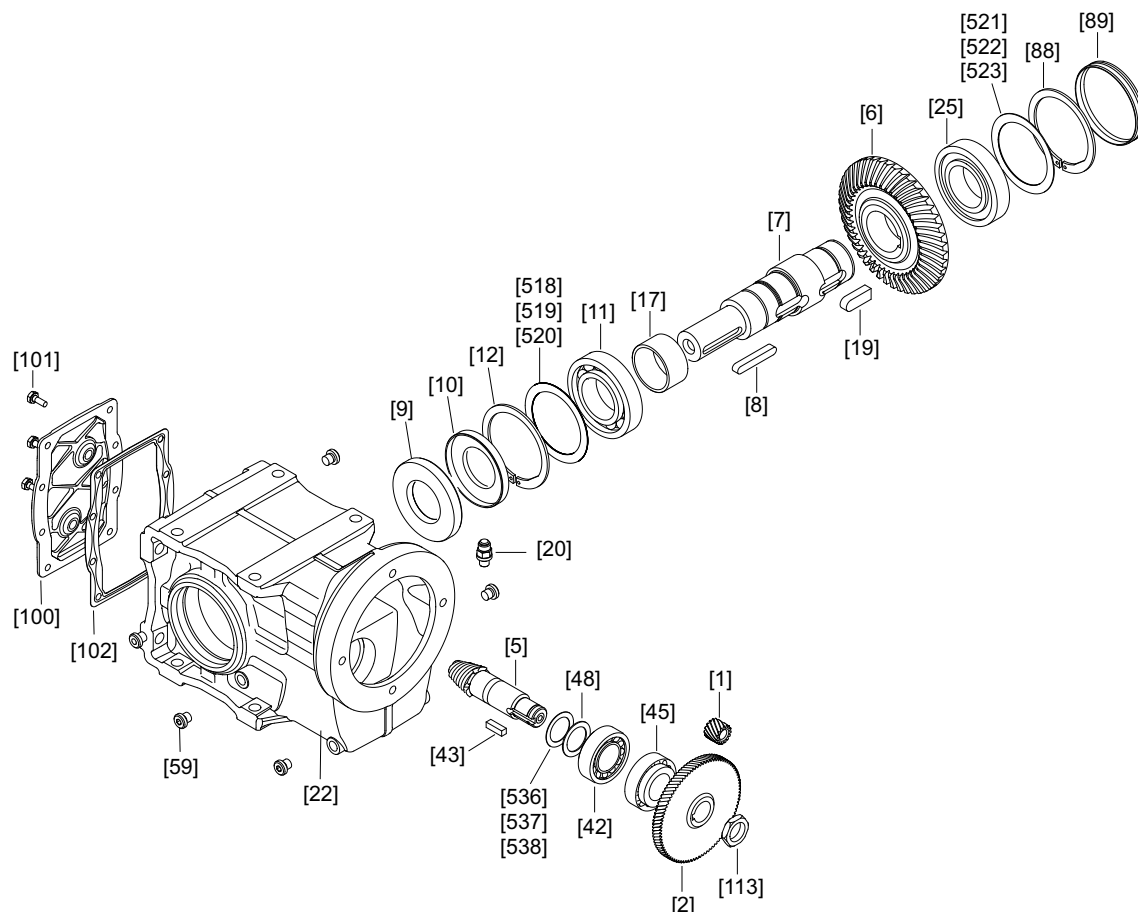
3.3 Basic structure of helical-bevel gear units K..19/K..29



9007206676351499

[1] Pinion	[26] Housing 1. Stage	[94] Hex head screw	[520] Shim
[2] Gear	[36] Stud	[95] Protection cap	[521] Shim
[5] Pinion shaft	[42] Tapered roller bearing	[115] Retaining ring	[522] Shim
[6] Gear	[43] Key	[141] Bushing	[523] Shim
[7] Hollow shaft	[44] Gasket	[159] Closing plug	[530] Shim
[9] Oil seal	[45] Tapered roller bearing	[163] Supporting ring	[531] Shim
[11] Rolling bearing	[50] Bevel gear set	[167] Closing plug	[532] Shim
[12] Retaining ring	[59] Screw plug	[168] Protection cap	[536] Shim
[19] Key	[88] Retaining ring	[183] Oil seal	[537] Shim
[20] Breather valve	[91] Retaining ring	[193] Closing plug	[538] Shim
[22] Gear unit housing	[92] Washer	[518] Shim	
[25] Deep groove ball bearing	[93] Lock washer	[519] Shim	

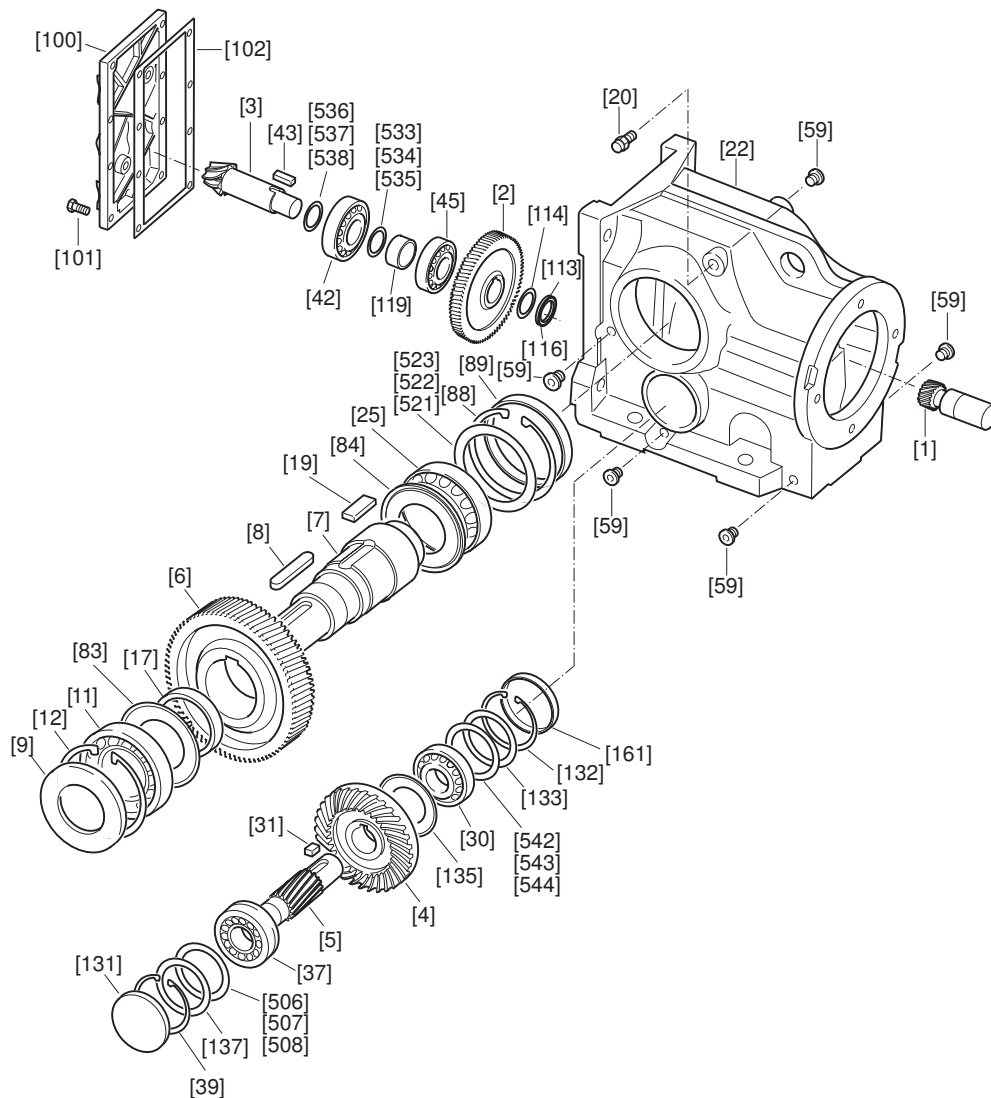
3.4 Basic structure of helical-bevel gear units K..39/K..49



14457456395

[1] Pinion	[12] Retaining ring	[48] Supporting ring	[518] Shim
[2] Gear	[17] Spacer tube	[50] Bevel gear set	[519] Shim
[5] Pinion shaft	[19] Key	[59] Screw plug	[520] Shim
[6] Gear	[20] Breather valve	[88] Retaining ring	[521] Shim
[7] Hollow shaft	[22] Gear unit housing	[89] Closing cap	[522] Shim
[8] Key	[25] Deep groove ball bearing	[100] Inspection cover	[523] Shim
[9] Oil seal	[42] Tapered roller bearing	[101] Hex head screw	[536] Shim
[10] Oil seal	[43] Key	[102] Gasket	[537] Shim
[11] Deep groove ball bearing	[45] Tapered roller bearing	[113] Slotted nut	[538] Shim

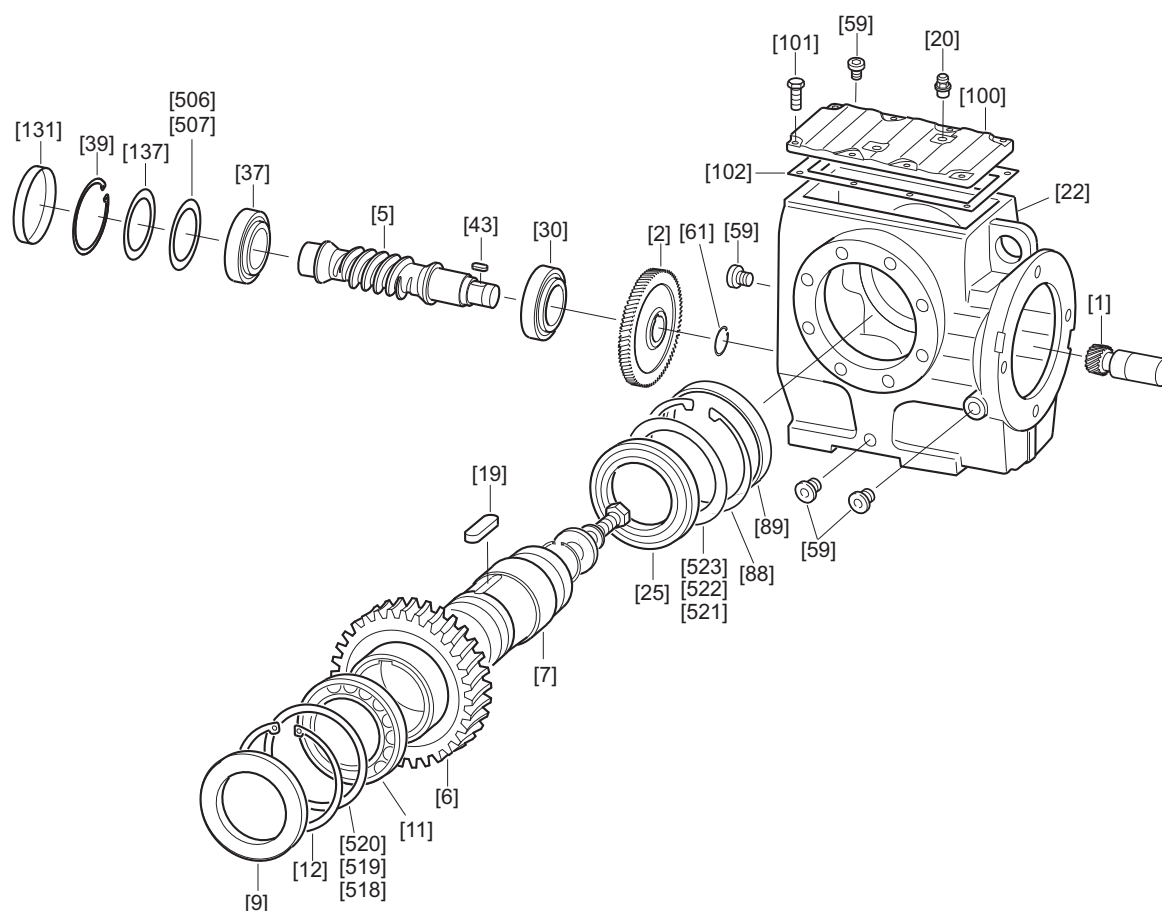
3.5 Basic structure of helical-bevel gear units K..37 – K..187



9007199274042123

[1] Pinion	[25] Rolling bearing	[102] Gasket	[522] Shim
[2] Gear	[30] Rolling bearing	[113] Slotted nut	[523] Shim
[3] Pinion shaft	[31] Key	[114] Multi-tang washer	[533] Shim
[4] Gear	[37] Rolling bearing	[116] Thread lock	[534] Shim
[5] Pinion shaft	[39] Retaining ring	[119] Spacer tube	[535] Shim
[6] Gear	[42] Rolling bearing	[131] Closing cap	[536] Shim
[7] Output shaft	[43] Key	[132] Retaining ring	[537] Shim
[8] Key	[45] Rolling bearing	[133] Supporting ring	[538] Shim
[9] Oil seal	[59] Screw plug	[135] Shield ring	[542] Shim
[11] Rolling bearing	[83] Shield ring	[137] Supporting ring	[543] Shim
[12] Retaining ring	[84] Shield ring	[161] Closing cap	[544] Shim
[17] Spacer tube	[88] Retaining ring	[506] Shim	
[19] Key	[89] Closing cap	[507] Shim	
[20] Breather valve	[100] Inspection cover	[508] Shim	
[22] Gear unit housing	[101] Hex head screw	[521] Shim	

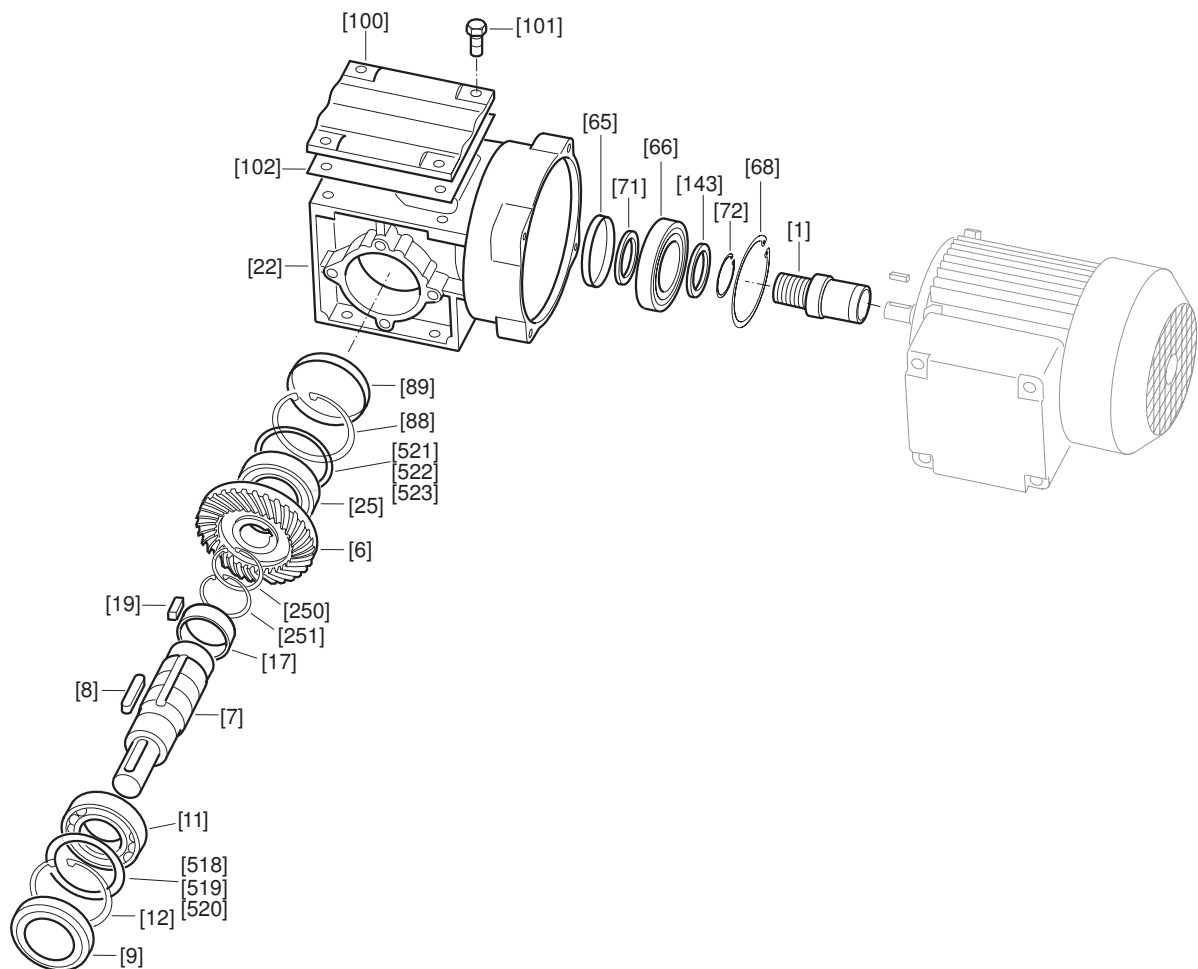
3.6 Basic structure of helical-worm gear units



9007199274045195

[1] Pinion	[20] Breather valve	[88] Retaining ring	[518] Shim
[2] Gear	[22] Gear unit housing	[89] Closing cap	[519] Shim
[5] Worm	[25] Rolling bearing	[100] Inspection cover	[520] Shim
[6] Worm gear	[30] Rolling bearing	[101] Hex head screw	[521] Shim
[7] Output shaft	[37] Rolling bearing	[102] Gasket	[522] Shim
[9] Oil seal	[39] Retaining ring	[131] Closing cap	[523] Shim
[11] Rolling bearing	[43] Key	[137] Supporting ring	
[12] Retaining ring	[59] Screw plug	[506] Shim	
[19] Key	[61] Retaining ring	[507] Shim	

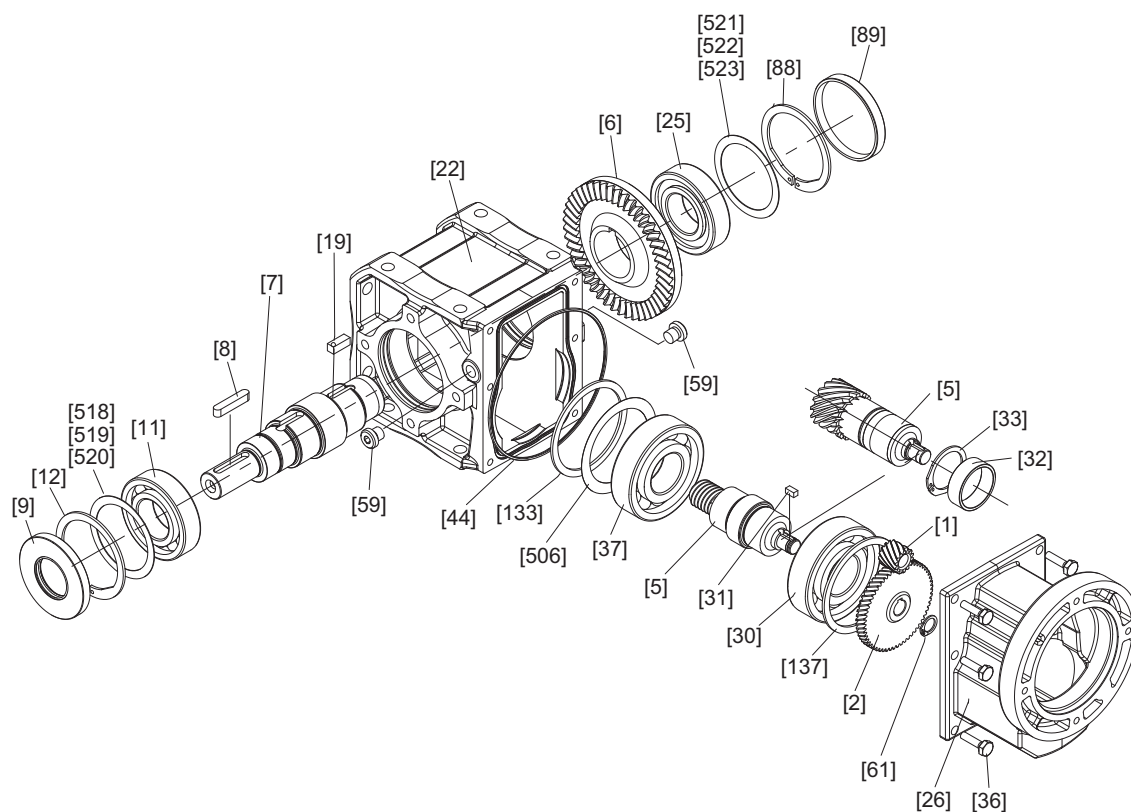
3.7 Basic structure of SPIROPLAN® gear units W..10 – W..30



9007199274048267

[1] Pinion	[19] Key	[88] Retaining ring	[518] Shim
[6] Gear	[22] Gear unit housing	[89] Closing cap	[519] Shim
[7] Output shaft	[25] Rolling bearing	[100] Inspection cover	[520] Shim
[8] Key	[65] Oil seal	[101] Hex head screw	[521] Shim
[9] Oil seal	[66] Rolling bearing	[102] Gasket	[522] Shim
[11] Rolling bearing	[68] Retaining ring	[143] Supporting ring	[523] Shim
[12] Retaining ring	[71] Supporting ring	[250] Retaining ring	
[17] Spacer tube	[72] Retaining ring	[251] Retaining ring	

3.8 Basic structure of SPIROPLAN® gear units W..37 – W..47



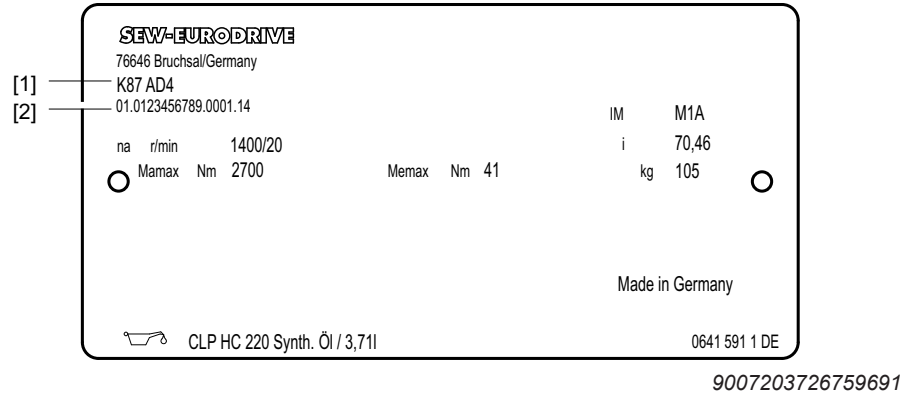
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[1] Pinion	[22] Gear unit housing	[59] Screw plug	[521] Shim
[2] Gear	[25] Deep groove ball bearing	[61] Retaining ring	[522] Shim
[5] Pinion shaft	[26] Housing stage 1	[88] Retaining ring	[523] Shim
[6] Gear	[30] Deep groove ball bearing	[89] Closing cap	
[7] Output shaft	[31] Key	[133] Shim	
[8] Key	[32] Spacer tube	[137] Shim	
[9] Oil seal	[33] Retaining ring	[506] Shim	
[11] Deep groove ball bearing	[36] Hex head screw	[518] Shim	
[12] Retaining ring	[37] Deep groove ball bearing	[519] Shim	
[19] Key	[44] O-ring	[520] Shim	

3.9 Nameplate/type designation

3.9.1 Gear unit nameplate

The following figure shows an example of a nameplate for a helical-bevel gear unit with input cover:



[1]	Type designation of the gear unit
[2]	Serial number
n_a r/min	Maximum permitted output speed
M_{amax} Nm	Maximum permitted output torque i
M_{emax} Nm	Maximum permitted input torque
i	Gear unit ratio
IM	Mounting position

Explanation for serial number:

01.	0123456789.	0001.	14
Sales organization	Order number	Item number	Year of manufacture

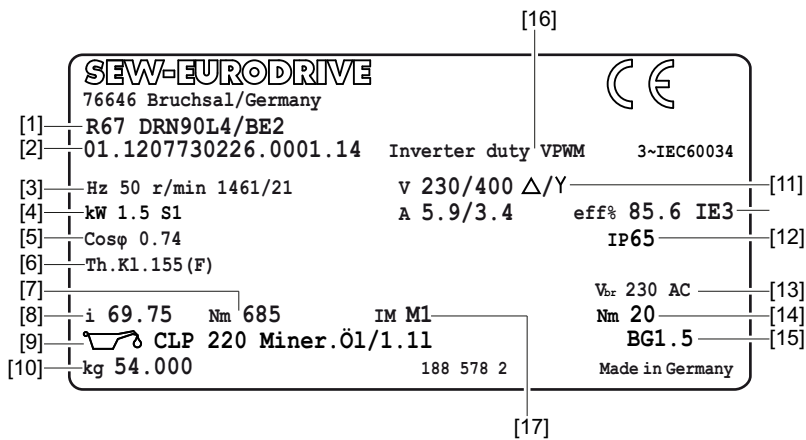
3.9.2 Type designation of the gear unit

A helical-bevel gear unit with AQA adapter, for example has the following type designation:

Example: K37/R AQA 80 /1		
Gear unit type	K	Helical-bevel gear units
Gear unit size	37	19 – 49; 37 – 187
Option	/R	e.g. option /R for servo drives: Reduced rotational clearance
Adapter	AQA	e.g. adapter for servo drives: AQA: Adapter with keyway AQH: Adapter with clamping ring hub
Flange key figure	80	
Variants	/1	

3.9.3 DRN.. gearmotor nameplate

The following figure shows an example of the nameplate of a DRN.. gearmotor.



18014411882555659

- [1] Type designation gearmotor
- [2] Serial number
- [3] Hz Line frequency
- [4] kW Motor power
- [5] Power factor
- [6] Temperature class
- [7] Nm Maximum output torque
- [8] Gear unit ratio
- [9] Oil type and oil fill volume
- [10] kg Weight
- [11] V Clamping connection
- [12] Degree of protection
- [13] V Brake voltage
- [14] Nm Braking torque
- [15] Brake control
- [16] Inverter operation
- [17] Mounting position

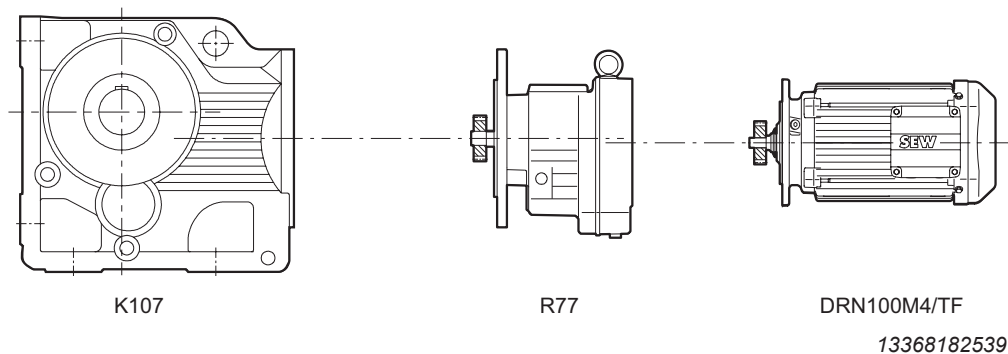
3.9.4 Type designation gearmotor

The type designation of the gearmotor starts from the component on the output end.

For instance, a multi-stage helical-bevel gearmotor with temperature sensor in the motor winding has the following type designation:

Example: K107R77DRN100M4 /TF		
Gear unit type	K	1. Gear unit
Gear unit size	107	
Gear unit series	R	2. Gear unit
Gear unit size	77	
Motor series	DRN..	Motor
Motor size	100	
Length	M	
Number of poles	4	
Motor option temperature sensor	/TF	Option

Example: DRN.. double gearmotor



4 Mechanical installation

4.1 Prerequisites for installation

NOTICE

Damage to the gear unit/gearmotor due to improper installation.

Damage to property.

- Observe the following notes.

Make sure that the following requirements are met before you start installing the unit:

- The drive has not been damaged during transportation or storage.
- The entries on the nameplate of the gearmotor match the voltage supply system.
- In case of abrasive ambient conditions, the output end oil seals must be protected against wear.
- Output shafts and flange surfaces must be completely free from anti-corrosion agent and any kind of pollution. Use a commercially available solvent to clean the flange surfaces. Note that solvent damages the oil seal. Do not let the solvent come into contact with the sealing lips of the oil seals.
- **For standard drives:**
 - Check if the gear unit/gearmotor is designed for the ambient temperatures. For the application limits refer to the technical documentation, the nameplate or the lubricant table (see chapter "Lubricant table (→ 149)").
 - Make sure the environment contains no hazardous substances (oils, acids, gases, vapors, dusts,...) or radiation.
- **For special designs:**
 - Check if the gear unit/gearmotor is designed for the ambient temperatures. You find the application limits on the nameplate.
- **With helical-worm/SPIROPLAN® gear units:**
 - Note that no large external mass moments of inertia must be present, which could exert a retrodriving load on the gear unit.
 - Note the self-locking at $\eta' \text{ (retrodriving)} < 0.5$.
Calculation of η' : $\eta' = 2 - 1/\eta$
- **Servomotor mounting:**
 - The drive may only be mounted if it is ensured that after the mounting the drive will be sufficiently ventilated. Ventilation prevents heat build-up.

4.1.1 Required tools/resources

The following tools and resources are required for the mechanical installation:

- Wrench
- Torque wrench for:
 - Gear unit mounting
 - Shrink disks
 - Motor adapter AQH or EWH
 - Input shaft assembly with centering shoulder

- Mounting device
- Compensation elements (shims and spacing rings)
- Fasteners for input and output elements
- Lubricant (e.g. NOCO® fluid)
- Threadlocker compound for input cover with centering shoulder (e.g. Loctite® 243)

INFORMATION



Standard parts are not included in the delivery.

4.1.2 Installation tolerances

Shaft end	Flanges
Diameter tolerance according to DIN 748 <ul style="list-style-type: none"> • ISO k6 for solid shafts with $\varnothing \leq 50$ mm • ISO m6 for solid shafts with $\varnothing > 50$ mm • ISO H7 for hollow shafts • Centering bore in accordance with DIN 332, shape DR 	Centering shoulder tolerance to DIN 42948 <ul style="list-style-type: none"> • ISO j6 with $b1 \leq 230$ mm • ISO h6 with $b1 > 230$ mm

4.2 Installing the gear unit



⚠ CAUTION

Risk of injury due to improper installation/disassembly

Severe personal injury and damage to property.

- Work on the gear unit only when the machine is not in use.
- Secure the drive unit against unintentional power-up.
- Prevent heavy component parts (e.g. shrink disks) against falling during installation/disassembly.



⚠ CAUTION

Risk of injury due to protruding gear unit parts.

Severe injuries

- Keep a sufficient safety distance to the gear unit/gearmotor.



NOTICE

Danger due to static overdetermination if gear units with foot (e.g. KA19/29B, KA127/157B or FA127/157B) are mounted both via the torque arm and via the foot plate.

Risk of injuries and damage to property.

- Especially with the KA.9B/T design, it is not permitted to use the foot plates and the torque arm at the same time.
- Attach the KA 9B/T design only via the torque arm.
- Attach the K.9 or KA.9B design only via the foot plate.
- If you want to use foot plates and torque arms for mounting, contact SEW-EURODRIVE.

NOTICE

Damage to gear unit/gearmotor due to cold air currents. Condensed water in the gear unit can cause damage.

Damage to property.

- Protect the gear unit from direct cold air currents.



INFORMATION

When installing the gear unit, make sure that the oil level and drain plugs as well as the breather plugs are easily accessible!

Mounting position

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. Observe the information on the nameplate. SPIROPLAN® gear units of sizes W10-W30 do not depend on a particular mounting position.

Oil fill volume

Check the oil fill depending on the mounting position (for information on the fill quantity refer to the nameplate or chapter "Lubricant fill quantities" (→ 151)). Control the oil fill level at this opportunity. See chapter "Inspection/maintenance for the gear unit" (→ 95). The gear units are filled with the required oil quantity at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position. Observe chapter "Lubricant fill quantities" (→ 151) and chapter "Mounting Positions" (→ 110).

Consult the SEW customer service if you intend to change the mounting position of K gear to M5 or M6 or between M5 and M6.

Please contact our SEW customer service if you want to change the mounting position of size S47 – S97 helical-worm gear units to mounting position M2 or M3.

Submounting

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

The following table shows the maximally permitted flatness defect for foot- and flange-mounting (guide values based on DIN ISO 1101):

Gear unit size	Flatness defect
≤ 67	max. 0.4 mm
77 – 107	max. 0.5 mm
137/147	max. 0.7 mm
157 – 187	max. 0.8 mm

Do not twist housing legs and mounting flanges against each other. Observe the permitted overhung and axial forces. Observe chapter "Project Planning" in the Gear unit/gearmotor catalog for calculating the permitted overhung and axial loads.

Screw quality

Secure the gearmotors listed in the following table using quality 10.9 screws. Use suitable washers.

Gear unit	Flange Ø in mm
RF37/R37F	120
RF47/R47F	140
RF57/R57F	160
FF/FAF77/KF/KAF77	250
RF147	450
RF167	550
RZ37 – RZ87	60ZR – 130ZR

Secure the gearmotors not listed in the table using quality 8.8 screws.

Corrosion protection for screw connections

Use plastic inserts (2 – 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical leakage resistance $< 10^9 \Omega$. Electrochemical corrosion can occur between various metals, for example, cast iron and stainless steel. Also fit the screws with plastic washers. Additionally ground the housing. Use grounding screws on the motor.

4 Mechanical installation

Installing the gear unit

4.2.1 Tightening torques for retaining screws

Mount the gearmotors with the following tightening torques:

Screw/nut	Tightening torque $\pm 10\%$ Strength class 8.8 Nm
M6	11
M8	25
M10	48
M12	86
M16	210
M20	410
M24	710
M30	1450
M36	2500
M42	4600
M48	6950
M56	11100

Mount the specified gearmotors in flange-mounted design with the following increased tightening torques:

Flange \varnothing mm	Gear unit	Screw/nut	Tightening torque $\pm 10\%$ Strength class 10.9 Nm
120	RF37	M6	16.5
140	RF37/RF47	M8	40.1
160	RF57	M8	40.1
450	RF147	M20	661
550	RF167	M20	661
60ZR	RZ37	M8	40
70ZR	RZ47	M8	40
80ZR	RZ57	M10	79
95ZR	RZ67	M10	79
110ZR	RZ77	M10	79
130ZR	RZ87	M12	137
250	FF77/KF77/ FAF77/KAF77	M12	137

4.2.2 Gear unit mounting

INFORMATION



If you use the gear unit in flange-mounted design or foot/flange-mounted design with VARIGEAR® variable speed gear units, use screws of 10.9 quality and suitable washers for flange mounting on customer side.

To improve the friction contact between flange and mounting surface, SEW-EURODRIVE recommends anaerobic gaskets or anaerobic glue.

Foot-mounted gear unit

The following table shows the thread sizes of the gear units in foot-mounted design depending on the gear unit type and size:

Screw	Gear unit type					
	R/R..F	RX	F/FH..B/ FA..B	K/KH..B/KV..B/ KA..B	S	W
M6	07	-	-	19	-	10/20
M8	17/27/37	-	27/37	29	37	30/37/47
M10	-	57	47	37/39/47/49	47/57	-
M12	47/57/67	67	57/67	57/67	67	-
M16	77/87	77/87	77/87	77	77	-
M20	97	97/107	97	87	87	-
M24	107	-	107	97	97	-
M30	137	-	127	107/167	-	-
M36	147/167	-	157	127/157/187	-	-

Gear unit with B14 flange-mounted design and/or hollow shaft

The following table shows the thread sizes of the gear units with B14 flange and/or hollow shaft depending on the gear unit type and size:

Screw	Gear unit type				
	RZ	FZ/FAZ/FHZ/ FVZ	KZ/KAZ/KHZ/KVZ	SA/SAZ/SHZ	WA
M6	07/17/27	—	—	37	10/20/30 ¹⁾
M8	37/47	27/37/47	37/47	47/57	37
M10	57/67	—	—	—	47
M12	77/87	57/67/77	57/67/77	67/77	—
M16	—	87/97	87/97	87/97	—
M20	—	107/127	107/127	—	—
M24	—	157	157	—	—

1) For W30 gear units mounted directly to a CMP motor or mounted via an EWH.. adapter, the thread size is M8.

4 Mechanical installation

Installing the gear unit

Gear unit with B5 flange

The following table shows the thread sizes of the gear units with B5 flange depending on the gear unit type, size and flange diameter:

Flange Ø mm	Screw	Gear unit type				
		RF/R..F/RM	FF/FAF/ FHF/FVF	KF/KAF/ KHF/KVF	SF/SAF/SHF	WF/WAF/ WHF
80	M6	-	-	-	-	10
110	M8	-	-	-	-	20
120	M6	07/17/27	-	-	37	10/20/30/37
120	M8	-	-	19	-	-
140	M8	07/17/27/37/47	-	-	-	-
160	M8	07/17/27/37/47	27/37	19/37	37/47	30/37/47
160	M10	-	-	29/39	-	-
200	M10	37/47/57/67	47	29/47	57/67	-
200	M12	-	-	49	-	-
250	M12	57/67/77/87	57/67	57/67	77	-
300	M12	67/77/87	77	77	-	-
350	M16	77/87/97/107	87	87	87	-
450	M16	97/107/137/147	97/107	97/107	97	-
550	M16	107/137/147/167	127	127	-	-
660	M20	147/167	157	157	-	-

4.2.3 Installation in damp locations or outdoors

Drives are supplied in corrosion-resistant designs with an according surface protection coating for use in damp areas or outdoors.

- Repair damage to the paint work e.g. at the breather valve or the lifting eyes (see "Painting the gear unit" (→ 30)).
- When mounting the motors onto AM, AQ adapters and to AR, AT start-up and friction couplings, seal the flange areas with a suitable sealant (e.g. Loctite® 574).
- Units installed outdoors must be protected from the sun. Provide for suitable protective devices such as covers or roofs. Avoid heat build-up.
- The system operator must ensure that no foreign objects (e.g. falling objects or coverings) affect the operation of the gear unit.

4.2.4 Gear unit venting

NOTICE

Dirt and dust in the environment affect the function of the breather valve.

Possible damage to property.

- Check the breather valve function regularly and replace it if necessary.
- In case of high dirt and dust load use a breather filter instead of a breather valve.

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The following table lists gear units that do not require venting:

Gear unit	Mounting position
R..07	M1/M2/M3/M5/M6
R..17/R..27/F..27	M1/M3/M5/M6
W..10/W..20/W..30	M1– M6
W..37/W..47/	M1/M2/M3/M5/M6
K..19/K..29	M1/M2/M3/M5/M6

All other gear units are delivered with a breather valve suitable to the mounting position and activated.

Exceptions:

1. The following gear units are delivered with a screw plug on the provided breather hole:

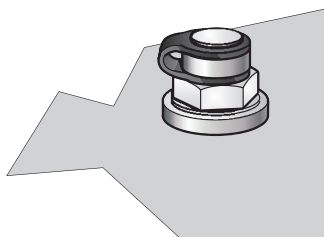
- Gear units with pivoted mounting positions, if possible
- Gear units for inclined mounting

Before startup, replace the highest screw plug in the terminal box of the motor with the breather valve provided.

2. For **gear head units** venting on the input end, a breather valve is supplied in a plastic bag.
3. **Enclosed gear units** are delivered without a breather valve.
4. In some countries, the breather valve is installed, but not activated due to possible pressure fluctuations during transport. In such cases the transport protection must be removed. This activates the breather valve (see chapter "Activating the breather valve" (→ 29)).

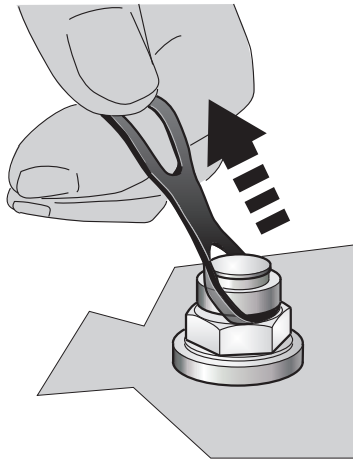
Activating the breather valve

Check whether the breather valve is activated. If the breather valve has not been activated, you must remove the transport protection device from the breather valve before starting up the gear unit!



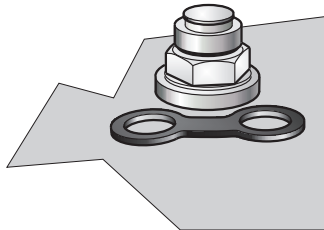
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Breather valve with transport protection



211316875

Removing the transport protection



211314699

Activated breather valve

4.2.5 Painting the gear unit

NOTICE

Paint can block the breather valve and damage the sealing lips of the oil seals.

Damage to property.

- Thoroughly cover the breather valve and sealing lip of the oil seals with strips prior to painting/re-painting.
- Remove the strips after painting.

4.3 Gear unit with solid shaft

4.3.1 Information about assembly

INFORMATION



Assembly of the shaft is easier if you first apply lubricant to the output element or heat it up briefly (80 °C – 100 °C).

4.3.2 Assembling input and output elements

NOTICE

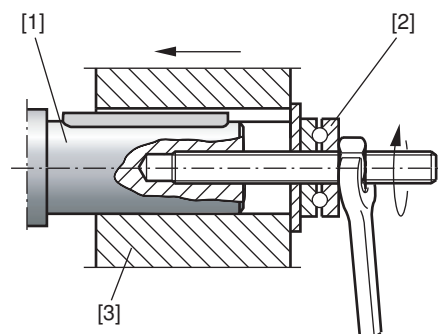
Damage to bearing, housing or shafts due to incorrect mounting

Possible damage to property.

- Only use a mounting device for installing input and output elements (see chapter "Using the mounting device" (→ 31)). Use the threaded centering bore at the shaft end.
- Never force belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer.
- In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.
- Make sure the transmission elements are balanced after fitting and do not give rise to any impermissible radial or axial forces. For the approved values, refer to the catalog "Gearmotors" or "Explosion-Proof Drives".

Using a mounting device

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. Should you be able to tighten the screw without any problems, you may not need the thrust bearing on the mounting device.



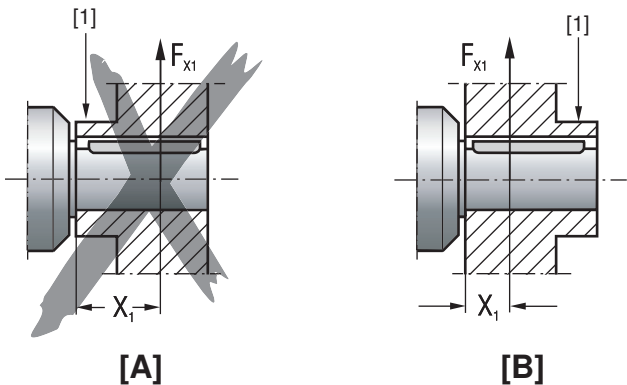
211368587

[1] Gear shaft end
[2] Thrust bearing

[3] Coupling hub

Avoiding excessive overhung loads

To avoid high overhung loads, mount gears and sprockets according to figure B.



211364235

- | | | | |
|-----|--------------------|----------|---------------------------|
| [1] | Hub | F_{X1} | Overhung load at point X1 |
| [A] | Incorrect assembly | [B] | Correct assembly |

4.3.3 Mounting of couplings



CAUTION

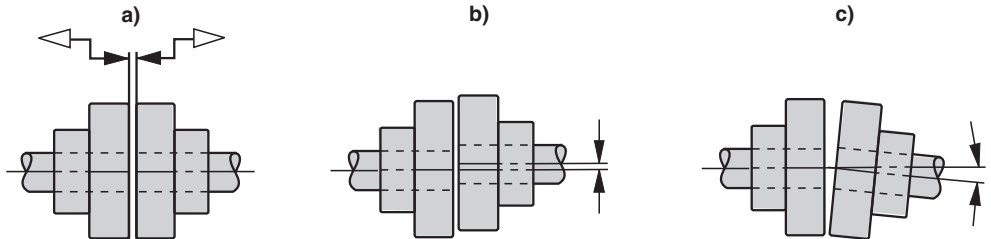
Risk of injury due to moving drive elements, such as belt pulleys or couplings, during operation.

Risk of jamming and crushing.

- Equip the input and output elements with a touch guard.

Adjust the following misalignments according to the coupling manufacturer's specifications when mounting couplings:

- Maximum and minimum clearance
- Axial misalignment
- Angular misalignment



211395595

4.4 Torque arms for shaft-mounted gear units

NOTICE

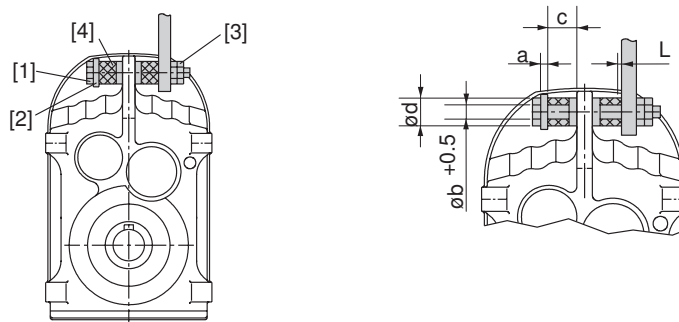
Damage to gear unit due to improper installation.

Damage to the gear unit

- Do not place torque arms under strain during installation.
- Always use bolts of quality 8.8 to fasten torque arms.

4.4.1 Mounting torque arms for parallel-shaft helical gear units

The following figure shows the torque support for parallel-shaft helical gear units.



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- | | |
|-------------------|---|
| [1] Screw | a Washer width |
| [2] Washer | b Rubber buffer inner diameter |
| [3] Nuts | c Rubber buffer length in loose state |
| [4] Rubber buffer | d Rubber buffer diameter |
| | ΔL Rubber buffer preload in loose state |

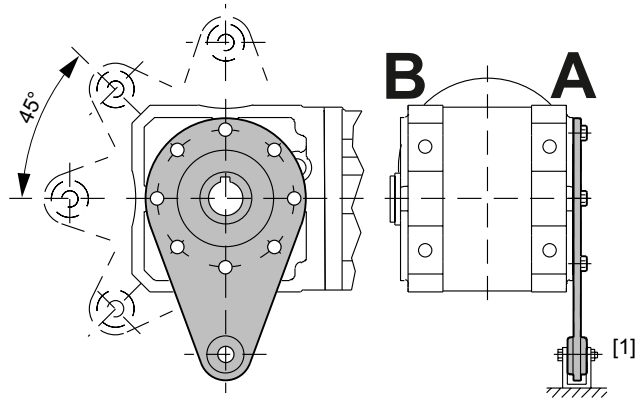
Proceed as follows:

1. Use screws [1] and washers [2] according to the following table.
2. Secure the screw connection with a nut [3].
3. Tighten the screw [1] until the preload "Δ L" of the rubber buffers is reached according to the table:

Gear unit	Washer a mm	Rubber buffer			
		d mm	b mm	c mm	Δ L mm
F..27 /G	5	40	12.5	20	1
F..37 /G	5	40	12.5	20	1
F..47 /G	5	40	12.5	20	1.5
F..57 /G	5	40	12.5	20	1.5
F..67 /G	5	40	12.5	20	1.5
F..77 /G	10	60	21.0	30	1.5
F..87 /G	10	60	21.0	30	1.5
F..97 /G	12	80	25.0	40	2
F..107 /G	12	80	25.0	40	2
F..127 /G	15	100	32.0	60	3
F..157 /G	15	120	32.0	60	3

4.4.2 Mounting torque arms for helical-bevel gear unit K..19 – K..49

The following figure shows the torque support for the helical-bevel gear units K..19 – K..49:



9007206972372491

[1] Bushing

A Connection side

B Connection side

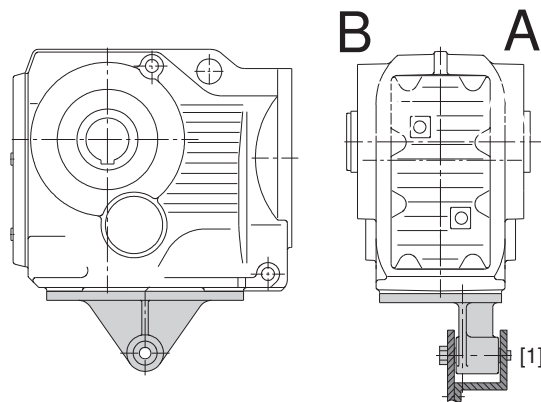
Observe the following points during assembly:

- Apply bearings to both sides of the bushing [1].
- Mount connection side B so that it mirrors side A.
- Use screws and tightening torques according to the following table:

Gear unit	Screws	Tightening torque $\pm 10\%$
		Nm
K..19 /T	4 x M8 x 20 – 8.8	25
K..29 /T	4 x M8 x 22 – 8.8	25
K..39/T	4 x M10 x 30 – 8.8	48
K..49/T	4 x M12 x 35 – 8.8	86

4.4.3 Mounting torque arms for helical-bevel gear unit K..37 – K..157

The following figure shows the torque support for the helical-bevel gear units K..37 – K..157.



9007199466103051

[1] Bushing

A Connection side

B Connection side

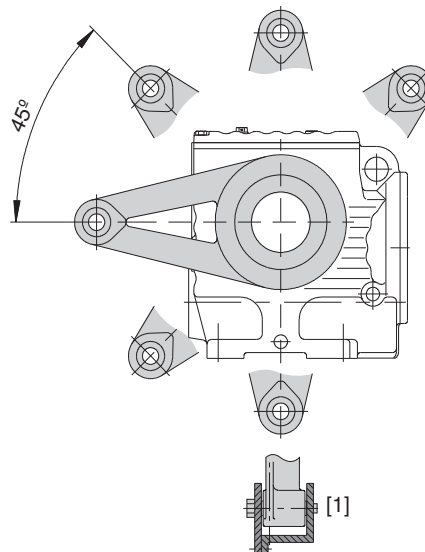
Proceed as follows:

1. Apply bearings to both sides of the bushing [1].
2. Mount connection side B so that it mirrors side A.
3. Use screws and tightening torques according to the following table:

Gear unit	Screws	Tightening torque $\pm 10\%$ Nm
K..37 /T	4 × M10 × 25 – 8.8	48
K..47 /T	4 × M10 × 30 – 8.8	48
K..57 /T	4 × M12 × 35 – 8.8	86
K..67 /T	4 × M12 × 35 – 8.8	86
K..77 /T	4 × M16 × 40 – 8.8	210
K..87 /T	4 × M16 × 40 – 8.8	210
K..97 /T	4 × M20 × 50 – 8.8	410
K..107 /T	4 × M24 × 60 – 8.8	710
K..127 /T	4 × M36 × 130 – 8.8	2500
K..157 /T	4 × M36 × 130 – 8.8	2500

4.4.4 Mounting torque arms for helical-worm gear units

The following figure shows the torque support for helical-worm gear units.



9007199466232715

[1] Bushing

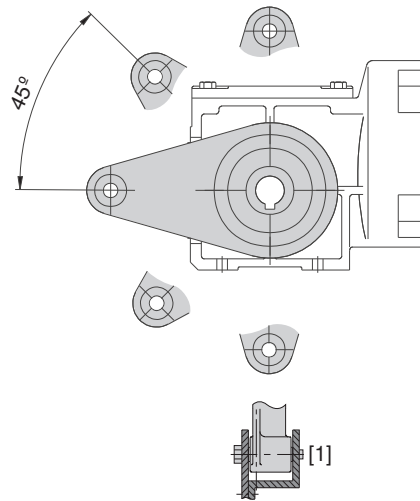
Proceed as follows:

1. Apply bearings to both sides of the bushing [1].
2. Use screws and tightening torques according to the following table:

Gear unit	Screws	Tightening torque $\pm 10\%$ Nm
S..37 /T	4 x M6 x 16 – 8.8	11
S..47 /T	4 x M8 x 25 – 8.8	25
S..57 /T	6 x M8 x 25 – 8.8	25
S..67 /T	4 x M12 x 35 – 8.8	86
S..77 /T	4 x M12 x 35 – 8.8	86
S..87 /T	4 x M16 x 45 – 8.8	210
S..97 /T	4 x M16 x 50 – 8.8	210

4.4.5 Mounting torque arms for SPIROPLAN® W gear units

The following figure shows the torque support for SPIROPLAN® W gear units.



9007199466230539

[1] Bushing

Proceed as follows:

1. Apply bearings to both sides of the bushing [1].
2. Use screws and tightening torques according to the following table:

Gear unit	Screws	Tightening torque $\pm 10\%$ Nm
W..10 /T	4 x M6 x 16 - 8.8	11
W..20 /T	4 x M6 x 16 - 8.8	11
W..30 /T	4 x M6 x 16 - 8.8	11
W..37 /T	4 x M8 x 20 - 8.8	25
W..47 /T	4 x M10 x 20 - 8.8	48

4.5 Shaft-mounted gear units with keyway or splined hollow shaft

INFORMATION

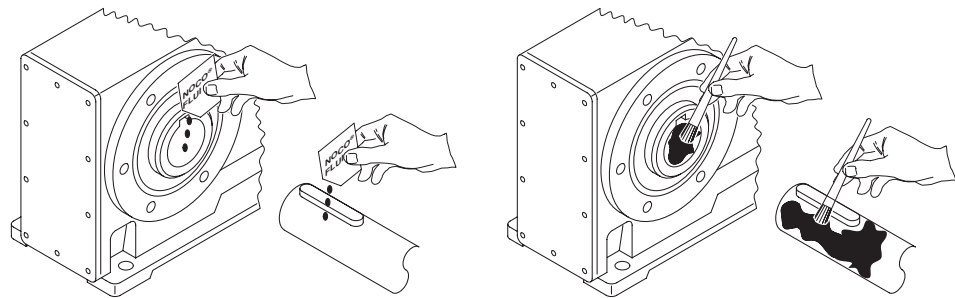


Concerning the configuration of the customer shaft, please also refer to the design notes in the "Gearmotors" catalog.

4.5.1 Mounting the shaft-mounted gear unit

Proceed as follows:

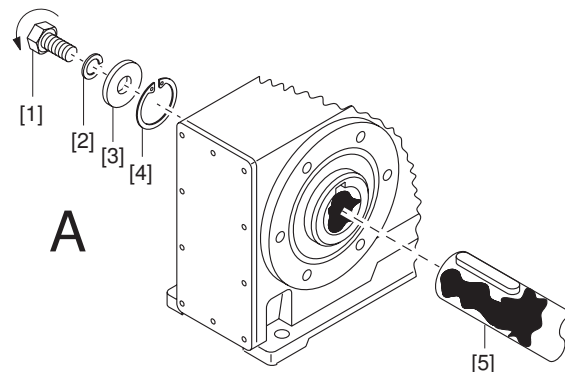
1. Apply NOCO® fluid. Spread carefully.



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2. Install the shaft and secure it axially. For easier mounting, use a mounting device. Following a description of the **3 mounting types**, depending on the scope of delivery.

- **Mount customer shaft (standard scope of delivery):**

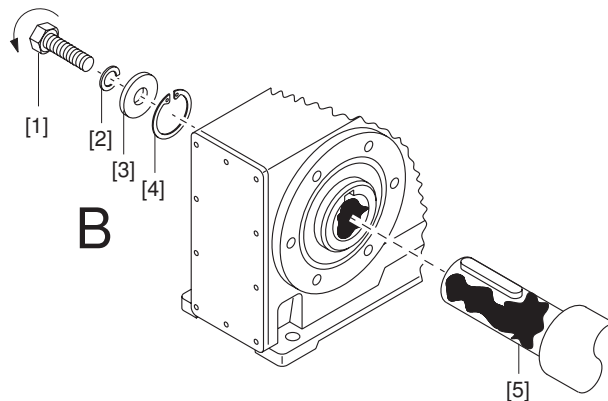


9007199466259339

- [1] Short retaining screw
(standard scope of delivery)
- [2] Lock washer

- [3] Washer
- [4] Retaining ring
- [5] Customer shaft

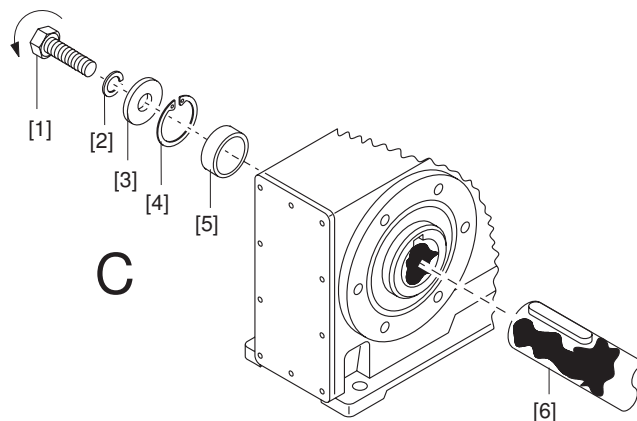
- **Mount customer shaft with contact shoulder using the SEW-EURODRIVE assembly/disassembly kit:**



9007199466261515

- | | | | |
|-----|-----------------|-----|--------------------------------------|
| [1] | Retaining screw | [4] | Retaining ring |
| [2] | Lock washer | [5] | Customer shaft with contact shoulder |
| [3] | Washer | | |

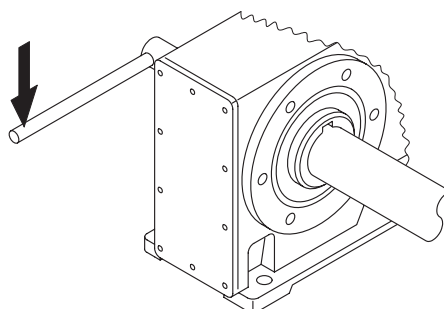
- **Mount customer shaft without contact shoulder using the SEW-EURODRIVE assembly/disassembly kit:**



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- | | | | |
|-----|-----------------|-----|---|
| [1] | Retaining screw | [4] | Retaining ring |
| [2] | Lock washer | [5] | Spacer tube |
| [3] | Washer | [6] | Customer shaft without contact shoulder |

3. Tighten the retaining screw to the appropriate torque. Observe the tightening torques specified in the following table.



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Screw	Tightening torque Nm
M5	5
M6	8
M10/12	20
M16	40
M20	80
M24	200

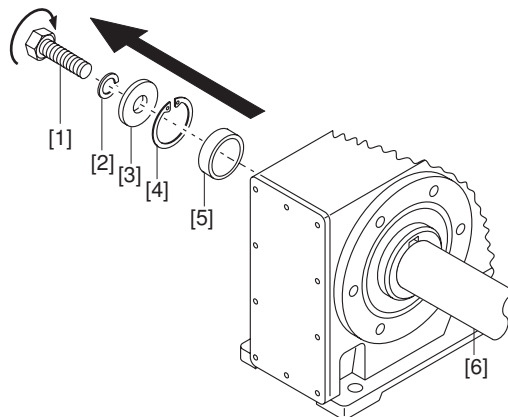
INFORMATION



To avoid contact corrosion, SEW-EURODRIVE recommends that the customer shaft should be lathed down between the 2 contact surfaces.

4.5.2 Remove the shaft-mounted gear unit

This description is only applicable when the gear unit was assembled using the SEW-EURODRIVE assembly/disassembly kit (see step 2 of "Mount the shaft-mounted gear unit" (→ 38)).



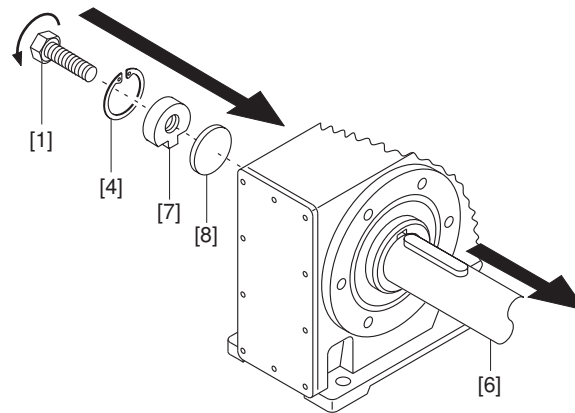
9007199466268043

- | | |
|---------------------|--------------------|
| [1] Retaining screw | [4] Retaining ring |
| [2] Lock washer | [5] Spacer tube |
| [3] Washer | [6] Customer shaft |

Proceed as follows:

1. Loosen the retaining screw [1].
2. Remove parts [2] to [4] and, if applicable, the spacer tube [5].
3. Insert the forcing washer [8] and the fixed nut [7] from the SEW-EURODRIVE assembly/disassembly kit between the customer shaft [6] and the retaining ring [4] (see "SEW-EURODRIVE assembly/disassembly kit" (→ 42)).

4. Re-install the retaining ring [4].
5. Re-install the retaining screw [1]. Press the gear unit off the shaft by tightening the screw.



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- | | | | |
|-----|-----------------|-----|----------------|
| [1] | Retaining screw | [7] | Fixed nut |
| [4] | Retaining ring | [8] | Forcing washer |
| [6] | Customer shaft | | |

4.5.3 Assembly/disassembly kit by SEW-EURODRIVE

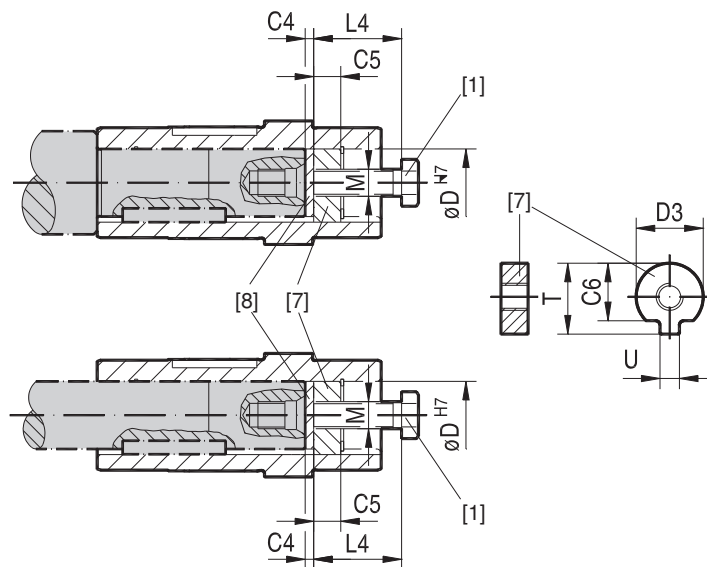
INFORMATION



The depicted assembly kit for attaching the customer shaft is a recommendation by SEW-EURODRIVE.

- You must always check whether this design can compensate the present axial loads.
- In particular applications (e.g. mounting agitator shafts), a different design may have to be used to secure the shaft axially. You can use your own devices to secure the shaft axially, if you ensure that these designs do not cause potential sources of combustion according to DIN EN 13463 (e.g. impact sparks).

The following figure shows the SEW-EURODRIVE assembly/disassembly kit.



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[1] Retaining screw

[8] Forcing washer

[7] Locked nut for removal

For the assembly/disassembly kit part numbers necessary to order, refer to the following table:

Gear unit type	D ^{H7} mm	M ¹⁾	C4 mm	C5 mm	C6 mm	U ^{-0.5} mm	T ^{-0.5} mm	D3 ^{-0.5} mm	L4 mm	Part number of the installation/ removal kit
WA..10	16	M5	5	5	12	4.5	18	15.7	50	643 712 5
WA..20	18	M6	5	6	13.5	5.5	20.5	17.7	25	643 682 X
KA..19, SA..37, WA..20, WA..30, WA..37,	20	M6	5	6	15.5	5.5	22.5	19.7	25	643 683 8
FA..27, KA..29, SA..47, WA..47,	25	M10	5	10	20	7.5	28	24.7	35	643 684 6
FA..37, KA..29, KA..37, KA..39, SA..47, SA..57, WA..47	30	M10	5	10	25	7.5	33	29.7	35	643 685 4
FA..47, KA..39, KA..47, KA..49, SA..57	35	M12	5	12	29	9.5	38	34.7	45	643 686 2
FA..57, FA..67, KA..49, KA..57, KA..67, SA..67	40	M16	5	12	34	11.5	41.9	39.7	50	643 687 0
SA..67	45	M16	5	12	38.5	13.5	48.5	44.7	50	643 688 9
FA..77, KA..77, SA..77	50	M16	5	12	43.5	13.5	53.5	49.7	50	643 689 7
FA..87, KA..87, SA..77, SA..87	60	M20	5	16	56	17.5	64	59.7	60	643 690 0
FA..97, KA..97, SA..87, SA..97	70	M20	5	16	65.5	19.5	74.5	69.7	60	643 691 9
FA..107, KA..107	80	M20	5	20	75.5	21.5	85	79.7	70	106 8211 2

Gear unit type	D ^{H7} mm	M ¹⁾	C4 mm	C5 mm	C6 mm	U ^{-0.5} mm	T ^{-0.5} mm	D3 ^{-0.5} mm	L4 mm	Part number of the installation/ removal kit
FA..107, KA..107, SA..97	90	M24	5	20	80	24.5	95	89.7	70	643 692 7
FA..127, KA..127	100	M24	5	20	89	27.5	106	99.7	70	643 693 5
FA..157, KA..157	120	M24	5	20	107	31	127	119.7	70	643 694 3

1) Retaining screw

4.6 Shaft-mounted gear unit with shrink disk

4.6.1 Mounting the shaft-mounted gear unit

NOTICE

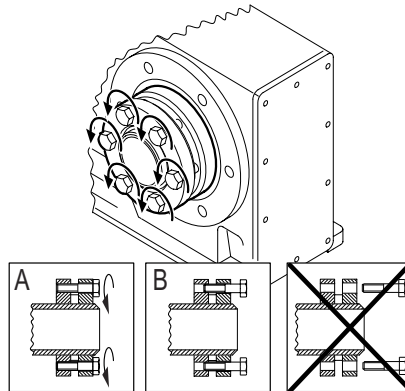
Deformation of the hollow shaft due to tightening the clamping screws without first installing the shaft.

Damages to the hollow shaft.

- Never tighten the screws without the shaft installed.

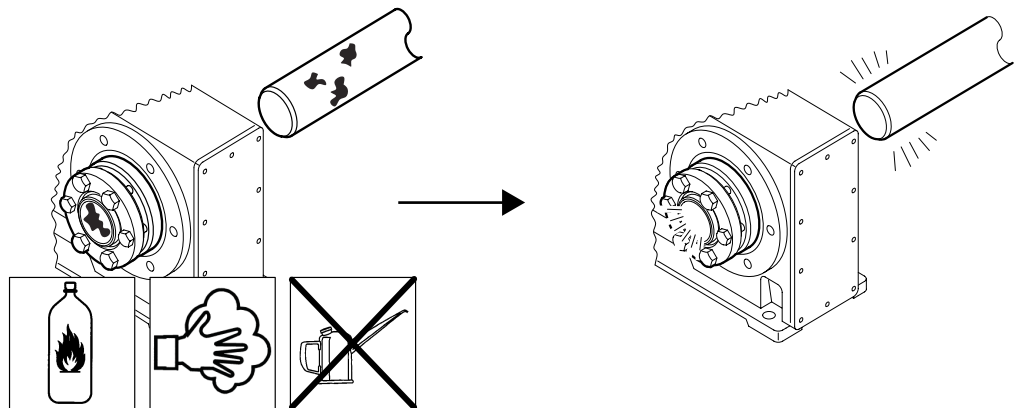
Proceed as follows:

1. Slightly loosen the locking screws. Do not remove the locking screws completely.



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2. Carefully **degrease** the hollow shaft bore and the input shaft using a commercial solvent.



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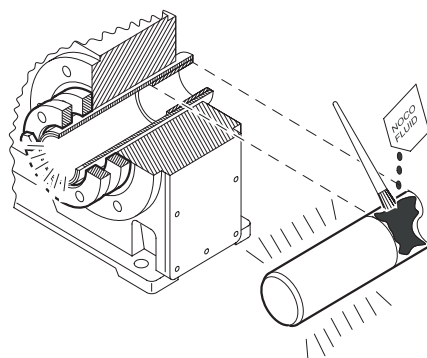
3. Only apply NOCO® fluid to the input shaft around the bushing.

NOTICE

The hollow shaft mounting system is without function if NOCO® fluid is applied directly to the bushing. When the input shaft is installed, NOCO® fluid can get into the clamping area of the shrink disk.

Possible damage to property

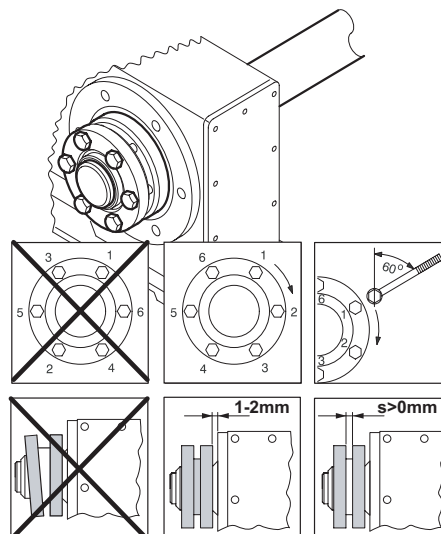
- Never apply NOCO® fluid directly to the bushing. The clamping area of the shrink disk must be absolutely free of grease.



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4. Install the input shaft. Proceed as follows:

- Make sure that the outer rings of the shrink disk are plane-parallel.
- In case of a gear unit housing with shaft shoulder, mount the shrink disk to stop at the shaft shoulder.
- In case of a gear unit without shaft shoulder, mount the shrink disk with a distance of 1 mm to 2 mm from the gear unit housing.
- Tighten the clamping screws with the specified tightening torque according to the following table. Tighten the screws in several turns. Tighten screws one after the other, not in diametrically opposite sequence.



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INFORMATION



The exact values for the tightening torques are shown on the shrink disk.

Gear unit type				Clamping screws 10.9 ISO 4014 / ISO 4017	Tightening torque Nm
KH19/29	FH27	SH37	WH37	M5	5
KH37/47/ 57/67/77	FH37/47/ 57/67/77	SH47/57/ 67/77	WH47	M6	12
KH87/97	FH87/97	SH87/97	—	M8	30
KH107	FH107	—	—	M10	59
KH127/157	FH127/157	—	—	M12	100
KH167				M16	250
KH187				M20	470

5. After installation, make sure the remaining gap "s" between the outer rings of the shrink disk is > 0 mm.
6. To prevent corrosion, grease the outside of the hollow shaft around the shrink disk.

4.6.2 Remove the shaft-mounted gear unit

Proceed as follows:

1. To prevent the outer rings from jamming, loosen the clamping screws for a quarter turn, one after the other.
2. Steadily loosen the clamping screws one after the other, but do not remove the clamping screws completely.
3. If rust has formed on the shaft in front of the hub, remove the rust.
4. Remove the shaft or pull the hub off the shaft.
5. Remove the shrink disk from the hub.

4.6.3 Cleaning and lubricating shaft-mounted gear units



INFORMATION

There is no need to dismantle removed shrink disks before they are reinstalled.

Proceed as follows:

1. If the shrink disk is dirty, clean and lubricate the shrink disk.
2. Lubricate the tapered surfaces. Use one of the following solid lubricants:

Lubricant (Mo S2)	Sold as
Molykote 321 (lube coat)	Spray
Molykote spray (powder spray)	Spray
Molykote G Rapid	Spray or compound
Aemasol MO 19P	Spray or compound
Aemasol DIO-sétral 57 N (lube coat)	Spray

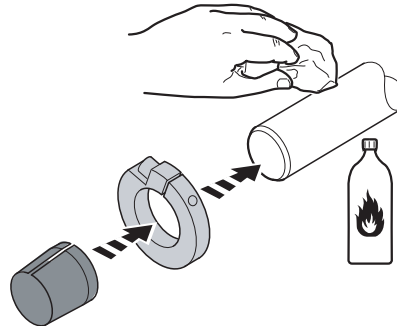
3. Grease the clamping screws with a multipurpose grease such as Molykote BR 2.

4.7 Shaft-mounted gear units with TorqLOC®

4.7.1 Mounting a customer shaft without contact shoulder

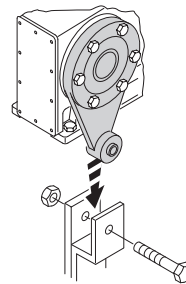
Proceed as follows:

1. Clean the customer shaft and the inside of the hollow shaft. Ensure that all traces of grease or oil are removed.
2. Install the stop ring and the bushing on the customer shaft.



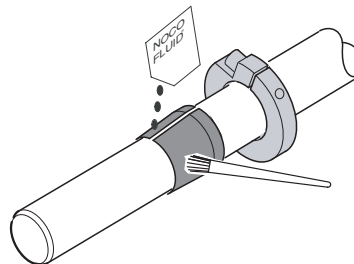
211941003

3. Attach the Torque arm to the drive unit. Note the information in chapter "Torque arm for shaft-mounted gear units" (→ 33).



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4. Apply NOCO® fluid to the bushing. Spread carefully.

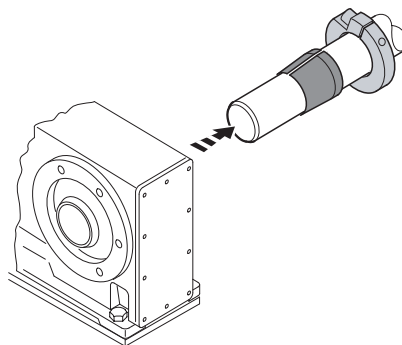


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4 Mechanical installation

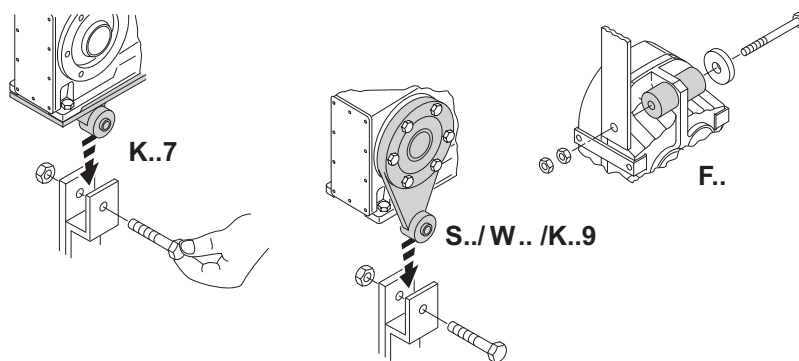
Shaft-mounted gear unit with TorqLOC

5. Push the gear unit onto the customer shaft.



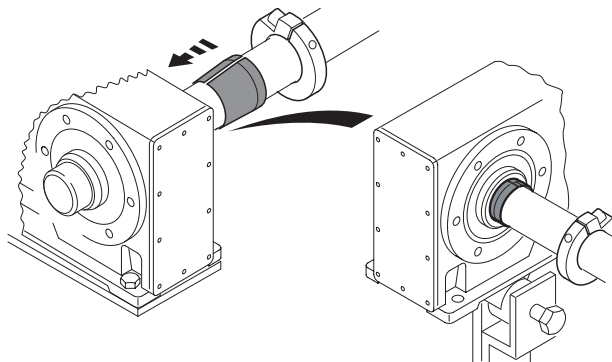
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6. Preassemble the torque arm. Do not firmly tighten the screws.



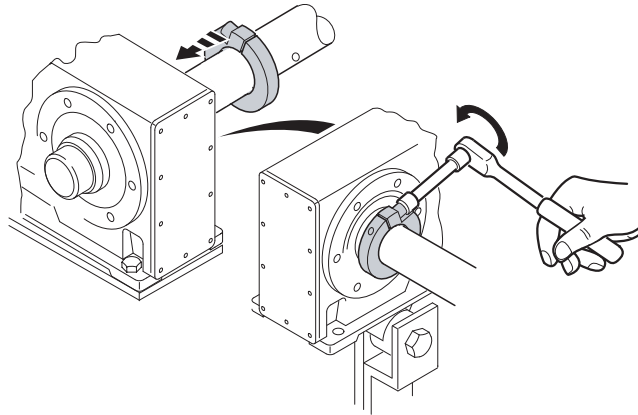
27021597976166155

7. Push the busing into the gear unit up to the stop.



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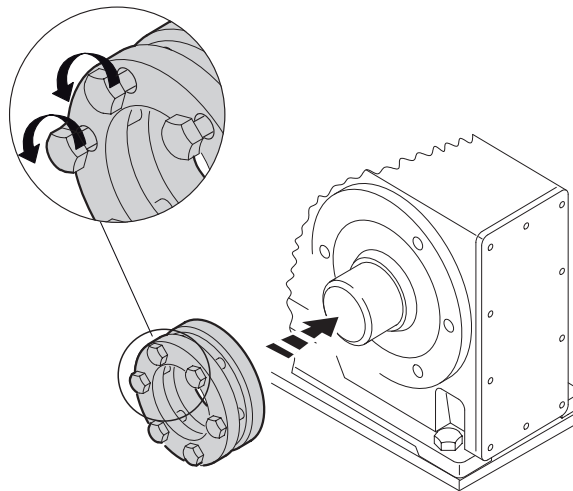
8. Secure the bushing with the stop ring. Attach the stop ring to the bushing with the respective tightening torque. Refer to the following table for the suitable tightening torque.



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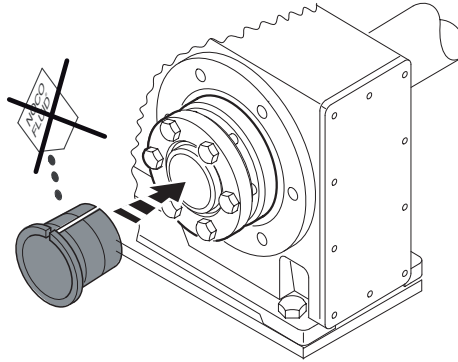
Type		Tightening torque Nm	
KT/FT	ST/WT	Nickel-plated (standard)	Stainless steel
–	37	10	10
37	47	10	10
39/47	57	10	10
49/57/67	67	25	25
77	77	25	25
87	87	25	25
97	97	25	25
107	–	38	38
127	–	65	65
157	–	150	150

9. Make sure that all screws are loosened and slide the shrink disk onto the hollow shaft.



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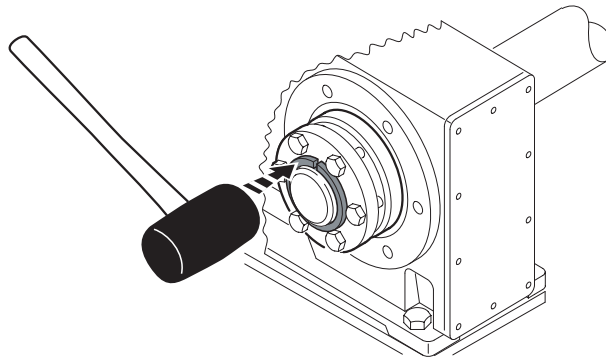
10. Slide the counter bushing onto the customer shaft and into the hollow shaft.



9007199466746251

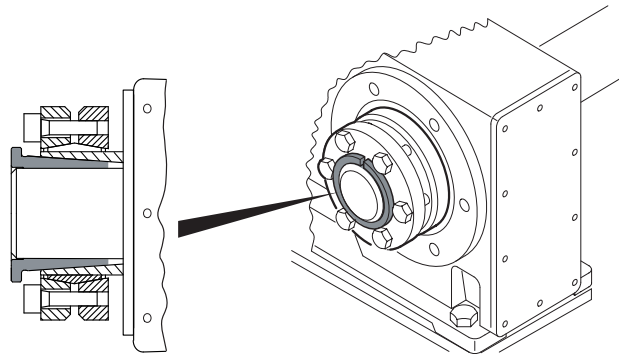
11. Until the shrink disk is properly seated.

12. Tap lightly on the flange of the counter bushing to ensure that the socket is fitted securely in the hollow shaft.



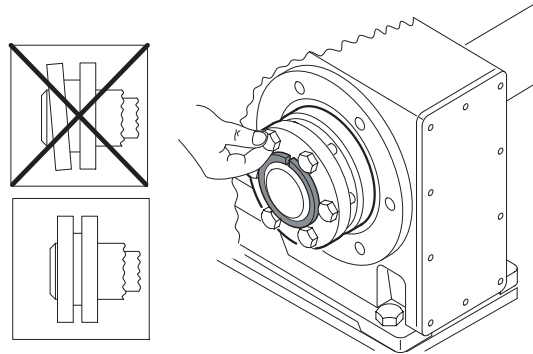
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13. Make sure that the customer shaft is seated in the counter bushing.



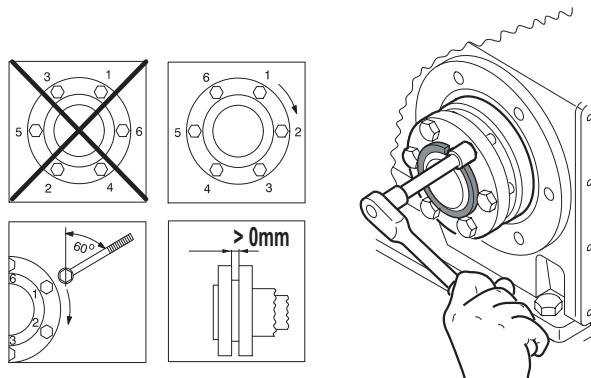
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14. Manually tighten the screws of the shrink disk. Make sure that the outer rings of the shrink disk are plane-parallel.



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15. Tighten the clamping screws with the specified tightening torque according to the following table. Tighten the screws by working round several times from one bolt to the next (not in diametrically opposite sequence).



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INFORMATION

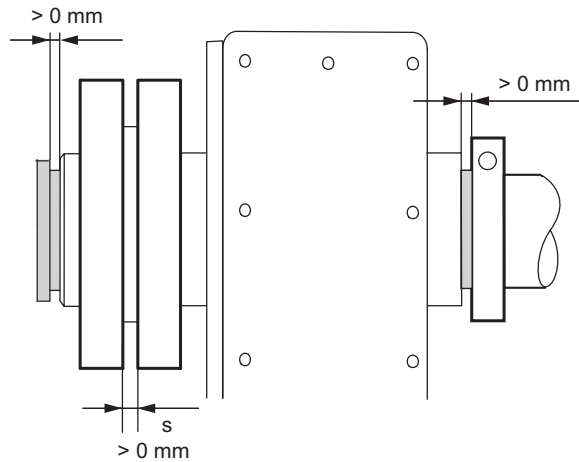


The exact values for the tightening torques are shown on the shrink disk.

Gear unit type				Clamping screws 10.9 ISO 4014 / ISO 4017	Tightening torque Nm	
					Nickel-plated (standard)	Stainless steel
–	–	ST37	WT37	M5	4	5
KT37	FT37	ST47	WT47	M6	12	12
KT39/47/ 49/57/67	FT47/57/67	ST57/67	–	M6	12	12
KT77/87/97	FT77/87/97	ST77/87/97	–	M8	30	30
KT107	FT107	–	–	M10	59	59
KT127	FT127	–	–	M12	100	100
KT157	FT157	–	–	M12	100	100

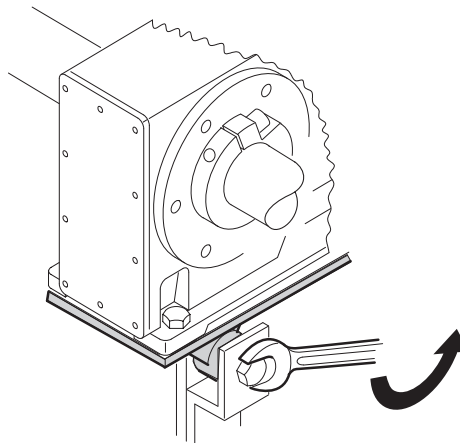
16. After mounting, make sure the remaining gap "s" between the outer rings of the shrink disk is > 0 mm.

17. Make sure, that the remaining gap between counter bushing and hollow shaft end, as well as between bushing and stop ring is > 0 mm.



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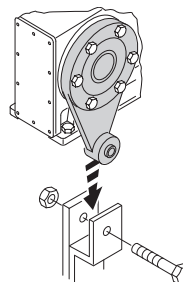
18. Tighten the torque arm. Note the information in chapter "Torque arm for shaft-mounted gear units" (→ 33).



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4.7.2 Installation notes for customer shaft with contact shoulder

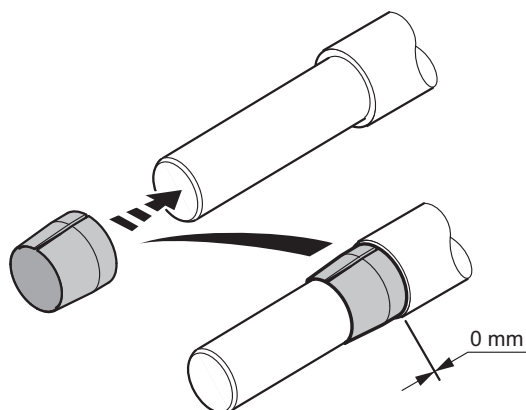
1. Clean the customer shaft and the inside of the hollow shaft. Ensure that all traces of grease or oil are removed.
2. Attach the Torque arm to the drive unit. Note the information in chapter "Torque arm for shaft-mounted gear units" (→ 33).



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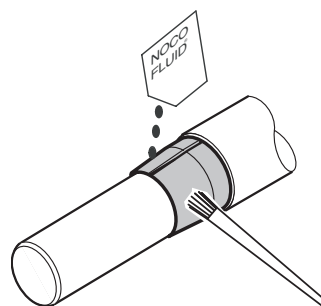
21932786/EN – 05/2015

3. Slide the bushing onto the customer shaft.



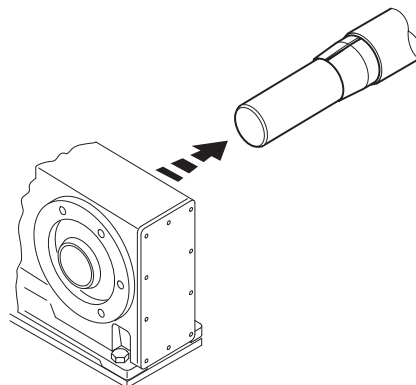
2349377035

4. Apply NOCO® fluid to the bushing. Spread carefully.



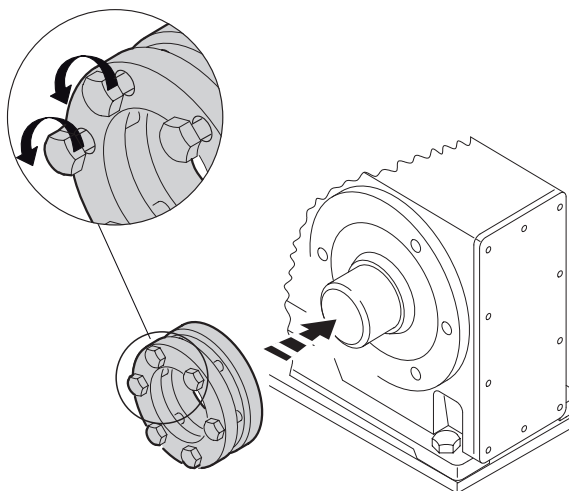
2349367435

5. Push the gear unit onto the customer shaft.



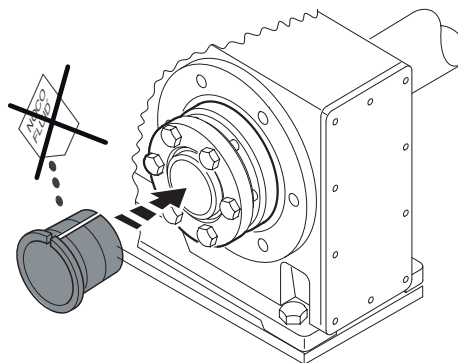
5129650443

6. Ensure that all screws have been loosened. Slide the shrink disk onto the hollow shaft.



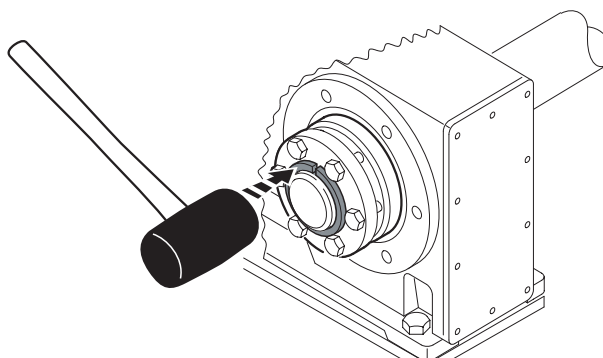
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7. Slide the counter bushing onto the customer shaft and into the hollow shaft.



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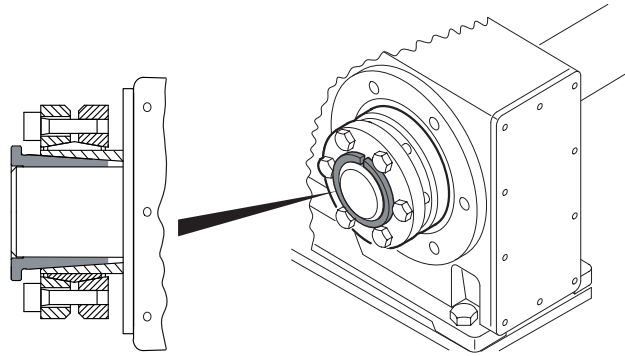
8. Until the shrink disk is properly seated.
9. Tap lightly on the flange of the counter bushing to ensure that the socket is fitted securely in the hollow shaft.



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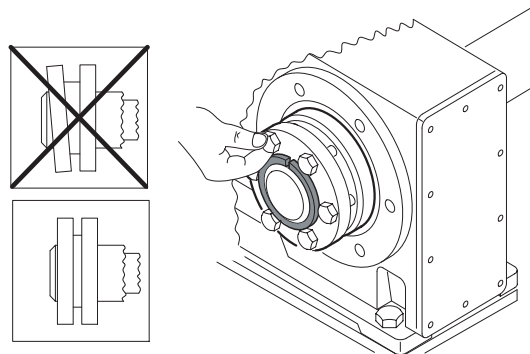
21932786/EN – 05/2015

10. Make sure that the customer shaft is seated in the counter bushing.



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11. Manually tighten the screws of the shrink disk. Make sure that the outer rings of the shrink disk are plane-parallel.



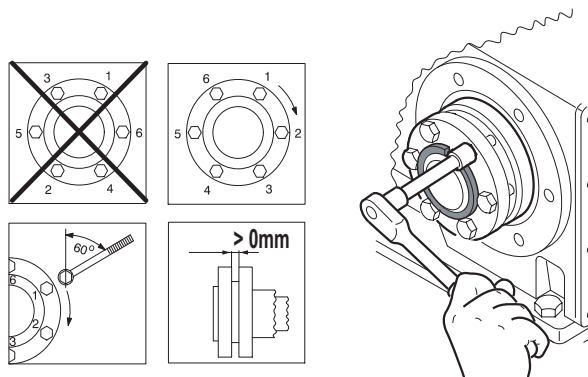
9007199466752779

12. Tighten the clamping screws with the specified tightening torque according to the following table. Tighten the screws by working round several times from one bolt to the next (not in diametrically opposite sequence).

INFORMATION



The exact values for the tightening torques are shown on the shrink disk.



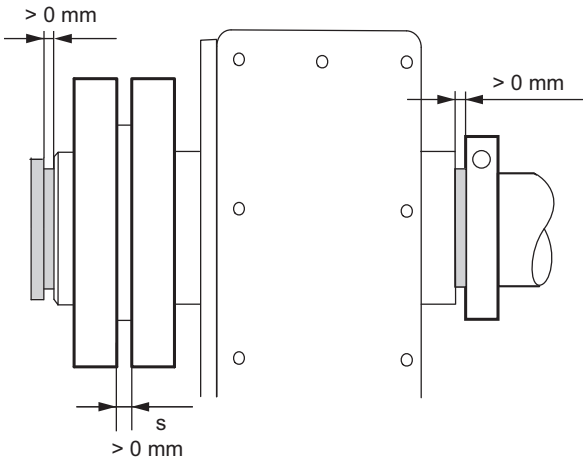
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4 Mechanical installation

Shaft-mounted gear unit with TorqLOC

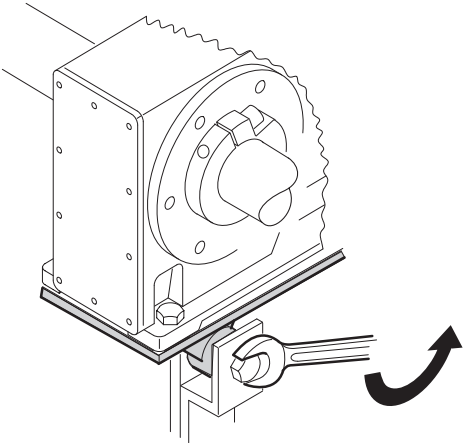
Gear unit type				Clamping screws 10.9 ISO 4014 / ISO 4017	Tightening torque in Nm	
					Nickel-plated (standard)	Stainless steel
-	-	ST37	WT37	M5	4	5
KT37	FT37	ST47	WT47	M6	12	12
KT39/47/49/ 57/67	FT47/57/67	ST57/67	-	M6	12	12
KT77/97	FT77/97	ST77/97	-	M8	30	30
KT107	FT107	-	-	M10	59	59
KT127	FT127	-	-	M12	100	100
KT157	FT157	-	-	M12	100	100

- 13.After the installation, make sure the remaining gap between the outer rings of the shrink disk is > 0 mm.
- 14.Make sure, that the remaining gap between counter bushing and hollow shaft end, as well as between bushing and stop ring is > 0 mm.



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- 15.Mount the torque arm and firmly tighten it. Note the information in chapter "Torque arm for shaft-mounted gear units" (→ 33).



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21932786/EN – 05/2015

4.7.3 Remove the shaft-mounted gear unit

▲ CAUTION



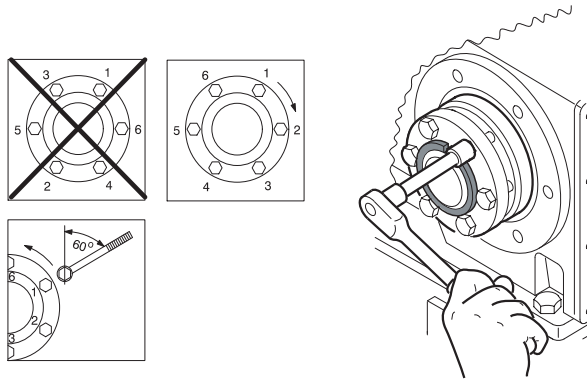
Risk of burns caused by hot surfaces

Severe injuries

- Let the units cool down before working on them.

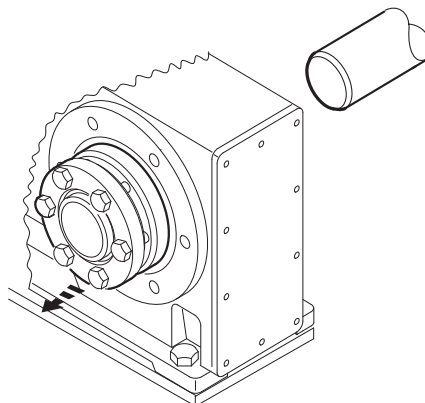
Proceed as follows:

1. To prevent the outer rings from jamming, loosen the clamping screws for a quarter turn, one after the other.



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2. Unscrew the clamping screws evenly one after the other. Do not remove the clamping screws completely.
3. Dismantle the conical steel bushing. If required, use the outer rings as pullers. Proceed as follows:
 - Remove all the locking screws.
 - Screw the respective number of screws in the tapped holes of the shrink disk.
 - Support the inner ring against the gear unit housing.
 - Pull off the conical steel bushing by tightening the screws.
4. Remove the gear unit from the shaft.



2903780235

5. Remove the shrink disk from the hub.

4.7.4 Cleaning and lubricating shaft-mounted gear units

There is no need to dismantle removed shrink disks before they are reinstalled.

- If the shrink disk is dirty, clean and lubricate the shrink disk.
- Lubricate the tapered surfaces with one of the following solid lubricants:

Lubricant (Mo S2)	Sold as
Molykote 321 (lube coat)	Spray
Molykote spray (powder spray)	Spray
Molykote G Rapid	Spray or compound
Aemasol MO 19P	Spray or compound
Aemasol DIO-sétral 57 N (lube coat)	Spray

- Grease the clamping screws with a multipurpose grease such as Molykote BR 2.

4.8 Mounting the cover

⚠ CAUTION

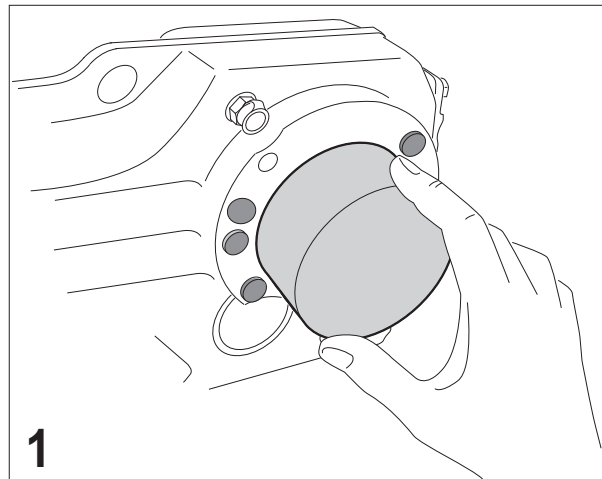


Injury due to assembly work during operation.

Injury

- Before you begin working on the unit, disconnect the motor from the power supply. Safeguard the drive against unintentional restart.

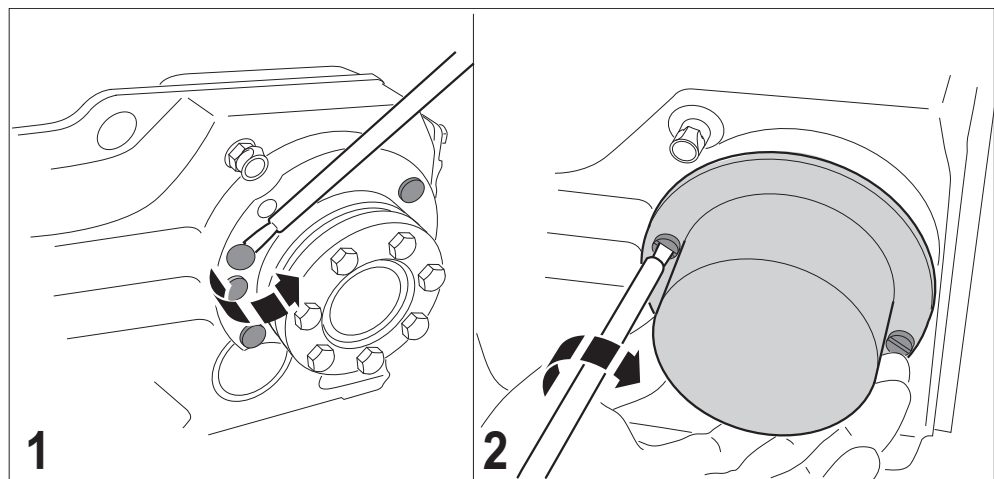
4.8.1 Mounting the rotating cover



662284299

1. Slide the rotating cover onto the shrink disk until it snaps in.

4.8.2 Mounting the fixed cover



18497547

1. To fasten the cover, remove the plastic plug on the gear unit housing (see figure 1)
2. Use the delivered screws to mount the cover to the gear unit housing (see figure 2).

4.8.3 Operation without cover

In certain application cases, e.g. with a through-shaft, a cover cannot be installed. The cover is not necessary if the system or unit manufacturer provides corresponding components to guarantee for compliance with the required degree of protection. If this results in additional maintenance, the manufacturer has to describe this in the operating instructions for the system or component.

4.9 Coupling of AM adapters

4.9.1 Mounting the IEC adapter AM63 – 280/NEMA adapter AM56 – 365

NOTICE

Damage to adapter due to ingress of moisture when mounting a motor to the adapter.

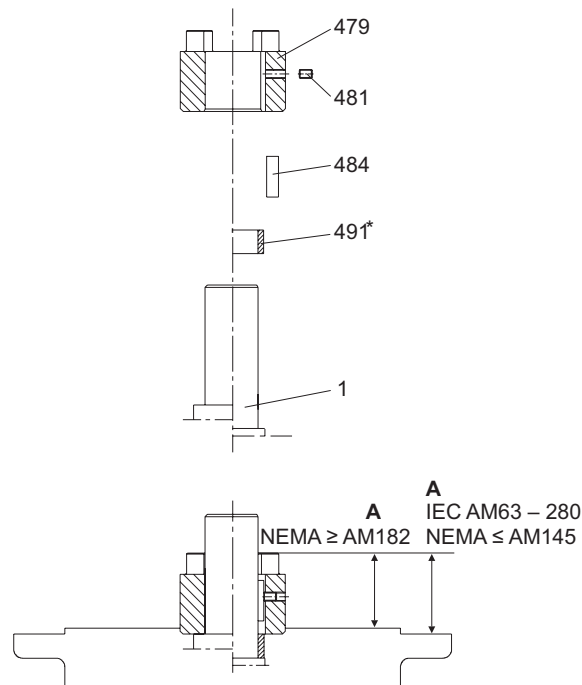
Damage to the adapter

- Seal the adapter with an anaerobic fluid seal.

INFORMATION



To avoid contact corrosion, SEW-EURODRIVE recommends to apply NOCO® fluid to the motor shaft before mounting the coupling half.



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[1]	Motor shaft	[484]	Key
[479]	Coupling half	[491]	Spacer tube
[481]	Set screw		

Proceed as follows:

1. Clean the motor shaft and flange surfaces of the motor and the adapter.
2. Remove the key from the motor shaft. Replace the key from the motor shaft with the supplied key [484] (not AM63 and AM250).
3. Heat the coupling half [479] to approx. 80 °C – 100 °C and push the coupling half onto the motor shaft. Position as follows:
 - IEC adapter AM63 – 225 until stop at motor shaft shoulder.
 - IEC adapter AM250 – 280 to distance "A". The values for the distance "A" are listed in the following table.
 - NEMA adapter with spacer tube [491] to distance "A." The values for the distance "A" are listed in the following table.

4. Secure the key and coupling half using the set screw [481] on the motor shaft. Refer to the following table for the required tightening torque " T_A ".
5. Check the position of the coupling half. The values for the distance "A" are listed in the following table.
6. Seal the contact surfaces between the adapter and motor using a suitable sealing compound.
7. Mount the motor on the adapter. Ensure that the coupling claws of the adapter shaft are engaged in the plastic cam ring.

IEC AM	63/71	80/90	100/112	132	160/180	200	225	250/280
A	24.5	31.5	41.5	54	76	78.5	93.5	139
T_A	1.5	1.5	4.8	4.8	10	17	17	17
Thread	M4	M4	M6	M6	M8	M10	M10	M10
NEMA AM	56	143/145	182/184	213/215	254/256	284/286	324/326	364/365
A	46	43	55	63.5	78.5	85.5	107	107
T_A	1.5	1.5	4.8	4.8	10	17	17	17
Thread	M4	M4	M6	M6	M8	M10	M10	M10

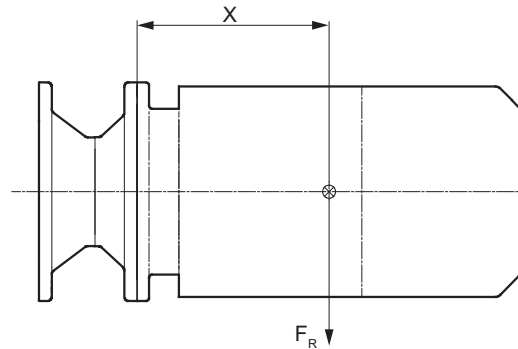
4.9.2 Permitted loads

NOTICE

Damages to gear unit due to impermissibly high loads when mounting a motor.

Damage to gear unit

- Note that the load data specified in the following table are not to be exceeded.



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- ⊗ Motor's center of gravity
- X Distance from adapter flange to the middle of the motor
- F_R Overhung load

Permitted loads for gear unit series R..7, F..7, K..7, K..9, and S..7:

Adapter type		x ¹⁾ in mm	F _R ¹⁾ in N	
IEC	NEMA		IEC adapter	NEMA adapter
AM63/71	AM56	77	530	410
AM80/90	AM143/145	113	420	380
AM100/112	AM182/184	144	2000	1760
AM132 ²⁾	AM213/2152 ²⁾	186	1600	1250
AM132..	AM213/215		4700	3690
AM160/180	AM254/286	251	4600	4340
AM200/225	AM324-AM365	297	5600	5250
AM250/280	-	390	11200	—

1) As the center of gravity distance x increases, the maximum permitted weight of the attached motor F_{R_max} must be reduced linearly. If this center of gravity distance x is reduced, the maximum permitted weight F_{R_max} cannot be increased.

2) Diameter of the adapter output flange: 160 mm

Permitted loads for gear unit series SPIROPLAN® W37 – W47

Adapter type			$F_R^{1)}$ in N	
IEC	NEMA	$x^1)$ in mm	IEC adapter	NEMA adapter
AM63/71	AM56	115	140	120
AM80/90	AM143/145	151	270	255

- 1) As the center of gravity distance x increases, the maximum permitted weight of the attached motor F_{R_max} must be reduced linearly. If this center of gravity distance x is reduced, the maximum permitted weight F_{R_max} cannot be increased.

4.9.3 AM adapter with AM../RS backstop

Check the direction of rotation of the drive prior to assembly or startup. In case of a wrong direction of rotation, contact SEW-EURODRIVE.

The backstop is maintenance-free in operation. Backstops have a minimum lift-off speed depending on the size (see following table).

NOTICE

If the speed is below the minimum lift-off speed of the drive, the backstop is subject to wear and heats up.

Possible damage to property.

- In nominal operation the lift-off speed of the drive must not drop below the specified minimum.
- During startup or braking, the lift-off speed of the drive may drop below the minimum levels.

Type	Maximal locking torque of the back-stop in Nm	Minimum lift-off speed in 1/min
AM80/90/RS, AM143/145/RS	65	820
AM100/112/RS, AM182/184/RS	425	620
AM132/RS, AM213/215/RS	850	530
AM160/180/RS, AM254/286/RS	1450	480
AM200/225/RS, AM324-365/RS	1950	450
AM250/280/RS	1950	450

4.10 AQ. adapter coupling

4.10.1 Mount adapter AQA80 – 190 (with keyway)/Adapter AQH80 – 190 (without keyway)

NOTICE

Damage to adapter due to ingress of moisture when mounting a motor to the adapter.

Damage to the adapter

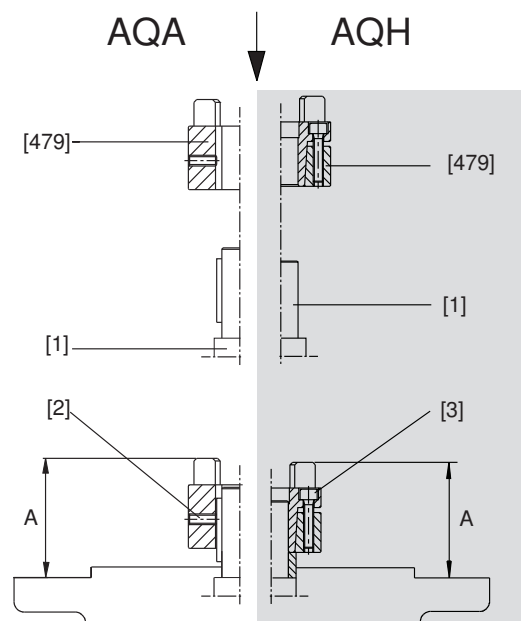
- Seal the adapter with an anaerobic fluid seal.

INFORMATION



For AQA: To avoid contact corrosion, SEW-EURODRIVE recommends to apply NO-CO® fluid to the motor shaft before mounting the coupling half.

For AQH: Using NOCO® fluid is not approved.



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- | | |
|-----------------|---------------------|
| [1] Motor shaft | [479] Coupling half |
| [2] Lock washer | [5] Spacer tube |
| [3] Washer | [6] Customer shaft |

Proceed as follows:

1. Clean the motor shaft and flange surfaces of the motor and the adapter.
2. **Design AQH:** Loosen the screws of the coupling half [479] and loosen the conical connection.
3. **AQA/AQH design:** Heat the coupling half to approx. 80 °C – 100 °C and push the coupling half onto the motor shaft until distance "A". The values for the distance "A" are listed in the table in chapter "Setting standards and tightening torques (→ 66)".
4. **Design AQH:** Tighten the screws of the coupling half evenly in diametrically opposite sequence, working around several times. The values for the tightening torque "T_A" are listed in the table in chapter "Setting standards and tightening torques (→ 66)".

5. **AQA design:** Secure the coupling half using the set screw (see figure).
6. Check the position of the coupling half. The values for the distance "A" are listed in the table in chapter "Setting standards and tightening torques (→ 66)".
7. Mount the motor onto the adapter, making sure that the claws of the two coupling halves engage in each other.
 - ⇒ The force that must be applied when joining the two coupling halves is dissipated after final assembly, so there is no risk of any axial load being applied to adjacent bearings.

4.10.2 Setting standards and tightening torques

Type	Coupling size	Distance A mm	Screws		Tightening torque T _A Nm	
			AQA	AQH	AQA	AQH
AQA /AQH 80 /1 /2 /3	19	44.5	M5	6 x M4	2	4.1
AQA /AQH 100 /1 /2		39				
AQA /AQH 100 /3 /4		53				
AQA /AQH 115 /1 /2		62				
AQA /AQH 115 /3	24	62	M5	4 x M5	2	8.5
AQA /AQH 140 /1 /2		62				
AQA /AQH 140 /3 /4	28	74.5	M8	8 x M5	10	8.5
AQA /AQH 160 /1		74.5				
AQA /AQH 190 /1 /2		76.5				
AQA /AQH 190 /3	38	100	M8	8 x M6	10	14

4.10.3 Permitted loads



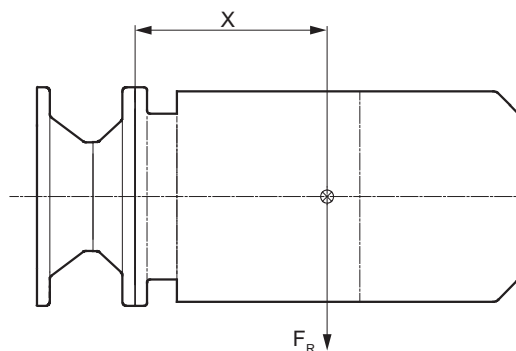
⚠ CAUTION

Impermissibly high loads may occur when mounting a motor.

Possible damage to property.

- The load data specified in the following table are not to be exceeded.

The following figure shows the permitted force application points for the permitted maximum weights:



- ⊗ Motor's center of gravity
- X Distance from adapter flange - motor center

F_R Overhung load

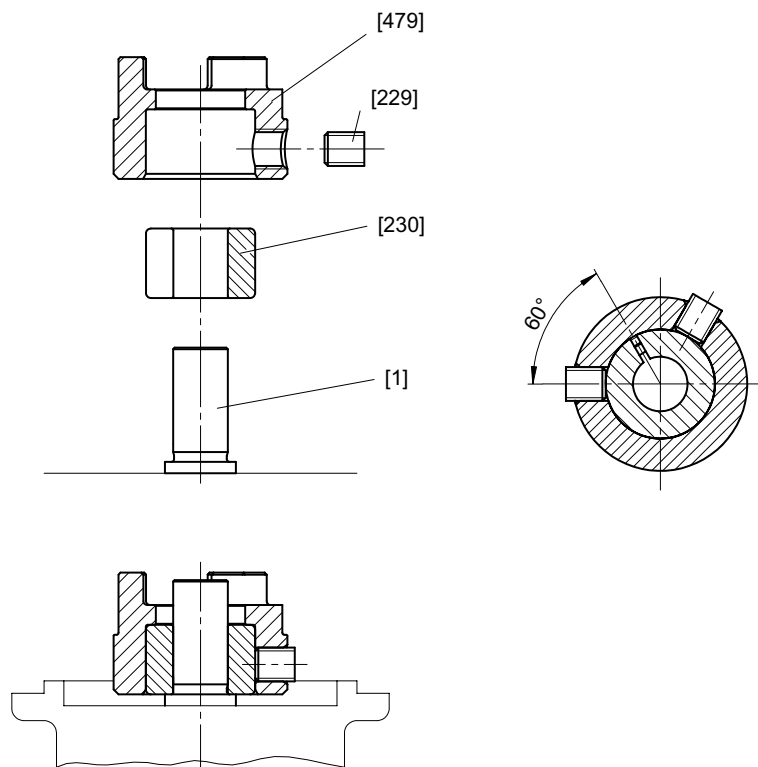
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Type	$x^{1)}$ mm	$F_R^{1)}$ N
AQ80	77	370
AQ100/1/2	113	350
AQ100/3/4	113	315
AQ115	113	300
AQ140/1/2	144	1550
AQ140/3	144	1450
AQ160	144	1450
AQ190/1/2; Flange Ø: 160	186	1250
AQ190/3; Flange Ø: 160	186	1150
AQ190/1/2	186	3750
AQ190/3	186	3400

- 1) Maximum load values for connection screws of strength class 8.8. As the center of gravity distance x increases, the maximum permitted weight of the attached motor F_{R_max} must be reduced linearly. As the center of gravity distance x decreases, the maximum permitted weight F_{R_max} must not be increased.

4.11 EWH adapters

4.11.1 Adapter EWH01 – 03



4557485195

[1]	Motor shaft	[230]	Motor shaft sleeve
[229]	Clamping screws	[479]	Coupling half

1. Clean and de-grease the hollow shaft hole of the coupling half [479], the motor shaft sleeve [230], and the motor shaft [1].
2. Insert the motor shaft sleeve [230] into the coupling half [479] so that the slot of the motor shaft sleeve [230] is at a 60° angle to the two clamping screws [229].
3. Push the coupling half [479] on the shoulder of the motor shaft to the stop.
4. Tighten the clamping screws [229] one after the other with a suitable torque wrench, first to 25% of the tightening torque specified in the following table.
5. Tighten the two clamping screws [229] to the full specified tightening torque.

Adapter type	Motor shaft diameter in mm	Number of clamping screws	Tightening torque of the clamping screw in Nm	Wrench size in mm
EWH01	9	2	5.6	3
EWH01	11	2	10	4
EWH02	11; 14; 16	2	10	4
EWH03	11; 14; 16	2	10	4

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4.11.2 Permitted loads

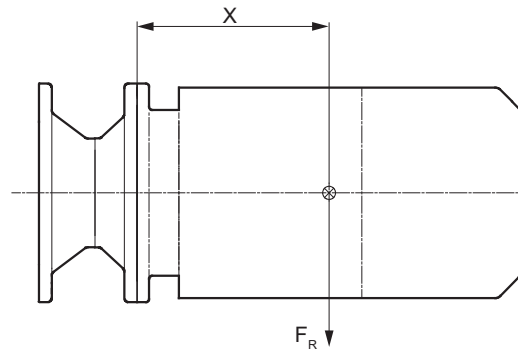
NOTICE

Impermissibly high loads may occur when mounting a motor.

Possible damage to property.

- The load data specified in the following table are not to be exceeded.

The following figure shows the permitted force application points for the permitted maximum weights:



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- ⊗ Motor's center of gravity F_R Overhung load
X Distance from adapter flange to the middle of the motor

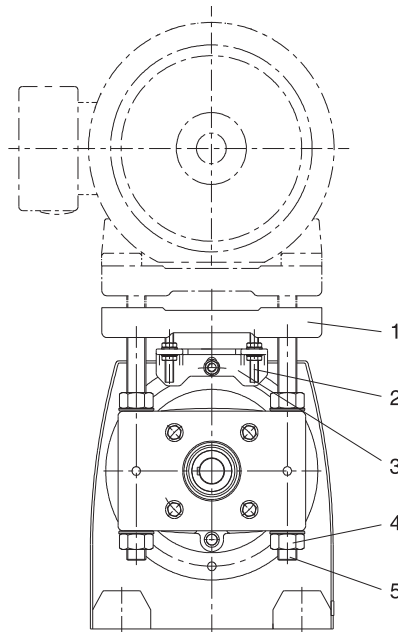
Type	$x^{1)}$ mm	$F_R^{1)}$ N
EWH01	113	40
EWH02	120	56
EWH03	120	56

- 1) Maximum load values for connection screws of strength class 8.8. As the center of gravity distance x increases, the maximum permitted weight of the attached motor F_{R_max} must be reduced linearly. As the center of gravity distance x decreases, the maximum permitted weight F_{R_max} must not be increased.

4.12 AD Input shaft assembly

Observe section "Mounting the input and output components" (→ 31) when installing input components.

4.12.1 Mounting the cover with motor platform AD../P



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- | | |
|--|---------------------|
| [1] Motor platform | [4] Nut |
| [2] Threaded bolt (only AD6/P / AD7/P) | [5] Threaded column |
| [3] Support (only AD6/P / AD7/P) | |

To mount the motor and to adjust the motor platform proceed as follows:

1. Set the motor platform [1] to the required mounting position by evenly tightening the adjusting nuts [4].
2. If necessary, remove the eyebolt/lifting eye of the helical gear unit to reach the lowest adjustment position. Touch up any damage to the paint work.
3. Align the motor on the motor platform [1], so that the shaft ends are in line. Attach the motor.
4. Mount the drive component onto the input side shaft end and the motor shaft.
5. Align drive component, shaft end and motor shaft. If necessary correct the motor position again.
6. Put on the traction elements (V-belt, chain, etc.) and apply a preload by evenly adjusting the motor platform [1]. Do not stress the motor platform and the columns against each other when doing this.
7. To fasten the threaded columns [5] tighten the nuts [4] that are not used for adjustment.

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4.12.2 Special aspects of AD6/P and AD7/P

Proceed as follows:

1. Unscrew the nuts on the threaded bolts [2] before adjustment, to allow the threaded bolts [2] to move axially in the support [3] without restriction.
2. Only tighten the nuts, when the final adjustment position is reached.

INFORMATION

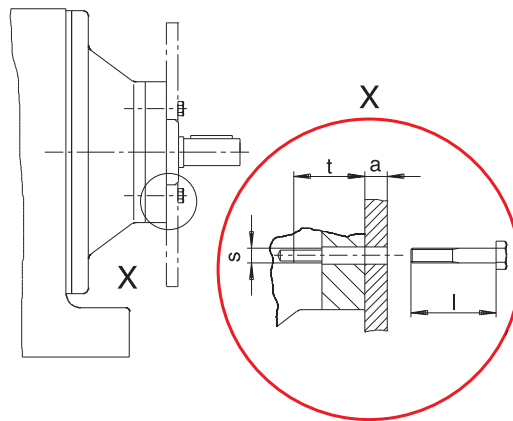


Do not adjust the motor platform [1] via the support [3].

4.12.3 AD../ZR input shaft assembly with centering shoulder

Mounting applications on the input shaft assembly with centering shoulder.

1. Prepare screws of a suitable length for attaching the application. The following figure shows the screw length $l = t + a$. **Round off the result to the next smaller standard length.**



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- a Thickness of the application s Retaining thread (see table)
t Screw-in depth (see table)

2. Remove the retaining screw from the centering shoulder.
3. Clean the contact surface and the centering shoulder.
4. Clean the threads of the new screws and apply a threadlocker compound (e.g. Loctite® 243) to the first few threads.
5. Place the application on the centering shoulder. Tighten the retaining screws with the specified tightening torque " T_A " (see table).

Type	Screw-in depth t mm	Retaining thread s	Tightening torque T_A for connection screws of strength class 8.8 Nm
AD2/ZR	25.5	M8	25
AD3/ZR	31.5	M10	48
AD4/ZR	36	M12	86
AD5/ZR	44	M12	86
AD6/ZR	48.5	M16	210

4 Mechanical installation

AD Input shaft assembly

Type	Screw-in depth t mm	Retaining thread s	Tightening torque T_A for connection screws of strength class 8.8 Nm
AD7/ZR	49	M20	410
AD8/ZR	42	M12	86

Permitted loads

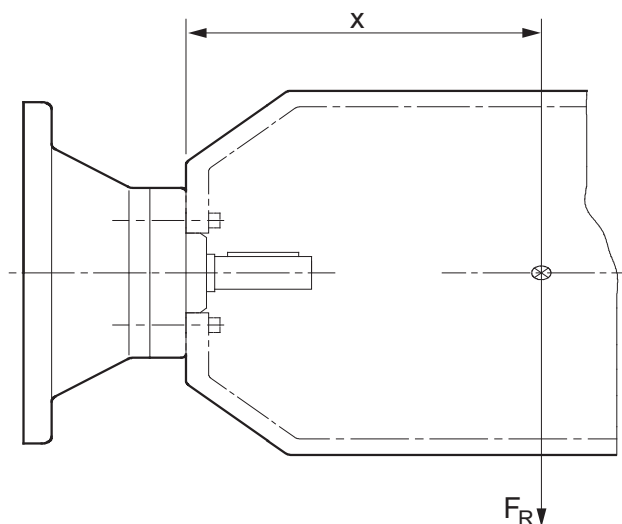
NOTICE

Damage to gear unit due to impermissibly high loads when mounting a motor.

Damage to gear unit

- Note that the load data specified in the following table are not to be exceeded.

The following figure shows the permitted force application points for the permitted maximum weights:



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- ⊗ Motor's center of gravity F_R Overhung load
 X Distance from adapter flange to the middle of the motor

Type	$x^{1)}$ mm	$F_R^{1)}$ N
AD2/ZR	193	330
AD3/ZR	274	1400
AD4/ZR ²⁾	361	1120
AD4/ZR		3300
AD5/ZR	487	3200
AD6/ZR	567	3900
AD7/ZR	663	10000

21932786/EN – 05/2015

Type	$x^{1)}$ mm	$F_R^{1)}$ N
AD8/ZR	516	4300

- 1) Maximum load values for connection screws of strength class 8.8. As the center of gravity distance x increases, the maximum permitted weight of the attached motor $F_{R_{max}}$ must be reduced linearly. As the center of gravity distance x decreases, the maximum permitted weight $F_{R_{max}}$ must not be increased.
- 2) Diameter of the adapter output flange: 160 mm

4.12.4 Cover with backstop AD../RS

Check the direction of rotation of the drive prior to assembly or startup. In case of a wrong direction of rotation, contact SEW-EURODRIVE.

The backstop is maintenance-free in operation. Backstops have a minimum lift-off speed depending on the size (see following table).

NOTICE

If the speed is below the minimum lift-off speed of the drive, the backstop is subject to wear and heats up.

Possible damage to property.

- In nominal operation the lift-off speed of the drive must not drop below the specified minimum.
- During startup or braking, the lift-off speed of the drive may drop below the minimum levels.

Type	Maximum locking torque of the backstop Nm	Minimum lift-off speed 1/min
AD2/RS	65	820
AD3/RS	425	620
AD4/RS	850	530
AD5/RS	1450	480
AD6/RS	1950	450
AD7/RS	1950	450
AD8/RS	1950	450

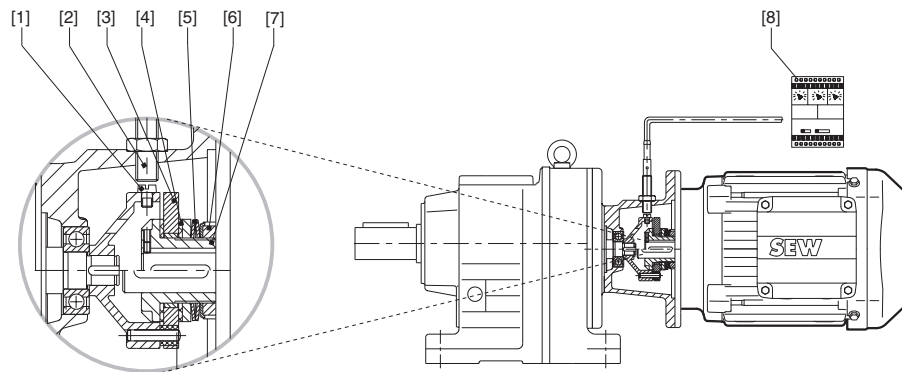
4.13 Accessory equipment

4.13.1 AR.. and AT.. centrifugal and friction couplings

AR.. friction coupling

Drives with a slip clutch consist of a standard gear unit and motor/variable speed gear-motor with an adapter installed between them. This adapter accommodates the slip clutch. In gearmotors with a double gear unit, the slip clutch may be located between the first and second gear units. On delivery, the slip torque is set individually according to the drive selection.

The following figure shows a drive with slip clutch and W speed monitor:



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- | | | |
|-------------------------|---------------------|-------------------|
| [1] Trip cam | [4] Friction lining | [7] Friction hub |
| [2] Incremental encoder | [5] Cup spring | [8] Speed monitor |
| [3] Driving disk | [6] Slotted nut | |

W speed monitor:

The speed monitor is used with constant-speed gearmotors and is connected to the incremental encoder in the adapter.

WS slip monitor:

The slip monitor is used with the following components:

- Speed-controlled motors with speed sensor
- VARIGEAR® variable-speed gear units

INFORMATION



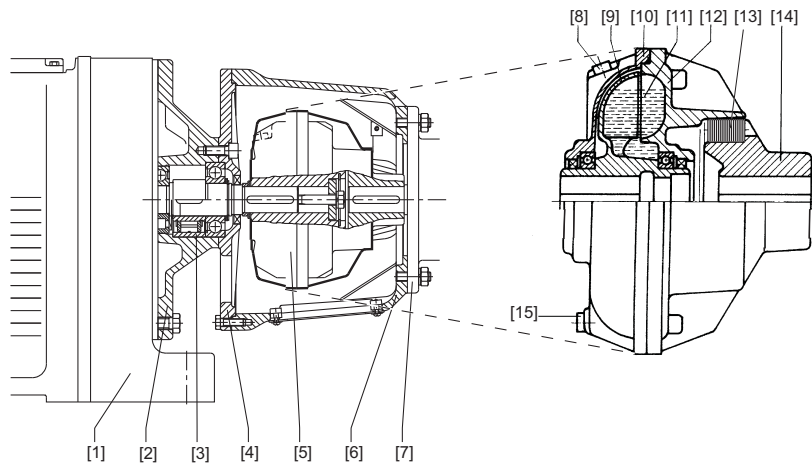
For further information about the AR.. coupling, refer to the "Start-up coupling and slip clutch AR.. and AT.." operating instructions.

AT.. hydraulic centrifugal coupling

Hydraulic centrifugal couplings are fluid couplings based on the Föttinger principle. They consist of 2 hinged hemispheres with blades separated by a tight gap.

The applied torque is transmitted by the inertial force of the streaming fluid. This fluid circulates within a closed circuit, between the pump wheel (primary side) [12] on the driving shaft (motor shaft) and the turbine wheel (secondary side) [9] on the driven shaft (gear unit input shaft).

The following figure shows the structure of a drive with hydraulic centrifugal coupling:



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- | | | |
|---------------------------|-------------------------------|--------------------------------------|
| [1] Gear unit | [6] Extended housing complete | [11] Operating fluid (hydraulic oil) |
| [2] Basic flange complete | [7] Motor | [12] Pump wheel |
| [3] Backstop (optional) | [8] Filler plug | [13] Elastic components |
| [4] Intermediate flange | [9] Turbine wheel | [14] Flexible connection coupling |

INFORMATION



For detailed information about the AT.. coupling, refer to the "Start-up coupling and slip clutch AR.. and AT.." operating instructions.

4.13.2 Diagnostic units DUV and DUO

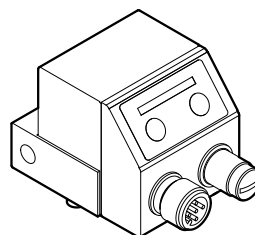
Diagnostic unit DUV

The DUV30A diagnostic unit evaluates vibration signals using frequency analysis methods. A micromechanical acceleration sensor is used in the unit. Data can be recorded, processed and evaluated locally without any expert knowledge.

The DUV30A diagnostic unit is suitable for early recognition of rolling bearing damage or imbalance. The continuous monitoring function represents a reliable and cost-effective solution compared to intermittent methods.

The DUV30A has been designed as a combined sensor that can be used as normal-speed unit or slow-speed unit. The only difference is the measuring time in the firmware and the resulting frequency range.

The following figure depicts the diagnostic unit DUV30A:



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INFORMATION



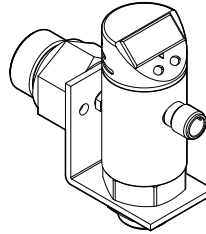
For further information on the evaluation unit, refer to the manual "DUV30A Diagnostic Unit".

Diagnostic unit DUO

DUO10A comprises a diagnostic unit and a temperature sensor. The temperature sensor (PT100 or PT1000 resistance sensor) is positioned in the gear unit oil to record the oil's temperature. The diagnostic unit uses the oil temperature values to calculate the remaining service life of the oil.

The diagnostic unit continuously records the gear unit temperature and calculates the remaining service life for the selected oil type immediately. For this purpose, the diagnostic unit must be supplied with a 24 V voltage supply. Times when the diagnostic unit is switched off are not included in the forecast.

The following figure shows the DUO10A diagnostic unit:



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INFORMATION



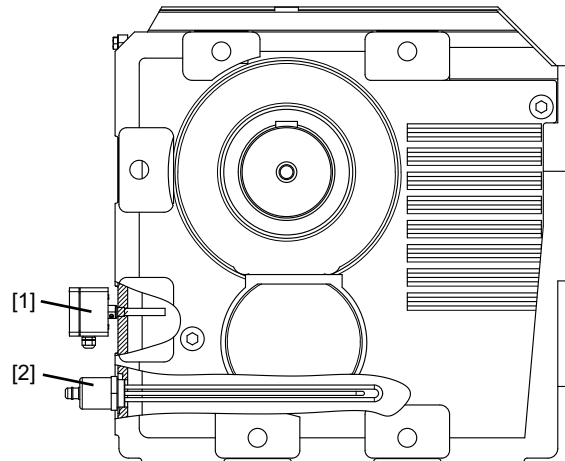
For further information on the evaluation unit, refer to the manual "DUV30A Diagnostic Unit".

4.13.3 Gear unit heater for gear unit series R..7, F..7, and K..7

An oil heating can be required in order to allow for a smooth startup in the event of a cold start at low ambient temperatures. An oil heating is available with an external or an integrated thermostat depending on the gear unit design.

The heater is screwed into the gear unit housing and is controlled via a thermostat. The limit temperature of the thermostat below which the oil must be heated, is set depending on the respective lubricant.

The following figure shows a gear unit with heater and external thermostat:



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[1] Thermostat

[2] Heater

INFORMATION



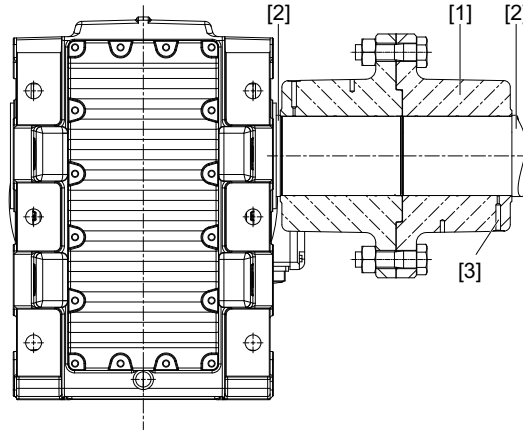
For further information regarding gear unit heaters, refer to the addendum "Gear unit heaters for gear unit series R..7, F..7 and K..7" to the operating instructions "Gear unit series R..7, F..7, K..7, K..9, S..7, SPIROPLAN® W".

4.13.4 Flange coupling

Flange couplings [1] are rigid couplings for connecting 2 shafts [2].

Flange couplings are suitable for operation in both directions of rotation, but cannot compensate any shaft misalignments.

Torque between shaft and coupling is transmitted via a cylindrical interference fit. The two coupling halves are mounted together at the flanges. The couplings are equipped with several disassembly bores [3] for removing the interference fit hydraulically.



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[1] Rigid flange coupling
[2] Customer and gear shaft

[3] Disassembly bores

INFORMATION



For detailed information about the rigid flange coupling, refer to the "Gear Unit Series R..7, F..7, K..7, S..7, and SPIROPLAN® W – Rigid flange coupling" addendum to the operating instructions.

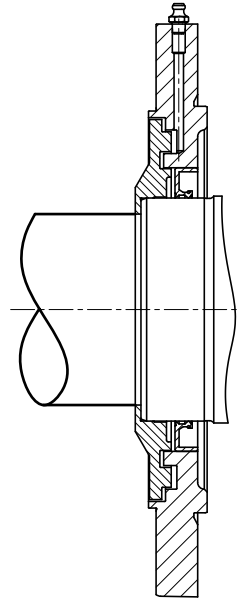
4.13.5 Regreasing the labyrinth seal

Labyrinth seals are used to protect the oil seal in case of very high dust load or other abrasive substances.

Output shaft

The following figure shows an example of a regreasable radial labyrinth seal (taconite).

- Single oil seal with radial labyrinth seal
- Used in **very dusty** environments with abrasive particles



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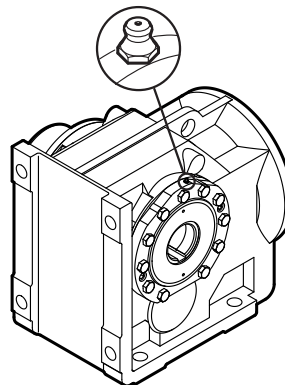
INFORMATION



The gear shaft must rotate during relubrication.

Position of greasing points

Regreasable sealing systems are usually equipped with taper greasing nipples according to DIN 71412 A. Relubrication must be carried out at regular intervals. The greasing points are located near the output shaft, see following figure:



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Refilling grease

Regreasable sealing systems can be refilled with lubricating grease. Use moderate pressure to force grease into each lubrication point until new grease leaks out of the sealing gap.

Used grease, including contaminants and sand, is in this way pressed out of the sealing gap.

INFORMATION



Immediately remove the old grease that leaked out.

Inspection and maintenance intervals



Observe the following inspection and maintenance intervals for the regreasing of labyrinth seals:

Time interval	What to do?
Every 3000 operating hours, at least every 6 months	Fill regreasable sealing systems with grease.

Technical data

Sealing and rolling bearing grease

The table shows the greases recommended by SEW-EURODRIVE for an operating temperature of -40 °C to +80 °C:

Manufacturer	Grease
Fuchs	Renolit CX TOM 15 OEM
Aral 	Aral Eural Grease EP2
Aral 	Aral Aralube BAB EP2

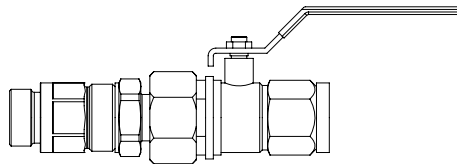
INFORMATION



If a customer wants to use a grease that is not listed in the above table, the customer has to make sure that it is suitable for the intended application.

4.13.6 Oil drain valve

The gear unit is equipped with an oil drain plug as standard. An oil drain valve can optionally be installed, that enables attaching a drain pipe for changing the gear unit oil.

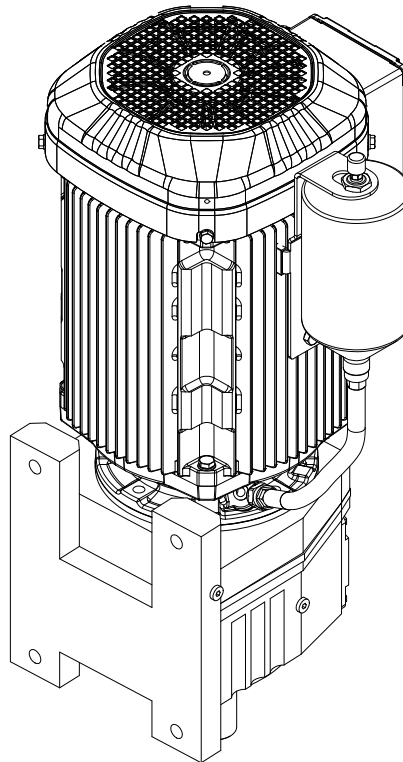


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4.13.7 Oil expansion tank

The oil expansion tank equalizes oil volume fluctuations in the system due to changing temperatures. If the gear unit temperature rises, part of the expanding oil volume can flow into the oil expansion tank. If the gear unit temperature falls again, the oil flows back into the system. Thus the gear unit is completely filled with oil in all operating states.

The following figure shows an example of a gearmotor in mounting position M4:



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4.13.8 Oil-air cooler for splash lubrication /OAC

If the thermal rating of the naturally cooled gear unit is not sufficient, an oil-air cooling system can be used.

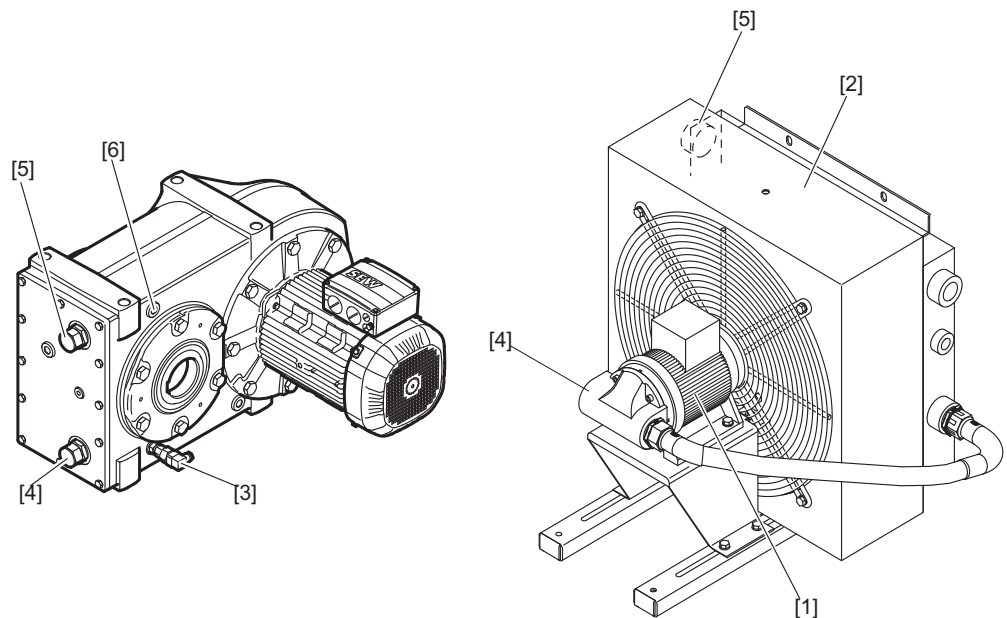
The cooling system is delivered without electrical wiring and piping as a complete unit on a base frame for separate installation.

The standard scope of delivery of the cooling system includes:

- Pump with directly mounted asynchronous motor
- Oil-air heat exchanger
- Temperature switch with 2 switching points

SEW-EURODRIVE uses oil-air cooling systems for standard gear units in sizes OAC 005 and OAC 010.

The following figure shows an example of a standard parallel-shaft helical gear unit next to an oil-air cooler.



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- | | |
|--|---|
| [1] Motor for pump and fan | [4] Suction pipe connections |
| [2] Oil-air heat exchanger | [5] Pressure pipe connections |
| [3] Temperature switch with 2 switching points | [6] Option: Oil expansion tank connection |

INFORMATION



For more information on the cooling system, refer to the addendum to the operating instructions "Gear unit series R..7, F..7, K..7, K..9, S..7 and SPIROPLAN® W: Oil-air cooler for splash lubrication /OAC".

5 Startup



▲ CAUTION

Damage to the gear unit due to improper startup.

Possible damage to property.

- Observe the following notes.
- Before startup, always check that the oil level is correct. Refer to the unit's nameplate for lubricant fill quantities.
- The oil level plugs and oil drain plugs, as well as the breather plugs and breather valves must be freely accessible.
- The most important technical data is provided on the nameplate. Additional data relevant for operation is available in drawings and the order confirmation.
- After having gear unit setup, ensure that all retaining screws are tight.
- Make sure that the alignment has not changed after tightening the mounting elements.
- Prior to startup, ensure that rotating shafts as well as couplings are equipped with suitable protective covers.
- If the gear unit has an oil sight glass to monitor the oil level, the oil sight glass must be protected against damage.
- It is essential that there is no open fire or risk of sparks when working on the gear unit.
- Protect the gear unit from falling objects.
- Remove transport protection prior to startup.
- Strictly observe the safety notes in the individual chapters.

5.1 Checking the oil level

Before startup, make sure that the oil level corresponds to the mounting position. Observe section "Checking the oil level and changing the oil" (→ 95).

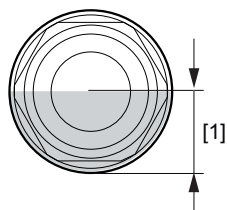
If the gear unit is equipped with an oil sight glass, you can also determine the oil level at the oil sight glass.

NOTICE

Damage to the gear unit due to oil leaking from the damaged oil sight glass.

Possible damage to the unit.

- Attach a protective device to prevent the oil sight glass from being damaged by mechanical impacts.
1. Observe the notes in chapter "General information (→ 88)".
 2. Check the oil level at the oil sight glass according to the following figure:



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[1] The oil level must be within this range.

3. Proceed as follows if the oil level is too low:

- Open the respective oil fill plug, see chapter "Inspection/maintenance for the gear unit (→ 95)".
- Fill in new oil of the same type through the oil fill plug up to the mark.
- Screw in the oil fill plug.

Before startup, make sure that the oil level corresponds to the mounting position. Observe section "Checking the oil level and changing the oil" (→ 95).

5.2 Pseudo-leakage at shaft seals

Due to their operating principle, seals between moving surfaces at shaft passages cannot be completely tight, as a lubricant film must form during operation. The lubricant film between shaft and sealing lip keeps the development of heat and wear on the sealing system to a minimum and ensures the intended service life. The optimum sealing properties are only achieved after the run-in phase.

5.3 Helical-worm gear units and SPIROPLAN® W gear units

5.3.1 Run-in period

SPIROPLAN® and helical-worm gear units require a run-in period of at least 48 h before reaching their maximum efficiency. A separate run-in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.

Helical-worm gear units

	Worm	
	i range	η reduction
1-start	Approx. 50 ... 280	About 12 %
2-start	Approx. 20 ... 75	About 6 %
3-start	Approx. 20 ... 90	About 3 %
4-start	-	-
5-start	Approx. 6 ... 25	About 3 %
6-start	Approx. 7 ... 25	About 2 %

SPIROPLAN® gear units

W10 / W20 / W30		W37 / W47	
i range	η reduction	i range	η reduction
Approx. 35 ... 75	About 15 %		
Approx. 20 ... 35	About 10 %		
Approx. 10 ... 20	About 8 %	Approx. 30...70	About 8 %
About 8	About 5 %	Approx. 10 ... 30	About 5%
About 6	About 3 %	Approx. 3...10	About 3%

5.4 Helical/parallel shaft helical/helical-bevel gear units

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with section "Mechanical Installation" (→ 22).

5.5 Gear units with backstop

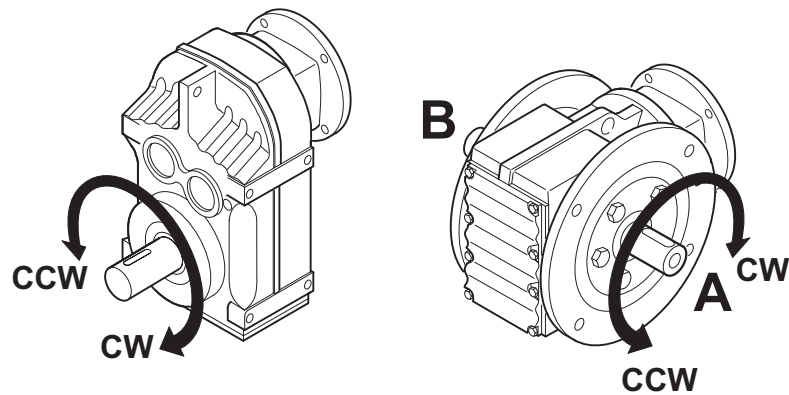
NOTICE

Operating the motor in the blocking direction could destroy the backstop.

Possible damage to property

- Do not start up the motor in the blocking direction. Before motor startup, make sure the current supply of the motor for the direction of rotation is connected accordingly.
- For control purposes, operation in blocking direction with half the output torque is permitted once.

The purpose of a backstop is to prevent unwanted directions of rotation. During operation, the backstop permits rotation only in the specified direction.



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The direction of rotation is specified as viewed onto the output shaft (LSS):

- CW rotation
- CCW rotation

The permitted direction of rotation is indicated on the housing.

5.6 Components made of elastomers with fluorocarbon rubber



⚠ CAUTION

Health risk due to dangerous gases, vapors, and residue created by heating fluorocarbon rubber to $> 200\text{ }^{\circ}\text{C}$.

Damage to health.

- Make sure that components made of fluorocarbon rubber are not exposed to temperatures $> 200\text{ }^{\circ}\text{C}$. Remove the components, if necessary.
- Avoid inhaling fluorocarbon rubber gases and vapors as well as skin and eye contact.
- Avoid contact with the cooled-down fluorocarbon rubber, as dangerous residue has formed it was heated.

Under normal operating conditions and at temperatures up to 200 °C, fluorocarbon rubber is very stable and safe. However, when heated to more than 300 °C, e.g. by fire or the flame of a cutting torch, fluorocarbon rubber forms harmful gases and vapors as well as residue.

The following components of R..7, F..7, K..7, K..9, S..7, and SPIROPLAN® W gear units can contain elastomers made of fluorocarbon rubber:

- Oil seals
- Breather valve
- Screw plugs

The user is responsible for safe handling during the service life including eco-friendly disposal.

SEW-EURODRIVE is not responsible for damage caused by improper handling.

6 Inspection/maintenance

6.1 General information

Observe the following notes regarding inspection/maintenance work at the gear unit:



⚠ WARNING

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Disconnect the gearmotor from the power supply before you start working on the unit.
- Prevent the gearmotor from starting up unintentionally (for example, by locking the key switch or removing the fuses from the current supply).



⚠ WARNING

Risk of injury if preloaded shaft connections are loosened.

Severe or fatal injuries.

- Before releasing any shaft connections, make sure there is no active torsional torque present that could lead to tension within the system.



⚠ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries

- Let the gear unit cool down before you start working on it.
- Carefully remove the oil level plug and the oil drain plug.

NOTICE

Loss of lubricant qualities due to filling of wrong gear unit oil.

Damage to the gear unit

- Do not mix different synthetic lubricants and do not mix synthetic and mineral lubricants.
- As standard lubricant use mineral oil.

NOTICE

Ingression of water at the sealing lip of the oil seal due to cleaning the gear unit with a high-pressure cleaning device.

Damage to oil seals

- Do not clean the variable-speed gear unit with a high-pressure cleaning device.

NOTICE

Damage to gear unit due to ingress of foreign objects during maintenance and inspection work.

Destruction of the gear unit.

- Prevent foreign particles from entering into the gear unit during maintenance and inspection work.

NOTICE

Damage to gear unit due to improper inspection and maintenance work.

Damage to the gear unit

- It is important that you observe the notes in this chapter.

INFORMATION

- Maintain the inspection and maintenance intervals. This is necessary to ensure operational safety.
- The position of the oil level plug, oil drain plug and the breather valve depends on the mounting position. Refer to the mounting position sheets in chapter "Mounting positions".
- Perform safety and functional check following all maintenance and repair work.

6.2 Wearing parts

Gearing

If the SEW-EURODRIVE design criteria and the intervals for inspection and maintenance are observed, the gearing components are wear-free after the run-in period. The worm gearing is an exception to this for constructional reasons. The amount of material abrasion on the worm gear tooth flanks varies depending on the operating conditions. The main influencing factors are:

- Speed
- Load
- Operating temperature
- Lubricant (type, viscosity, additives, pollution)
- Operating frequency

For information on the worm gearing service life under certain operating conditions, contact SEW-EURODRIVE.

Rolling bearing

Rolling bearing, adapter and input shaft assembly have a limited service life, even under ideal operating conditions. This nominal bearing service life is a solely statistical value. The actual service life of an individual bearing may deviate greatly from this value. The main influencing factors are:

- Speed
- Equivalent bearing load
- Operating temperature
- Lubricant (type, viscosity, additives, pollution)
- Lubricant supply of the bearing
- Misalignment under operating load

Therefore the rolling bearings must be inspected regularly. Note the respective inspection and maintenance intervals in chapters Inspection/maintenance intervals (→ [92](#)), Lubricant change intervals (→ [93](#)), Maintenance of AL/AM/AQ./EWH adapter (→ [93](#)) and AD input shaft assembly maintenance (→ [94](#)).

For information on the nominal bearing service life under certain operating conditions, contact SEW-EURODRIVE.

Lubricants

Lubricants are subject to aging. Their service life is limited depending on the load conditions.

The service life significantly depends on the oil operating temperature. The dependency of lubricant change intervals and operating temperature is depicted in the figure in chapter Lubricant change intervals (→ [93](#)).

Oil seals

Oil seals are contact seals that are used to seal unit housings at emerging elements, such as shafts, from the environment. Oil seals are wear parts with a service life that is influenced by various factors, such as:

- Shaft speed and circumferential velocity at the sealing lip
- Ambient conditions (temperature, dust, humidity, pressure, chemicals, radiation)
- Lubricant (type, viscosity, additives, pollution)
- Surface quality of the sealing
- Lubricant supply of the sealing
- Oil seal material

**Cam ring/
Coupling ring**

Due to the various influencing factors it is not possible to predict the service life. Therefore the oil seals must be inspected regularly. Note the respective inspection and maintenance intervals in chapters Inspection/maintenance intervals (→ 92), Lubricant change intervals (→ 93), Maintenance of AL/AM/AQ./EWH adapter (→ 93) and AD input shaft assembly maintenance (→ 94).

The couplings used in the AM, AL, AQ. and EWH adapters are designed to be positive, puncture-proof and low-maintenance claw couplings. They have a an impact and vibration-absorbing cam ring (AM, EWH) or coupling ring (AQ., AL). The service life of cam ring/coupling ring is influenced by various factors, such as:

- Ambient conditions (temperature, chemicals, radiation)
- Operational conditions (starting frequency, impact characteristics)

Note the respective inspection and maintenance intervals in chapters Maintenance of AL/AM/AQ./EWH adapter (→ 93).

6.3 Inspection/maintenance intervals

The following gear units are lubricated for life:

- Helical gear units R07, R17, R27
- Parallel-shaft helical gear unit F27
- SPIROPLAN® gear units

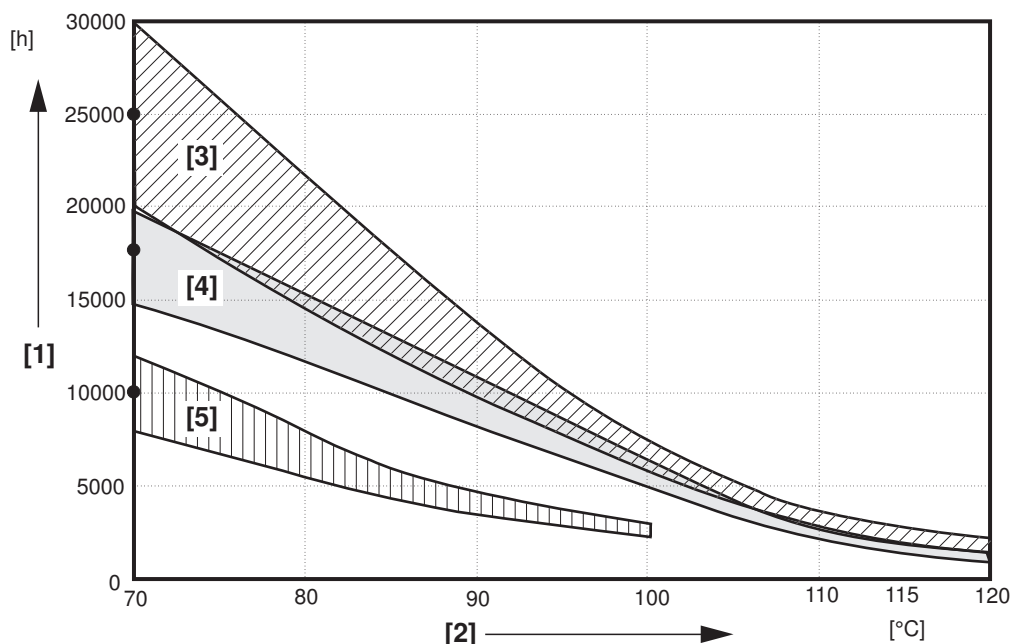
If necessary touch up or renew the surface protection/ corrosion protection coating.

The following table lists the obligatory intervals and the corresponding measures:

Time interval	What to do?
<ul style="list-style-type: none"> • Every 3000 hours of operation, at least every 6 months 	<ul style="list-style-type: none"> • Check oil and oil level • Check running noise for possible bearing damage • Visual inspection of the seals for leakage • For gear units with a torque arm: Check and replace the rubber buffers, if necessary
<ul style="list-style-type: none"> • Depending on the operating conditions (see illustration below), every 3 years at the latest • according to oil temperature 	<ul style="list-style-type: none"> • Change mineral oil • Replace rolling bearing grease (recommendation) • Replace oil seal (do not install it in the same track)
<ul style="list-style-type: none"> • Depending on the operating conditions (see illustration below), every 5 years at the latest • according to oil temperature 	<ul style="list-style-type: none"> • Change synthetic oil • Replace rolling bearing grease (recommendation) • Replace oil seal (do not install it in the same track)
<ul style="list-style-type: none"> • Varying (depending on external factors) 	<ul style="list-style-type: none"> • Touch up or renew the surfaces/anti-corrosion coating

6.4 Lubricant change intervals

The following image depicts the change intervals for standard gear units under normal ambient conditions. In case of special designs under severe/aggressive ambient conditions change the lubricant more frequently.



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- | | |
|---------------------------------------|---|
| [1] Operating hours | [3] CLP PG |
| [2] Sustained oil bath temperature | [4] CLP HC / HCE (food grade lubricants for the food industry) |
| • Average value per oil type at 70 °C | [5] CLP / HLP / E (lubricants made of biodegradable oils for agriculture, forestry, and water management) |

6.5 Maintenance of AL/AM/AQ./EWH adapter

The following table lists the obligatory intervals and the corresponding measures:

Time interval	What to do?
<ul style="list-style-type: none"> Every 3000 hours of operation, at least every 6 months 	<ul style="list-style-type: none"> Check the running noises to detect possible bearing damage. Visually check the adapter for leakage.
<ul style="list-style-type: none"> After 10000 operating hours 	<ul style="list-style-type: none"> Check the rotational clearance. Visual check the cam ring (AM, EWH) or coupling ring (AQ., AL). Change the bearing grease. Change the oil seal. Do not mount it in the same track.

6.6 AD input shaft assembly maintenance

The following table lists the obligatory intervals and the corresponding measures:

Time interval	What to do?
<ul style="list-style-type: none">• Every 3000 hours of operation, at least every 6 months	<ul style="list-style-type: none">• Check the running noises to detect possible bearing damage.• Visually check the adapter for leakage.
<ul style="list-style-type: none">• After 10000 operating hours	<ul style="list-style-type: none">• Change the bearing grease.• Change the oil seal. Do not mount it in the same track.

6.7 Inspection/maintenance for the gear unit

6.7.1 Checking the oil level and changing the oil

The procedure when checking the oil level and changing the oil depends on gear unit type, size and mounting position. Determine the key letter (A, B, C, D or E) in the following table in regard of gear unit type and size. The key letter indicates the procedure for the respective gear unit, that can be found in the second table.

Gear unit type	Size	Code letter for chapter "Checking the oil level and changing the oil"					
		M1	M2	M3	M4	M5	M6
R	R..07 – 27	B					
	R..37 / R..67	A					
	R..47 / R..57	A				B	A
	R..77 – 167	A					
	RX..57– 107	A					
F	F..27	B					
	F..37 – 157	A					
K	K..19 / K..29	C					
	K..39 / K49	A					
	K..37 – 187	A					
S	S..37	C					
	S..47 – 97	A					
W	W..10 – 30	B					
	W..37 – 47	D			E	D	

Code letter	Chapter "Checking the oil level and changing the oil"	Reference
A:	<ul style="list-style-type: none"> Helical gear units... Parallel-shaft helical gear units... Helical-bevel gear unit ...K..39 / K..49, K..37 – 187 Helical-worm gear units... S..47 – 97 With oil level plug	(→ 96)
B:	<ul style="list-style-type: none"> Helical gear units... Parallel-shaft helical gear units... SPIROPLAN® gear units... Without oil level plug, with cover plate	(→ 98)
C:	<ul style="list-style-type: none"> Helical-worm gear units S..37 Helical-bevel gear units K..19 / K..29 Without oil level plug, without cover plate	(→ 102)
D:	<ul style="list-style-type: none"> SPIROPLAN® W..37 / W..47 In mounting positions M1, M2, M3, M5, M6 with oil level plug	(→ 105)

Code letter	Chapter "Checking the oil level and changing the oil"	Reference
E:	<ul style="list-style-type: none"> SPIROPLAN® W..37 / W..47... In mounting position M4 without oil level plug and cover plate	(→ 107)

For notes on the mounting positions, refer to chapter "Mounting Positions (→ 110)".

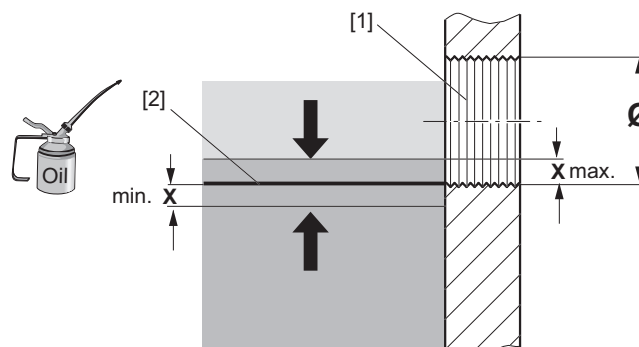
You cannot check the oil level of gear units in pivoted mounting position. The gear units are delivered with the correct oil level. Observe the designations and fill quantities on the nameplate if you have to change the oil.

6.7.2 A: Helical, parallel-shaft helical, helical-bevel and helical-worm gear units with oil level plug

Checking the oil level at the oil level plug

Proceed as follows to check the oil level of the gear unit:

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Determine the position of the oil level plug and the breather valve using the mounting position sheets. See chapter "Mounting positions" (→ 110).
3. Place a container underneath the oil level plug.
4. Slowly remove the oil level plug. Small amounts of oil may leak out as the permitted maximum oil level is higher than the lower edge of the oil level bore.
5. Check the oil level according to the following figure and the corresponding table.



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- [1] Oil level bore
[2] Ideal oil level
- X min/max oil level

Ø oil level bore	Approved oil level fluctuation x mm
M10 x 1	1.5
M12 x 1.5	2
M22 x 1.5	3
M33 x 2	4
M42 x 2	5

6. Proceed as follows if the oil level is too low:

- Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the breather bore, up to the lower edge of the oil level bore.
- Re-insert the breather valve.

7. Screw in the oil level plug again.

Checking the oil via the oil drain plug

Proceed as follows to check the gear unit oil:

1. Observe the notes in section "Information on gear unit inspection/maintenance" (→ 88).
2. Determine the position of the oil drain plug using the mounting position sheets. See chapter "Mounting positions" (→ 110).
3. Remove a little oil from the oil drain plug.
4. Check the oil consistency:
 - Viscosity
 - If you can see that the oil is heavily contaminated, SEW-EURODRIVE recommends to change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (→ 92).
5. Check the oil level. See section "Checking the oil level via the oil level plug" (→ 96).

Changing the oil via the oil drain plug and the breather valve



▲ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it. Due to the better flowability, the gear unit oil should still be warm so that the gear unit can be drained best.

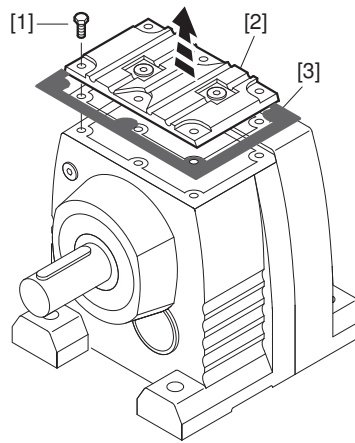
1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Determine the position of the oil drain plug, the oil level plug and the breather valve using the mounting position sheets. See chapter "Mounting positions" (→ 110).
3. Place a container underneath the oil drain plug.
4. Remove the oil level plug, the breather valve and the oil drain plug.
5. Drain the oil completely.
6. Re-insert the oil drain plug.
7. Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the breather bore. Do not mix different synthetic lubricant.
 - Observe the oil quantity according to the specifications on the nameplate or according to the mounting position. See chapter "Lubricant fill quantities".
 - Check the oil level at the oil level plug.
8. Re-insert the oil level plug and the breather valve.

6.7.3 B: Helical, parallel shaft helical, SPIROPLAN® gear units without oil level plug with cover plate

Checking the oil level via the cover plate

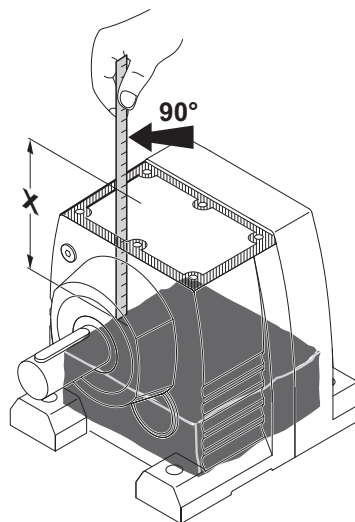
For gear units without oil level bore, the oil level is checked via the cover plate opening. Proceed as follows:

1. Observe the notes in section "Information on gear unit inspection/maintenance" (→ 88).
2. To position the cover plate on the top, place the gear unit in the following mounting position:
 - R07 - R57 in M1 mounting position
 - F27 in M3 mounting position
 - W10 - W30 in M1 mounting position
3. Loosen the screws [1] of the cover plate [2] and remove the cover plate [2] and the corresponding gasket [3] (see following figure).



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4. Determine the vertical distance "x" between oil level and sealing surface of the gear unit housing (see following figure).



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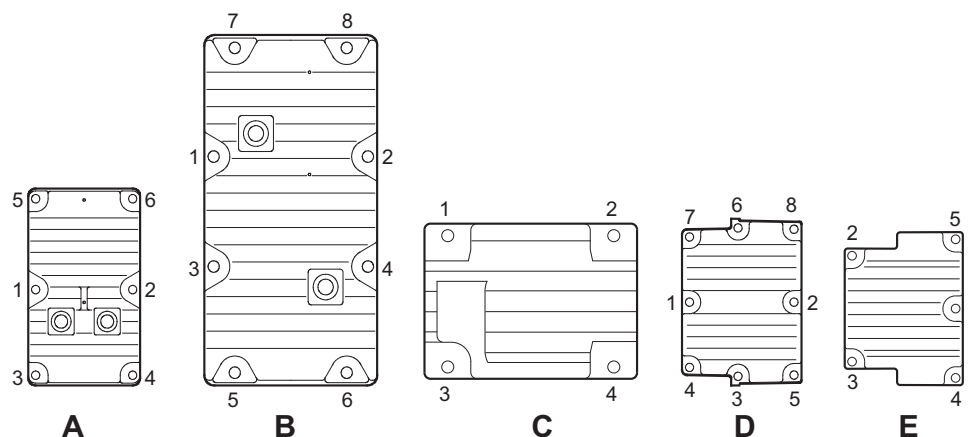
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5. Compare the determined value "x" to the max. distance between oil level and sealing surface of the gear unit housing specified in the following table. Adjust the fill level if required.

Gear unit type		Max. distance x in mm between oil level and sealing surface of the gear unit housing for mounting position					
		M1	M2	M3	M4	M5	M6
R07	2-stage	52 ± 1	27 ± 1	27 ± 1	27 ± 1	27 ± 1	27 ± 1
	3-stage	49 ± 1	21 ± 1	21 ± 1	21 ± 1	21 ± 1	21 ± 1
R17	2-stage	63 ± 1	18 ± 1	46 ± 1	18 ± 1	46 ± 1	46 ± 1
	3-stage	58 ± 1	11 ± 2	40 ± 2	11 ± 2	40 ± 2	40 ± 2
R27	2-stage	74 ± 1	22 ± 1	45 ± 1	22 ± 1	45 ± 1	45 ± 1
	3-stage	76 ± 1	19 ± 1	42 ± 1	19 ± 1	42 ± 1	42 ± 1
R47	2-stage	–	–	–	–	39 ± 1	–
	3-stage	–	–	–	–	32 ± 1	–
R57	2-stage	–	–	–	–	32 ± 1	–
	3-stage	–	–	–	–	28 ± 1	–
F27	2-stage	78 ± 1	31 ± 1	72 ± 1	56 ± 1	78 ± 1	78 ± 1
	3-stage	71 ± 1	24 ± 1	70 ± 1	45 ± 1	71 ± 1	71 ± 1
		Irrespective of mounting position					
W10		12 ± 1					
W20		19 ± 1					
W30		31 ± 1					

6. Close the gear unit after the oil level check:
- Re-attach the gasket of the cover plate. Make sure that the sealing surfaces are clean and dry.

- Screw on the cover plate. Tighten the cover plate screw connections working from the inside to the outside. Tighten the cover plate screw connections in the sequence depicted in the following figure. Tighten the cover plate screw connections with the specified tightening torque according to the following table. Repeat the tightening procedure until the screws are properly tightened. To avoid damaging the cover plate, use only impulse wrenches or torque wrenches. Do not use impact screwdrivers.



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Gear unit type	Figure	Retaining thread	Tightening torque T_N Nm	Minimum tightening torque T_{min} Nm
R/RF07	E	M5	6	4
R/RF17/27	D	M6	11	7
R/RF47/57	A			
F27	B			
W10	C	M5	6	4
W20	C	M6	11	7
W30	A			

Checking the oil via cover plate

Proceed as follows to check the gear unit oil:

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Open the cover plate of the gear unit according to section "Checking the oil level via the cover plate" (→ 98).
3. Take an oil sample via the cover plate opening.
4. Check the oil consistency.
 - Viscosity
 - If you can see that the oil is heavily contaminated, SEW-EURODRIVE recommends to change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (→ 95).
5. Check the oil level. See section "Checking the oil level via the cover plate" (→ 98).

6. Screw on the cover plate. Observe the order and the tightening torques according to section "Checking the oil level via the cover plate".

Changing the oil via the cover plate



▲ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it. Due to the better flowability, the gear unit oil should still be warm so that the gear unit can be drained best.
1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
 2. Open the cover plate of the gear unit according to chapter "Checking the oil level via the cover plate".
 3. Completely drain the oil into a container via the cover plate opening.
 4. Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the cover plate. Do not mix different synthetic lubricants.
 - Pour in the oil as specified on the nameplate or in accordance with the mounting position. See chapter "Lubricant fill quantities".
 5. Check the oil level.
 6. Screw on the cover plate. Observe the order and the tightening torques according to chapter "Checking the oil level via the cover plate" (→ 98).

6.7.4 C: Helical-worm gear units S..37 and helical-bevel gear units K..19/K..29 without oil level plug and cover plate

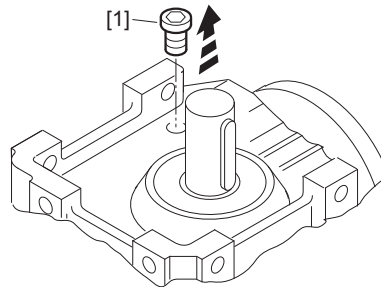
Checking the oil level via screw plug

The gear units S..37, K..19, and K..29 are not equipped with an oil level plug or a cover plate. This is why the oil level is checked via the control bore.

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Place the gear unit in the mounting position stated in the following table. Thus the control bore always points upwards.

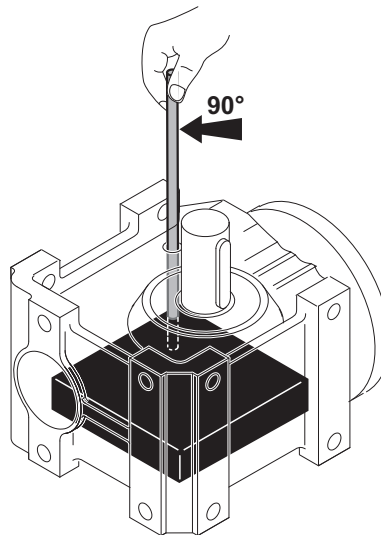
Gear unit	Mounting position
S..37	M5/M6
K19/29	M6

3. Remove the screw plug [1] as shown in the following figure.



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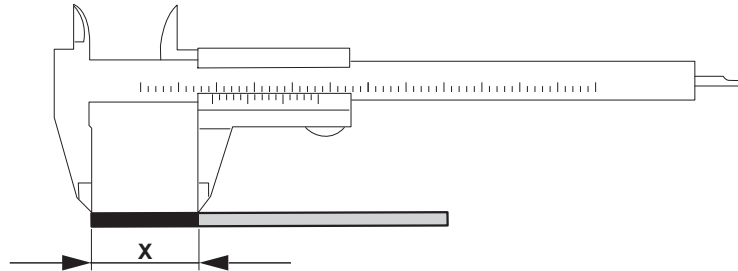
4. Insert the dipstick vertically via the control bore all the way to the bottom of the gear unit housing. Vertically pull the dipstick out of the control bore, as shown in the following figure.



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- Determine the size of the section "x" of the dipstick covered with lubricant using a slide-gauge as depicted in the following figure.



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- Compare the determined value "x" to the min. value depending on the mounting position specified in the following table. Correct the fill level if required.

Gear unit type	Oil level = wetted section x [mm] of the dipstick					
	Mounting position					
	M1	M2	M3	M4	M5	M6
K..19	33 ± 1	33 ± 1	33 ± 1	35 ± 1	33 ± 1	33 ± 1
K..29	50 ± 1	50 ± 1	50 ± 1	63 ± 1	50 ± 1	50 ± 1
S..37	10 ± 1	24 ± 1	34 ± 1	37 ± 1	24 ± 1	24 ± 1

- Re-insert and tighten the screw plug.

Checking the oil via the screw plug

- Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
- Open the screw plug of the gear unit according to section "Checking the oil level via screw plug".
- Take an oil sample via the screw plug bore.
- Check the oil consistency.
 - Viscosity
 - If you can see that the oil is heavily contaminated, SEW-EURODRIVE recommends to change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (→ 92).
- Check the oil level. See previous section.
- Re-insert and tighten the screw plug.

Changing the oil via the screw plug

▲ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it. Due to the better flowability, the gear unit oil should still be warm so that the gear unit can be drained best.



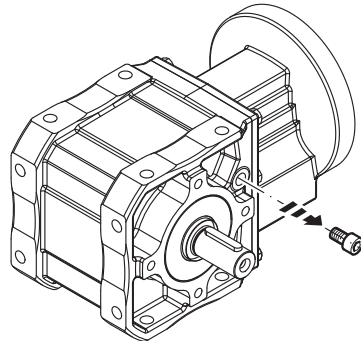
1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Open the screw plug of the gear unit according to section "Checking the oil level via screw plug".
3. Completely drain the oil via the screw plug bore.
4. Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the control bore. Do not mix different synthetic lubricants.
 - Observe the oil quantity specified on the nameplate or according to the mounting position. Observe section "Lubricant fill quantities".
5. Check the oil level.
6. Re-insert and tighten the screw plug.

6.7.5 D: SPIROPLAN® W..37/W..47 in mounting position M1, M2, M3, M5, M6 with oil level plug

Checking the oil level at the oil level plug

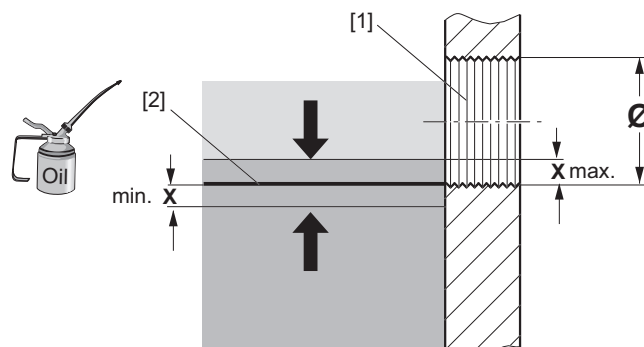
Proceed as follows to check the oil level of the gear unit:

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Set up the gear unit in M1 mounting position.
3. Slowly remove the oil level plug (see following figure). Small amounts of oil may leak out.



787235211

4. Check the oil level according to the following figure.



634361867

[1] Oil level bore

[2] Ideal oil level

Ø oil level bore	Fluctuation x for minimum and maximum fill level in mm
M10 x 1	1.5

5. In case the oil level is too low, fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the oil level bore, up to the lower edge of the oil level bore.
6. Screw in the oil level plug again.

Checking the oil level at the oil level plug

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Remove some oil at the oil level plug.

3. Check the oil consistency.
 - Viscosity
 - If you can see that the oil is heavily contaminated, SEW-EURODRIVE recommends to change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (→ 92).
4. Check the oil level. See previous section.

Changing the oil at the oil level plug



▲ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

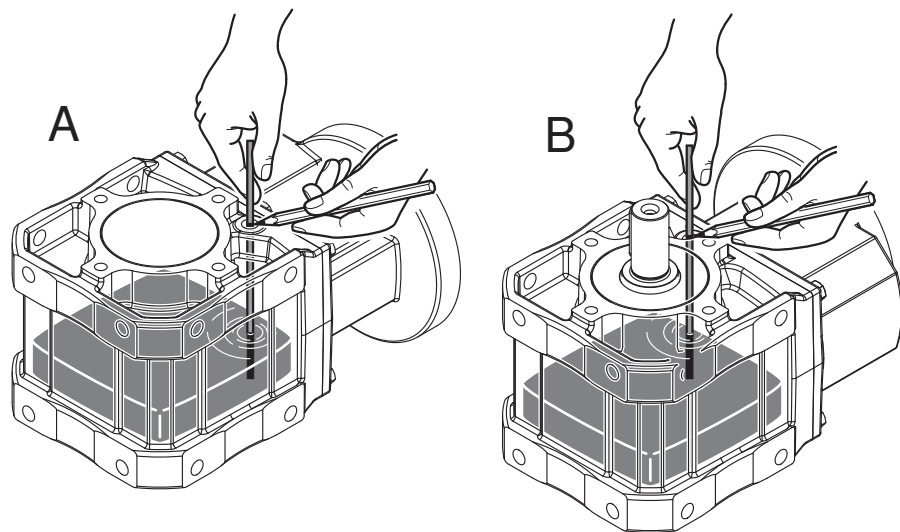
- Let the gear unit cool down before you start working on it. Due to the better flowability, the gear unit oil should still be warm so that the gear unit can be drained best.
1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
 2. Set up the gear unit in M5 or M6 mounting position. See chapter "Mounting positions" (→ 110).
 3. Place a container underneath the oil level plug.
 4. Remove the oil level plugs on the A and B-side of the gear unit.
 5. Drain the oil completely.
 6. Re-insert the lower oil level plug.
 7. Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the upper oil level plug. Do not mix different synthetic lubricants.
 - Observe the oil quantity according to the specifications on the nameplate or according to the mounting position. See chapter "Lubricant fill quantities".
 - Check the oil level according to chapter "Checking the oil level via oil level plug".
 8. Re-insert the upper oil level plug.

6.7.6 E: SPIROPLAN® W..37 / W..47 in mounting position M4 without oil level plug and cover plate

Checking the oil level via screw plug

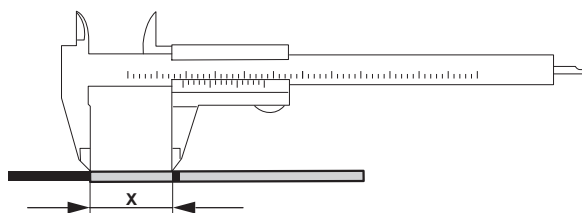
The W37 / W47 gear units are not equipped with an oil level plug or a cover plate. This is why the oil level is checked via the control bore.

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Set up the gear unit in M5 or M6 mounting position. See chapter "Mounting positions" (→ 110).
3. Remove the screw plug.
4. Insert the dipstick vertically via the control bore all the way to the bottom of the gear unit housing. Mark the point on the dipstick where it exits the gear unit. Pull out the dipstick vertically (see following figure).



784447371

5. Determine the section "x" between the wetted part and the marking using a caliper (see following figure).



9007200039761803

6. Compare the determined value "x" to the min. value depending on the mounting position specified in the following table. Correct the fill level if required.

Gear unit type	Oil level = wetted section x mm of the dipstick	
	Mounting position during check	
	M5 Lying on the A-side	M6 Lying on the B-side
W37 in M4 mounting position	37 ± 1	29 ± 1

Gear unit type	Oil level = wetted section x mm of the dipstick	
	Mounting position during check	
	M5 Lying on the A-side	M6 Lying on the B-side
W47 in M4 mounting position	41 ± 1	30 ± 1

7. Re-insert and tighten the screw plug.

Checking the oil via the screw plug

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Remove a little oil at the oil screw plug.
3. Check the oil consistency:
 - Viscosity
 - If you can see that the oil is heavily contaminated, SEW-EURODRIVE recommends to change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (→ 92).
4. Check the oil level. See previous section.

Changing the oil via the screw plug



▲ WARNING

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it. Due to the better flowability, the gear unit oil should still be warm so that the gear unit can be drained best.

1. Observe the notes in chapter "Information on gear unit inspection/maintenance" (→ 88).
2. Set up the gear unit in M5 or M6 mounting position. See chapter "Mounting positions" (→ 110).
3. Place a container underneath the screw plug.
4. Remove the screw plugs on the A and B-side of the gear unit.
5. Drain the oil completely.
6. Re-insert the lower screw plug.
7. Fill in fresh oil of the same type (contact SEW-EURODRIVE if necessary) via the upper screw plug. Do not mix different synthetic lubricants.
 - For the required oil quantity, refer to the nameplate or chapter "Lubricant fill quantities".
 - Check the oil level according to chapter "Checking the oil level via oil level plug".
8. Re-insert the upper screw plug.

6.7.7 Replacing the oil seal

NOTICE

Damage to oil seal when mounted below 0 °C.

Damage to oil seal.

- Store oil seals at ambient temperatures over 0 °C.
- If necessary, heat the oil seal before mounting it.

Proceed as follows:

1. Ensure that there is a sufficient grease reservoir between the dust lip and sealing lip, depending on the gear unit design.
2. If you use double oil seals, the space has to be filled with grease for one third.

6.7.8 Painting the gear unit

NOTICE

Ingress of paint at breather valve and sealing lips of the oil seal during painting or repainting of the gear unit.

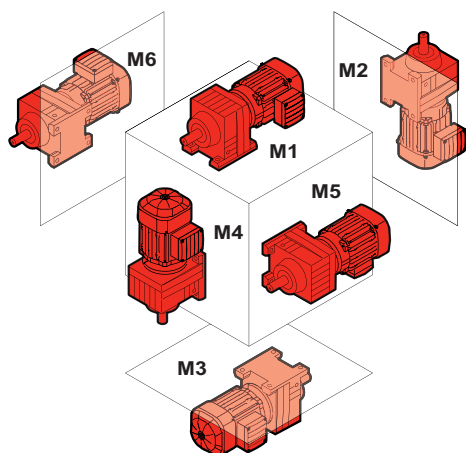
Damage to oil seal and breather valve.

- Thoroughly cover the breather valve and sealing lip of the oil seals with strips prior to painting.
- Remove the strips after painting.

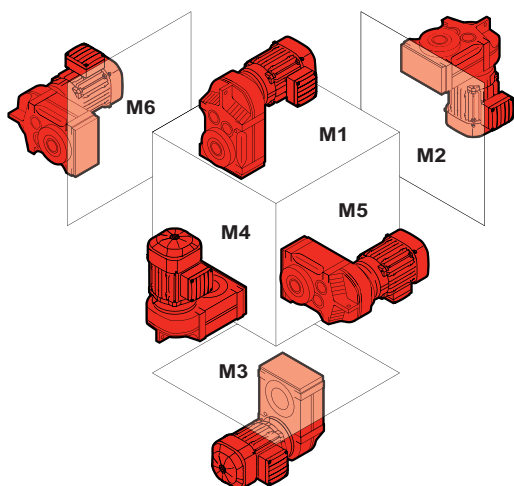
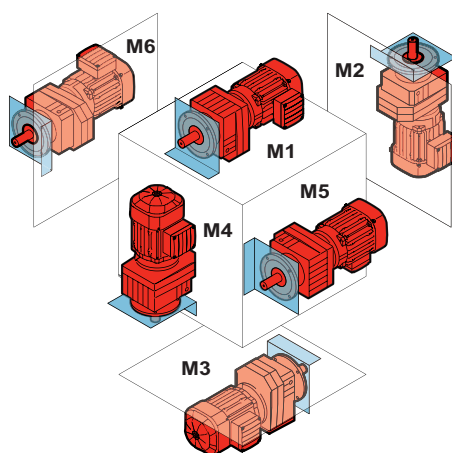
7 Mounting positions

7.1 Designation of the mounting positions

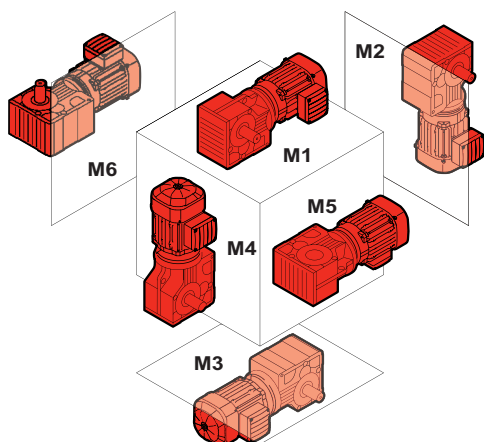
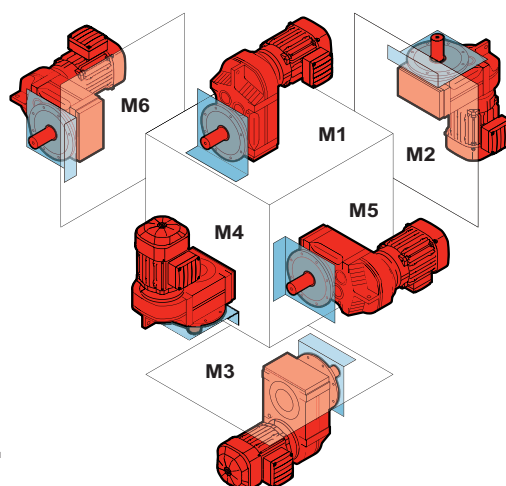
SEW-EURODRIVE distinguishes between the gear unit mounting positions M1 – M6. The following figure shows the gearmotor in the 6 mounting positions:



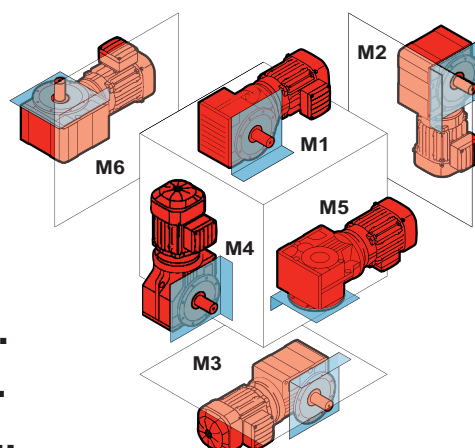
R..



F..



K..
S..
W..



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7.2 Churning losses


*(→  XY)


Churning losses may occur in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

Mounting position	Gear unit type	Gear unit size	Input speed rpm
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

7.3 Mounting position MX

Mounting position MX is available for all gear units of the R..7, F..7, K..7, K..9, S..7 and SPIROPLAN® W series.

For mounting position MX, the gear units are delivered with the maximally possible amount of oil and sealed with oil screw plugs. A breather valve is included with each drive. The oil fill volume must be adapted according to the mounting position of the gear unit. Customers will also have to mount the enclosed breather valve at the proper location depending on the mounting position (see section "Mounting position sheets (→  112)").

Check for the correct oil level, as described in chapter "Oil level check and oil change" (→  95).

7.4 Universal mounting position M0

SPIROPLAN® W10 – W30 gearmotors can be ordered with M0 universal mounting position as an option. Gear units with mounting position M0 are filled with the standard oil quantity.

These gear units are entirely enclosed due to their small size and have no breather valve. Customers can use the gear unit universally in every mounting position (M1 – M6) without having to take any measures prior to startup.

7.5 Mounting positions of SPIROPLAN® gear units



NOTICE

SPIROPLAN® gearmotors of sizes W10 – W30 cannot be equipped with breather valves, oil level plugs or oil drain plugs.




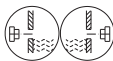

INFORMATION

SPIROPLAN® gearmotors are independent on the mounting position, except for W37 – W47 in M4 mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors for a complete overview.

7.6 Mounting position sheets

7.6.1 Key

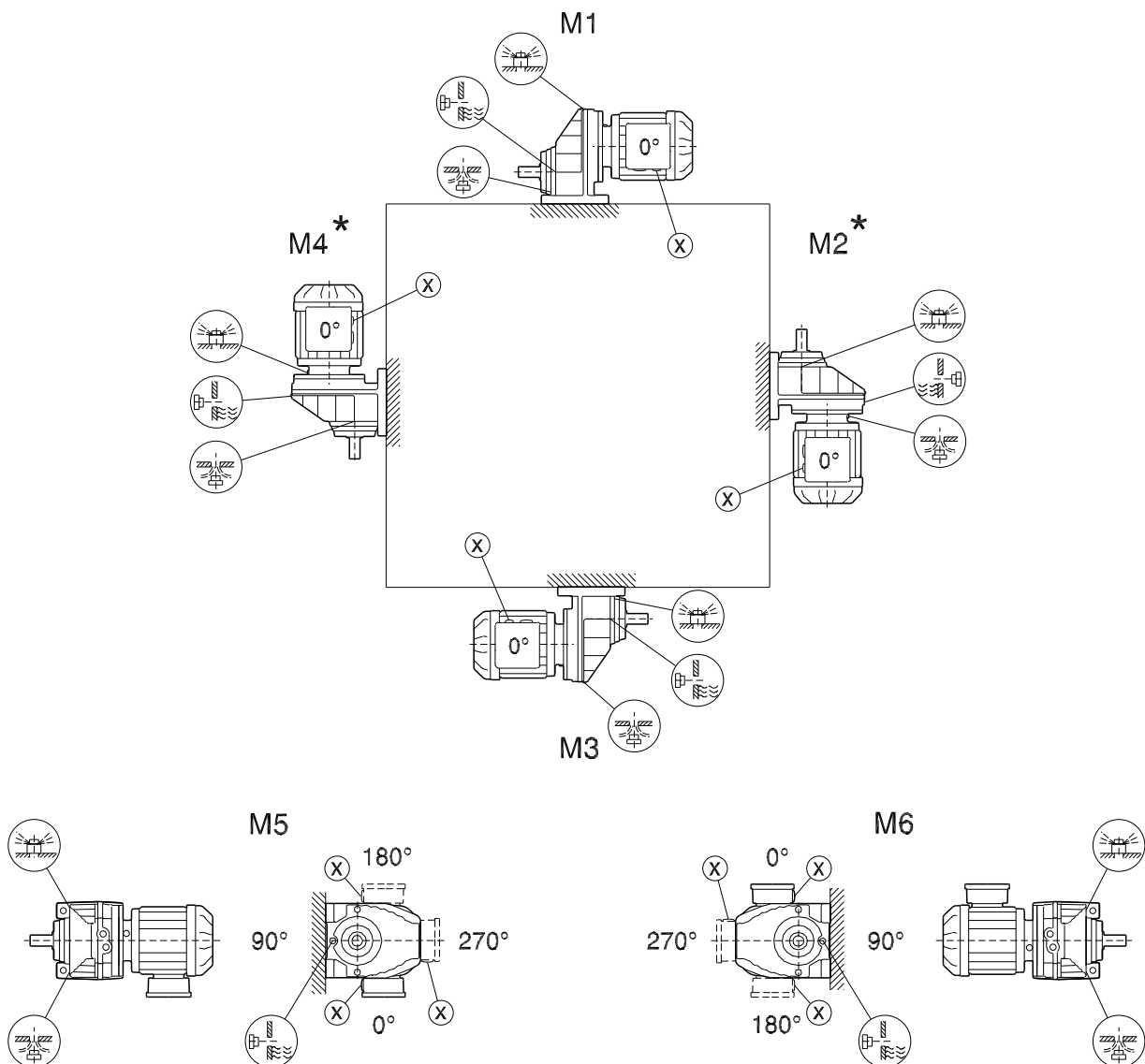
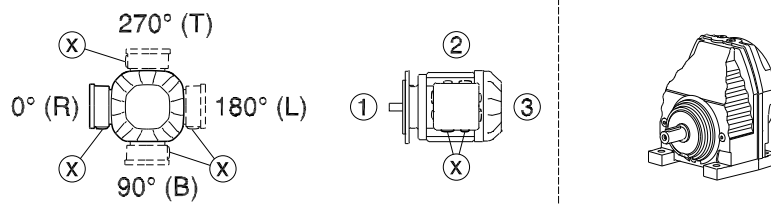
The following table shows the symbols used in the mounting position sheets and what they mean:

Icon	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

7.6.2 Mounting positions of helical gearmotors

RX57-RX107

04 043 03 00



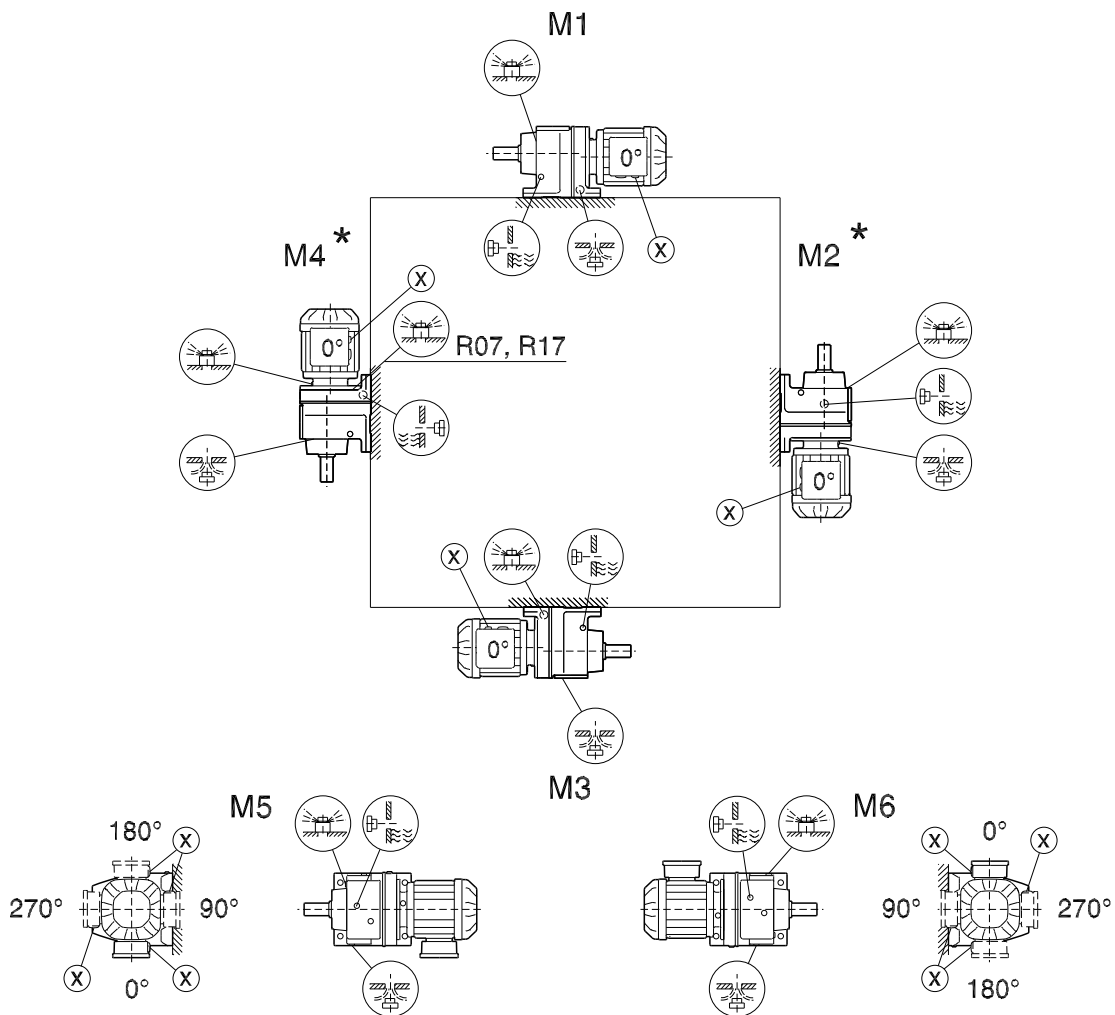
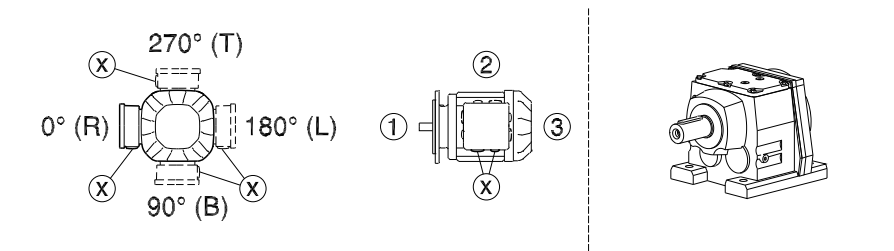
* (→ 111)

04 044 03 00



R07-R167

04 040 04 00

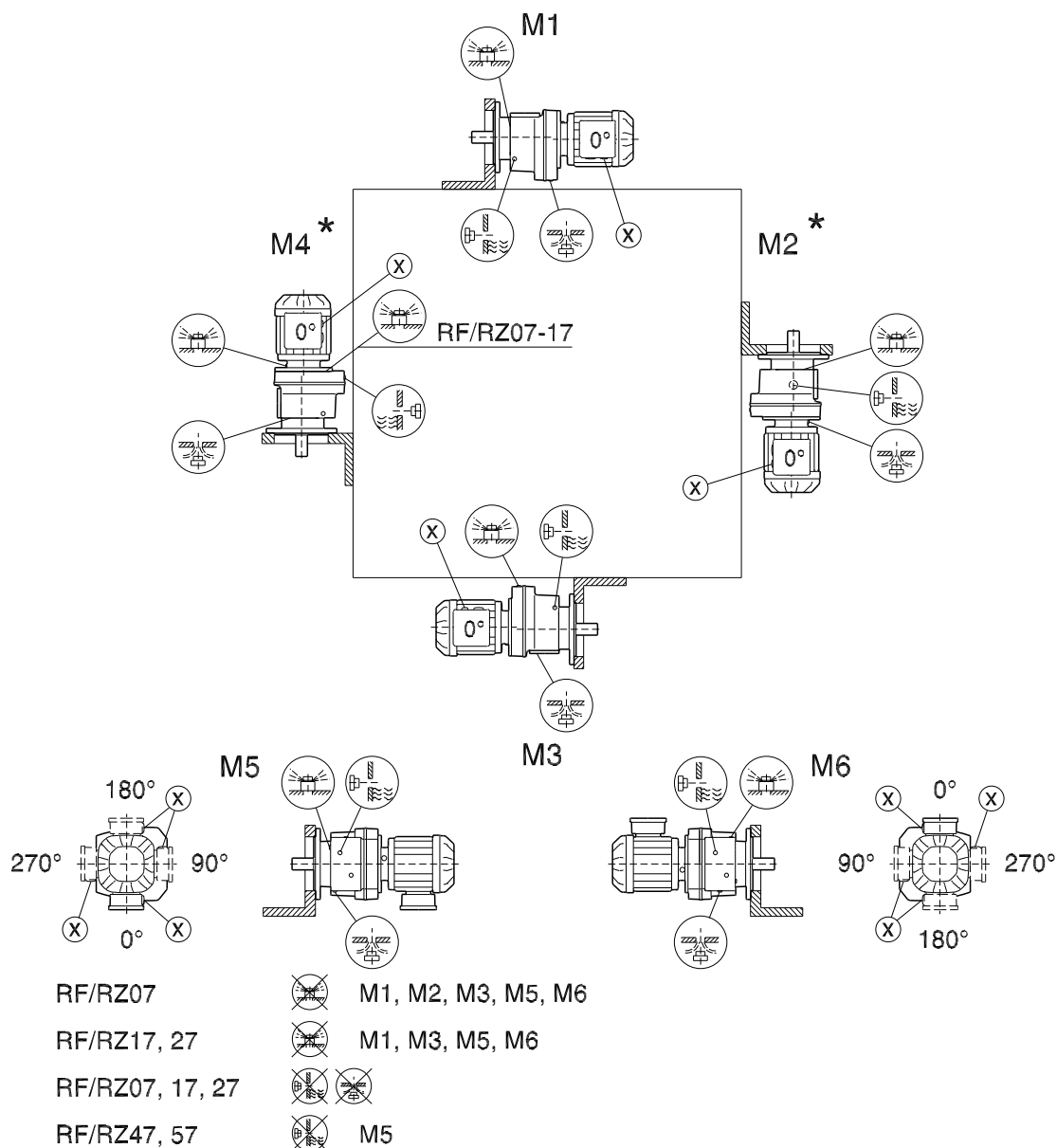
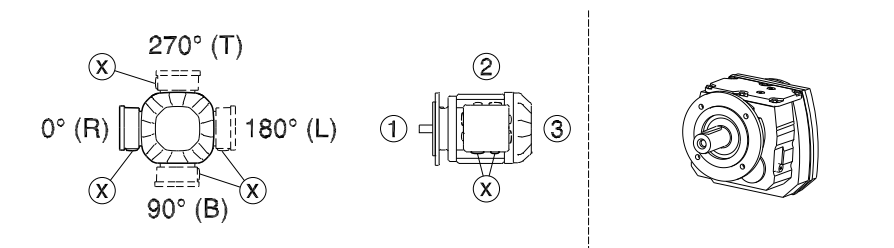


R07	M1, M2, M3, M5, M6
R17, R27	M1, M3, M5, M6
R07, R17, R27	
R47, R57	M5

* (→ 111)

RF07-RF167, RZ07-RZ87

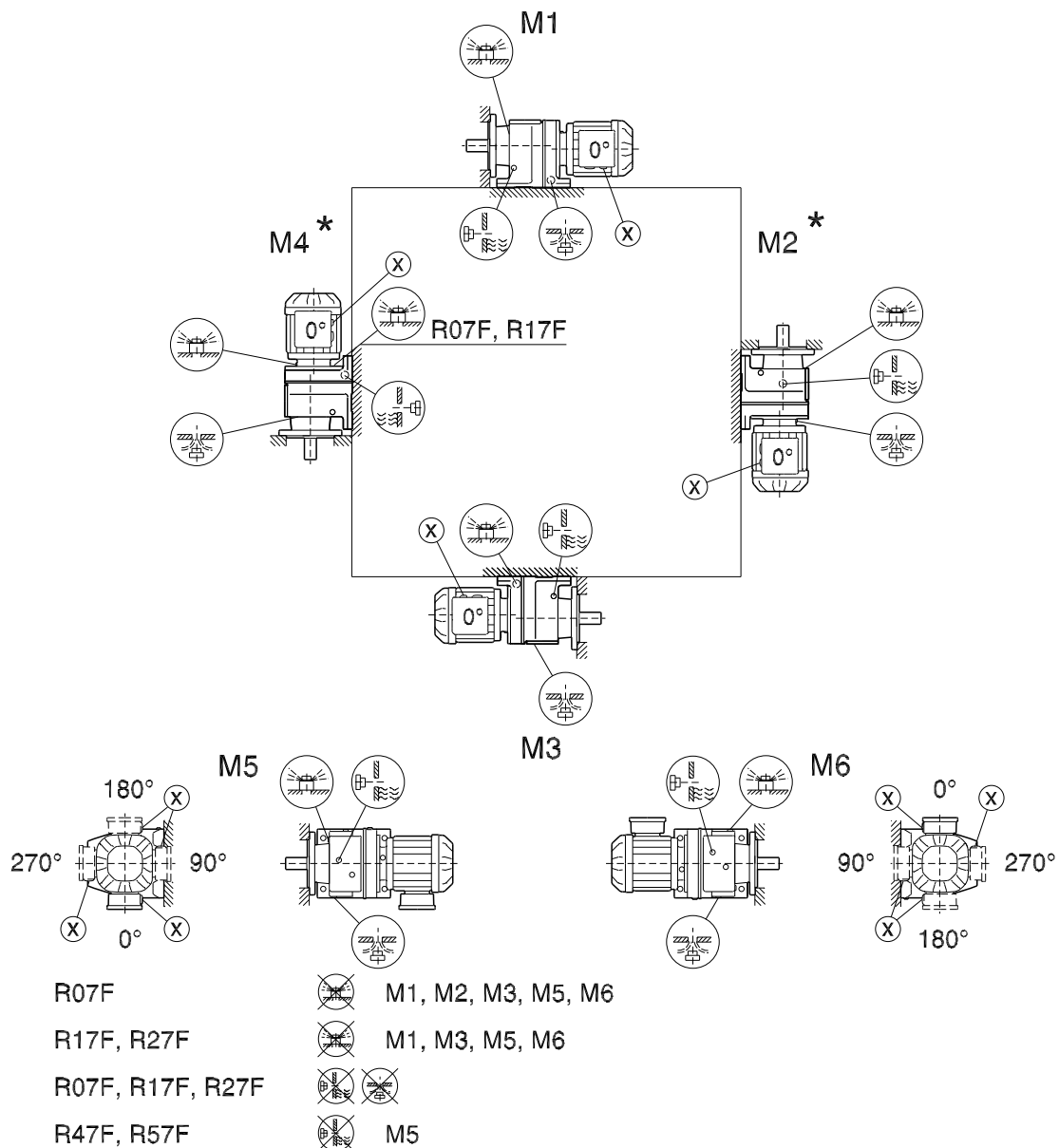
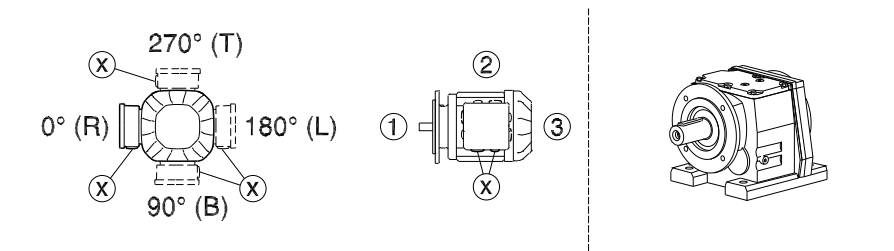
04 041 04 00



* (→ 111)

R07F-R87F

04 042 04 00

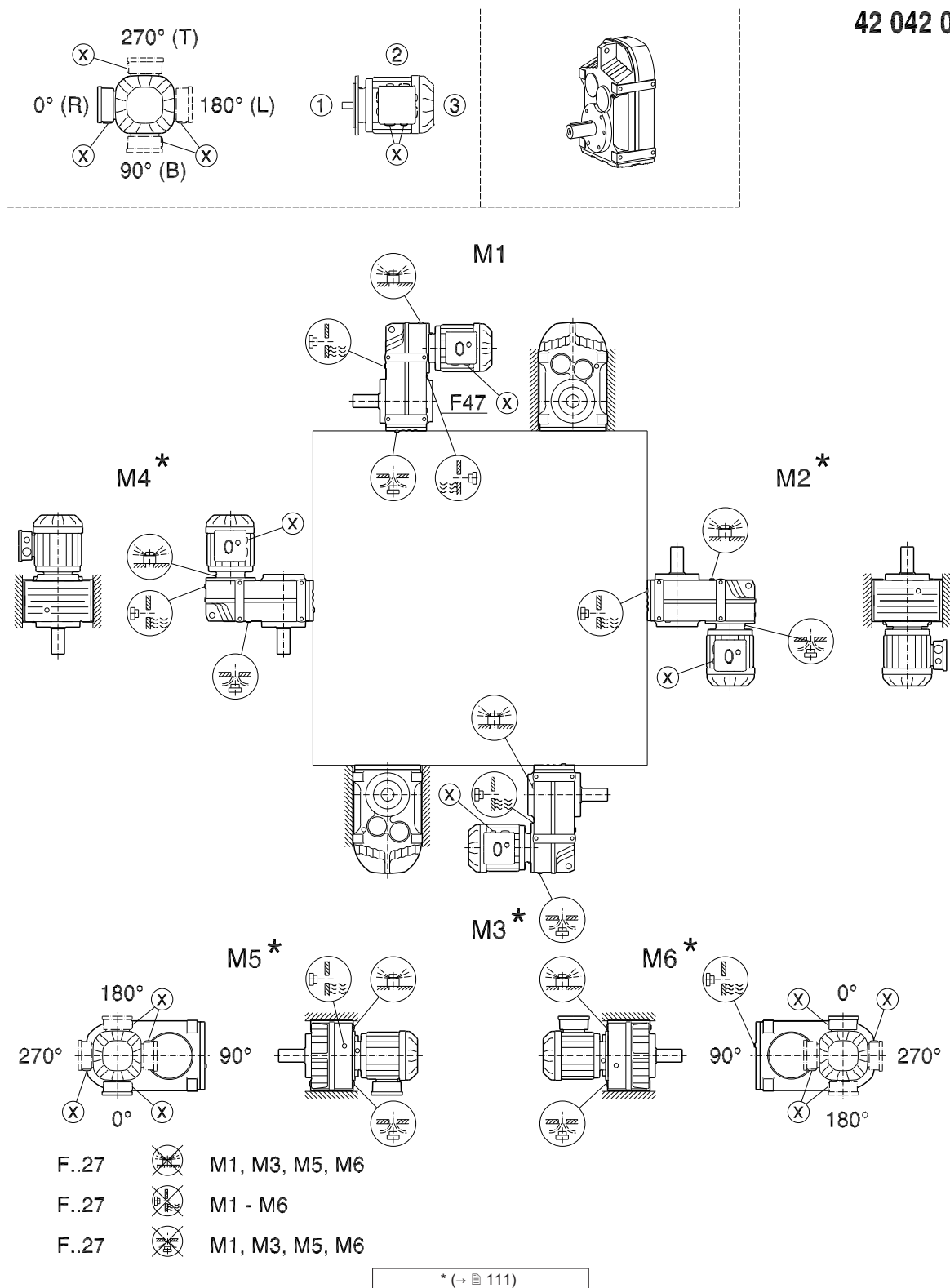


* (→ 111)

7.6.3 Mounting positions of parallel-shaft helical gearmotors

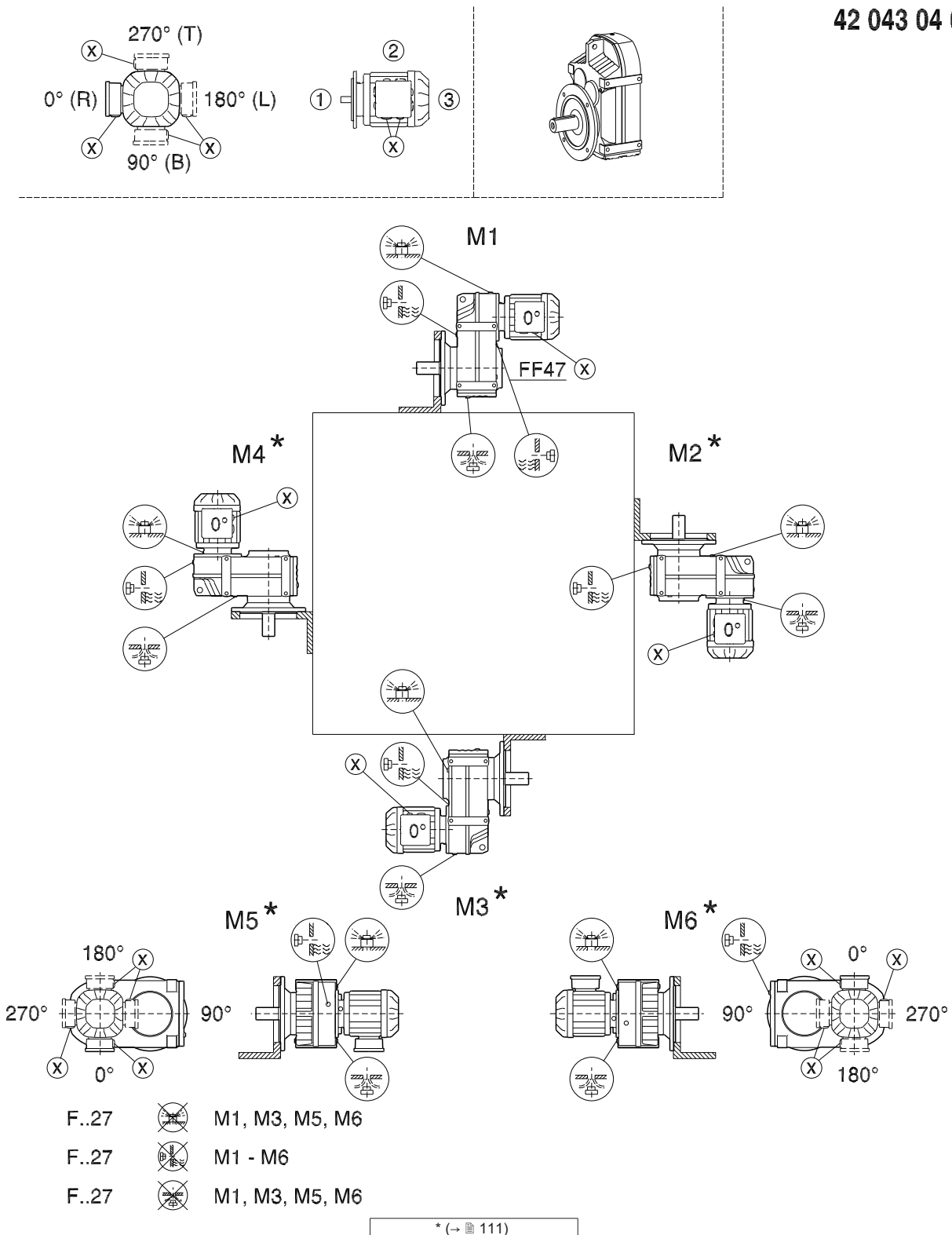
F/FA..B/FH27B-157B, FV27B-107B

42 042 04 00



FF/FAF/FHF/FZ/FAZ/FHZ27-157, FVF/FVZ27-107

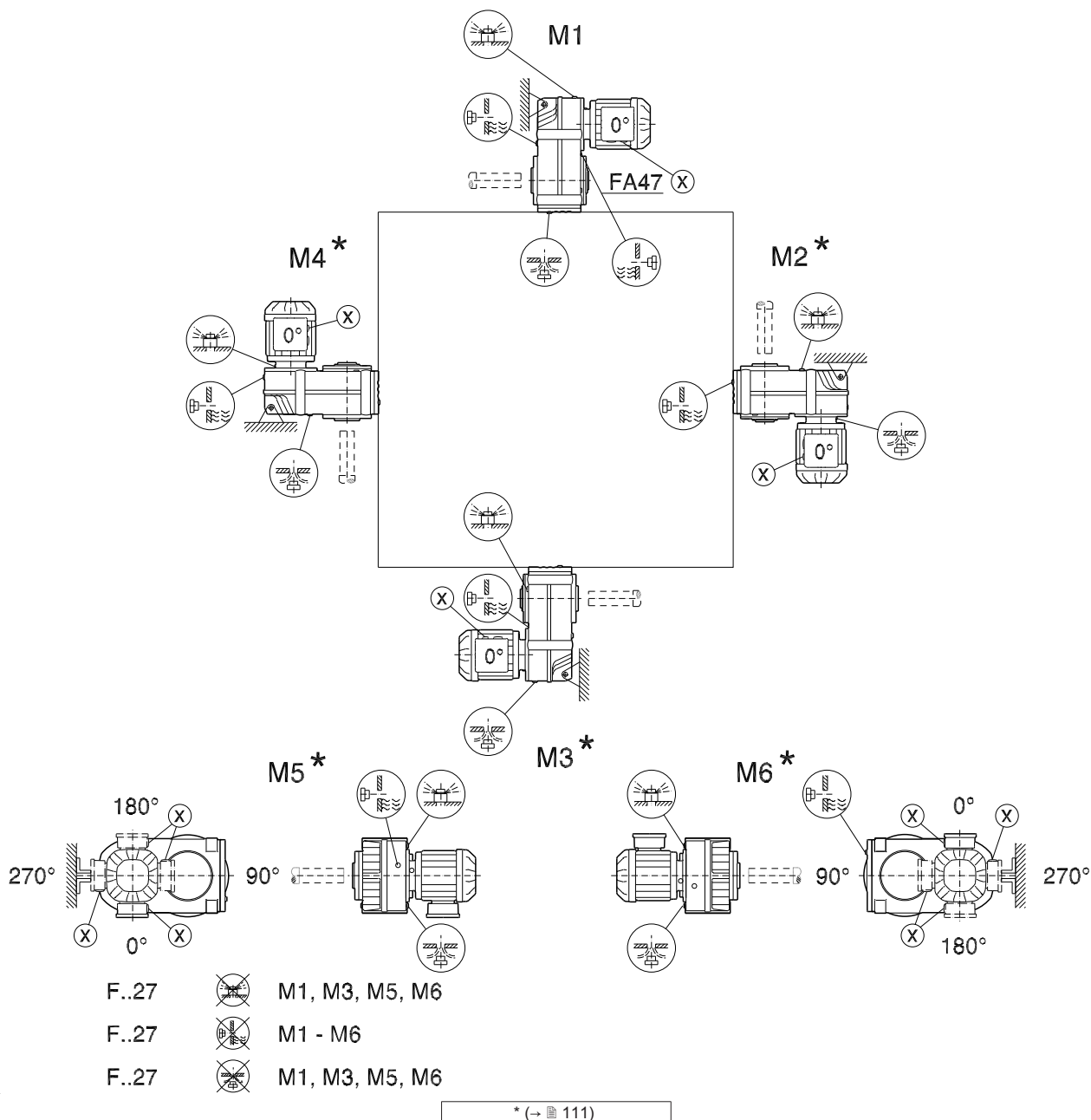
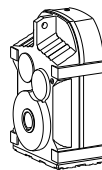
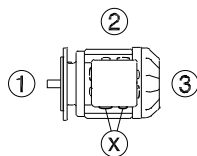
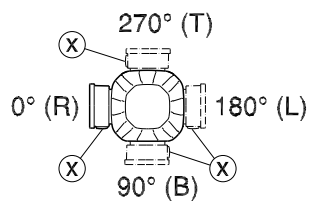
42 043 04 00



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FA/FH27-157, FV27-107, FT37-97

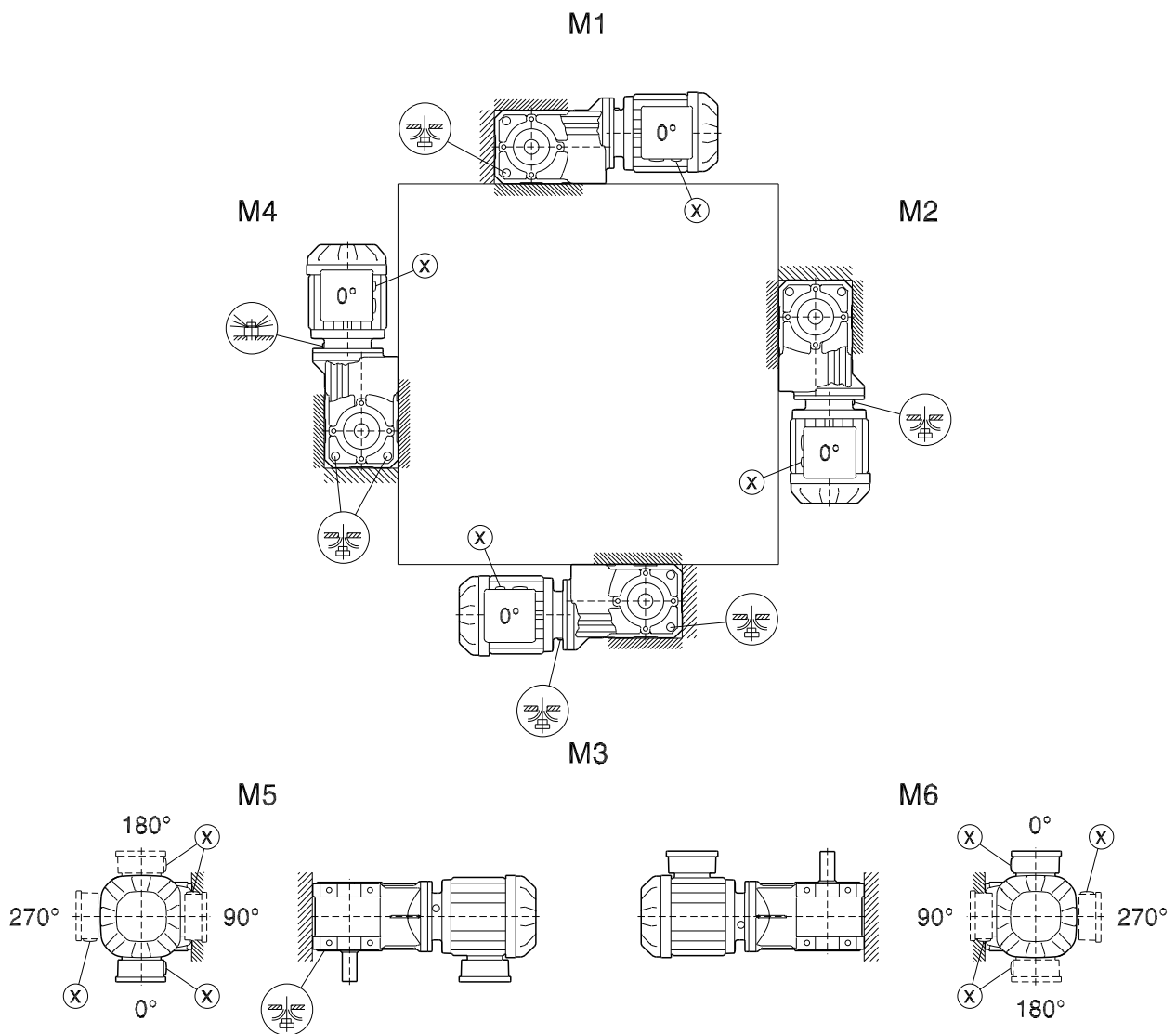
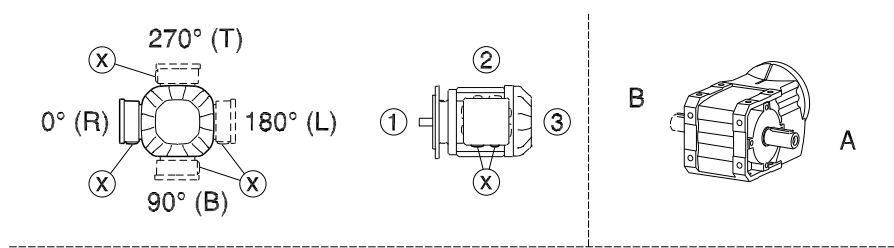
42 044 04 00



7.6.4 Mounting positions of helical-bevel gearmotors

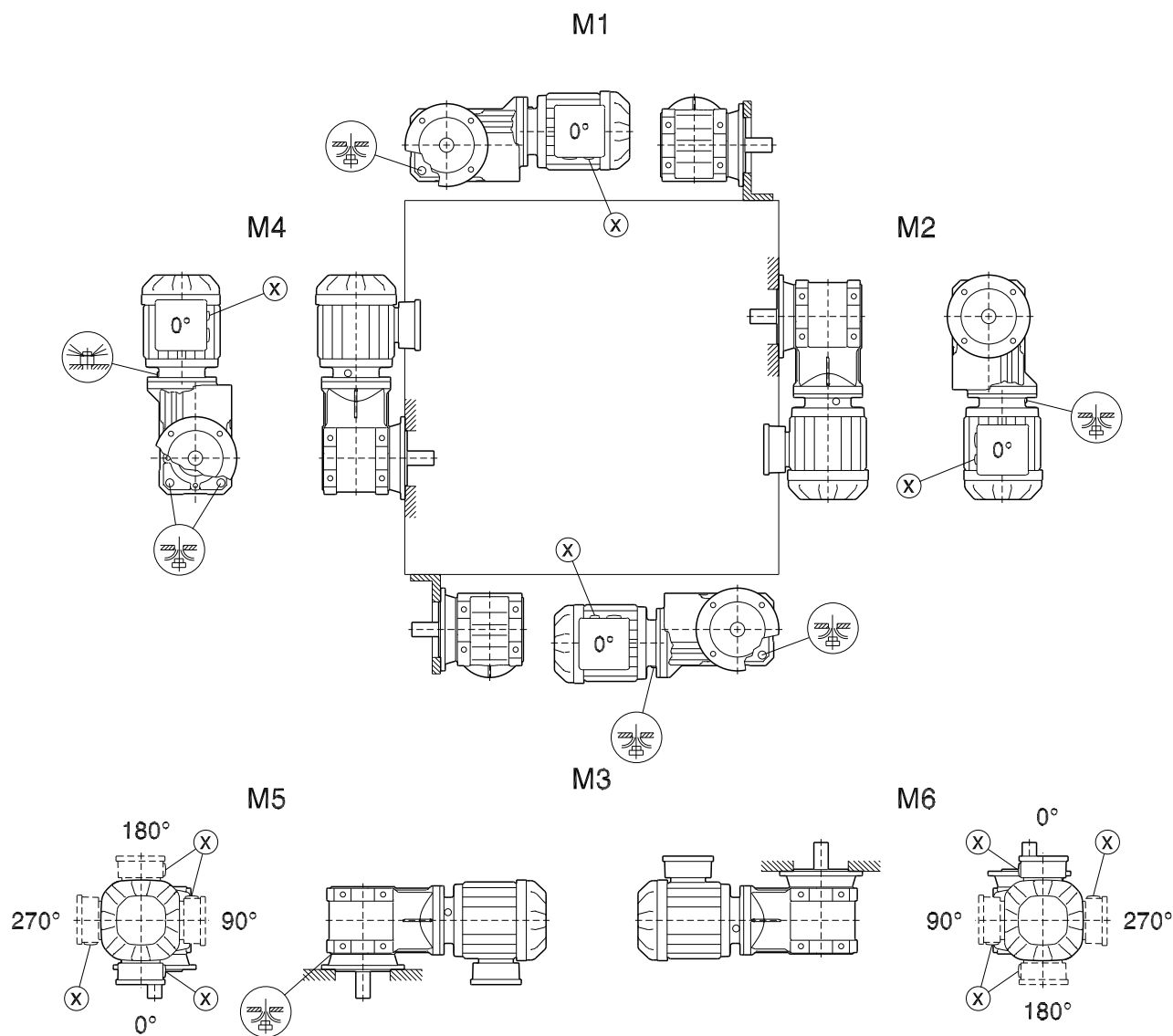
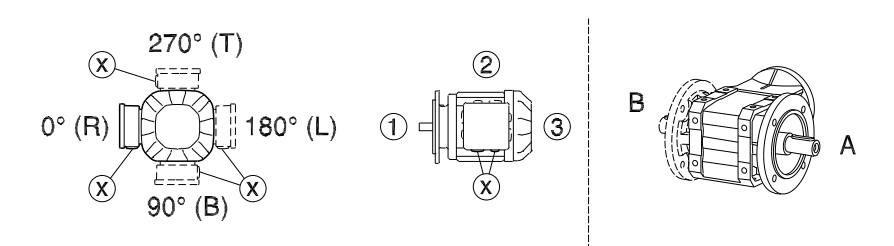
K/KA..B/KH19B-29B

33 023 00 15



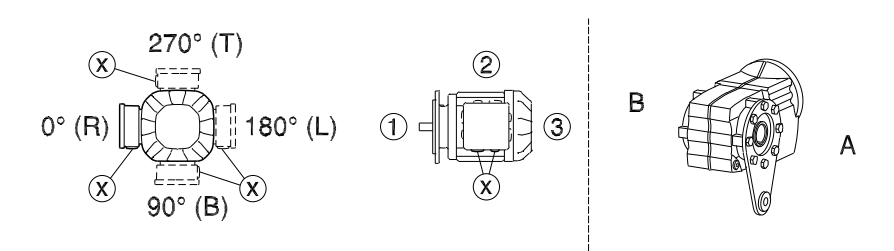
KF..B/KAF..B/KHF19B-29B

33 024 00 15

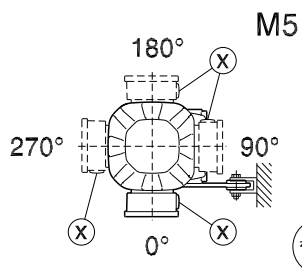
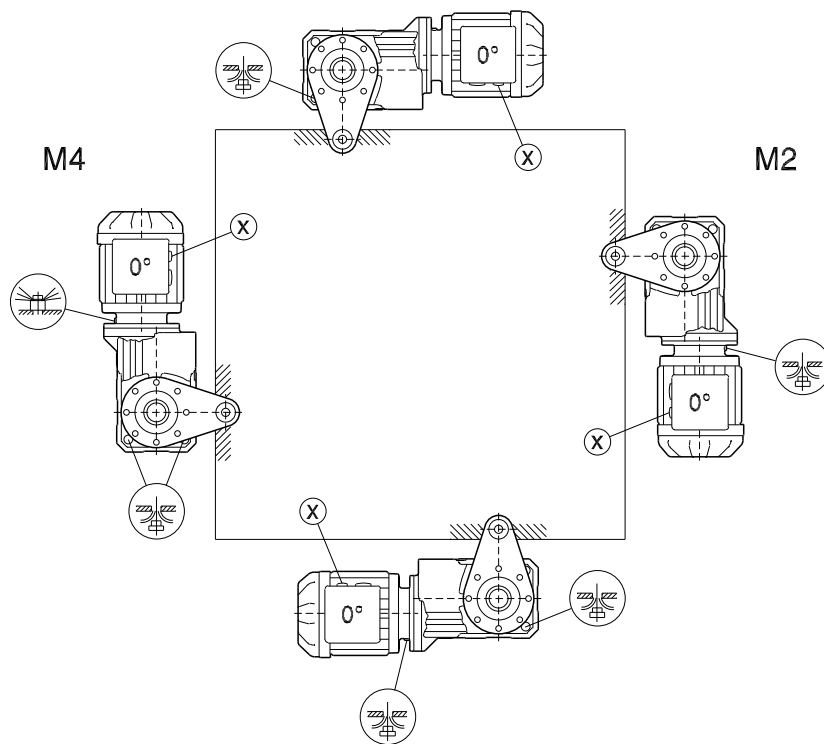


KA..B/KH19B-29B

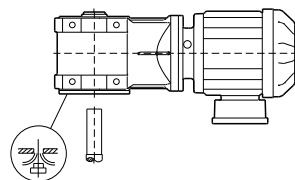
33 025 00 15



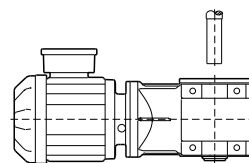
M1



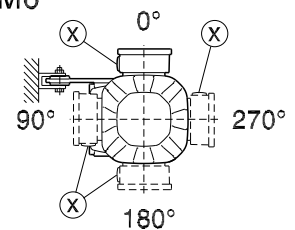
M5



M3

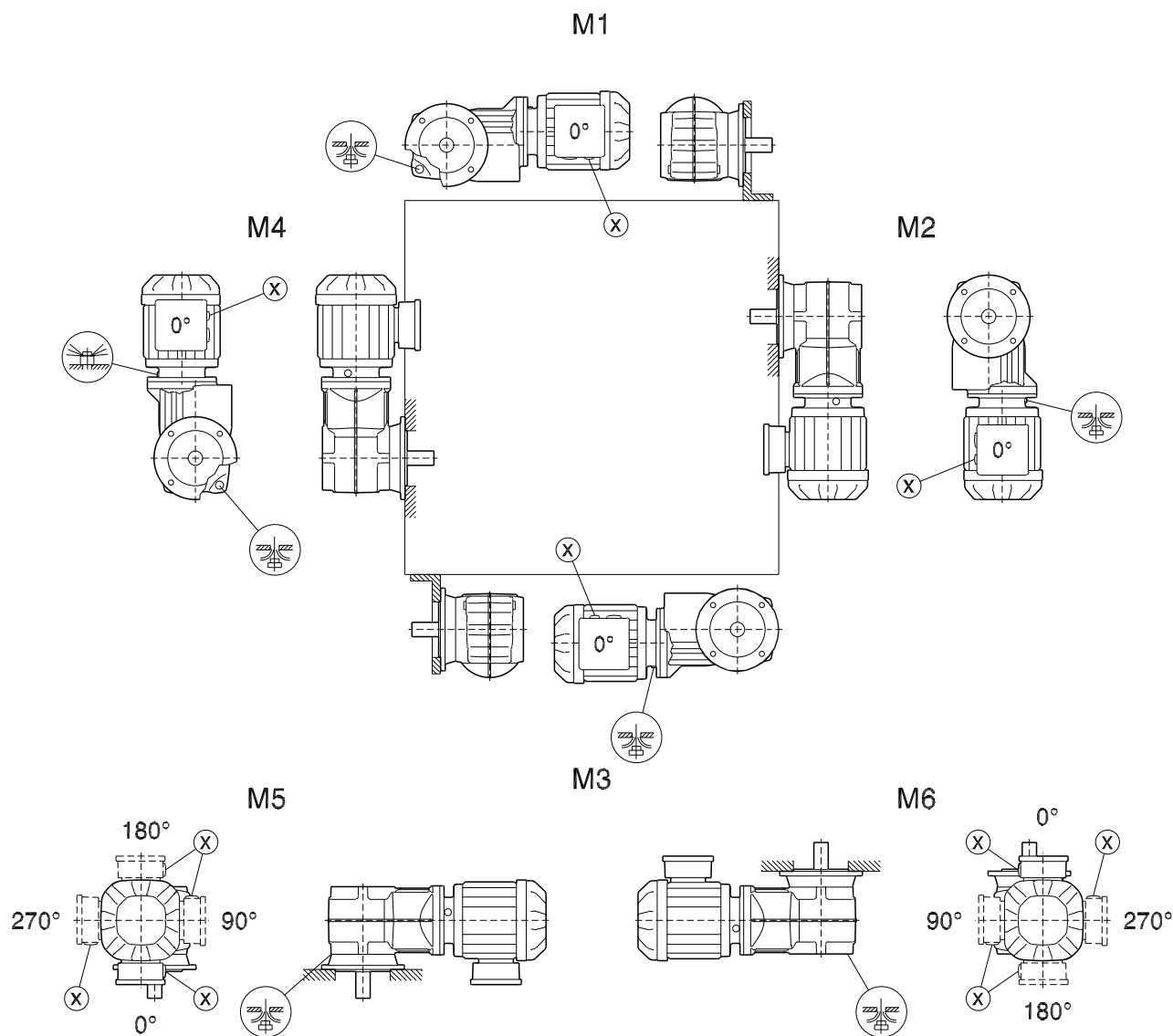
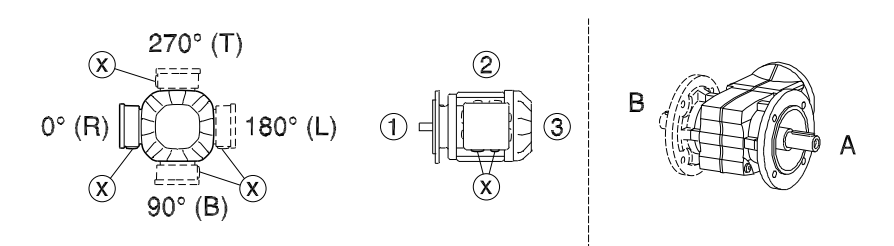


M6



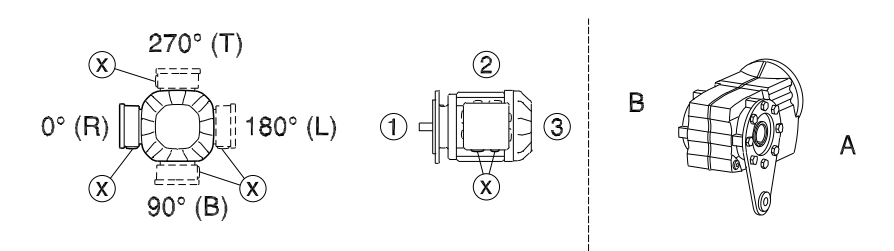
KF/KAF/KHF19-29

33 026 00 15

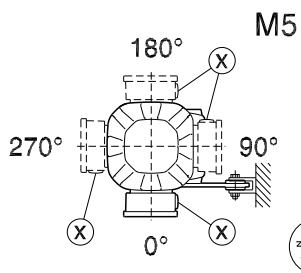
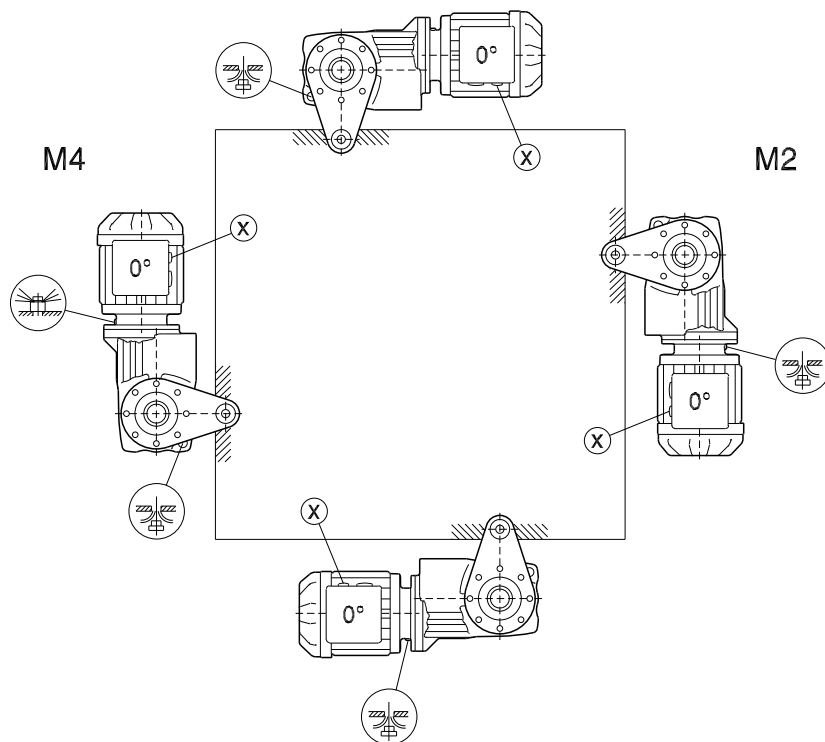


KA/KH19-29

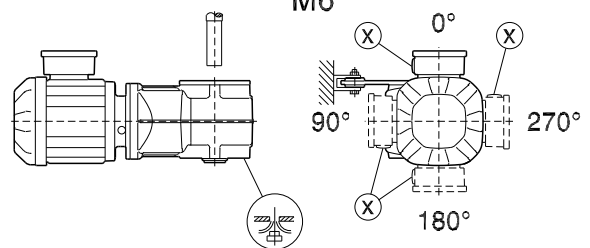
33 027 00 15



M1



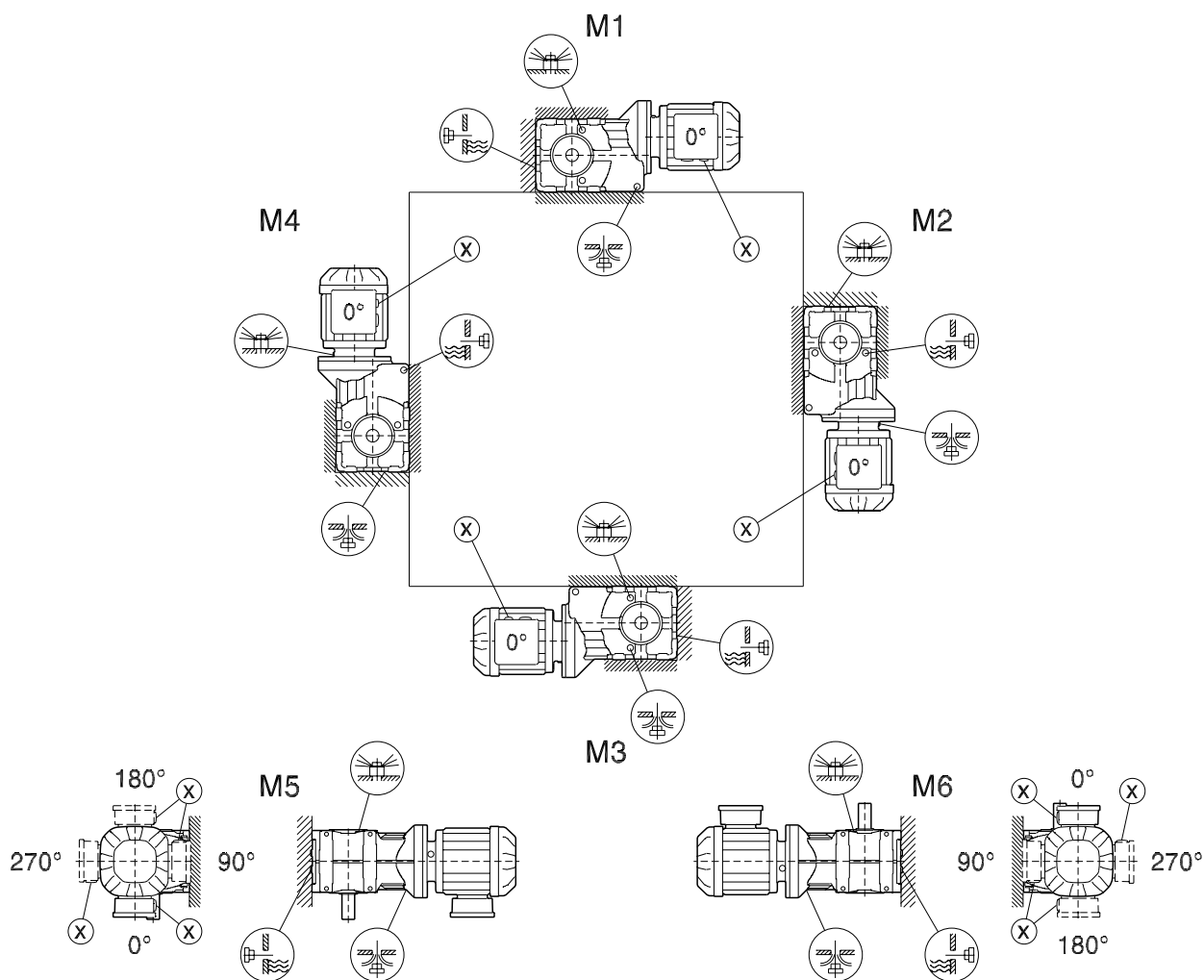
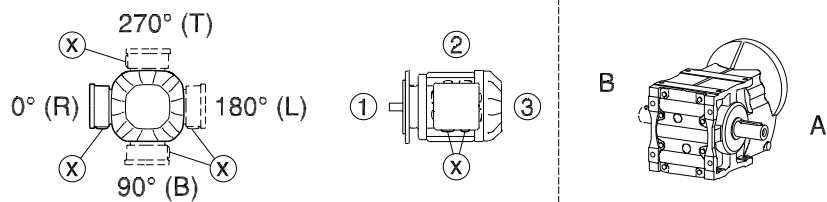
M5






M6

K39-49

33 092 00 14

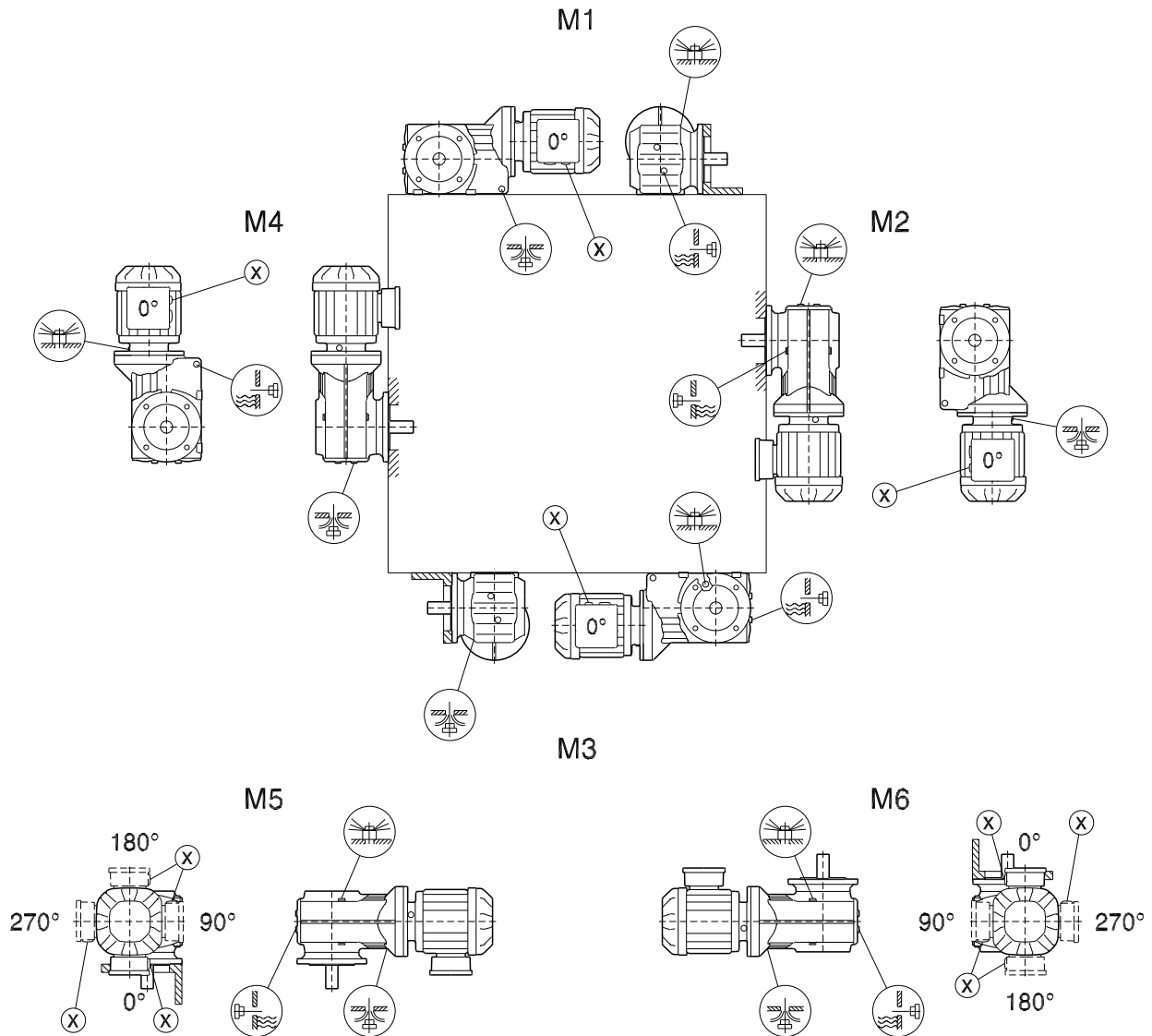
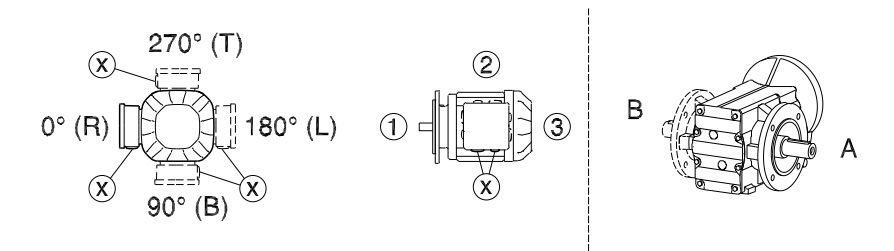


For front-end mounting:

-  M2
-  M1, M3, M5, M6
-  M4

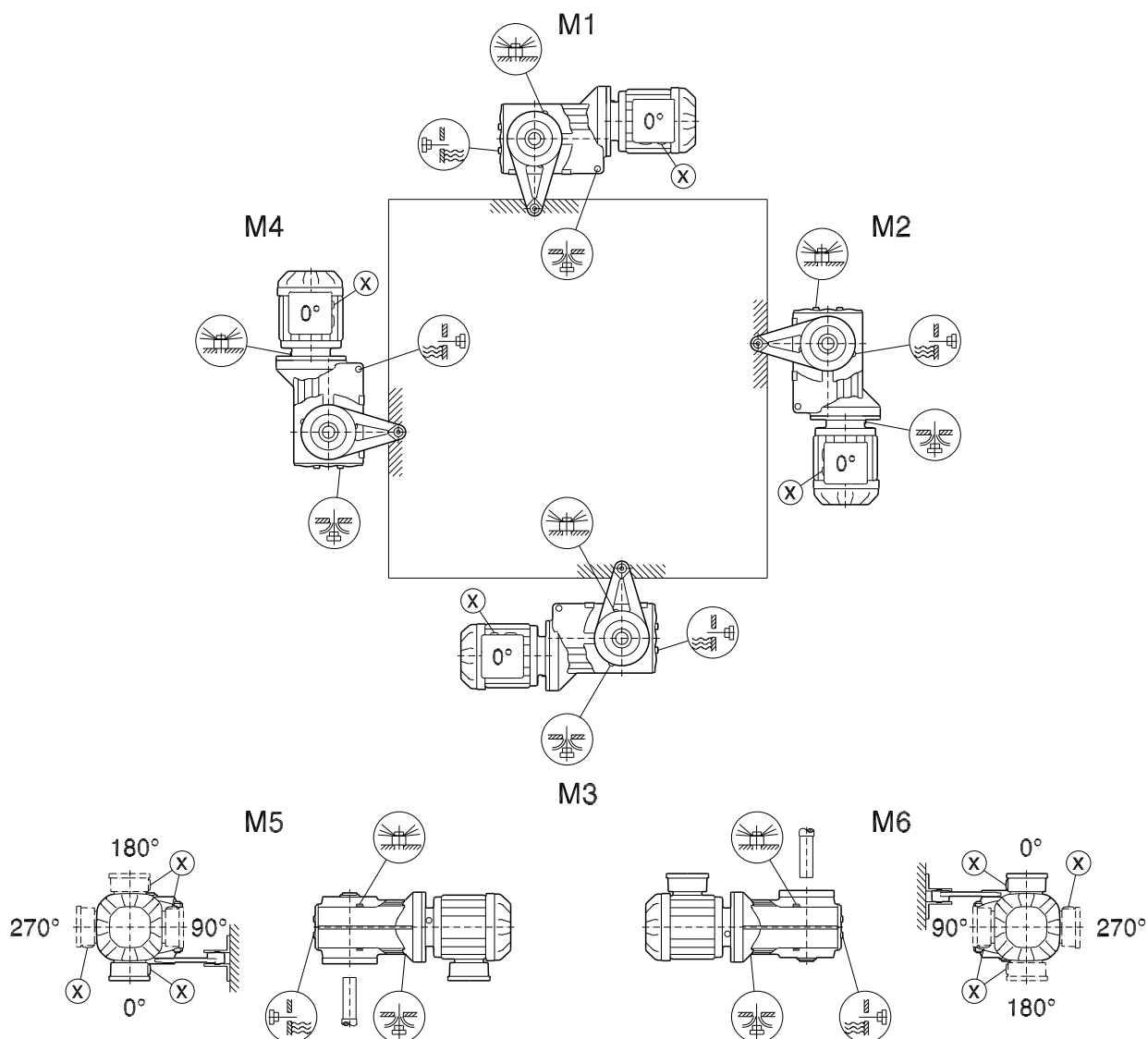
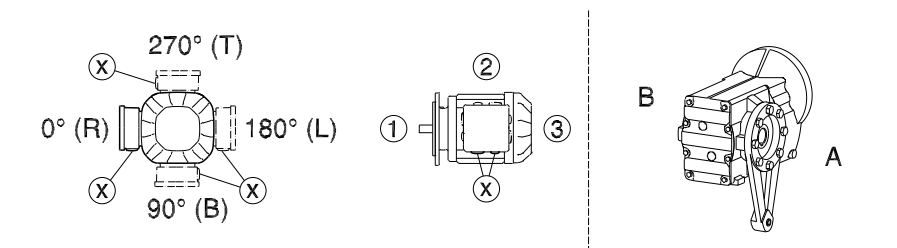
KF/KAF39-49

33 093 00 14



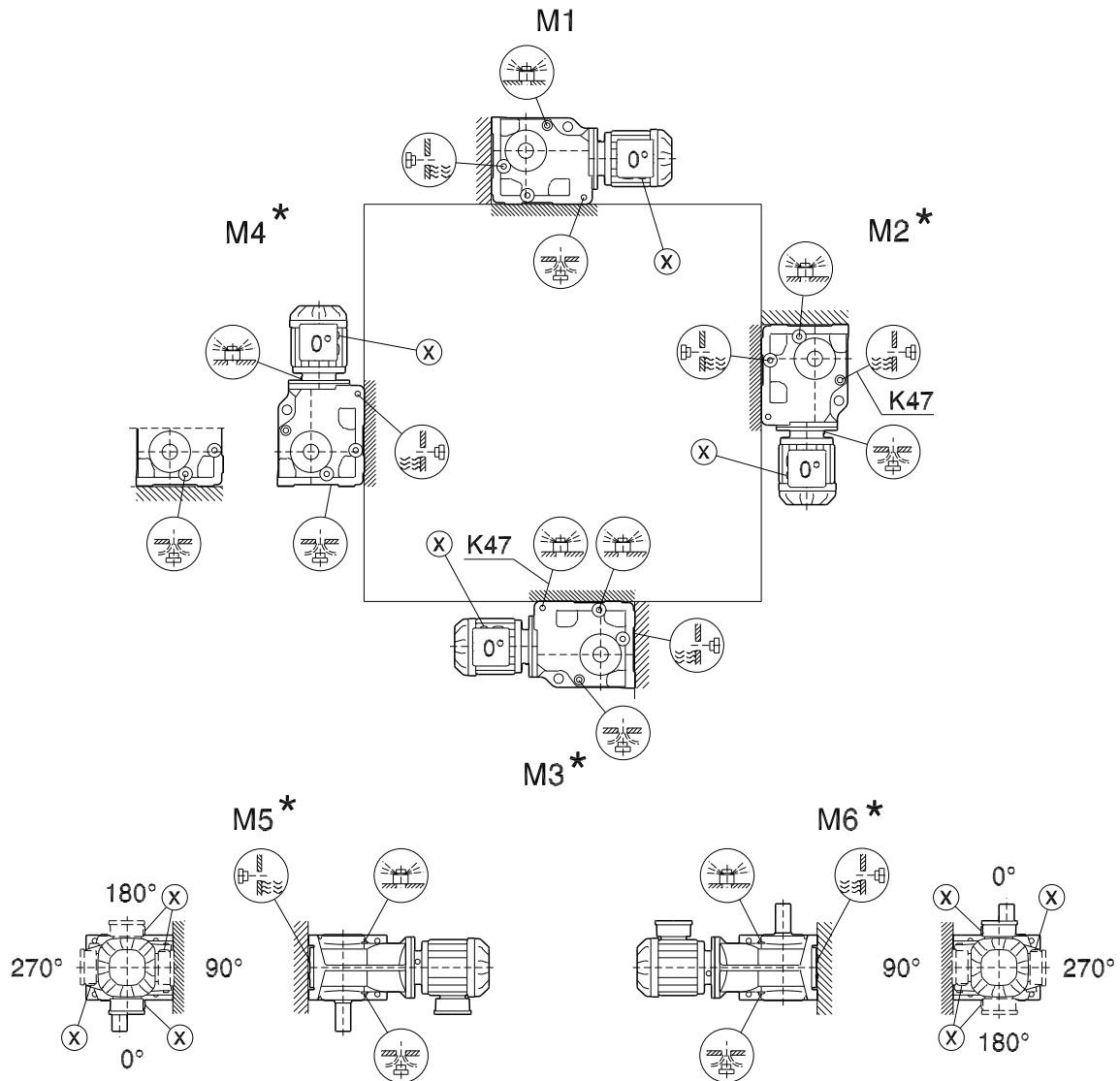
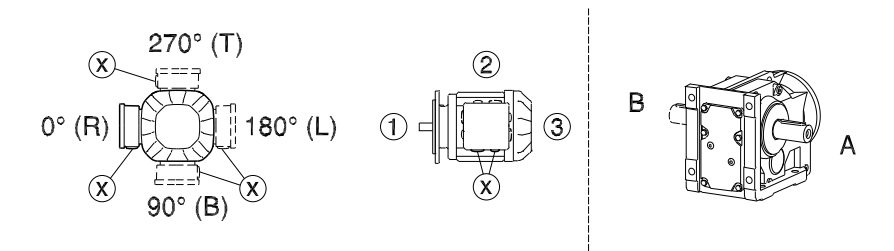
KA/KT39-49

33 094 00 14



K/KA..B/KH37B-157B, KV37B-107B

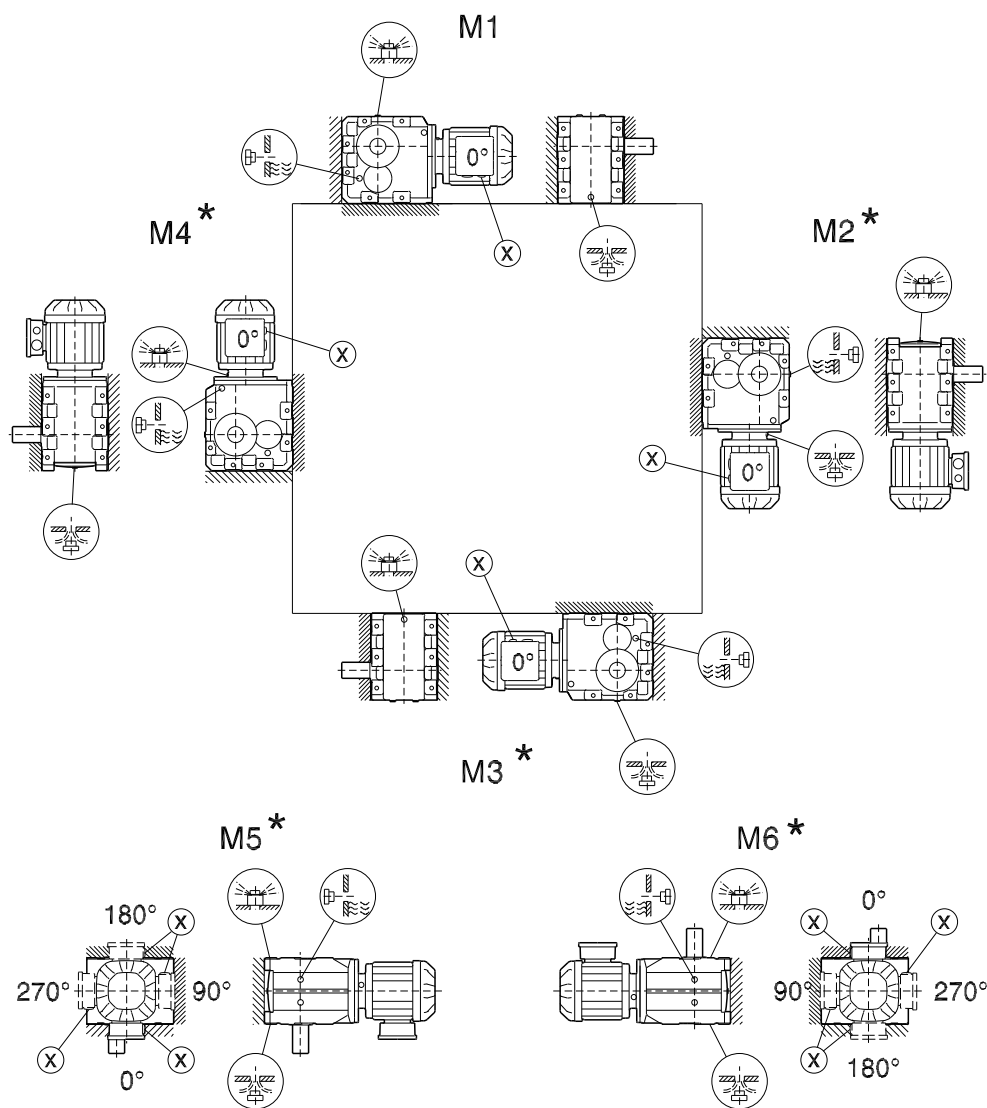
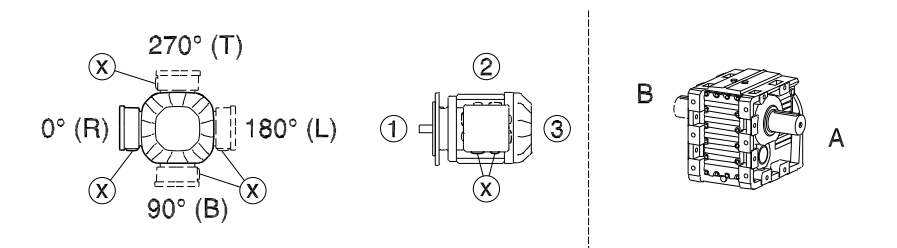
34 025 04 00



* (→ 111)

K167-187, KH167B-187B

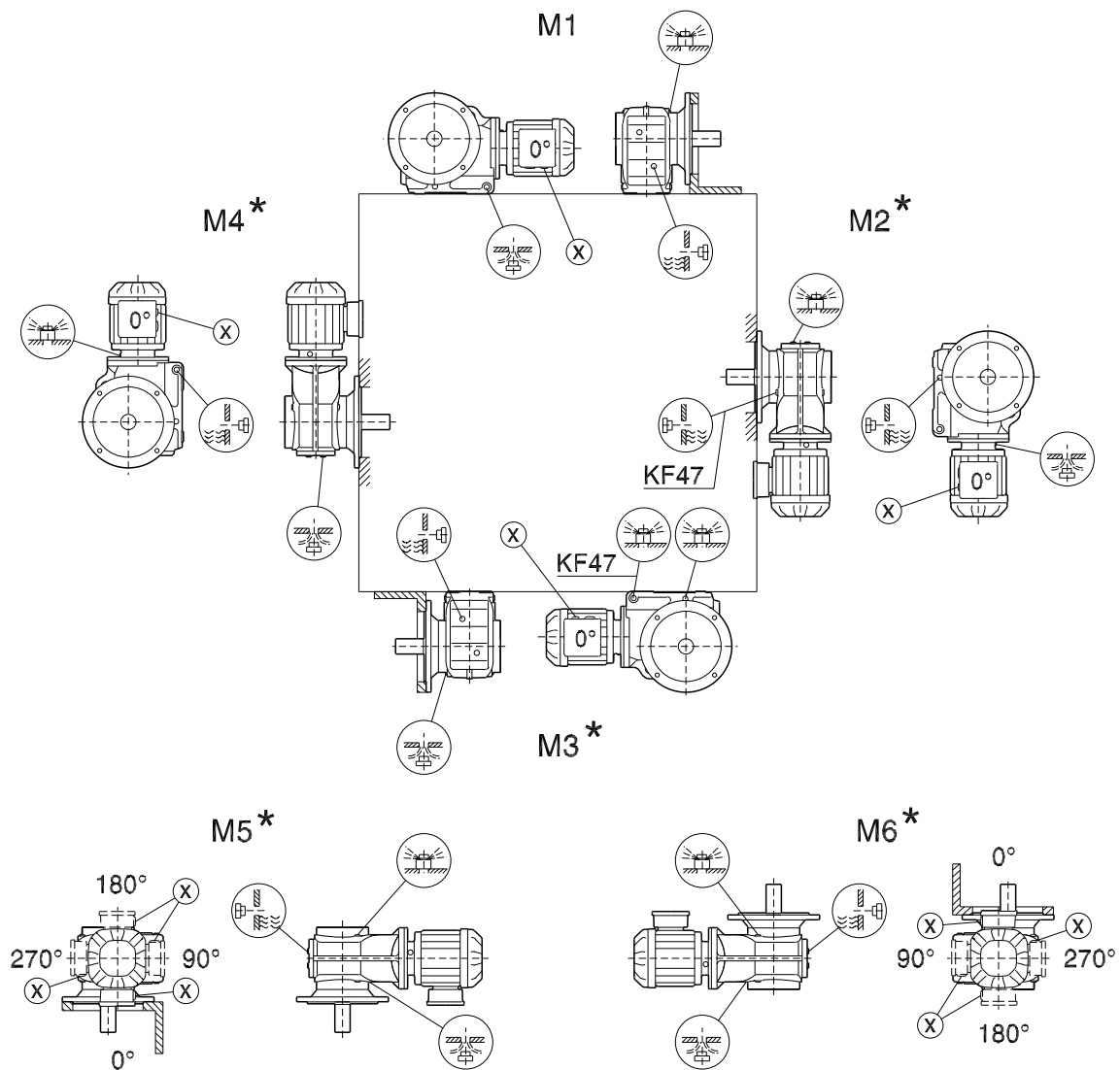
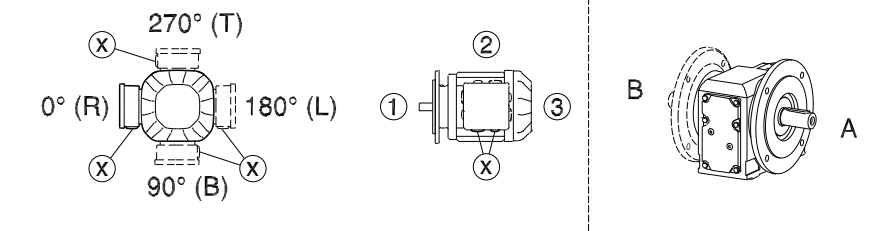
34 026 04 00



* (→ 111)

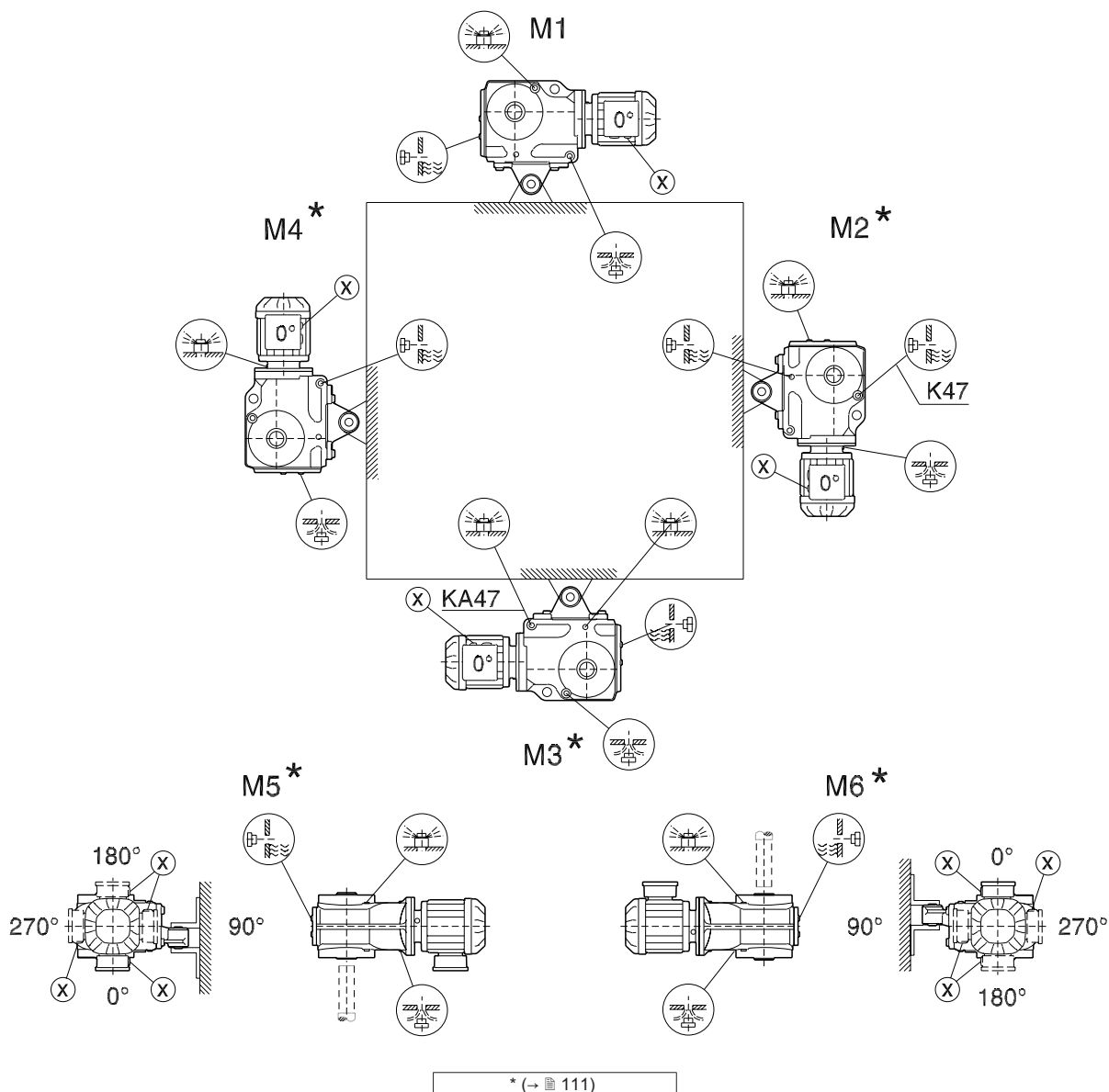
KF/KAF/KHF/KZ/KAZ/KHZ37-157, KVF/KVZ37-107

34 027 04 00



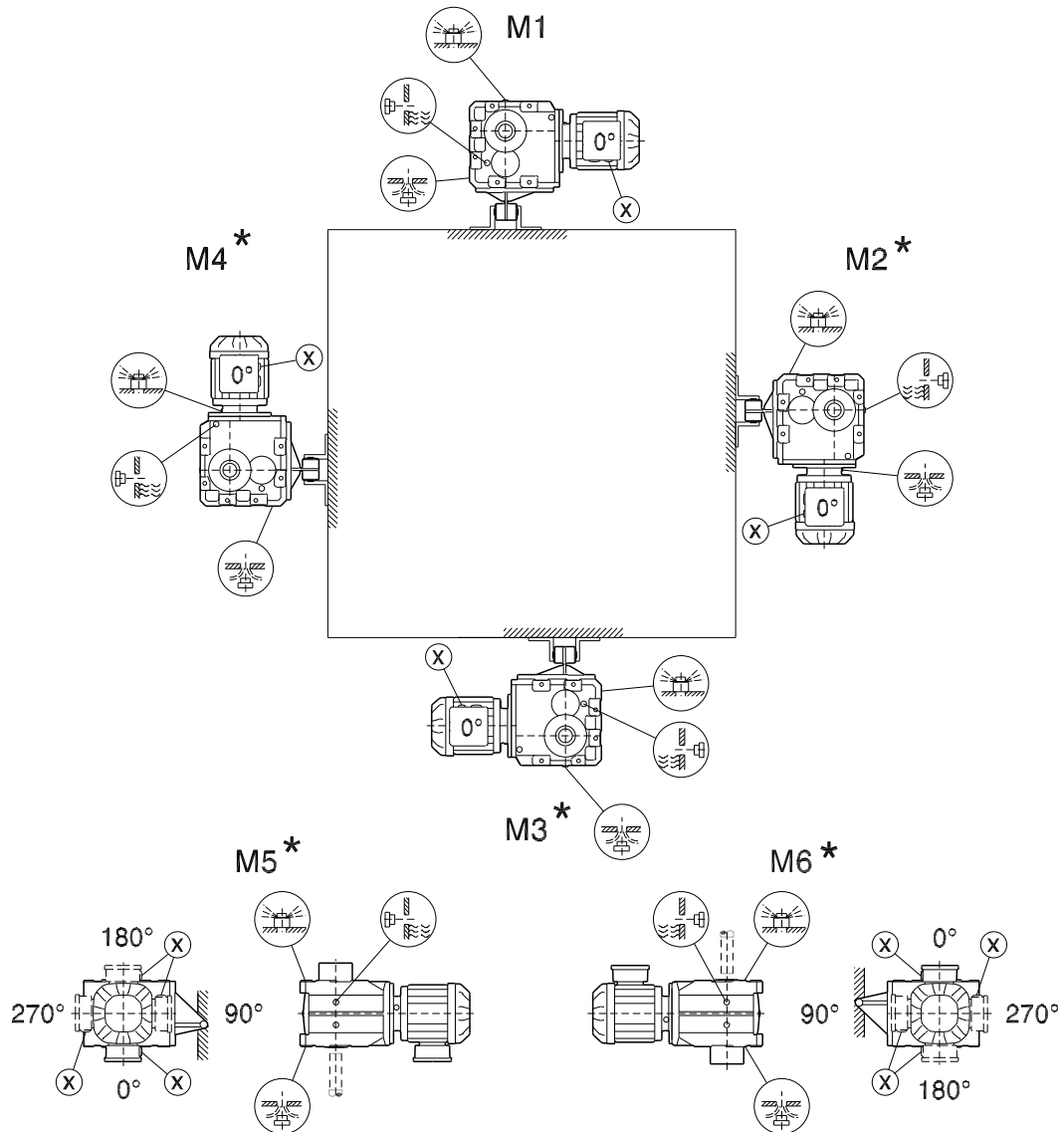
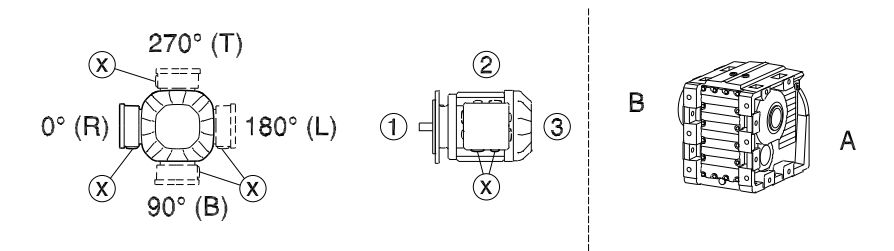
* (→ 111)

39 025 05 00



KH167-187

39 026 05 00

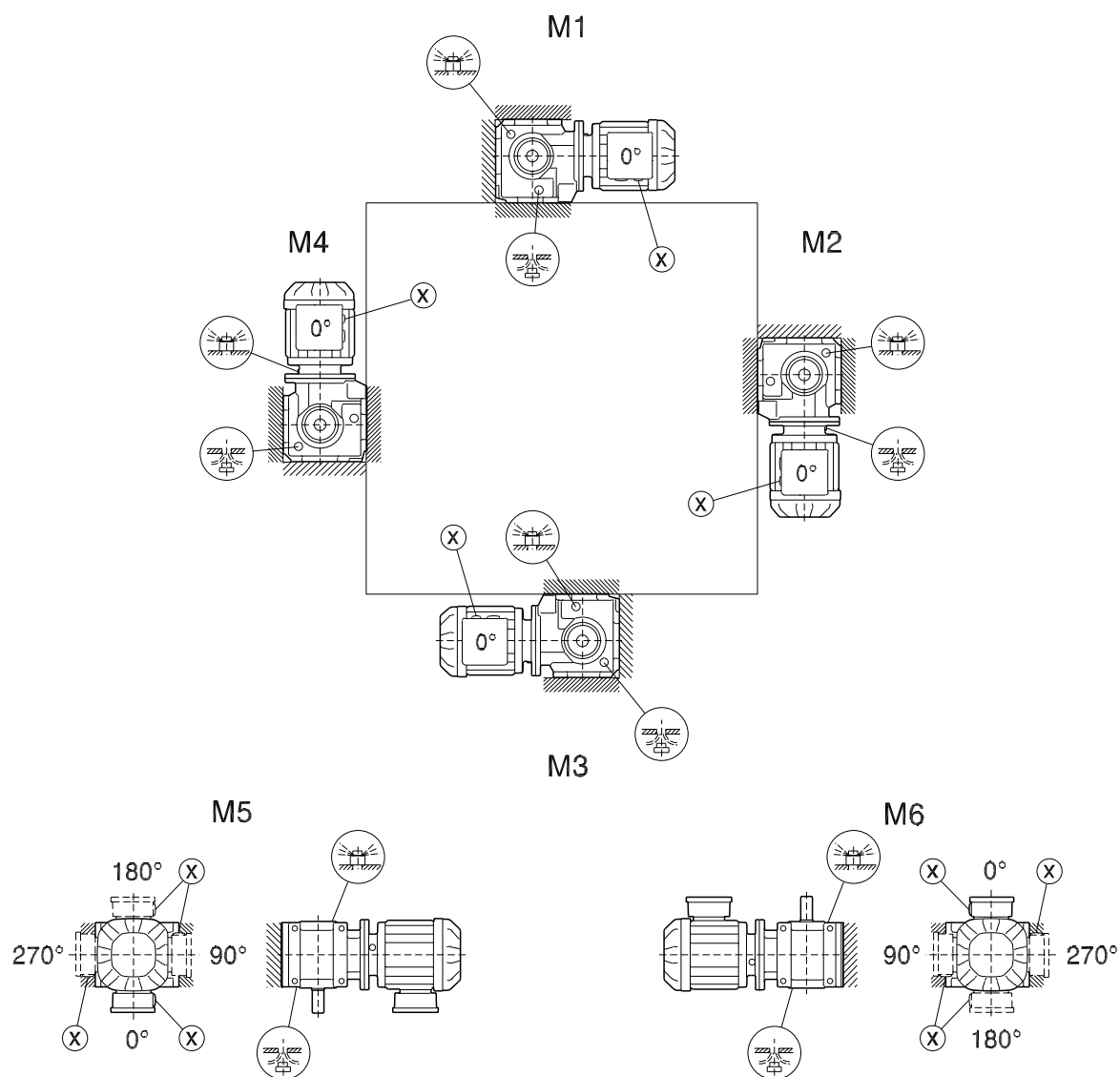
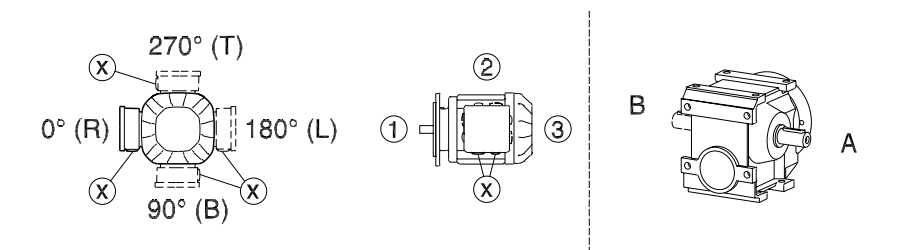


* (→ 111)

7.6.5 Mounting positions of helical-worm gearmotors

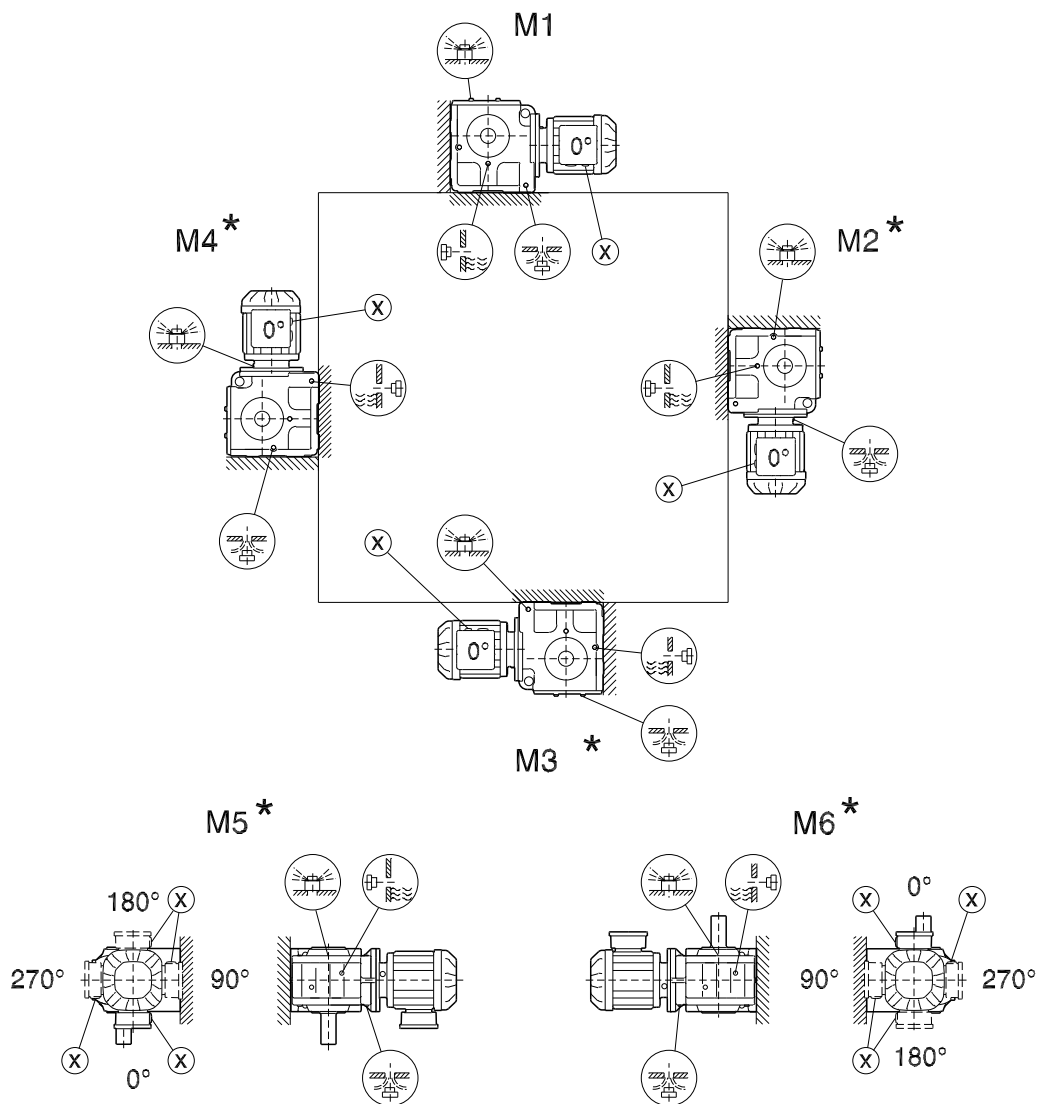
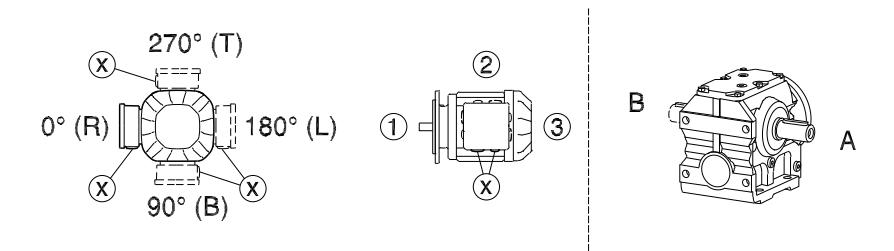
S37

05 025 04 00



S47-S97

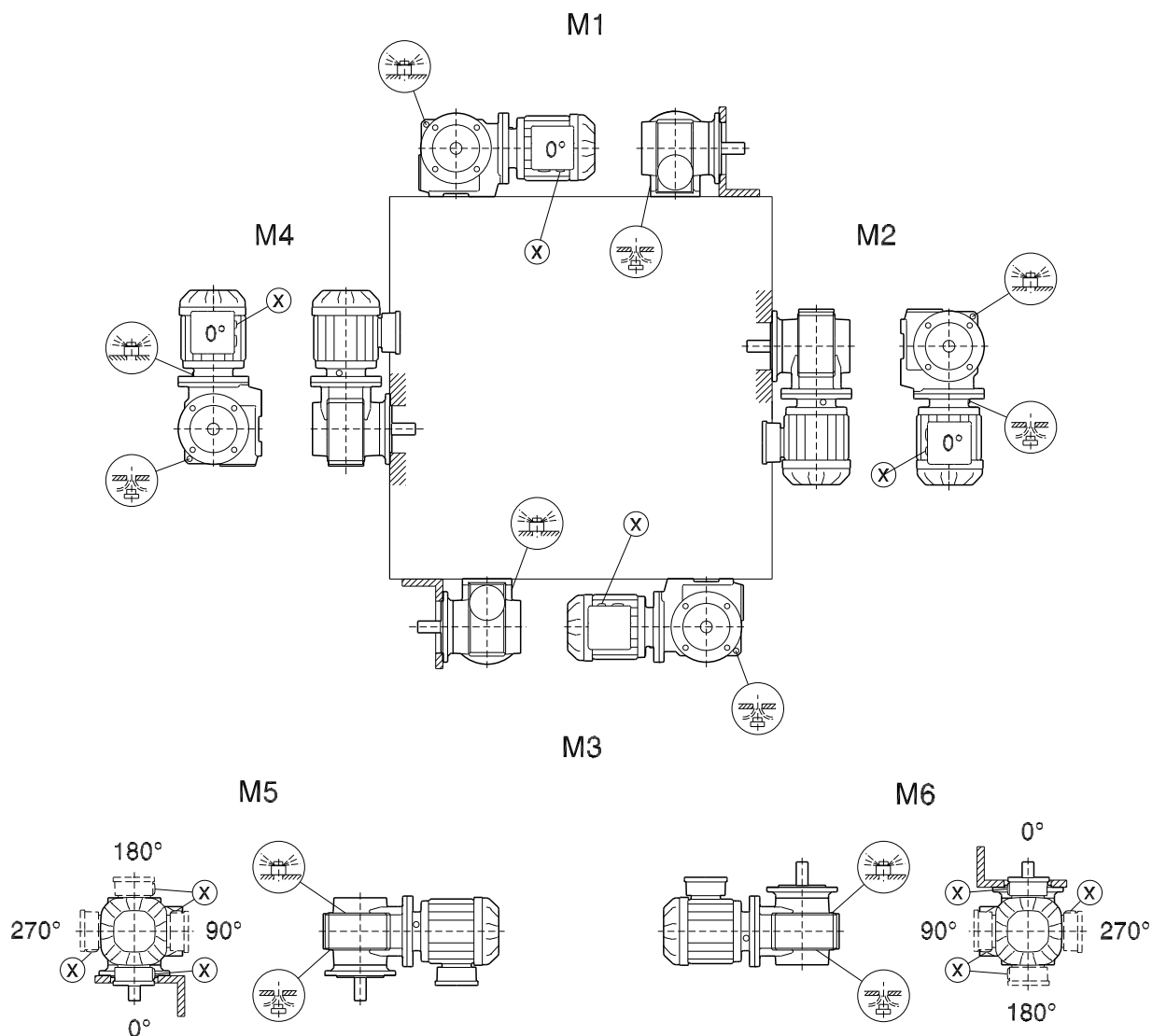
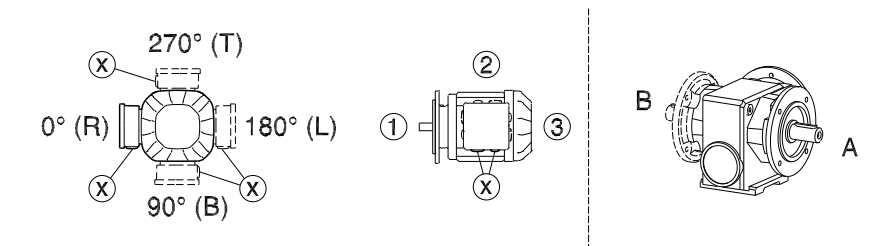
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* (→ 111)

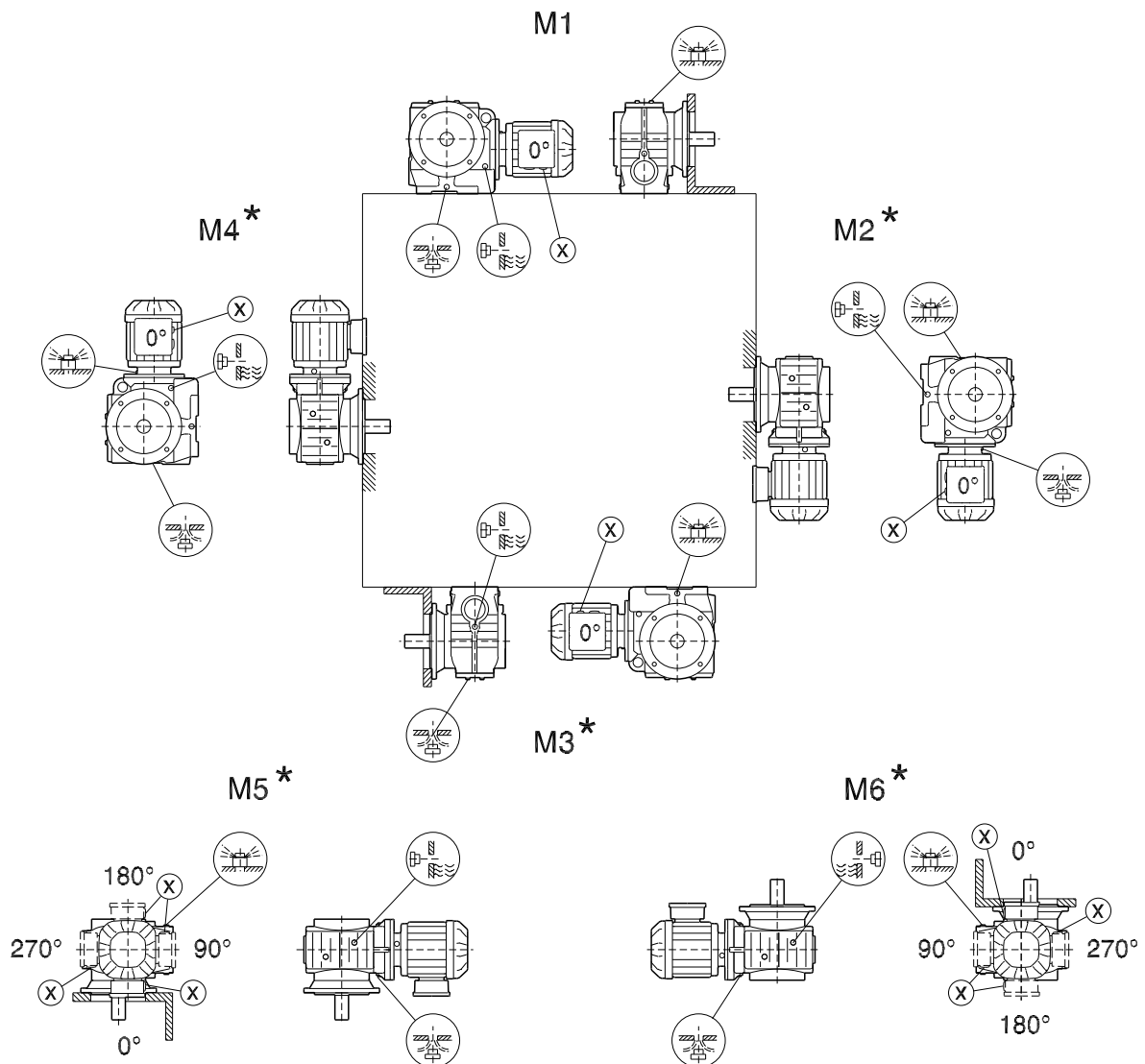
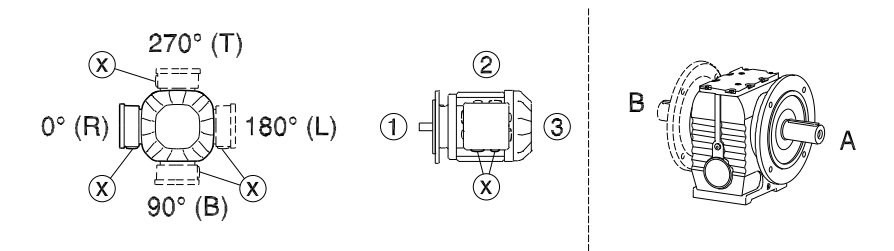
SF/SAF/SHF37

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SF/SAF/SHF/SAZ/SHZ47-97

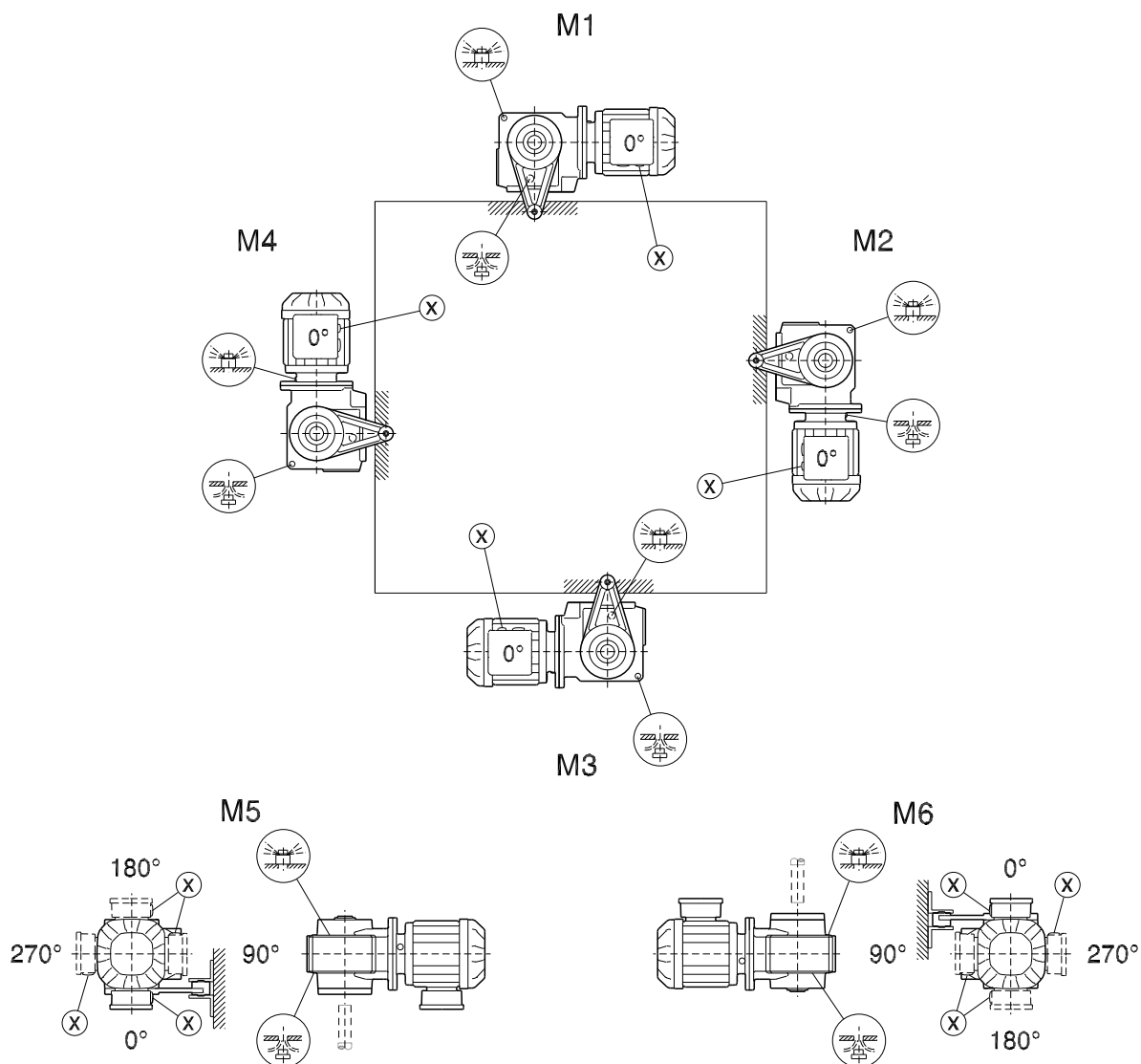
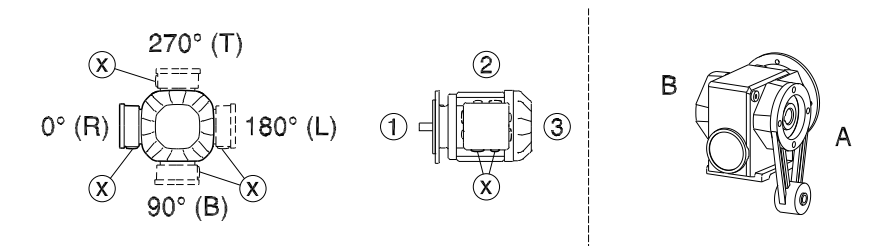
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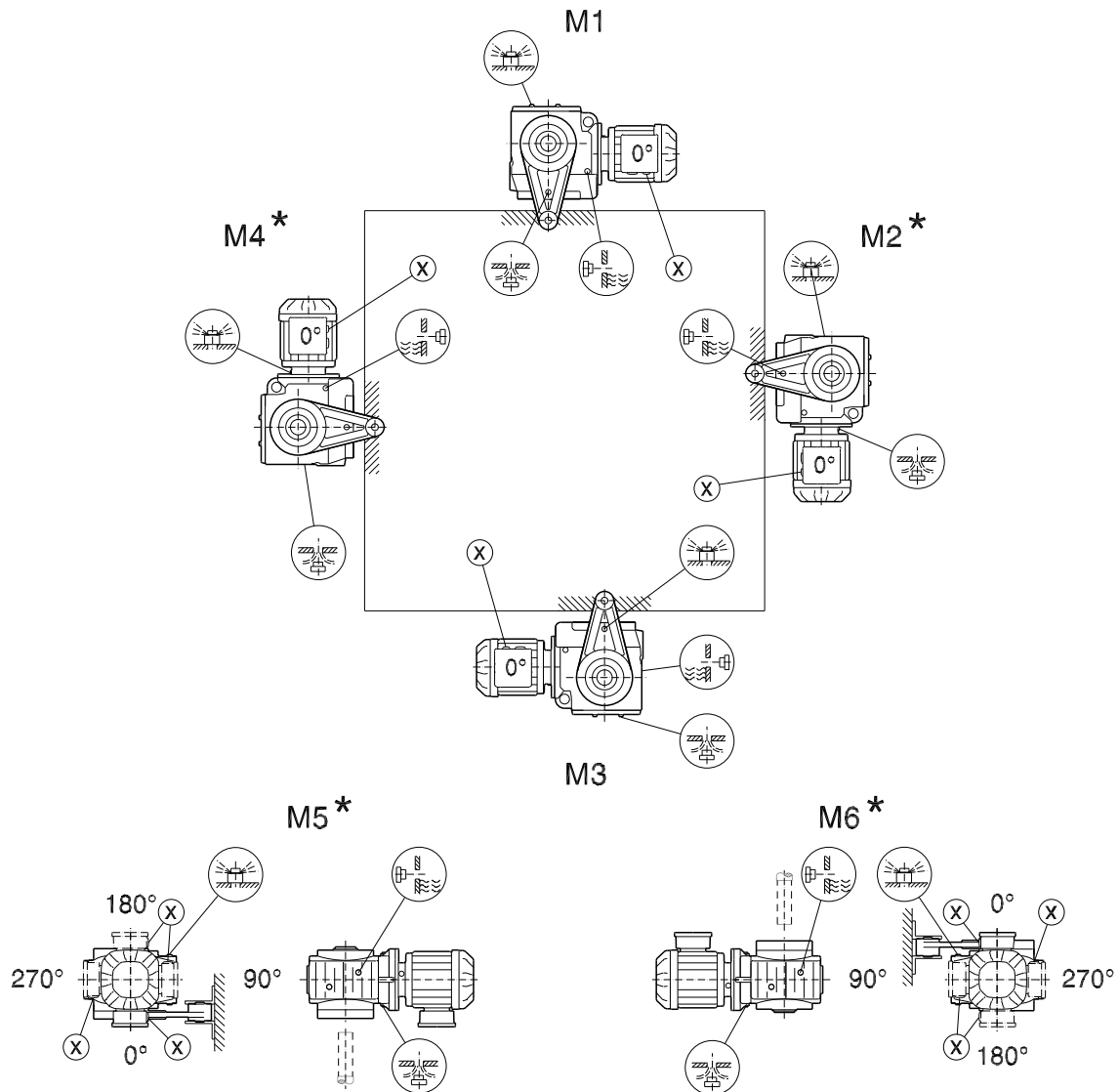
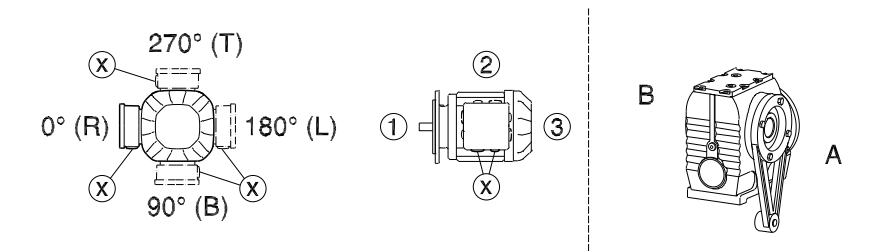
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SA/SH/ST47-97

28 021 04 00

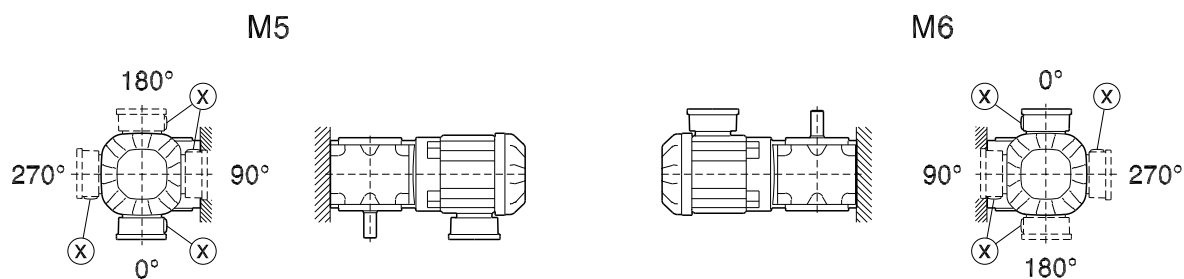
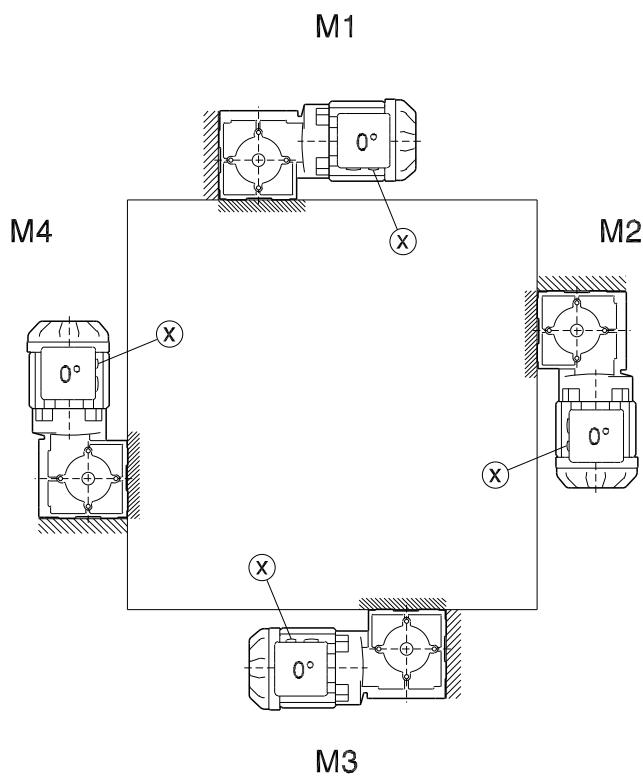
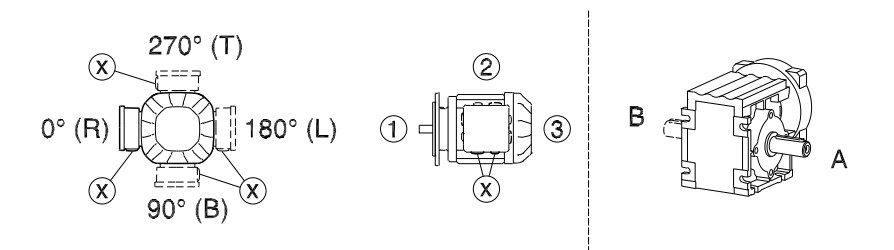


* (→ 111)

7.6.6 Mounting positions of SPIROPLAN® gearmotors

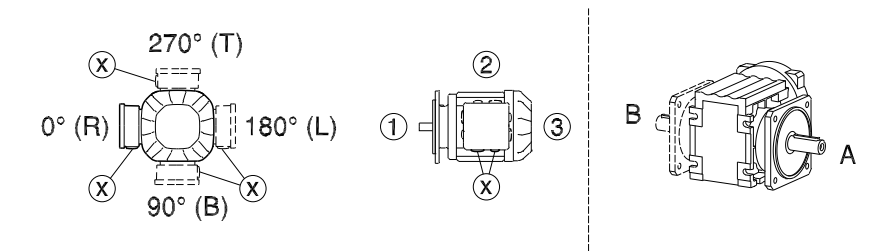
W10-30

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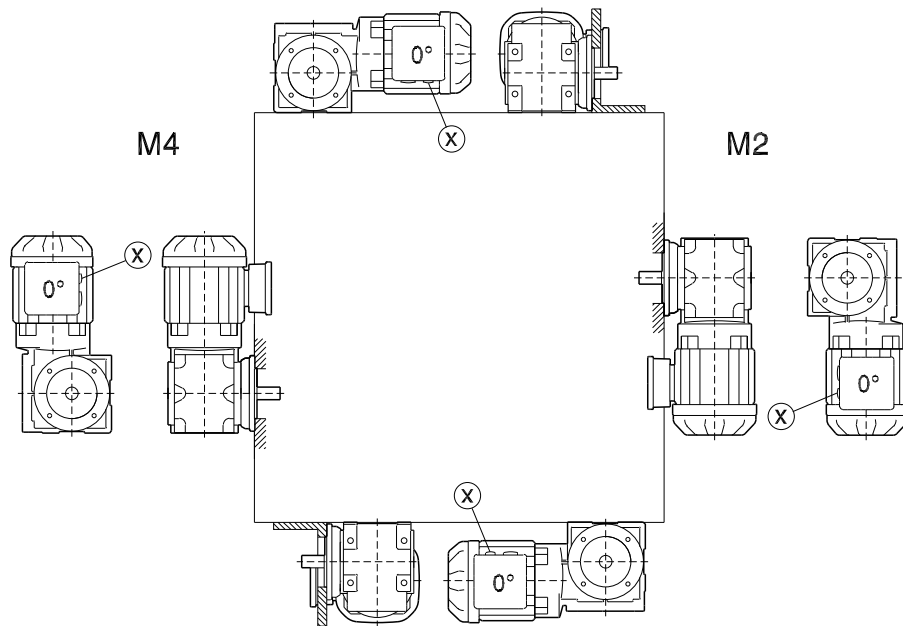


WF10-30

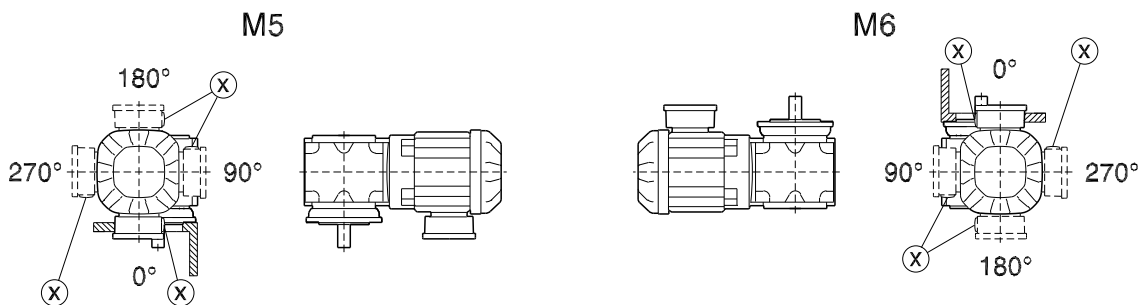
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M1

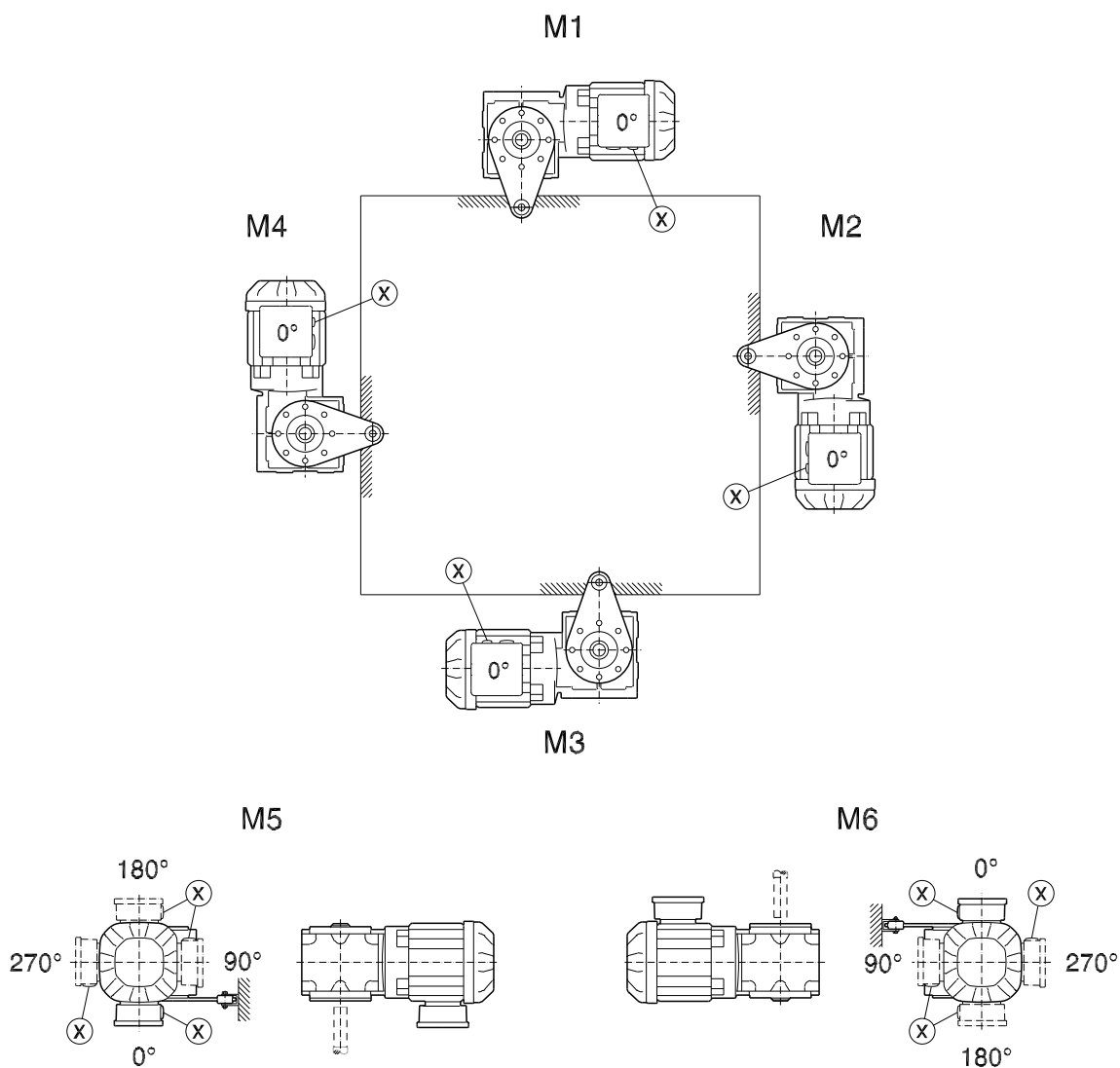
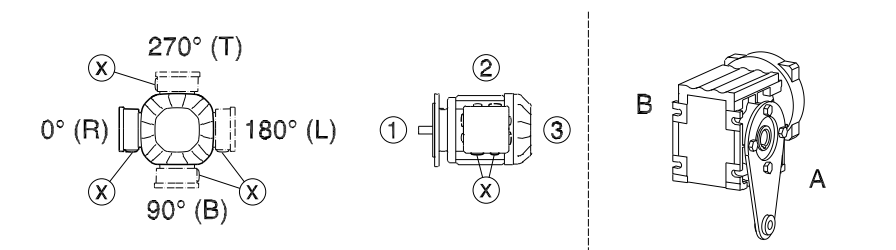


M3



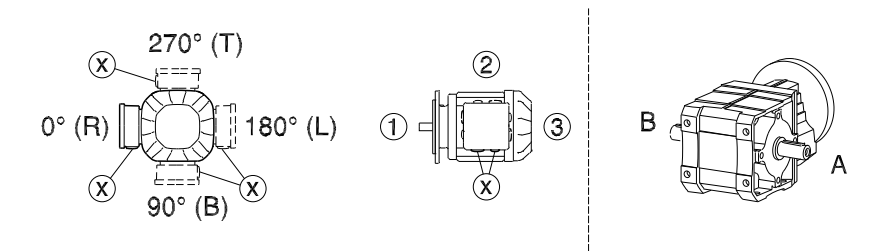
WA10-30

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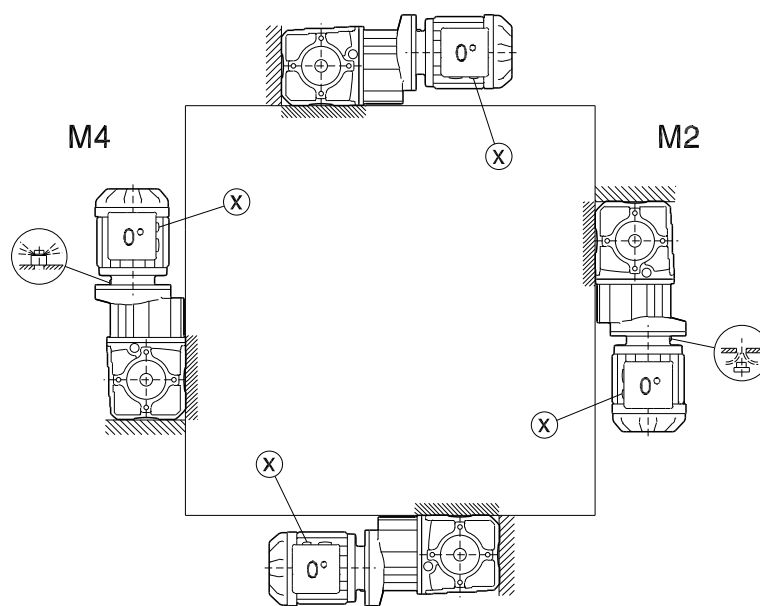


W/WA..B/WH37B-47B

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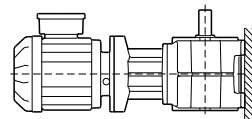
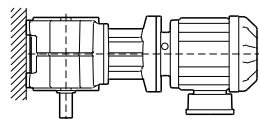
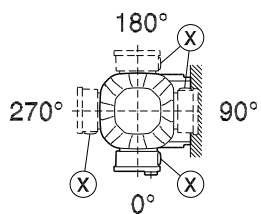


M1

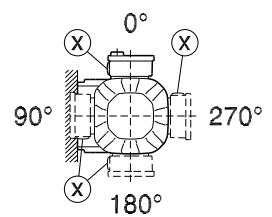


M3

M5

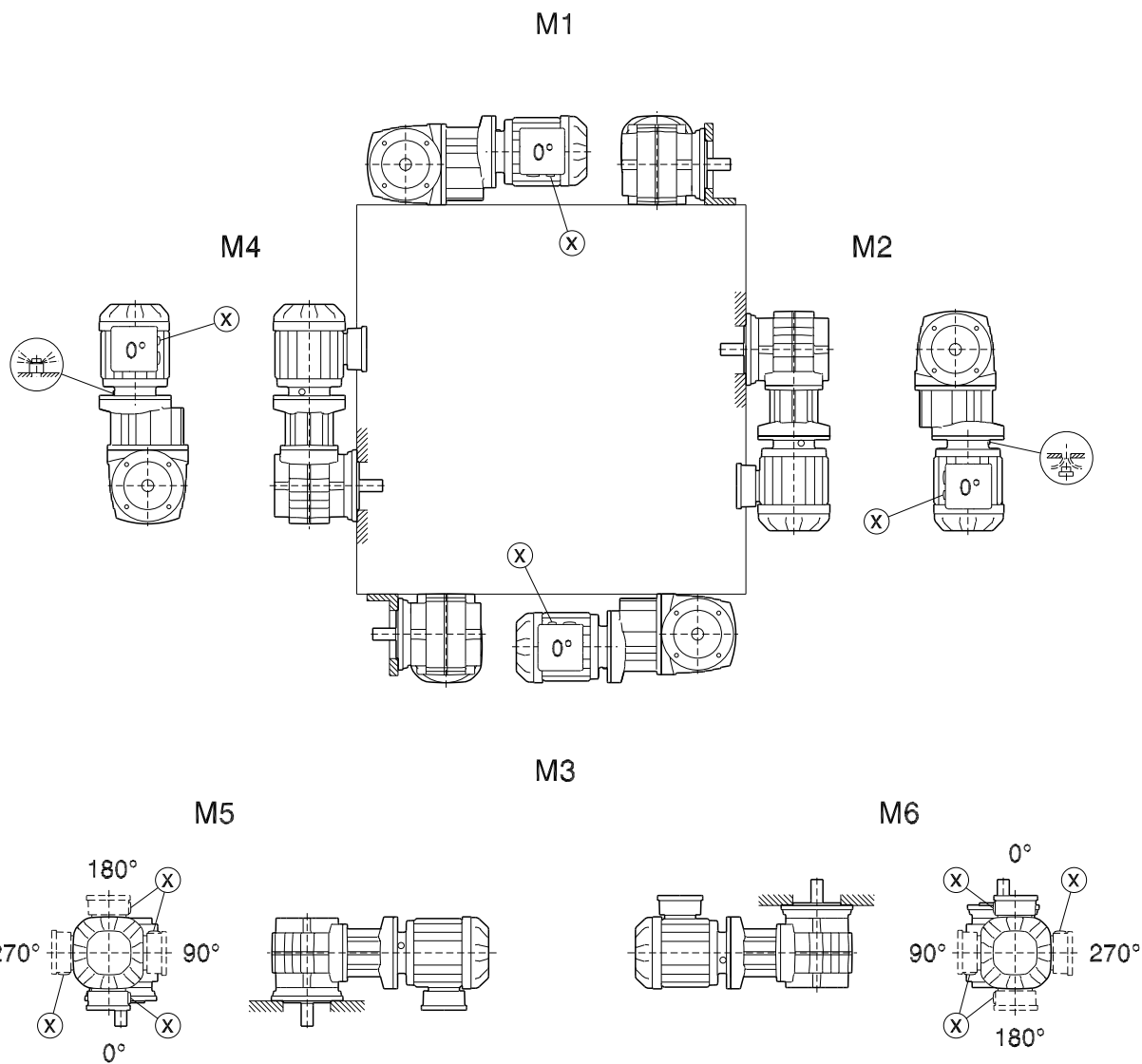
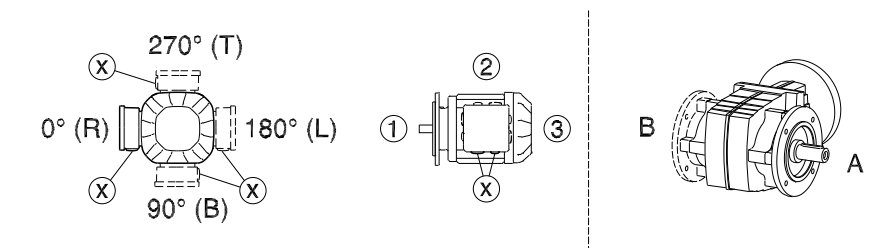


M6



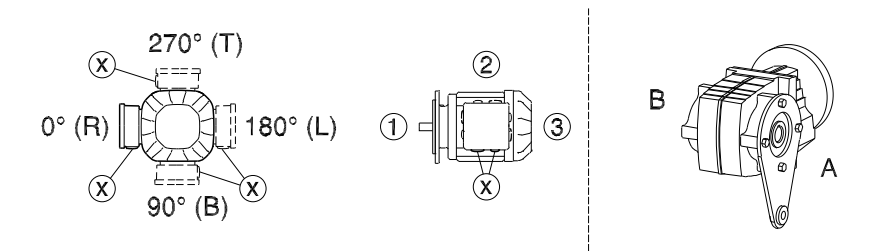
WF/WAF/WHF37-47

20 013 02 07

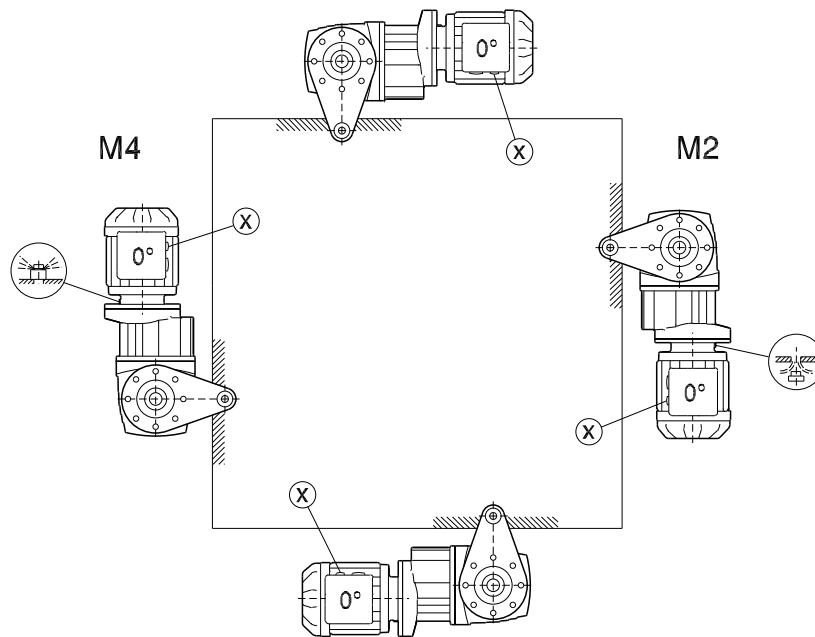


WA/WH/WT37-47

20 014 02 07



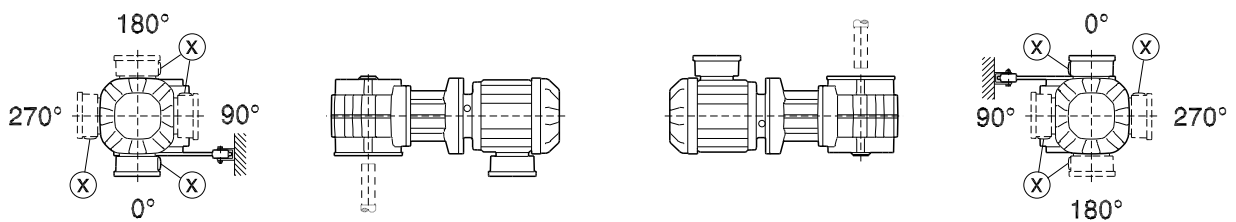
M1



M3

M5

M6



8 Technical data

8.1 Extended storage

INFORMATION



For storage periods longer than 9 months, SEW-EURODRIVE recommends the "extended storage" gear unit type. Gear units in this design are designated with a corresponding label.

For gear units of the "extended storage" design, the following measures are taken:

- A VCI anti-corrosion agent (volatile corrosion inhibitors) is added to the lubricant.

Please note that this VCI anti-corrosion agent is only effective in a temperature range of -25 °C to +50 °C.

- The flange contact surfaces and shaft ends are also treated with an anti-corrosion agent.

Observe the storage conditions specified in the following table for extended storage.

8.1.1 Storage conditions

Observe the storage conditions specified in the following table for extended storage:

Climate zone	Packaging ¹⁾	Storage ²⁾	Storage duration
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	<ul style="list-style-type: none"> • Packed in containers • With desiccant and moisture indicator sealed in the plastic wrap 	<ul style="list-style-type: none"> • Roofed • Protected against rain and snow • Shock-free 	Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%)
	Open	<ul style="list-style-type: none"> • Under roof and enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 50 °C, < 50% relative humidity) • No sudden temperature variations • Controlled ventilation with filter (free from dust and dirt) • No aggressive vapors • No shocks 	2 years or more with regular inspections <ul style="list-style-type: none"> • Check for cleanness and mechanical damage during the inspection • Check corrosion protection

Climate zone	Packaging ¹⁾	Storage ²⁾	Storage duration
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	<ul style="list-style-type: none"> • Packed in containers • With desiccant and moisture indicator sealed in the plastic wrap • Protected against insect damage and mildew by chemical treatment 	<ul style="list-style-type: none"> • Roofed • Protected against rain and snow • Shock-free 	Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%)
	Open	<ul style="list-style-type: none"> • Under roof and enclosed at constant temperature and atmospheric humidity (5 °C < θ < 50 °C, < 50% relative humidity) • No sudden temperature variations • Controlled ventilation with filter (free from dust and dirt) • No aggressive vapors • No shocks • Protected against insect damage 	2 years or more with regular inspections <ul style="list-style-type: none"> • Check for cleanness and mechanical damage during the inspection • Check corrosion protection

1) The packaging must be carried out by an experienced company using the packaging materials that have been explicitly specified for the particular application.



2) SEW-EURODRIVE recommends to store the gear units according to the mounting position.

8.2 Lubricants

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The mounting position (M1 – M6, see chapter "Mounting positions (→ 110)") must be specified in the order. You must adapt the lubricant fill in case of any subsequent changes made to the mounting position, see chapter "Lubricant fill quantities (→ 151)".

8.2.1 Bearing greases

The gear unit rolling bearings are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends re-greasing the rolling bearings with a grease filling at the same time as changing the oil.

	Ambient temperature	Manufacturer	Type
Gear unit rolling bearings	-40 °C to +80 °C	Fuchs	Renolit CX-TOM 15 ¹⁾
	-40 °C to +80 °C	Klüber	Petamo GHY 133 N
	-40 °C to +40 °C	Castrol	Castrol Optileb GR FS 2
	-20 °C to +40 °C	Fuchs	Plantogel 2S

1) Bearing grease based on semi-synthetic base oil.

INFORMATION



The following grease quantities are required:

- **For fast-running bearings (gear unit input side):** Fill the cavities between the rolling elements one-third full with grease.
- **For slow-running bearings (gear unit output end):** Fill the cavities between the rolling elements two-thirds full with grease.

8.2.2 Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units.

Key to lubricant table

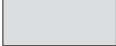
CLP PG = Polyglycol (W gear units, conforms to USDA-H1)

CLP HC = Synthetic hydrocarbons

E = Ester oil (water hazard class 1 (German regulation – "WKG"))

HCE = Synthetic hydrocarbons + ester oil (USDA - H1 certification)

HLP = Hydraulic oil

 = Synthetic lubricant (= synthetic roller bearing grease)

1) Helical-worm gear units with PG oil: please consult SEW-EURODRIVE

2) Special lubricant for SPIROPLAN® gear units only


3) Use SEW $f_B \geq 1.2$


4) Pay attention to critical starting behavior at low temperatures.

5) Low-viscosity grease

6 Ambient temperature










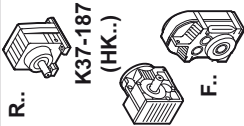
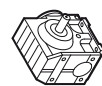









7) Bold

 Lubricant for the food industry (food grade oil)

 Biodegradable oil (lubricant for agriculture, forestry, and fisheries)

Lubricant table

01 751 09 04

			ISO, NLGI	Mobil®	Shell	bp				
	°C	DIN (ISO)								
R.. 	Standard -15	CLP (CC)	VG 220	Mobilgear 600 XP 220	Shell Omala S2 G 220	BP Energol GR-XP 220	Klüberol GEM 1-220 N	Tribol 1100/220	Renolin CLP 220	Carter EP 220
	+80	CLP PG	VG 220	Mobil Glycolite 220	Shell Omala S4 WE 220	BP Energol SG-XP 220	Klüberol GH 6-220	Tribol 800/220	Optiflex A 220	Carter SY 220
	-20	CLP HC	VG 220	Mobil SHC 630	Shell Omala S4 GX 220		Klüberol GEM 4-220 N	Tribol 1510/220	Optigear Synthetic X 220	Carter SH 220
	-40	CLP HC	VG 150	Mobil SHC 629	Shell Omala S4 GX 150		Klüberol GEM 4-150 N		Optigear Synthetic X 150	Carter SH 150
K..19 - K..49 	+25	CLP (CC)	VG 150	Mobilgear 600 XP 150	Shell Omala S2 G 150	BP Energol GR-XP 150	Klüberol GEM 1-150 N	Tribol 1100/150	Renolin CLP 150	Carter EP 150
	+20	CLP HC	VG 68	Mobil SHC 626	Shell Omala S4 GX 68				Renolin Unisyn CLP 68	
	+0	CLP HC	VG 32	Mobil SHC 624			Klüber-Summit HySyn FG-32	Optilub HY 32	Renolin Unisyn OL 32	Dacnis SH 32
	Standard	CLP PG	VG 460				Klüberol GH 6-460			
S..(HS..) 	+60	H1 PG 	VG 460				Klüberol UH1 6-460			
	+40	CLP (CC)	VG 680	Mobilgear 600 XP 680	Shell Omala S2 G 680	BP Energol GR-XP 680	Klüberol GEM 1-680 N	Tribol 1100/680	Optigear BM 680	Carter EP 680
	+80	CLP PG	VG 680	Mobil glycolite 680	Shell Omala S4 WE 680	BP Energol SG-XP 680	Klüberol GH 6-680	Tribol 800/680	Optiflex A 680	
	-20	CLP HC	VG 460	Mobil SHC 634	Shell Omala S4 GX 460		Klüberol GEM 4-460 N	Optigear Synthetic X 460	Renolin Unisyn CLP 460	Carter SH 460
R.. K37-187 (HK..) F.. S..(HS..) 	+30	CLP HC	VG 150	Mobil SHC 629	Shell Omala S4 GX 150		Klüberol GEM 4-150 N	Optigear Synthetic X 150	Renolin Unisyn CLP 150	Carter SH 150
	+10	CLP (CC)	VG 150	Mobilgear 600 XP 150	Shell Omala S2 G 150	BP Energol GR-XP 150	Klüberol GEM 1-150 N	Tribol 1100/150	Optigear BM 150	Carter EP 150
	+40	CLP PG	VG 220	Mobil Glycolite 220	Shell Omala S4 WE 220	BP Energol SG-XP 220	Klüberol GH 6-220	Tribol 800/220	Optiflex A 220	Carter SY 220
	+20	CLP HC	VG 68	Mobil SHC 626	Shell Omala S4 GX 68				Renolin Unisyn CLP 68	
W..(HW..) 	0	CLP HC	VG 32	Mobil SHC 624			Klüber-Summit HySyn FG-32	Alphasyn T32	Renolin Unisyn OL 32	Dacnis SH 32
	-10	CLPHC NSF H1	VG 460				Klüberol 4UH1-460 N	Optilub GT 460	Cassida Fluid GL 460	
	+40	SEW PG	SAE 75W90 (-VG 100)	Mobil Synth 680 75W90			Klüberol 4UH1-220 N	Optilub GT 220	Cassida Fluid GL 220	
	-20	API GL5	VG 460				Klüberol 4UH1-68 N	Optilub HY 68	Cassida Fluid HF 68	Plantogear 460 S
PS.F. 	+60	H1 PG 	VG 460				Klüberbio CA2-460			
	+40	CLP PG	VG 220				Klüberol UH1 6-460			
	+20	H1 PG 	VG 460				Klüberol GH 6-220			
	-20	CLP HC	VG 32	Mobil SHC 624			Klüberol UH1 6-460			
PS.C.. 	Standard	CLP (CC)	VG 220	Mobilgear 600 XP 220						
	+40	DIN 51 818	NLGI 00	Mobilux EP 004						
	+20	DIN 51 818	NLGI 1 				Klüberol UH1 14-151			
	-40	CLP HC	VG 32	Mobil SHC 624						
BS.F. 	Standard	CLP PG	VG 220				Klüberol GH 6-220			
	+60	H1 PG 	VG 460				Klüberol UH1 6-460			
	+40	CLP (CC)	VG 680							
	-20	H1 PG 	VG 460							

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INFORMATION


This lubricant recommendation in no way represents a guarantee as to the quality of the lubricant delivered by each respective supplier. Each lubricant manufacturer is responsible for the quality of their product. Thus the lubricant table is not binding. It may be necessary to contact SEW-EURODRIVE.

8.2.3 Lubricant fill quantities

INFORMATION



The specified fill quantities are only given as a **guideline**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil volume**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 – M6.

Helical (R) gear units

R.., R..F

Gear unit	Fill quantity in liters					
	M1 ¹⁾	M2	M3	M4	M5	M6
R07	0.12			0.20		
R17	0.25	0.55	0.35	0.55	0.35	0.40
R27	0.25/0.40	0.70	0.50	0.70	0.50	
R37	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47	0.70/1.50	1.60	1.50	1.65	1.50	
R57	0.80/1.70	1.90	1.70	2.10	1.70	
R67	1.10/2.30	2.40	2.80	2.90	1.80	2.00
R77	1.20/3.00	3.30	3.60	3.80	2.50	3.40
R87	2.30/6.0	6.4	7.2		6.3	6.5
R97	4.60/9.8	11.7		13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil quantity.

RF.., RZ..

Gear unit	Fill quantity in liters					
	M1 ¹⁾	M2	M3	M4	M5	M6
RF07	0.12			0.20		
RF17	0.25	0.55	0.35	0.55	0.35	0.40
RF27	0.25/0.40	0.70	0.50	0.70	0.50	
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.50	1.65	1.50	
RF57	0.80/1.70	1.80	1.70	2.00	1.70	
RF67	1.20/2.50	2.50	2.70	2.80	1.90	2.10
RF77	1.20/2.60	3.10	3.30	3.60	2.40	3.00
RF87	2.40/6.0	6.4	7.1	7.2	6.3	6.4
RF97	5.1/10.2	11.9	11.2	14.0	11.2	11.8
RF107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF137	9.5/25.0	27.0	29.0	32.5	25.0	
RF147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil quantity.

RX..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RX57	0.60	0.80	1.30		0.90	
RX67	0.80		1.70	1.90	1.10	
RX77	1.10	1.50	2.60	2.70	1.60	
RX87	1.70	2.50	4.80		2.90	
RX97	2.10	3.40	7.4	7.0	4.80	
RX107	3.90	5.6	11.6	11.9	7.7	

RXF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RXF57	0.50	0.80	1.10		0.70	
RXF67	0.70	0.80	1.50	1.40	1.00	
RXF77	0.90	1.30	2.40	2.00	1.60	
RXF87	1.60	1.95	4.90	3.95	2.90	
RXF97	2.10	3.70	7.1	6.3	4.80	
RXF107	3.10	5.7	11.2	9.3	7.2	

Parallel-shaft helical (F) gear units

F.., FA..B, FH..B, FV..B

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.60	3.50	2.10	3.50	2.80	2.90
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	
F..127	40.5	54.5	34.0	61.0	46.3	47.0
F..157	69.0	104.0	63.0	105.0	86.0	78.0

FF..

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
FF27	0.60	0.80	0.65	0.70	0.60	
FF37	1.00	1.25	0.70	1.30	1.00	
FF47	1.60	1.85	1.10	1.90	1.50	1.70
FF57	2.80	3.50	2.10	3.70	2.90	3.00
FF67	2.70	3.80	1.90	3.80	2.90	3.20
FF77	5.9	7.3	4.30	8.1	6.0	6.3
FF87	10.8	13.2	7.8	14.1	11.0	11.2
FF97	19.0	22.5	12.6	25.6	18.9	20.5
FF107	25.5	32.0	19.5	38.5	27.5	28.0
FF127	41.5	55.5	34.0	63.0	46.3	49.0
FF157	72.0	105.0	64.0	106.0	87.0	79.0

FA.., FH.., FV.., FAF.., FAZ.., FHF.., FZ.., FHZ.., FVF.., FVZ.., FT..

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.70	3.50	2.10	3.40	2.90	3.00
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	
F..127	39.0	54.5	34.0	61.0	45.0	46.5
F..157	68.0	103.0	62.0	104.0	85.0	79.5

Helical-bevel (K) gear units

INFORMATION



All K..9 gear have a universal mounting position, which means that K..9 gear units of the same design are filled with the same oil quantity independent of the mounting position. An exception to this is the M4 mounting position.

K.., KA..B, KH..B, KV..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..19	0.4			0.45	0.4	
K..29	0.7			0.85	0.7	
K..39	0.86	1.65	1.54	2.13	1.53	1.31
K..49	1.64	3.35	2.82	4.18	3.13	2.77
K..37	0.50	1.00		1.25	0.95	
K..47	0.80	1.30	1.50	2.00	1.60	
K..57	1.10	2.20		2.80	2.30	2.10
K..67	1.10	2.40	2.60	3.45	2.60	
K..77	2.20	4.10	4.40	5.8	4.20	4.40
K..87	3.70	8.0	8.7	10.9	8.0	
K..97	7.0	14.0	15.7	20.0	15.7	15.5
K..107	10.0	21.0	25.5	33.5	24.0	
K..127	21.0	41.5	44.0	54.0	40.0	41.0
K..157	31.0	62.0	65.0	90.0	58.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	

KF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
KF19		0.4		0.45	0.4	
KF29		0.7		0.85	0.7	
KF39	0.86	1.65	1.54	2.13	1.53	1.31
KF49	1.64	3.35	2.82	4.18	3.13	2.77
KF37	0.50	1.10		1.50	1.00	
KF47	0.80	1.30	1.70	2.20	1.60	
KF57	1.20	2.20	2.40	3.15	2.50	2.30
KF67	1.10	2.40	2.80	3.70	2.70	
KF77	2.10	4.10	4.40	5.9	4.50	
KF87	3.70	8.2	9.0	11.9	8.4	
KF97	7.0	14.7	17.3	21.5	15.7	16.5
KF107	10.0	21.8	25.8	35.1	25.2	
KF127	21.0	41.5	46.0	55.0	41.0	
KF157	31.0	66.0	69.0	92.0	62.0	

KA., KH., KV., KAF., KHF., KVF., KZ., KAZ., KHZ., KVZ., KT..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..19		0.4		0.45	0.4	
K..29		0.7		0.85	0.7	
K..39	0.86	1.65	1.54	2.13	1.53	1.31
K..49	1.64	3.35	2.82	4.18	3.13	2.77
K..37	0.50	1.00		1.40	1.00	
K..47	0.80	1.30	1.60	2.15	1.60	
K..57	1.20	2.20	2.40	3.15	2.70	2.40
K..67	1.10	2.40	2.70	3.70	2.60	
K..77	2.10	4.10	4.60	5.9	4.40	
K..87	3.70	8.2	8.8	11.1	8.0	
K..97	7.0	14.7	15.7	20.0	15.7	
K..107	10.0	20.5	24.0	32.4	24.0	
K..127	21.0	41.5	43.0	52.0	40.0	
K..157	31.0	66.0	67.0	87.0	62.0	
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	

Helical-worm (S) gear units

S..

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
S37	0.25	0.40	0.50	0.55	0.40	
S47	0.35	0.80	0.70/0.90	1.00	0.80	
S57	0.50	1.20	1.00/1.20	1.45	1.30	
S67	1.00	2.00	2.20/3.10	3.10	2.60	2.60
S77	1.90	4.20	3.70/5.4	5.9	4.40	
S87	3.30	8.1	6.9/10.4	11.3	8.4	
S97	6.8	15.0	13.4/18.0	21.8	17.0	

1) The larger gear unit of multi-stage gear units must be filled with the larger oil quantity.

SF..

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
SF37	0.25	0.40	0.50	0.55	0.40	
SF47	0.40	0.90	0.90/1.05	1.05	1.00	
SF57	0.50	1.20	1.00/1.50	1.55	1.40	
SF67	1.00	2.20	2.30/3.00	3.20	2.70	
SF77	1.90	4.10	3.90/5.8	6.5	4.90	
SF87	3.80	8.0	7.1/10.1	12.0	9.1	
SF97	7.4	15.0	13.8/18.8	22.6	18.0	

1) The larger gear unit of multi-stage gear units must be filled with the larger oil quantity.

SA.., SH.., SAF.., SHZ.., SAZ.., SHF.., ST..

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
S..37	0.25	0.40	0.50		0.40	
S..47	0.40	0.80	0.70/0.90	1.00	0.80	
S..57	0.50	1.10	1.00/1.50	1.50	1.20	
S..67	1.00	2.00	1.80/2.60	2.90	2.50	
S..77	1.80	3.90	3.60/5.0	5.8	4.50	
S..87	3.80	7.4	6.0/8.7	10.8	8.0	
S..97	7.0	14.0	11.4/16.0	20.5	15.7	

1) The larger gear unit of multi-stage gear units must be filled with the larger oil quantity.

SPIROPLAN® (W) gear units



INFORMATION

SPIROPLAN® gear units W..10 to W..30 have a universal mounting position, which means that gear units of the same design are filled with the same amount of oil independent of the mounting position.

The oil fill quantity of SPIROPLAN® gear units W..37 and W..47 in mounting position M4 is different from that of the other mounting positions.

W.., WA..B, WH..B

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
W..10	0.16					
W..20	0.24					
W..30	0.40					
W..37	0.50		0.70		0.50	
W..47	0.90		1.40		0.90	

WF..

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
WF10	0.16					
WF20	0.24					
WF30	0.40					
WF37	0.50		0.70		0.50	
WF47	0.90		1.55		0.90	

WA.., WAF..,WH.., WT.., WHF..

Gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
W..10	0.16					
W..20	0.24					
W..30	0.40					
W..37	0.50			0.70	0.50	
W..47	0.80			1.40	0.80	

9 Malfunctions



▲ WARNING

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- De-energize the motor before you start working on the unit.
- Secure the motor against unintended power-up.



▲ CAUTION

Risk of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it.
- Carefully remove the oil level plug and the oil drain plug.

NOTICE

Damage to gear unit due to improper operation.

Damage to the gear unit/gearmotor.

- Repair works at SEW-EURODRIVE gear units may only be performed by qualified personnel. In the context of this documentation, qualified personnel are persons who are familiar with the "Technical regulations on operating safety" (TRBS).
- Drive and motor may only be disconnected by qualified personnel.
- Contact SEW-EURODRIVE.

9.1 Gear units

Fault	Possible cause	Measure
Unusual, regular running noise	<ul style="list-style-type: none"> Meshing/grinding noise: Bearing damage Knocking noise: Irregularity in the gearing Deformation of the housing upon tightening Noise generated by insufficient stiffness of the gear unit foundation 	<ul style="list-style-type: none"> Check oil consistency, change bearings Consult SEW-EURODRIVE Check the gear unit mounting for possible deformation and correct if necessary Reinforce the gear unit foundation
Unusual, irregular running noises	<ul style="list-style-type: none"> Foreign objects in the oil 	<ul style="list-style-type: none"> Checking the oil consistency Stop the drive, contact SEW-EURODRIVE
Oil leaking from inspection cover	<ul style="list-style-type: none"> Seal of the inspection cover leaking 	<ul style="list-style-type: none"> Tighten the screws of the inspection cover and observe the gear unit. Contact SEW-EURODRIVE if oil is still leaking.
	<ul style="list-style-type: none"> Seal defective 	<ul style="list-style-type: none"> Contact SEW-EURODRIVE.
Small amounts of oil leak from the oil seal during run-in phase.	<ul style="list-style-type: none"> Function-related pseudo-leakage 	<ul style="list-style-type: none"> There is no fault. Remove with soft, lint-free cloth and keep monitoring it.
Film of moisture around the dust lip of the oil seal	<ul style="list-style-type: none"> Function-related pseudo-leakage 	<ul style="list-style-type: none"> There is no fault. Remove with soft, lint-free cloth and keep monitoring it.
Oil leaking from the oil seal.	<ul style="list-style-type: none"> Oil seal leaking/defective 	<ul style="list-style-type: none"> Check sealing system. It may be necessary to contact SEW-EURODRIVE.
Oil leaking from motor (e.g. terminal box or fan)	<ul style="list-style-type: none"> Too much oil 	<ul style="list-style-type: none"> Check oil level, correct if necessary
	<ul style="list-style-type: none"> Gear unit not ventilated 	<ul style="list-style-type: none"> Vent gear unit
	<ul style="list-style-type: none"> Oil seal leaking/defective 	<ul style="list-style-type: none"> Check sealing system. It may be necessary to contact SEW-EURODRIVE.
Oil leaking from flange	<ul style="list-style-type: none"> Flange gasket leaking/defective 	<ul style="list-style-type: none"> Check sealing system. It may be necessary to contact SEW-EURODRIVE.
	<ul style="list-style-type: none"> Too much oil 	<ul style="list-style-type: none"> Check oil level, correct if necessary
	<ul style="list-style-type: none"> Gear unit not ventilated 	<ul style="list-style-type: none"> Vent gear unit
Oil leaking from breather valve.	<ul style="list-style-type: none"> Too much oil. 	<ul style="list-style-type: none"> Check oil quantity, correct if necessary
	<ul style="list-style-type: none"> Function-related oil mist 	<ul style="list-style-type: none"> There is no fault.
	<ul style="list-style-type: none"> Drive not installed in proper mounting position. 	<ul style="list-style-type: none"> Install breather valve correctly and adjust the oil level.
	<ul style="list-style-type: none"> Frequent cold starts (oil foaming) and/or high oil level. 	<ul style="list-style-type: none"> Install oil expansion tank.
Output shaft does not turn although the motor is running or the input shaft is rotated.	<ul style="list-style-type: none"> Shaft-hub connection in the gear unit interrupted. 	<ul style="list-style-type: none"> Send in the gear unit/gearmotor for repair

9.2 Adapters AM/AQ./AL/EWH

Fault	Possible cause	Measure
Unusual, regular running noise	• Meshing/grinding noise: Bearing damage	• Contact SEW-EURODRIVE.
Oil leaking.	• Seal defective	• Contact SEW-EURODRIVE.
Output shaft does not turn although the motor is running or the input shaft is rotated.	• Shaft-hub connection in the gear unit interrupted.	• Send in the gear unit/gearmotor for repair.
Change in running noise and/or vibrations	• Ring gear wear, short-term torque transmission through metal contact	• Change the ring gear.
	• Screws to secure hub axially are loose	• Tighten the screws
Premature wear in girth gear	• Contact with aggressive fluids/oils; ozone influence; excessive ambient temperatures, etc. that can change the physical properties of the ring gear.	• Contact SEW-EURODRIVE.
	• Impermissibly high ambient/contact temperature for the girth gear; maximum permitted temperature: -20 °C to +80 °C.	• Contact SEW-EURODRIVE.
	• Overload	• Contact SEW-EURODRIVE.

9.3 AD input shaft assembly

Fault	Possible cause	Measure
Unusual, regular running noise.	• Meshing/grinding noise: Bearing damage.	• Contact SEW-EURODRIVE.
Oil is leaking.	• Seal defective.	• Contact SEW-EURODRIVE.
Output shaft does not turn although the input shaft is rotated.	• Shaft-hub connection in gear unit or cover interrupted.	• Send the gear unit to SEW-EURODRIVE for repair.

9.4 Customer service

If you require customer service, include the following information:

- Nameplate data (complete)
- Nature and extent of the problem
- Time the failure occurred and any accompanying circumstances
- Presumed cause
- A digital picture of the failure, if possible.

9.5 Waste disposal

Dispose gear units in accordance with the material structure and the regulations in force:

- As steel scrap
 - Housing parts
 - Gears
 - Shafts
 - Rolling bearing
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears appropriately.
- Collect used oil and dispose of it according to the regulations in force.

10 Address list

Algeria			
Sales	Algiers	REDUCOM Sarl 16, rue des Frères Zaghroune Bellevue 16200 El Harrach Alger	Tel. +213 21 8214-91 Fax +213 21 8222-84 http://www.reducom-dz.com info@reducom-dz.com
Argentina			
Assembly Sales	Buenos Aires	SEW EURODRIVE ARGENTINA S.A. Ruta Panamericana Km 37.5, Lote 35 (B1619IEA) Centro Industrial Garín Prov. de Buenos Aires	Tel. +54 3327 4572-84 Fax +54 3327 4572-21 http://www.sew-eurodrive.com.ar sewar@sew-eurodrive.com.ar
Australia			
Assembly Sales Service	Melbourne	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au
Austria			
Assembly Sales Service	Vienna	SEW-EURODRIVE Ges.m.b.H. Richard-Strauss-Strasse 24 A-1230 Wien	Tel. +43 1 617 55 00-0 Fax +43 1 617 55 00-30 http://www.sew-eurodrive.at sew@sew-eurodrive.at
Bangladesh			
Sales	Bangladesh	SEW-EURODRIVE INDIA PRIVATE LIMITED 345 DIT Road East Rampura Dhaka-1219, Bangladesh	Tel. +88 01729 097309 salesdhaka@seweurodrivebangladesh.com
Belarus			
Sales	Minsk	Foreign Enterprise Industrial Components Rybalko Str. 26 BY-220033 Minsk	Tel. +375 17 298 47 56 / 298 47 58 Fax +375 17 298 47 54 http://www.sew.by sales@sew.by
Belgium			
Assembly Sales Service	Brussels	SEW-EURODRIVE n.v./s.a. Researchpark Haasrode 1060 Evenementenlaan 7 BE-3001 Leuven	Tel. +32 16 386-311 Fax +32 16 386-336 http://www.sew-eurodrive.be info@sew-eurodrive.be
Service Competence Center	Industrial Gears	SEW-EURODRIVE n.v./s.a. Rue de Parc Industriel, 31 BE-6900 Marche-en-Famenne	Tel. +32 84 219-878 Fax +32 84 219-879 http://www.sew-eurodrive.be service-wallonie@sew-eurodrive.be
Brazil			
Production Sales Service	São Paulo	SEW-EURODRIVE Brasil Ltda. Estrada Municipal José Rubim, 205 – Rodovia Santos Dumont Km 49 Indaiatuba – 13347-510 – SP	Tel. +55 19 3835-8000 sew@sew.com.br
Assembly Sales Service	Rio Claro	SEW-EURODRIVE Brasil Ltda. Rodovia Washington Luiz, Km 172 Condomínio Industrial Conpark Caixa Postal: 327 13501-600 – Rio Claro / SP	Tel. +55 19 3522-3100 Fax +55 19 3524-6653 montadora.rc@sew.com.br
	Joinville	SEW-EURODRIVE Brasil Ltda. Rua Dona Francisca, 12.346 – Pirabeiraba 89239-270 – Joinville / SC	Tel. +55 47 3027-6886 Fax +55 47 3027-6888 filial.sc@sew.com.br
Bulgaria			
Sales	Sofia	BEVER-DRIVE GmbH Bogdanovetz Str.1 BG-1606 Sofia	Tel. +359 2 9151160 Fax +359 2 9151166 bever@bever.bg

Cameroon

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Canada

Assembly Sales Service	Toronto	SEW-EURODRIVE CO. OF CANADA LTD. 210 Walker Drive Bramalea, ON L6T 3W1	Tel. +1 905 791-1553 Fax +1 905 791-2999 http://www.sew-eurodrive.ca l.watson@sew-eurodrive.ca
	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. Tilbury Industrial Park 7188 Honeyman Street Delta, BC V4G 1G1	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Lasalle, PQ H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew-eurodrive.ca

Chile

Assembly Sales Service	Santiago de Chile	SEW-EURODRIVE CHILE LTDA Las Encinas 1295 Parque Industrial Valle Grande LAMP RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 2757 7000 Fax +56 2 2757 7001 http://www.sew-eurodrive.cl ventas@sew-eurodrive.cl
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China

Production Assembly Sales Service	Tianjin	SEW-EURODRIVE (Tianjin) Co., Ltd. No. 78, 13th Avenue, TEDA Tianjin 300457	Tel. +86 22 25322612 Fax +86 22 25323273 http://www.sew-eurodrive.cn info@sew-eurodrive.cn
Assembly Sales Service	Suzhou	SEW-EURODRIVE (Suzhou) Co., Ltd. 333, Suhong Middle Road Suzhou Industrial Park Jiangsu Province, 215021	Tel. +86 512 62581781 Fax +86 512 62581783 suzhou@sew-eurodrive.cn
	Guangzhou	SEW-EURODRIVE (Guangzhou) Co., Ltd. No. 9, JunDa Road East Section of GETDD Guangzhou 510530	Tel. +86 20 82267890 Fax +86 20 82267922 guangzhou@sew-eurodrive.cn
	Shenyang	SEW-EURODRIVE (Shenyang) Co., Ltd. 10A-2, 6th Road Shenyang Economic Technological Development Area Shenyang, 110141	Tel. +86 24 25382538 Fax +86 24 25382580 shenyang@sew-eurodrive.cn
	Taiyuan	SEW-EURODRIVE (Taiyuan) Co., Ltd. No.3, HuaZhang Street, TaiYuan Economic & Technical Development Zone ShanXi, 030032	Tel. +86-351-7117520 Fax +86-351-7117522 taiyuan@sew-eurodrive.cn
	Wuhan	SEW-EURODRIVE (Wuhan) Co., Ltd. 10A-2, 6th Road No. 59, the 4th Quanli Road, WEDA 430056 Wuhan	Tel. +86 27 84478388 Fax +86 27 84478389 wuhan@sew-eurodrive.cn
	Xi'An	SEW-EURODRIVE (Xi'An) Co., Ltd. No. 12 Jinye 2nd Road Xi'An High-Technology Industrial Development Zone Xi'An 710065	Tel. +86 29 68686262 Fax +86 29 68686311 xian@sew-eurodrive.cn
Sales Service	Hong Kong	SEW-EURODRIVE LTD. Unit No. 801-806, 8th Floor Hong Leong Industrial Complex No. 4, Wang Kwong Road Kowloon, Hong Kong	Tel. +852 36902200 Fax +852 36902211 contact@sew-eurodrive.hk

Colombia

Assembly Sales Service	Bogota	SEW-EURODRIVE COLOMBIA LTDA. Calle 22 No. 132-60 Bodega 6, Manzana B Santafé de Bogotá	Tel. +57 1 54750-50 Fax +57 1 54750-44 http://www.sew-eurodrive.com.co sew@sew-eurodrive.com.co
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Croatia			
Sales Service	Zagreb	KOMPEKS d. o. o. Zeleni dol 10 HR 10 000 Zagreb	Tel. +385 1 4613-158 Fax +385 1 4613-158 kompeks@inet.hr
Czech Republic			
Assembly Sales Service	Hostivice	SEW-EURODRIVE CZ s.r.o. Floriánova 2459 253 01 Hostivice	Tel. +420 255 709 601 Fax +420 235 350 613 http://www.sew-eurodrive.cz sew@sew-eurodrive.cz
	Drive Service Hotline / 24 Hour Service	+420 800 739 739 (800 SEW SEW)	Service Tel. +420 255 709 632 Fax +420 235 358 218 servis@sew-eurodrive.cz
Denmark			
Assembly Sales Service	Copenhagen	SEW-EURODRIVEA/S Geminivej 28-30 DK-2670 Greve	Tel. +45 43 95 8500 Fax +45 43 9585-09 http://www.sew-eurodrive.dk sew@sew-eurodrive.dk
Egypt			
Sales Service	Cairo	Copam Egypt for Engineering & Agencies 33 El Hegaz ST Heliopolis, Cairo	Tel. +20 222566299 Fax +20 2 22594-757 http://www.copam-egypt.com copam@copam-egypt.com
Estonia			
Sales	Tallin	ALAS-KUUL AS Reti tee 4 EE-75301 Peetri küla, Rae vald, Harjumaa	Tel. +372 6593230 Fax +372 6593231 http://www.alas-kuul.ee veiko.soots@alas-kuul.ee
Finland			
Assembly Sales Service	Hollola	SEW-EURODRIVE OY Vesimäentie 4 FIN-15860 Hollola 2	Tel. +358 201 589-300 Fax +358 3 780-6211 http://www.sew-eurodrive.fi sew@sew.fi
Service	Hollola	SEW-EURODRIVE OY Keskikankaantie 21 FIN-15860 Hollola	Tel. +358 201 589-300 Fax +358 3 780-6211 http://www.sew-eurodrive.fi sew@sew.fi
Production Assembly	Karkkila	SEW Industrial Gears Oy Santasalonkatu 6, PL 8 FI-03620 Karkkila, 03601 Karkkila	Tel. +358 201 589-300 Fax +358 201 589-310 http://www.sew-eurodrive.fi sew@sew.fi
France			
Production Sales Service	Hagenau	SEW-USOCOME 48-54 route de Soufflenheim B. P. 20185 F-67506 Haguenau Cedex	Tel. +33 3 88 73 67 00 Fax +33 3 88 73 66 00 http://www.usocom.com sew@usocom.com
Production	Forbach	SEW-USOCOME Zone industrielle Technopôle Forbach Sud B. P. 30269 F-57604 Forbach Cedex	Tel. +33 3 87 29 38 00
	Brumath	SEW-USOCOME 1 rue de Bruxelles F-67670 Mommenheim	Tel. +33 3 88 37 48 48
Assembly Sales Service	Bordeaux	SEW-USOCOME Parc d'activités de Magellan 62 avenue de Magellan – B. P. 182 F-33607 Pessac Cedex	Tel. +33 5 57 26 39 00 Fax +33 5 57 26 39 09
	Lyon	SEW-USOCOME Parc d'affaires Roosevelt Rue Jacques Tati F-69120 Vaulx en Velin	Tel. +33 4 72 15 37 00 Fax +33 4 72 15 37 15

France			
	Nantes	SEW-USOCOME Parc d'activités de la forêt 4 rue des Fontenelles F-44140 Le Bignon	Tel. +33 2 40 78 42 00 Fax +33 2 40 78 42 20
	Paris	SEW-USOCOME Zone industrielle 2 rue Denis Papin F-77390 Verneuil l'Étang	Tel. +33 1 64 42 40 80 Fax +33 1 64 42 40 88
Gabon			
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Germany			
Headquarters Production Sales	Bruchsal	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 D-76646 Bruchsal P.O. Box Postfach 3023 – D-76642 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 http://www.sew-eurodrive.de sew@sew-eurodrive.de
Production / Industrial Gears	Bruchsal	SEW-EURODRIVE GmbH & Co KG Christian-Pähr-Str. 10 D-76646 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-2970
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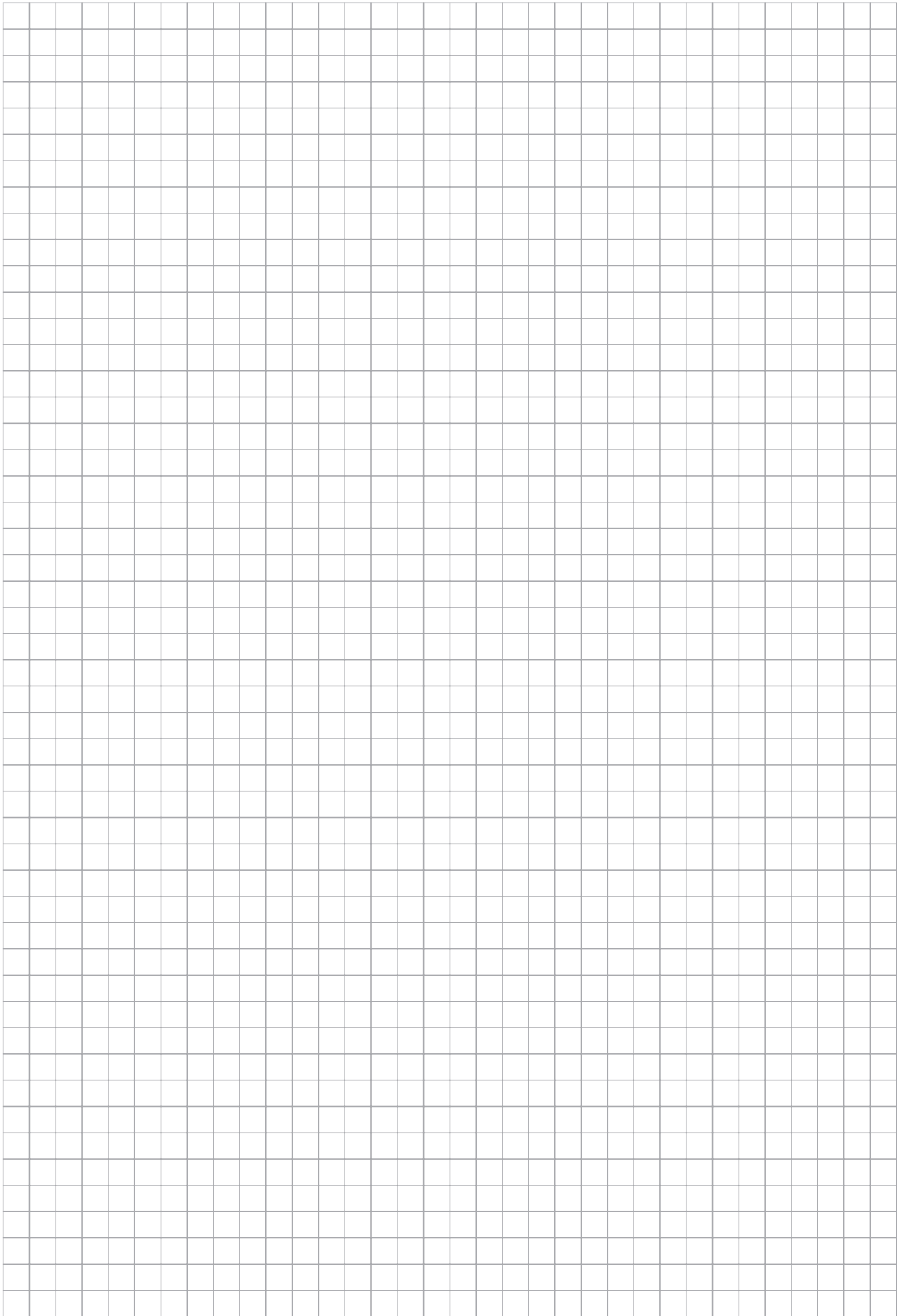
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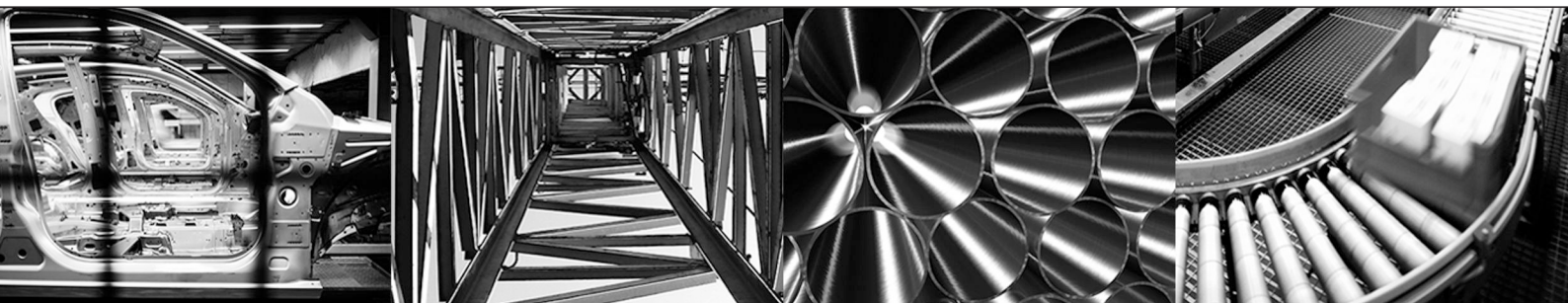
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