

FLENDER GEAR UNITS

Vertical-mill gear unit Fitting and demounting instructions

Assembly and operating instructions 9123en
Edition 06/2020

MultipleDrive®

FLENDER

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Assembly and operating instructions

MultipleDrive®

Original assembly and operating instructions
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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.

 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Flender products

Note the following:

 WARNING
Flender products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Flender. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

1.1 General information

Purpose of the operating instructions

These operating instructions describe the gear unit and provide information about handling it - from assembly to maintenance.

Please keep these operating instructions for later use. Please read these operating instructions prior to handling the gear unit and follow the information in them.

Note

Disclaimer

Please make sure that every person who is commissioned to work on the gear unit has read and understood these operating instructions prior to handling the gear units and adheres to all of the points. Failure to observe these operating instructions can cause product or property damage or personal injury.

Flender does not accept any liability for damage or operating failures which are due to non-adherence to these operating instructions.

The gear unit described in these instructions reflects the state of technical development at the time these operating instructions went to print.

In the interest of technical advancements, Flender reserves the right to make changes to the individual components and accessories which are considered necessary for improving their performance and safety, while maintaining their essential features.

Basic knowledge required

In order to understand these operating instructions, you will need the following general knowledge about gear units. You will also need a basic understanding of the following topics:

- Application planning
- Assembly
- Commissioning
- Maintenance

Documentation landscape

These operating instructions form part of the delivery of your gear unit.

These operating instructions form part of the complete documentation supplied with the gear unit. The complete documentation encompasses other documents, including:

- Data sheet
- List of equipment
- Dimension drawing
- Operating instructions for gear unit lubrication and preservation BA 7300
- Operating instructions for the gear unit modules
- Operating instructions for mounted components
- Operating instructions for third-party vendor devices

Copyright

The copyright for these operating instructions is held by Flender.

Without the authorisation of Flender, these operating instructions may not be used wholly or in parts for competitors' purposes or be given to third parties.

If you have any technical queries, please contact one of our Customer Service addresses (Page 157).

1.2 Lubricants

The quality of the oil used must meet the requirements of the operating instructions BA 7300, which is provided as a separate item, otherwise the warranty provided by Flender will be void. Flender urgently recommends that one of the oils listed in BA 7300 is used, which was appropriately tested and complies with the requirements.

To avoid any misunderstanding, Flender points out that by making this recommendation it is not approving the product in the sense of expressing a warranty for the quality of the lubricants supplied by your supplier. Every lubricant manufacturer is required to guarantee the quality of his/her products.

Information such as oil type, oil viscosity and required oil quantity can be found on the rating plate of the gear unit and in the documentation supplied with the gear unit.

The oil quantity specified on the rating plate is an approximate value. The decisive factors for the quantity of oil to be filled are the marking of the oil dipstick or oil inspection window.

The operating instructions for the current lubricant recommendations of Flender can also be viewed in the Internet (<https://www.flender.com/lubricants>).

The oils listed there undergo continuous testing. As a result, the recommended oil types might in future be removed from the list or replaced by more advanced oils.

Flender recommends regular inspection to ascertain whether the selected lubricating oil is still approved by Flender. If it is not, another brand of oil should be selected instead.

Safety instructions

2.1 Security notes

Flender offers products and solutions with industrial security functions, which support the safe and secure operation of plants, systems, machines and networks.

In order to safeguard plants, systems, machines and networks against cyber threats it is necessary to implement (and continually maintain) a holistic industrial security concept that corresponds to the current state of the art. Flender products and solutions undergo continuous development in this respect.

Customers are responsible for preventing unauthorised access to their plants, systems, machines and networks. These systems, machines and components shall be connected to the company network or the Internet only when and to the extent that this is absolutely necessary and appropriate protective measures (e.g. firewalls and/or network segmentation) shall be taken.

You can find further information about possible protection measures as part of Industrial Security in the following international series of standards, for example: IEC 62443 "Network and system security".

Flender products and solutions undergo continuous development in order to make them even safer. Flender strongly recommends that you regularly implement product updates as soon as they become available and that you only use the current product versions. Use of older or no longer supported versions can increase the risk of cyber threats.

2.2 The five safety rules

In order to protect yourself and prevent any damage to property, always observe the safety relevant information and the following five safety rules (as per EN 50110-1 "Working on isolated equipment") when working on electrical components of the plant.

Prior to starting work on the machine, follow the safety rules listed below:

1. Disconnect
Also disconnect auxiliary circuits such as the anti-condensation heater
2. Safeguard against restart
3. Ensure that the system is de-energised
4. Earth and short circuit
5. Cover or cordon off adjacent live parts

When all the work is complete, cancel the safety measures in the reverse sequence.

2.3 General information

Introduction

All work on the gear unit should be performed with care and only by qualified personnel.

Symbols on the gear unit

The following symbols apply to the gear unit; some of which are found as coloured markings on the gear unit:

Table 2-1 Symbols and markings

Points labelled on the gear unit	Symbol	Coloured markings
Earth connection point		
Air relief point		yellow
Oil filling point		yellow
Oil draining point		white
Oil level indicator		red
Oil level measurement		red
Oil overflow		
Connection point for vibration monitoring		
Lubrication point		red
Apply grease		
Lifting eye		
Eye bolt		

Points labelled on the gear unit	Symbol	Coloured markings
Do not unscrew		
Alignment surface, horizontal		
Alignment surface, vertical		
These symbols indicate the oil level checking procedure using the oil dipstick.		
These symbols indicate that the oil dipstick must be firmly screwed in.		

2.4 General warnings and symbols

The following table contains general warnings and their associated symbols.

Table 2-2 General warnings

ISO	ANSI	Warning
		Warning - hazardous electrical voltage
		Warning - explosive substances
	---	Warning - entanglement hazard
	---	Warning - hot surfaces
	---	Warning - substances that are harmful to health or are irritants
	---	Warning - caustic substances
	---	Warning - suspended load
	---	Warning - hand injuries

2.5 Special types of danger and personal protective equipment

Requirements

Fulfil the following requirements before commencing work on the gear unit:

- Ensure that the oil pressure lines are depressurised.
- Only perform work on the gear unit when it is not in operation.
- Disconnect electrical systems from the power supply.



DANGER
Electric shock
Energised parts can cause an electric shock.
Ensure that the entire plant is de-energised before starting electrical installation work.

Protective equipment

Wear the following personal protective equipment when handling the gear unit:

- Safety shoes
- Overalls
- Helmet
- Safety gloves
- Safety goggles

WARNING
Risk of eye injury
Small foreign particles such as sand or dust can enter the cover plates of the rotating parts and be hurled back by them.
Wear safety goggles.

Dangers during operation

Damage to the gear unit is possible.

2.5 Special types of danger and personal protective equipment

Switch the gear unit to standstill immediately if inexplicable changes are noticed during operation. Such changes may include unusual gear unit noise or a significant increase in operating temperature.

 WARNING
Risk of falling

There is an increased risk of falling when standing or walking on the gear unit during operation.

Only walk or stand on the gear unit and its mounted components for maintenance and repair work when it is at a standstill. Do not walk or stand on shaft ends, protection covers, mounted components or pipes.


 WARNING
Danger to life through rotating or moving parts

There is danger that rotating or moving parts may catch hold of you or pull you in.

Secure rotating or moving parts against contact using protective devices.

Surface temperature

The surface temperatures of the gear unit can become very extreme depending on the operating conditions.


 WARNING
Risk of burns

Possible risk of serious burn injury from hot surfaces (> 55 °C).

Wear suitable protective gloves and protective clothing.

 WARNING
Risk of scalding

Risk of serious injury possible through escaping hot operating media when these are being changed.

Wear suitable protective gloves, safety goggles and protective clothing.

 WARNING
Danger due to low temperatures

Possible risk of serious injuries due to frost (pain, numbness, frostbite) on cold surfaces (< 0 °C).

Wear suitable protective gloves and protective clothing.

Chemical substances

Injuries can be sustained when using chemical substances.



WARNING

Risk of chemical burns due to chemical substances

There is a risk of chemical burns when handling corrosive cleaning agents.

Please observe the manufacturer's guidelines on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety goggles). Please use binding agents to immediately clear up any spilt solvent.



CAUTION

Risk of injury due to chemically corrosive consumables

There is a risk of injury to eyes and hands when handling chemically corrosive consumables.

Please observe the safety instructions in the data sheets of the oil used. Wear suitable protective equipment (gloves, safety goggles). Use an oil-binding agent to immediately clean up spilt oil.

Danger of explosion

An explosion may occur in a potentially explosive atmosphere.



DANGER

Danger of explosion through ignition of a potentially explosive atmosphere

Danger to life through ignition of a potentially explosive atmosphere possible when operating the gear unit

Do not use the gear unit in potentially explosive atmospheres.

2.6 Intended use

Only use the gear unit according to the conditions specified in the service and delivery contract and the technical data (Page 165) in the annex. Deviating operating conditions are considered improper use. The user or owner of the machine or plant is solely liable for any resulting damage.

When using the gear unit please specifically observe the following:

- Do not make any modifications to the gear unit that go beyond the permissible handling described in these operating instructions. This also applies to safety features designed to prevent accidental contact.
- Only ever use original spare parts.
Other spare parts are not tested and approved by Flender. Non-approved spare parts may possibly change the design characteristics of the gear unit and thus impair its active or passive safety.
Flender will accept no liability or warranty whatsoever for damage occurring as a result of the use of non-approved spare parts. The same applies to any accessories that were not supplied by Flender.

If you have any queries, please contact Customer Service (Page 157).

 WARNING
Risk of falling Risk of possible serious injury through falling. Only walk or stand on the gear unit for maintenance and repair work when the gear unit is at a standstill. Do not walk or stand on shaft ends, protection covers, mounted components or pipes.

Gear unit use

When using the gear unit, please observe the following basic rules:

- Ensure that the gear unit is operationally safe.
- The gear unit should only be operated, maintained or repaired by authorised, trained and suitably qualified personnel.
- The relevant work safety and environmental protection regulations must be complied with at all times during transport, assembly, dismantling, operation, maintenance and servicing.
- The outside of the gear unit must not be cleaned using high-pressure cleaning equipment.
- No welding work must be performed on the gear unit or on parts connected to it. The gear unit and any parts connected to it must not be used as an earthing point for electric-welding operations. Toothed parts and plain or rolling-contact bearings may be irreparably damaged by welding.
- Perform potential equalisation in accordance with the applicable regulations and guidelines. If no threaded holes are available on the gear unit for an earth connection, please take suitable measures. This work must always be done by specialist electricians.
- In the case of gear units that are operated in combination with electrical machines that generate current or through which current flows (e.g. motors and generators), take measures to ensure that no current can flow through the gear unit.
Current flow can cause irreparable damage to plain and rolling-contact bearings and gearing. Short circuits, voltage flashovers and deposits of conductive dust, for example, can all allow current to flow.
Use insulators and earth the gear unit properly.

2.6 Intended use

- When removing any protective devices, retain their fastening elements safely.
- Removed protective devices must be re-fitted prior to starting up.
- Pay attention to the notices attached to the gear unit such as the rating plate, direction arrow symbol etc. Notices must not be concealed by paint or dirt. Replace missing plates.
- Bolts that have been damaged during assembly or disassembly work must be replaced with new bolts of the same strength class and type.

DANGER

Danger to life due to live system
--

Death or serious injury will occur.

Always shut down the gear unit and any oil supply system (whether separate or mounted on the gear unit) before you carry out any work. Secure the drive unit against being operated accidentally as follows:
--

- | |
|---|
| <ul style="list-style-type: none">• Turn off the key-operated switch.• Remove the fuses in the power supply.• Attach a notice to the start switch, clearly stating that work is being carried out on the gear unit. |
|---|

Ensure that the entire unit is load-free so that no danger is posed when you start to dismantle components.

Reactivating the gear unit

When installing the gear unit in machines or systems, the machine or system manufacturers must ensure that the regulations, notes and descriptions contained in these operating instructions are incorporated in their own operating instructions.

Description

3.1 General description

The FLENDER MultipleDrive® described in these operating instructions, referred to below simply as "gear unit", is a vertical mill gear unit with a modular design, which was developed to drive a vertical mill in the cement industry.

The gear unit essentially comprises three components:

- Girth gear for the grinding bowl support
- Gear unit module
 - KMRS gear unit, called just KMRS in the following
 - Coupling
 - Motor
- Frequency converter or three-phase liquid starter

The gear unit is designed as an active redundant drive concept. On the grinding bowl support of the customer, up to six gear unit modules can be positioned so that up to 18.9 MW drive power can be achieved with identical gear unit modules. If one of the modules fails, it can be deactivated very quickly and the mill can continue to run.

The gear unit always incorporates active machine protection.

3.2 Grinding bowl support (not part of delivery scope)

The grinding bowl support absorbs the axial and radial forces resulting from the grinding process and guides them directly into the foundation of the mill through hydrostatic axial and radial plain bearings. The grinding bowl support also contains the girth gear through which the torque required for the grinding process is applied.

Additional information

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

3.3 Gear unit module

The gear unit module usually consists of four units that are mounted complete on a base frame (carriage):

- Motor
- Coupling

3.3 Gear unit module

- KMRS
- Oil supply system

Depending on the order, the oil supply system can also be installed separately as a special variant.

The following figure shows the gear unit module:

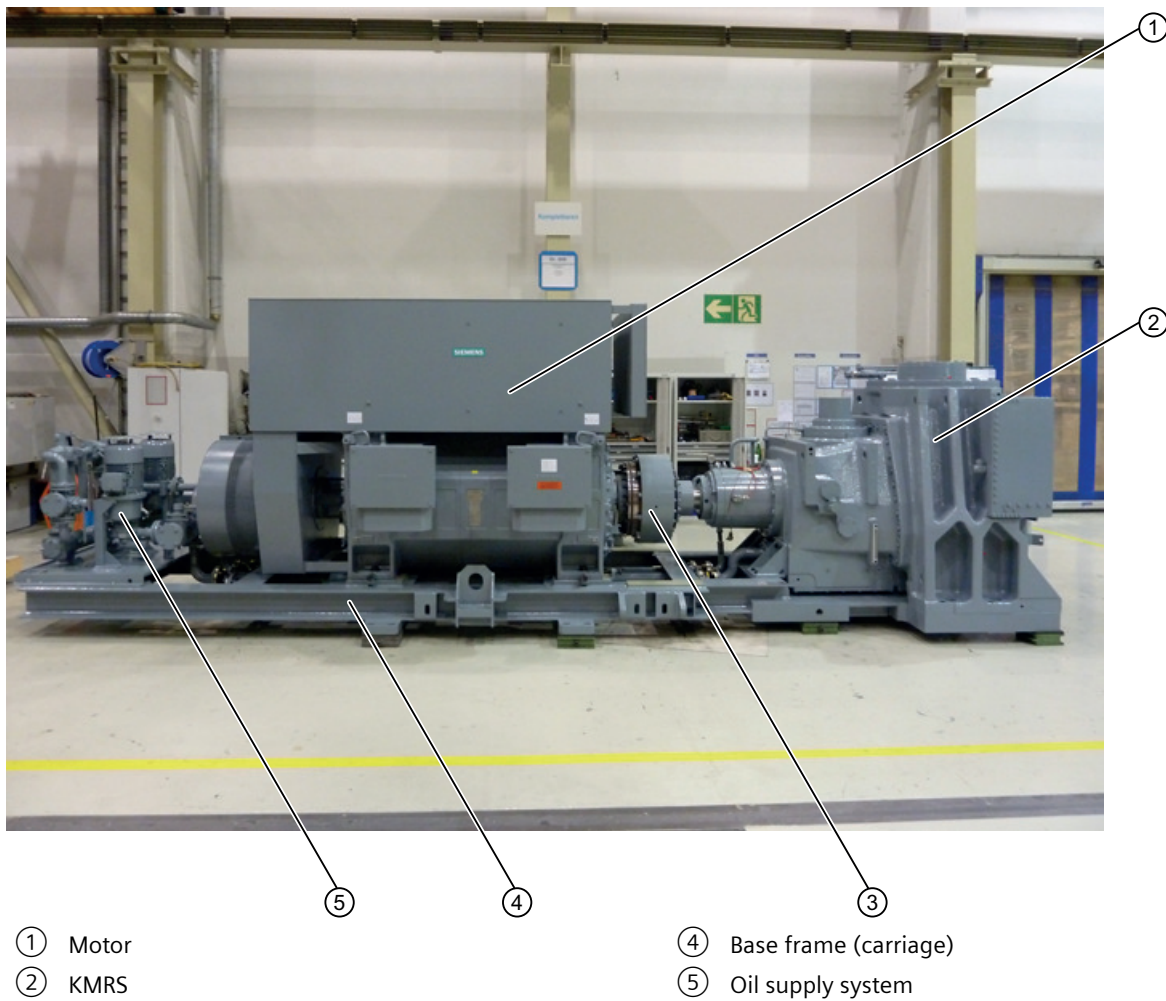


Figure 3-1 Gear unit module

3.3.1 KMRS

The KMRS is a two-stage bevel helical gear unit for driving the girth gear on the grinding bowl support.

The enclosure is not closed. The shaft of the last stage has an output pinion that engages the girth gear directly. This output pinion is designed to compensate for unavoidable tilt and wobble movements of the girth gear.

The input shaft of the KMRS has plain bearings. The other shafts are guided in rolling-contact bearings.

Further information

You can find additional information on the gear unit in the gear unit operating instructions, which are part of the complete documentation of the gear unit.

Depending on the type of drive, different starters, motors and couplings are used.

3.3.2 Coupling

3.3.2.1 Highly flexible coupling

The coupling is a highly elastic coupling that isolates electrically and from torsional vibration.

The coupling comprises two coupling parts that are connected electrically insulated with an elastic ring that transmits the torque by friction.

Further information

Check the higher-level coupling alignment according to the procedure. Observe the information provided in Chapter Gear unit module with highly flexible coupling – variable speed (Page 72).

You will find further information on the coupling in the operating instructions for the coupling, which are part of the complete documentation of the gear unit.

3.3.2.2 Fluid coupling

The coupling is a hydrodynamic fluid coupling.

The coupling consists of an input and an output side which are not mechanically connected to each other. The torque is transmitted via the oil filling rotating in the coupling. Other types of coupling are connected on either side of the fluid coupling.

Further information

Check the higher-level coupling alignment according to the procedure. Observe the information provided in Chapter Gear unit module with hydrodynamic fluid coupling – fixed speed (Page 82).

You will find further information on the coupling in the operating instructions for the coupling, which are part of the complete documentation of the gear unit.

3.3.3 Motor

The motor is a self-cooled Siemens induction motor. The rotor is supported on rolling-contact bearings.

3.3 Gear unit module

Further information

You will find further information on the motor in the operating instructions for the motor, which are part of the complete documentation of the gear unit.

3.3.4 Starting aids

3.3.4.1 Frequency converter

The frequency converter is a Siemens voltage converter of the "SINAMICS Cabinet Module" series.

NOTICE
Damage to the gear unit modules and the frequency converter The gear unit modules and the frequency converter may be damaged. The gear unit modules and the frequency converters are technically precisely matched. Do not replace individual gear unit modules and frequency converters with products of other types or from other manufacturers.

Further information

You will find further information on the frequency converter in the operating instructions for the frequency converter, which are part of the complete documentation of the gear unit.

3.3.4.2 Three-phase liquid starter

The three-phase liquid starter is of the "MKS" series.

NOTICE
Damage to the gear unit modules and the three-phase liquid starter The gear unit modules and the three-phase liquid starter may be damaged. The gear unit modules and the three-phase liquid starter are technically precisely matched. Do not replace individual gear unit modules and three-phase liquid starters with products of other types or from other manufacturers.

Further information

You will find further information on the liquid starter in the operating instructions for the liquid starter, which are part of the complete documentation of the gear unit.

3.3.5 Machine protection

The gear unit modules are actively monitored (torque and vibration behaviour). If permanently defined values are exceeded, an alarm is output to the control console or automatic shutdown of the plant is initiated.

Further information

You will find further information on the machine protection in the operating instructions for the machine protection, which are part of the complete documentation of the gear unit.

3.4 Oil supply to the gear unit

Lubrication and cooling are performed by constant oil circulation through several separate oil supply systems.

Each KMRS and grinding bowl support has its own oil supply system.

Further information

You will find further information on the oil supply systems in the operating instructions for the oil supply system, which are part of the complete documentation of the gear unit.

3.4.1 Low-pressure lubrication circuits

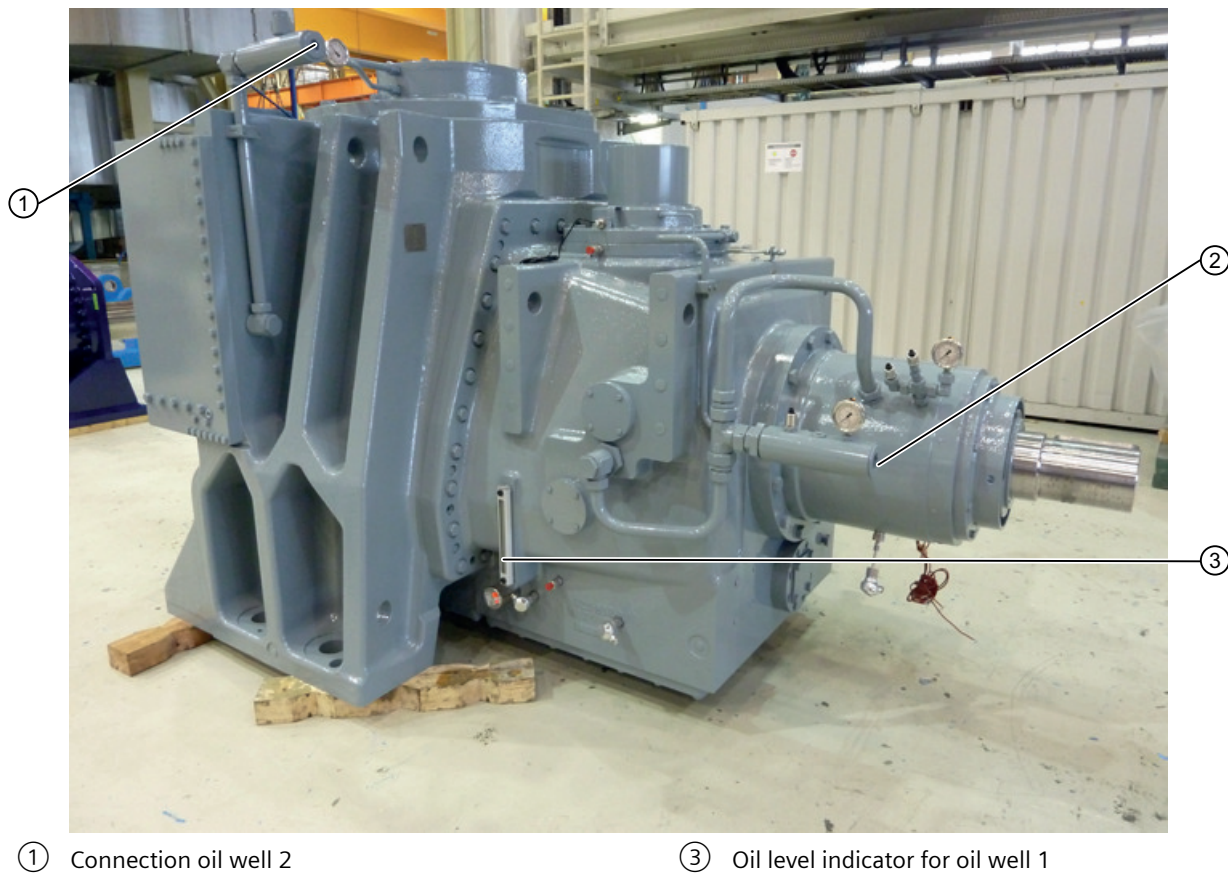
Each KMRS has two oil wells, which are separated by a labyrinth seal inside the gear unit.

The input stage (oil well 1) consists of gear teeth, plain bearings and rolling-contact bearings of the KMRS. This is cooled and pressure-lubricated by one Flender oil supply system each, which usually stands on a carriage.

The axial plain bearings, radial plain bearings and the girth gear inside the grinding bowl support - together with the output pinions of the KMRS (oil well 2) - are cooled and pressure-lubricated by a separately installed Flender oil supply system. Part of the oil is fed to the KMRS via a pipe that branches off directly after the cooler of the separate Flender oil supply system.

The following diagram shows the KMRS with two separate oil wells:

3.4 Oil supply to the gear unit



① Connection oil well 2

③ Oil level indicator for oil well 1

② Connection oil well 1

Figure 3-2 KMRs with two separate oil wells

3.4.2 High-pressure lubrication circuit

To absorb the loads from the mill and the grinding process, the axial and radial tilting-pad bearings of the grinding bowl support are lubricated hydrostatically via a high-pressure lubrication circuit.

Hydrostatic lubrication with a radial piston pump

In addition to hydrodynamic lubrication, part of the oil is fed to the high-pressure pumps via a pipe that branches off directly after the cooler.

The pumps are radial piston pumps and they pump a constant volume of oil at every oil connection port. The same quantity of oil is fed to each bearing pad irrespective of the back-pressure. The ports for the oil supply are distributed in such a way that adjacent pads are not fed by the same pump. In this way, operation can be continued for the time it takes to replace a failed pump.

To ensure that the pumps are running and no pipe is defective, the oil flows are monitored for minimum pressure. The pressure at the pressure gauge depends on the pressing force actually exerted by the grinding rolls.

If the pressure or flow rate in a component subject to pressure or flow monitoring falls below the minimum value, the main drive is shut down. The check valves installed in the bearing pads prevent the oil from flowing back during normal operation.

3.4.3 Separate oil supply system

A separate oil supply system can be used to cool the oil.

When installing the gear unit, make sure that unhindered convection across the housing surface is possible in order to protect the gear unit against overheating.

Further information

You will find further information on the separate oil supply system in the operating instructions for the oil supply system, which are part of the complete documentation of the gear unit.

You will find further information on the technical data in the separate data sheet and the list of equipment, which are part of the complete documentation of the gear unit.

3.5 Heating

Introduction

At low temperatures, it may be necessary to preheat the gear unit oil and the oil in the pipes between the KMRS and the oil supply system in the base frame (carriage) before switching on the drive or even during operation.

Heating elements

In such cases, the drives are implemented with heating elements. Heating elements convert electricity into heat. The thermal energy is dissipated to the surrounding oil. The heating elements are installed in protective tubes in the housing so that they can be replaced without having to first drain the oil.

The heating elements must be fully immersed in the oil bath by mounting the gear unit in the correct position as shown in the dimension drawing in the complete documentation and by keeping the oil topped up to the minimum level.

WARNING

Fire hazard

Exposed heating elements pose a fire hazard.

Do not switch on the heating elements unless you have checked that they are completely immersed in the oil bath.

Heating element control

The heating elements are controlled by a temperature monitor. The temperature monitor provides a signal to be amplified when the minimum and maximum temperatures are reached.

Auxiliary heating

In these cases, the interconnecting piping in the base frame (carriage) is equipped with an auxiliary heating system. This auxiliary heating system converts electricity into heat and dissipates this to the piping encased in a jacket arrangement.

The piping is encased in a jacket arrangement. The piping comprises heating cables and thermal insulation on the inside.

Control for the auxiliary heating system

The auxiliary heating system is controlled by a temperature monitor. Connect power to the heating system to maintain the process temperatures at the pipes.

Further information

Further information about the position of the mounted components and a detailed illustration of the gear unit can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about heating elements can be found in the separate data sheet, in the list of equipment and in the heating element operating instructions in the complete documentation for the gear unit.

Addition information about the auxiliary heating system can be found in the separate data sheet, in the list of equipment and in the operating instructions of the auxiliary heating system in the complete documentation for the gear unit.

Further information about the temperature monitor (such as control instructions) can be found in the temperature monitor operating instructions in the complete documentation for the gear unit.

3.6 Shaft seal

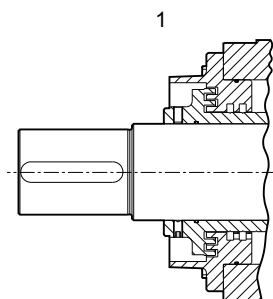
Depending on requirements, shaft seals prevent oil from escaping from the gear unit or dirt from entering the gear unit.

3.6.1 Labyrinth seals

Labyrinth seals as non-contact seals prevent shaft wear. They do not require any maintenance and improve the temperature behaviour of the gear unit. Labyrinth seals can only be used for certain gear ratios and minimum speeds.

The KMRS is fitted with a labyrinth and Taconite seal.

The following diagram shows the labyrinth seal at the KMRS:



1 KMRS

Figure 3-3 Labyrinth seal

To ensure reliable operation of these labyrinth seals, the gear unit must be permanently installed in a horizontal position and not exposed to waste water or high dust loads. Overfilling the KMRS can result in leaks, the same applies to oil with a high foam content.

NOTICE

Damage to the KMRS

Foreign bodies and particles can enter the KMRS if the upper girth gear shroud area is not correctly cleaned.

Carefully ensure that the upper girth gear shroud area is free of deposits, such as dirt or deposits of ground material.

Thoroughly clean and remove loose foreign bodies and particles from the upper girth gear shroud area.

Additional information

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

3.6.2 Taconite seal

The taconite seal is a combination of two sealing elements:

- Rotary shaft seal to prevent the escape of lubricating oil
- Grease-filled dust seal (comprising a labyrinth and a lamellar seal) to allow operation of the gear unit in extremely dusty environments

NOTICE

Regrease the labyrinth seals at the specified regreasing intervals. The regreasing intervals are specified in the maintenance schedule (Page 111).

- ① Lamellar seal ③ Grease nipple AM10x1 as per DIN 3404
② Labyrinth, filled with grease, can be regreased ④ Rotary shaft sealing ring

To work reliably, taconite seals must be installed in stationary, horizontal positions. Overfilling the KMRS can result in leaks, the same applies to oil with a high foam content.

NOTICE

An insufficient gap dimension results in wear. This can bring parts into contact with each other, causing impermissible temperature rise. In the case of a shaft seal with taconite seals, the set gap dimension of $1^{+0.5}$ mm on the grease labyrinth must not be changed. Rotating and stationary parts must not touch.

3.7 Oil temperature monitoring

To measure temperatures or temperature differences, connect the Pt 100 resistance thermometer to an evaluation unit (to be supplied by the customer).

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

Further information about oil temperature monitoring (such as control instructions) and the technical data can be found in the operating instructions for the oil temperature monitor and in the list of equipment in the complete documentation for the gear unit.

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

3.8 Bearing monitoring

3.8.1 Bearing monitoring using a Pt 100 resistance thermometer

The gear unit is equipped with Pt 100 resistance thermometers for monitoring the bearing.

To be able to measure temperatures or temperature differences, connect the Pt 100 resistance thermometer to an evaluation device provided by the customer.

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the dimension drawing in the complete documentation for the gear unit.

Further information on bearing monitoring with a Pt 100 resistance thermometer (such as control instructions) and the technical data can be found in the operating instructions for the bearing monitoring with a Pt 100 resistance thermometer and list of equipment, which are part of the complete documentation of the gear unit.

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

3.8.2 Bearing monitoring by acceleration sensor

The gear unit is equipped with acceleration sensors.

Further information

Further information and a detailed illustration of the gear unit with attached sensors can be found in the dimension drawing in the complete documentation for the gear unit.

Further information on the acceleration sensors (such as control instructions) and the technical data, can be found in the operating instructions of the acceleration sensor and the list of equipment, which are part of the complete documentation of the gear unit.

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

3.9 Auxiliary drive, designed as maintenance drive

Maintenance drive

The motor of the maintenance drive is dimensioned such that the mill can be run at low speed in the same direction of rotation with a partial load. The maintenance drive is a helical geared motor. The helical geared motor has its own oil filling.



WARNING

Severe physical injury due to the maintenance drive bursting

The maintenance drive can burst if the main drive is switched on.

Follow the control instructions and interlocking rules. Monitoring is realised using a proximity switch that is mounted on the KMRS.

NOTICE

Overload of the auxiliary drive

Damage or destruction of the maintenance drive and main drive due to overload.

Only run the mill from the maintenance drive with the load defined for this. Follow the control instructions and interlocking rules.

The following diagram shows the maintenance drive mounted on the KMRS:

3.9 Auxiliary drive, designed as maintenance drive



Figure 3-5 Maintenance drive mounted on the KMRS

Oil supply to the maintenance drive

The maintenance drive has its own oil circuit that is separate from the main gear unit. The maintenance drive is supplied ready-filled with oil.

Maintenance drive with several drives

For the maintenance drive with several drives, you require a frequency converter provided by the customer. Follow the operating instructions of the frequency converter.

Connection of the maintenance drive

Before connecting the motor, determine the phase sequence of the three-phase power system using a phase-sequence indicator and then connect the motor in accordance with the defined direction of rotation.

Observe the note attached to the KMRS.

Further information

You will find further information on the maintenance drive in the operating instructions for the maintenance drive, which are part of the complete documentation of the gear unit.

You will find the precise designation of the geared motor, and the mounting orientation in the dimension drawings, which are part of the complete documentation of the gear unit and in chapter Technical data (Page 165).

You will find further information, technical data and control instructions in the list of equipment drawn up specifically for the order, which are part of the complete documentation of the gear unit.

You will find further information on the frequency converter in the operating instructions for the frequency converter, which are part of the complete documentation of the gear unit.

Application planning

4.1 Scope of delivery

The scope of delivery is listed in the shipping documents. Immediately upon receiving the gearbox, check that everything has been delivered. Report any damaged and/or missing parts to Customer Services (Page 157) immediately.

 WARNING
Serious injury through defective product
Serious injury may occur.
If the gearbox exhibits any visible damage, you should not put it into operation.

4.2 Transport

General information

The gear unit modules are delivered on a base frame (carriage) with a coupling, coupling protection, motor and normally with an oil supply system (if fitted) as a preassembled unit without an oil filling.

A gear unit module with a separately installed oil supply system is a special version. The oil supply system is separate, and is connected to the gear unit module through pipes

The girth gear is separately packed and shipped.

When transporting the gear unit, observe the following instructions to avoid damaging the gear unit:

- Transport the gear unit only by suitable means of transport.
- Transport the gear unit without an oil filling and leave the gear unit on the transport packaging.
- Do not use incorrect attachment points.
The threads in the end faces of the shaft ends may not be used for attaching lifting equipment.
- Do not use the pipes for moving the gear unit.
- Ensure that the lifting equipment is adequately designed to accommodate the weight of the gear unit.
- Provide complete and flat packing under the gear unit modules. Ensure that the base frame (carriage) is not stressed or deformed by lashing during transport.



WARNING

Risk of crushing

There is a risk of being crushed by a component that becomes detached because the hoisting gear and load suspension device are not suitable for handling it.

When lifting, please observe the load distribution information on the packaging.

When the product is in a raised position, transport it slowly and carefully to avoid injury to persons or damage to the gear unit.

Attaching the gear unit

To transport the gear unit, only attach slings to the marked attachment points that are provided for this purpose.

Please observe the following when attaching slings to the load or raising, lowering or moving it:

- Do not exceed the specified load limits
- If you are using a load suspension device with several load hooks, make sure that the load is evenly distributed between them
- Note the eccentric centre of gravity
- Make sure that the lifting equipment is securely attached
- Keep your speed down when moving the load
- Do not allow the load to sway and do not attach the load to objects or structures inside the building
- Loads must not be suspended from the tip of a load hook
- Always place the products down on a level, non-slip and stable base



DANGER

Falling load

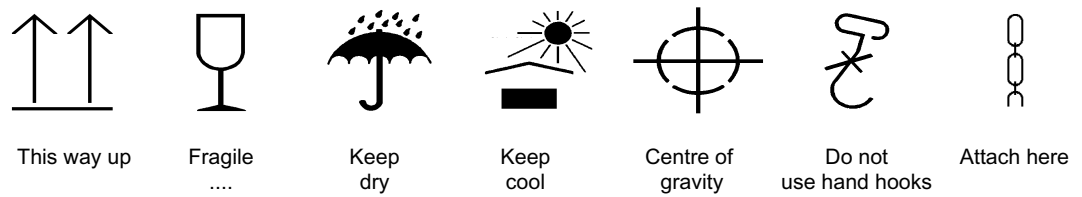
There is a risk of fatal injury from falling loads if these have not been securely attached to the lifting equipment.

Never stand or sit under suspended loads. Do not exceed the load limits of the lifting equipment.

Packaging

The gear unit may be packed in various forms, depending on the size of the unit and method of transport.

Please adhere to the symbols applied on the packaging.



4.3 Attachment points

Lifting eyes

Lifting eyes are fitted to the gear unit to assist with its transportation during manufacture and installation.

Attach slings to the lifting eyes in accordance with the specifications in the dimension drawings.

Position of the attachment points

The following figure shows the position of the attachment points and transport of the gear unit modules:



Figure 4-1 Position of the attachment points and transport of the gear unit modules

The following figure shows the marking on the cross-beam:



Figure 4-2 Marking on the cross-beam

Further information

Further information and a detailed illustration of the gear unit and the position of the attachment points can be found in the drawings in the complete documentation for the gear unit.

Further information on the cross-beam can be found in the operating instructions for the cross-beam, which are part of the complete documentation of the gear unit.

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

4.4 Special aspects of storage

Improper use can damage the gear unit. Be sure to take the following precautions during storage:

- Never stack drive components on top of one another.
- Only ever store the girth gear horizontally.
- Provide complete and flat packing under the gear unit modules.

4.5 Special aspects of gear unit lubrication and preservation

4.5.1 Filling with oil

Follow the instructions in BA 7300.

For the grinding bowl support, observe the documentation provided by the mill manufacturer.

Fill the oil supply system for the grinding bowl support with oil through a three-way valve. The oil supply system is fitted with a bypass filter through which the oil is pumped into the grinding bowl support.

Fill the oil supply systems of the KMRS with oil through a three-way valve. These are equipped with a bypass filter through which the oil is pumped into the KMRS.

For oil supply systems with a tank, fill the tank with oil.

Fill the oil circuit of the oil cooling systems with oil. Follow the operating instructions of the oil supply system.

Fill the oil pumps and all oil filling holes identified with special labels with oil before you commission the KMRS and the grinding bowl support. Fill the oil in through an oil filling hole provided on the oil pump or pressure pipe or identified by a label. Close the oil filling holes well so that the oil pump does not suck in air and no oil escapes.

Filter the oil during filling with a nominal filter fineness of 10 µm.

4.5.2 Draining oil

Empty the grinding bowl support through the three-way valves of the bypass filtering. Drain off the remaining oil through the oil drainage valves. If necessary, use new screw plugs.

For the grinding bowl support, observe the documentation provided by the mill manufacturer.

4.5.3 Checking the oil level

Follow the instructions in BA 7300. Shut down the KMRS and the grinding bowl support. Check the oil levels of the KMRS and the grinding bowl support while the oil pump of the low-pressure lubrication circuit of the oil supply system is operational.

To check the oil level of the oil supply system, observe the operating instructions of the oil supply system, which are part of the complete documentation of the gear unit.

For the grinding bowl support, observe the documentation provided by the mill manufacturer.

4.5.4 Taking oil samples

Follow the instructions in BA 7300. Take oil samples for analysis from downstream of the filter of the oil supply system while the plant is running. A suitable port for taking oil samples is usually located in front of the KMRS input (e.g. oil drain valve in the pressure pipe).

For the grinding bowl support, observe the documentation provided by the mill manufacturer.

As an alternative to changing the oil (Page 111) at fixed intervals, you can arrange for the technical services of the oil manufacturer to examine an oil sample regularly every 4 weeks, and approve the oil for further use. In this case, the oil manufacturer guarantees that the properties of the oil will comply with Flender specifications.

4.5.5 Preservation

Introduction

The gear unit is preserved with an interior preservation agent; the free ends of the shaft, its mounted components and the girth gear are protected with a suitable preservation agent.

A preservation agent must be applied to the interior of the gear unit once it has been taken out of operation and removed.

Improper use can damage the gear unit. Take the following precautions to ensure that the preservation remains effective:

- Carefully ensure that the input shaft seal remains covered.
- Carefully ensure that the protective cover (transport cover) remains mounted on the KMRS.

Extension of the life of the interior preservation using Castrol Corrosion Inhibitor N 213

Improper use can damage the gear unit. Take the following measures to extend the life of the interior preservation using Castrol Corrosion Inhibitor N 213:

- Follow the instructions in BA 7300.
- Remove any dirt from the inspection and assembly cover and the oil filling points.
- Fill the containers with the appropriate quantity of preservative agent "Castrol Corrosion Inhibitor N 213".
- For the grinding bowl support, observe the documentation provided by the mill manufacturer.

4.5.6 Special aspects of gap seals

Special aspects of labyrinth seals

For gear units with labyrinth seals, the air gap on the drive shaft is hermetically sealed with adhesive tape after standard preservation.

NOTICE

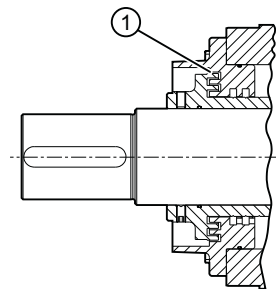
Risk of corrosion

There is a risk of corrosion if the gear unit is opened too early.

Do not remove the adhesive tape from the labyrinth seal until the gear unit is commissioned.

For the seal to the grinding bowl support, observe the documentation provided by the mill manufacturer.

The following diagram shows the labyrinth seal at the KMRS:



① Adhesive tape

Figure 4-3 Labyrinth seal at the KMRS

Assembly

5.1 General assembly instructions

The assembly work must be performed very carefully by authorised, trained and suitably instructed personnel. Liability will be disclaimed for damage caused by the incorrect performance of this work.

Requirements

Improper use can damage the gear unit. Be sure to take the following precautions:

- Protect the gear unit against falling objects and from becoming covered over.
- Do not perform any welding work anywhere on the drive.
- Do not use the gear unit as an earthing point for electric-welding operations.
- Use all of the fastening points fitted to the particular unit design.
- Replace any bolts which can no longer be used by bolts of the same strength class and type.
- Make sure that sufficient hoisting gear is available.
- Pay attention to the special rules of the mill manufacturer.
- The open gear unit is sealed with a transport cover to protect it against corrosion and the ingress of foreign particles.
Remove the transport cover as late as possible during assembly to ensure corrosion protection.

Mounting position and attachment points

During the actual planning phase, be sure to allow for sufficient space around the gear unit to enable subsequent upkeep and maintenance work. It must be possible to inspect the internal components through the inspection cover openings. Take suitable measures to ensure that unhindered convection across the housing surface is possible so that the gear unit does not overheat.

The positions of the attachment points are shown in the dimension drawings. To ensure that the unit is properly lubricated during operation, please observe the mounting position specified in the dimension drawings.

5.2 Information about the tool

Tools

The following table contains a selection of the most important tools required to mount the girth gear and the gear unit modules:

Table 5-1 Tools for assembly

Tool	Assembly specialist	Customer
2 dial gauges with magnetic stands (1/100)	X	
Micrometer (variable lengths) up to a depth of 500 mm	X	
Spirit level 0.02 mm/m 200 mm long	X	
Feeler gauge 0.05 to 2 mm	X	
Torque spanner for hex-socket nuts of the Superbolt clamping elements $T_A = {}^1) \text{ Nm}$		X
2 hydraulic jacks 10 t		X
4 chain hoists 10 t		X
Threadlocker Loctite 2701		X
Liquid nitrogen		X
Solvent		X
Liquid adhesive Loctite 401		X
4 heavy duty rollers ¹⁾		X
Measuring tool to check the coupling alignment		X

¹⁾ You will find the required size, further data on the design and technical data in the dimension drawings and data sheets, which are part of the complete documentation of the gear unit.

5.3 Unpacking the gear unit

Introduction

The scope of delivery is listed in the shipping documents.

WARNING

Risk of serious injury due to defective product

A defective gear unit can result in serious injury.

Do not start the gear unit if it is noticeably damaged.

Contact Customer Service (Page 157).

Requirements

Check that everything has been delivered immediately upon receipt.

NOTICE
Damage to the gear unit due to corrosion
Exposing the gear unit to moisture can result in damage from corrosion.
Do not damage or open the packaging prematurely if the packaging is designed to preserve the unit.

Procedure

To unpack and use the gear unit, please proceed as follows:

1. Remove packaging and transport devices in accordance with regulations.
2. Perform a visual inspection for damage and accumulations of dirt.
3. Place machines on the input and output sides in their correct order.
4. Immediately report any damaged and/or missing parts to Customer Services (Page 157).
5. Dispose of packaging material and transport devices in accordance with regulations.

Further information

You will find information on the weight and dimensions and further technical data in the dimension drawings and the data sheet drawn up specifically for the order, which are part of the complete documentation of the gear unit.

5.4 Foundation

Properties of the foundation

Mount the gear unit modules on a foundation that has the following properties:

- Flat
- Secure
- Free of vibration
- Rigid

It is especially important that the gear unit module mounting surfaces are absolutely flat as this influences the service life of the components.

Requirements of the foundation

All points of the grinding bowl support and the floor under the gear unit modules must be between two notional parallel planes that are 0.1 mm apart per 1 m (0.0036 inch per 3 ft).

The gear unit plate has a surface roughness of $R_a = 3.2$ and may be tilted by no more than 0.4 mm. The permissible deviation of the grinding bowl support and the floor under the gear unit modules from the horizontal plane is 0.1 mm per 1 m (0.0036 inch per 3 ft).

The following figure shows the foundation requirement:

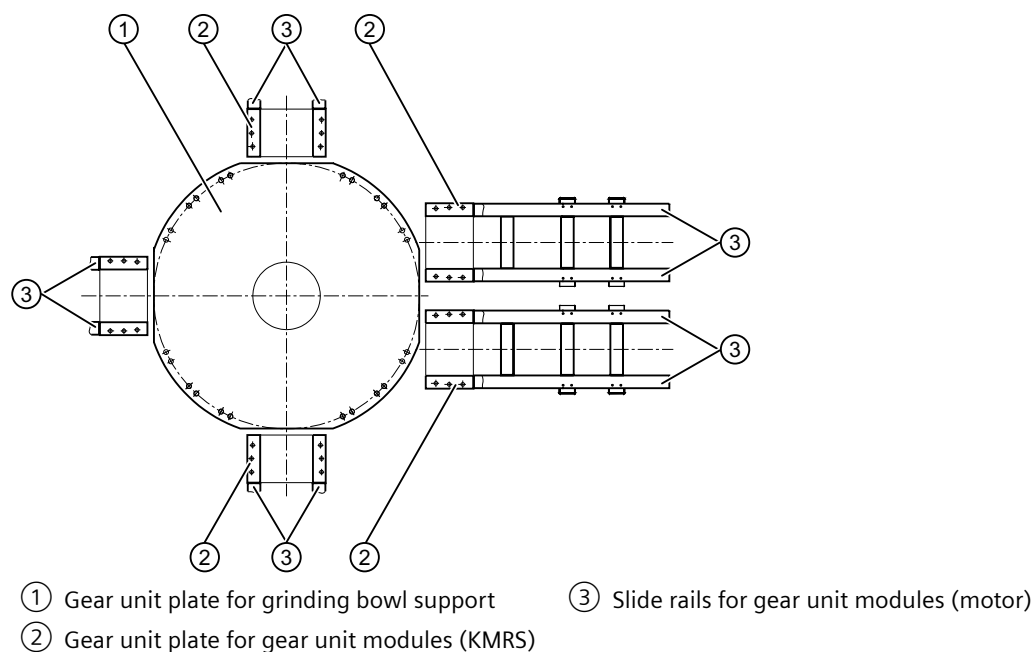


Figure 5-1 Requirements of the foundation

Shims

Take the following precautions when building the foundation:

- Measure the entire gear unit plate, in particular, the slide rails to the gear unit plate, and record these measurements.
- If the specified values are exceeded, level the gear unit plate with shims.
- Where possible, join the shims to the slide rails by spot welding.
- Use shims that are large enough to prevent the gear unit modules from shifting (in and out).

5.5 Preparatory measures

Every time the KMRS is opened, e.g. to remove the adhesive tape on the input shaft of the gear unit and to release a cover or screw plug, the guaranteed preservation time is reduced. Be sure to take the following precautions:

- Once the KMRS has been opened, commission the system within one week.

5.5.1 Preparatory measures before installing the gear unit modules

Proceed as follows to prepare for installing the gear unit modules:

1. Remove the packaging before installing the gear unit modules in the vertical mill.
2. Do not remove the adhesive tapes on the labyrinth seals until shortly before commissioning.
3. Clean the exterior of the gear unit modules.
4. Wash all preserved surfaces with a cleaning agent.
5. Clean the exterior of the gear unit modules and the foundation mounting surfaces.



! WARNING

Risk of chemical burns due to chemical substances

There is a risk of chemical burns when handling corrosive cleaning agents.

Please observe the manufacturer's guidelines on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety goggles). Please use binding agents to immediately clear up any spilt solvent.

NOTICE

Damage due to chemically corrosive cleaning agents

Damage due to chemically corrosive cleaning agents is possible.

Avoid all contact of the cleaning agent with gear unit components at risk.

5.6 Mounting the girth gear

Introduction

The girth gear transmits the torque required for grinding by means of friction.

The girth gear is installed after the grinding bowl support has been mounted.

! WARNING

Risk of injury by the girth gear and defective tools

Risk of injury as possible by the girth gear and defective tools.

Strictly adhere to the specified torques and protection measures. Only use tools that are calibrated and in perfect technical condition to tighten the bolts.

5.6 Mounting the girth gear

NOTICE

Damage to the KMRS possible

For the grinding bowl support, observe the documentation provided by the mill manufacturer.

Further information

Additional information on the grinding bowl support is given in the documentation provided by the mill manufacturer.

5.6.1 Equipment needed to mount the girth gear

To mount the girth gear, you need the following equipment:

- Hydraulic tightening tool (e.g. HYTORC, HY-¹⁾ XLT or an equivalent tool)
- Torque spanner for hex-socket bolts of the SUPERBOLT clamping elements, TA = ¹⁾
- Loctite 2701 for locking the threads
- Liquid nitrogen or dry ice

¹⁾ You will find the required size, further data on the design and technical data in the dimension drawings and data sheets, which are part of the complete documentation of the gear unit.

The Flender scope of supply includes the following parts:

- SUPERBOLT nuts
- Stud bolts and fitted bolts
- Appropriate washers

When connecting the girth gear to the thrust collar, carefully observe the documentation provided by the mill manufacturer.

5.6.2 Placing the girth gear on the grinding bowl support

The girth gear is supplied in two parts. The two halves of the girth gear are delivered in a wooden crate.



WARNING

Risk of falling

Serious injury may occur if temporary storage is incorrectly performed.

If the girth gear is set down again between unpacking and mounting on the grinding bowl support, store it horizontally only.

The girth gear is equipped with the holes and lifting threads required for transport. You need four lifting ropes for this.

The following figure shows the attachment points and transport of the girth gear:



Figure 5-2 Attachment points and transport of the girth gear

Procedure

To set the girth gear down on the grinding bowl support, proceed as follows:

1. For the grinding bowl support, observe the documentation provided by the mill manufacturer.
2. Place a bolt in the last hole on the girth gear joints.
3. Position the girth gear on the grinding bowl support. When doing this, observe the documentation provided by the mill manufacturer.
The mounting position of the two halves of the girth gear is defined precisely. During mounting, ensure that the same numbers match up on the joint (1/1;2/2).
The girth gear also has four holes for pins (two holes for each girth gear half). Ensure exact positioning relative to the thrust collar.
4. Loosely insert the two pins in the pin holes for positioning only.
5. Tighten the bolts finger-tight.
6. Repeat these steps for the second half of the girth gear.
7. When both halves of the girth gear are in position, tighten the connecting bolts between the girth gear and the thrust collar finger-tight.



! DANGER

Falling load

A danger to life is posed by a falling load due to bolts not being tightened finger-tight.
Do not release the lifting ropes until both bolts have been tightened finger-tight.

To avoid serious physical injury and damage to the gear unit, take the following precautions:

- When pushing in each of the halves of the girth gear, ensure that the contact surfaces are not damaged. These surfaces must be clean before bolting together.
- Only use lifting gear and load suspension devices with sufficient load bearing capacity during transport.
- When lifting, please observe the load distribution information on the packaging.
- Transport the girth gear in such a way that personal injury and damage to the girth gear are avoided.
For example, shock applied at the free ends of shafts can damage the girth gear and the grinding bowl support.
- When mounting the girth gear under the mill using an appropriate device, carefully comply with the mill manufacturer's regulations.
- The bolts are supplied with washers or sleeves. Place these items under the bolt heads. Do not tighten bolts without washers or sleeves in place.

5.6.3 Bolting the halves of the girth gear

Introduction

The scope of supply of the girth gear includes the girth gear joint bolts. These consist of the following single items:

- Fitted stud bolts
- Stud bolts
- SUPERBOLT nuts
- Washers to match.

The mounting position of the two halves of the girth gear is defined precisely. During mounting, ensure that the same numbers match up on the joint (1/1;2/2).

The following figure shows an example of a bolt arrangement:

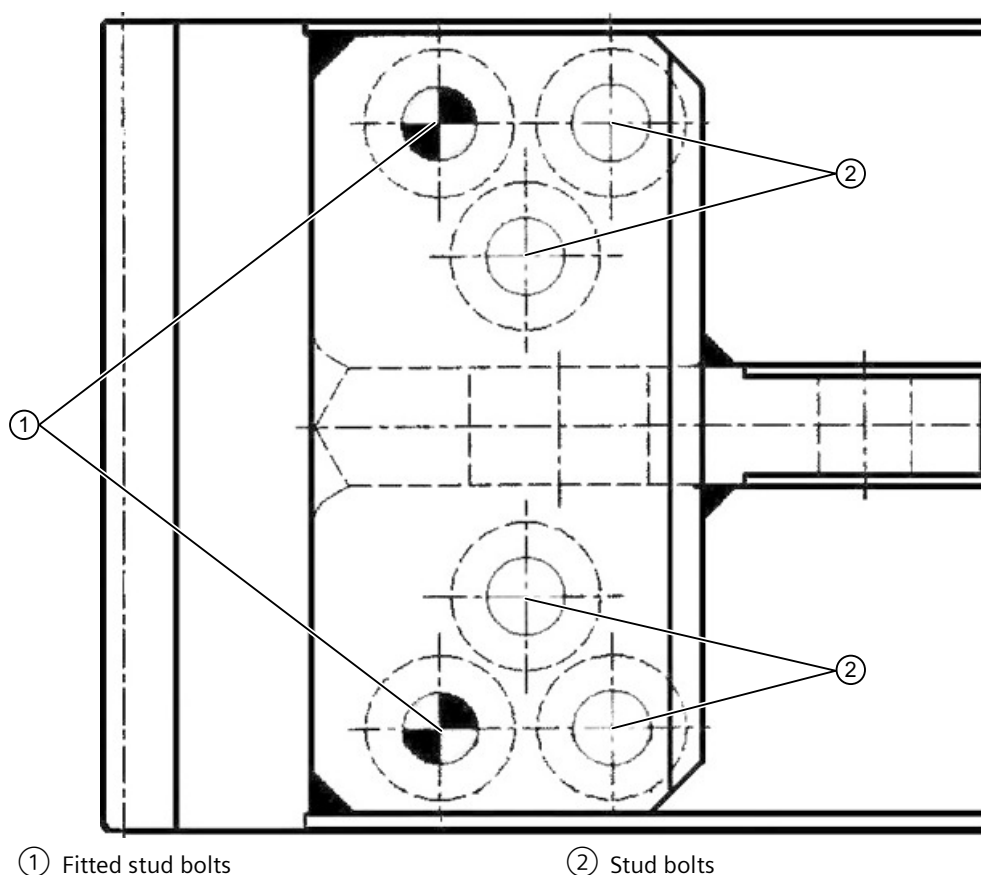


Figure 5-3 Bolt arrangement (example)

Inserting fitted stud bolts and threaded bolts

To insert the outer fitted stud bolts and threaded bolts, proceed as follows:

1. For assembly, cool the fitted stud bolts using liquid nitrogen or dry ice down to -10°C to -15°C .
2. Insert the fitted stud bolts.
3. When the fitted stud bolts have warmed up to the ambient temperature, insert the stud bolts.

WARNING

Danger due to low temperatures

Possible risk of serious injuries due to frost (pain, numbness, frostbite) on cold surfaces ($<0^{\circ}\text{C}$).

Only have work with liquid nitrogen performed by personnel trained in handling liquid nitrogen.

The following figure shows a cooled and inserted fitted stud bolt:

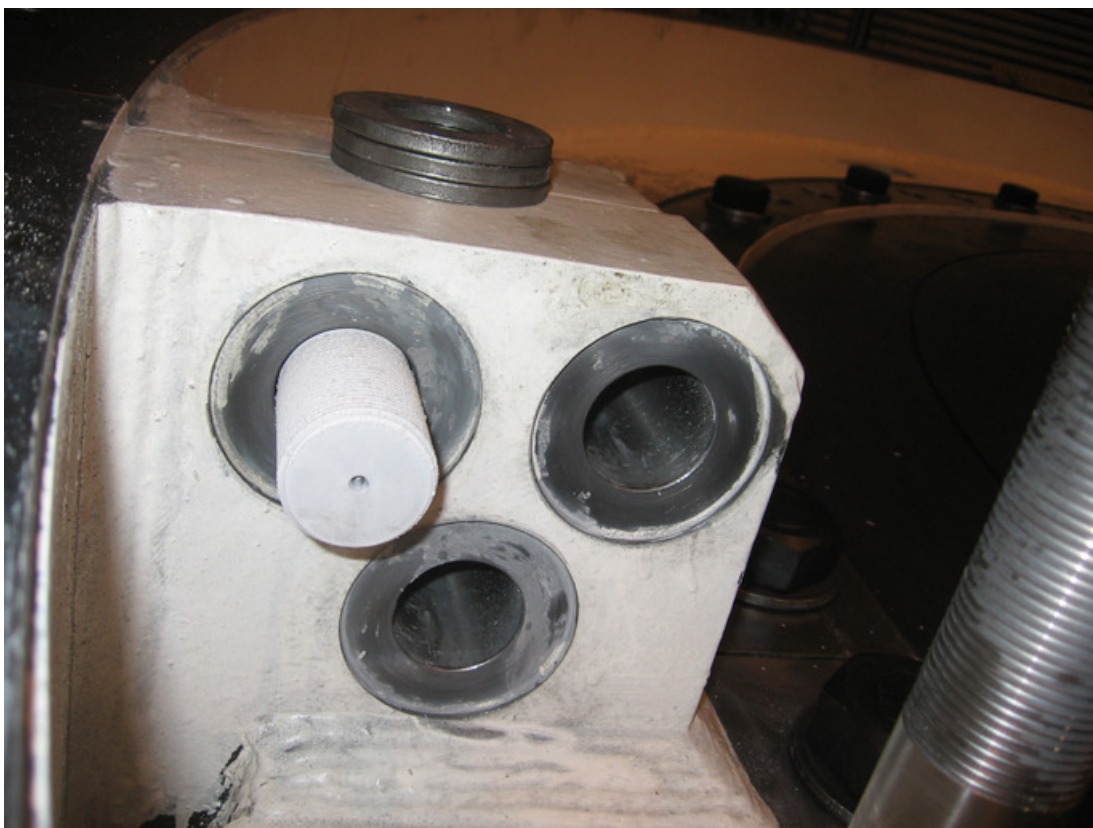


Figure 5-4 The following figure shows a cooled and inserted fitted stud bolt:

Tightening SUPERBOLT nuts

To avoid damage to the fastening elements, take the following precautions:

- Place these washers under the bolt heads.
- Only tighten SUPERBOLT nuts with washers in place.
- Follow the separate instructions on SUPERBOLT nuts in the appendix of the complete documentation of the gear unit.

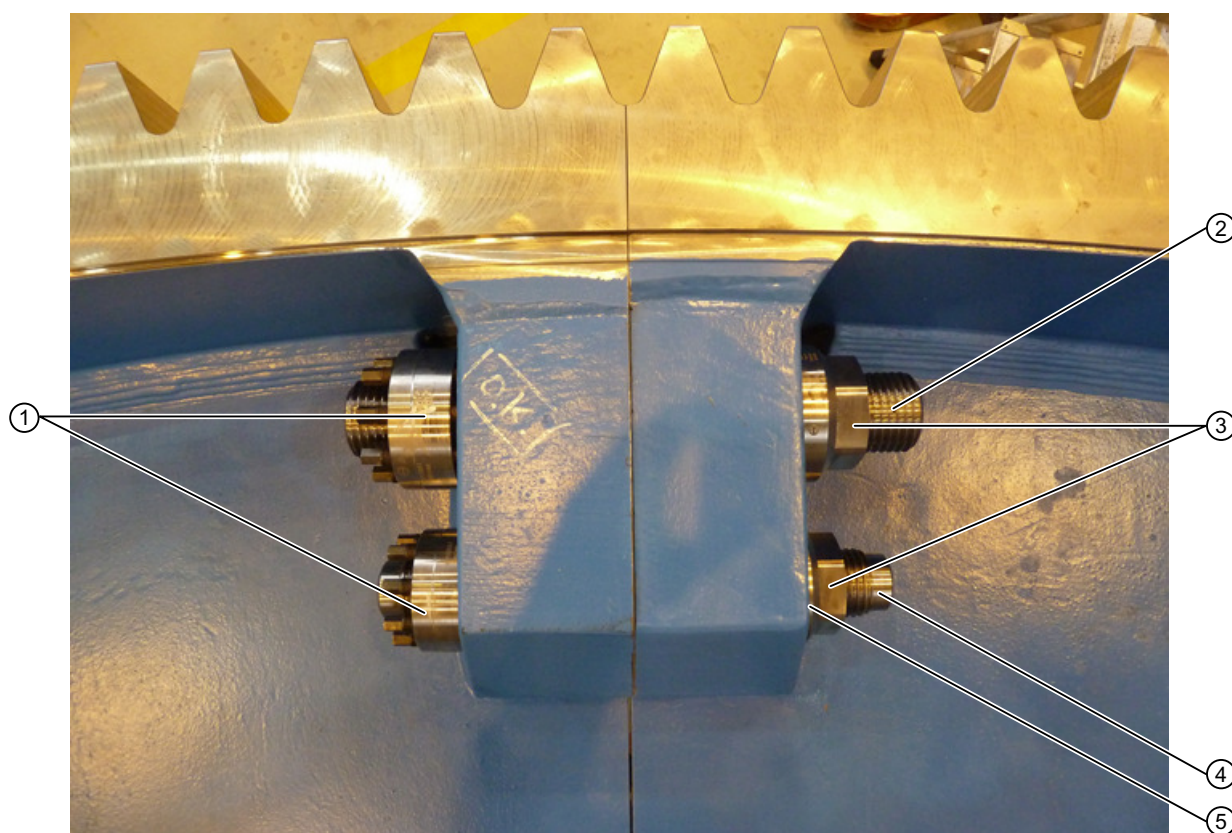
To tighten the nuts, proceed as follows:

1. Tighten the fitted stud bolts to the necessary tightening torque. Take the following precautions:
 - First tighten the fitted stud bolts to a third of the specified tightening torque.
 - In a second step, tighten the fitted stud bolts to two thirds of the specified tightening torque.
 - In a third step, tighten the fitted stud bolts to the full tightening torque.

You will find the specified tightening torque in the dimension drawing of the grinding bowl support, which is part of the complete documentation of the gear unit.

2. When the full tightening torque is applied to the fitted stud bolts, tighten the remaining stud bolts in the same way.

The following figure shows the bolted halves of the girth gear:



① SUPERBOLT nuts

② Stud bolts

③ SUPERBOLT flex nuts

④ Fitted stud bolts

⑤ Washers

Figure 5-5 Bolted halves of the girth gear

Cylindrical pins

Place the four cylindrical pins (previously loosely inserted) for centring the girth gear on the thrust collar.

The following figure shows the mounted cylindrical pins between the thrust collar and the girth gear:

5.6 Mounting the girth gear



① Cylindrical pins for positioning

Figure 5-6 Mounted cylindrical pins (4x) between the thrust collar and the girth gear

5.6.4 Mounting the pipes

To avoid damage to the oil supply system and the pipes, take the following precautions:

- Follow the operating instructions of the oil supply system.
- Make sure that the pipes are not under tension.

Further information

Additional information on the piping is provided in the documentation provided by the mill manufacturer.

5.6.5 Special instructions for the oil supply system before alignment of the girth gear and gear unit

Requirements

The instructions in this chapter only apply under the following conditions:

- The girth gear is not additionally located on the thrust collar by pins.
- The girth gear and the gear unit modules have not yet been aligned.
Once this work has been completed, set the oil supply system as described in the operating instructions of the oil supply system.

Introduction

Before aligning the girth gear, perform the following steps:

- Install the oil supply system for the grinding bowl support.
- Connect the oil supply system.
- Check that the oil supply system works.

Fill the grinding bowl support with oil before you start up the oil supply system.

To check for radial runout, start up the oil supply system so that the axial and radial plain bearings are supplied with oil and the girth gear can be turned.

NOTICE
Damage to the girth gear Damage to the girth gear possible. The girth gear is mounted to the thrust collar with four pins for the trial run and for inspection. If you are unable to pin the girth gear for any reason, then contact Flender.

Special instructions for the oil supply system

For alignment of the girth gear (Page 56) and gear unit (Page 66), the following special instruction applies to the oil supply system:

- Close the shutoff valve (part no. 86).
- Do not install the pipe to the gear unit modules (oil well 2) until all work on the grinding bowl support and gear unit modules has been completed.
- The pipes to the gear unit (oil well 1) are usually already mounted complete and connected to the associated oil supply system on the carriage (gear unit module).
- Set the shutoff valve (part no. 85) in such a way that a volume flow measuring instrument is set as follows:
Volume pumped by the main pump minus the number of high-pressure lines times 3.3.

Further information

You will find further information, data on the pumped volume and the part no. in the lubrication diagram, which is part of the complete documentation of the gear unit.

Additional information on the piping and the grinding bowl support is provided in the documentation provided by the mill manufacturer.

5.6.6 Aligning the girth gear

Introduction

Inspect the runout of the girth gear with a dial gauge (measuring precision 1/100) at at least eight points around the circumference (every 45°).

The radial runout is the difference between the maximum and minimum measurement around the circumference of the girth gear.

NOTICE

Damage to the girth gear bolts

The girth gear bolts may be damaged.

Ensure that the maximum radial runout of 0.5 mm is not exceeded.

Procedure

To align the girth gear, proceed as follows:

1. Rotate the girth gear with suitable equipment (e.g. cable winch).
2. If the maximum radial runout of 0.5 mm is exceeded, correct the alignment of the girth gear with the girth gear fastening bolts tightened finger-tight. Use appropriate hydraulic jacks.
3. Record the values of the at least eight measuring points.
4. If the runout is below the specified 0.5 mm, tighten the girth gear bolts. To avoid damage to the girth gear bolts and stressing of the girth gear, take the following precautions:
 - Unscrew the bolt to be tightened and reinsert it with Loctite 2701 threadlocker.
 - Do not operate the plant without the Loctite 2701 threadlocker.
 - Tighten the bolts in an offset sequence only.
Once you have tightened the first bolt, tighten the bolt that is 180° further round next. The third bolt to be tightened is 90° further round and the fourth is again 180° further round from the third, etc.
 - In a first step, tighten the bolts to a third of the specified tightening torque. In a second step, tighten them to two thirds of the torque and in the last step to the full tightening torque.
5. Measure and record the radial runout again after you have tightened the bolts of the girth gear.

Further information

You will find further information and the specified tightening torque in the dimension drawing, which is part of the complete documentation of the gear unit.

Additional information on the grinding bowl support and the required tightening torque is given in the documentation provided by the mill manufacturer.

5.6.7 Pre-mounting the girth gear shroud

Introduction

The complete girth gear shroud system is supplied by the mill manufacturer.

For the general design, observe the documentation provided by the mill manufacturer.

5.7 Mounting and aligning the gear unit modules

Introduction

The gear unit modules consist of the mechanical KMRS and the electric motor.

Depending on the drive type, there is a highly flexible coupling or a hydrodynamic coupling with couplings on both sides between the motor and KMRS. Unless contractually agreed otherwise, this module is pre-mounted and aligned on a base frame (carriage). Further, an oil supply system for the KMRS (oil well 1) is usually mounted at the end on the base frame (carriage).



! WARNING

Serious physical injury due to unintentional contact with the coupling

Serious physical injury may occur if the coupling is accidentally touched.

Unless otherwise agreed, the gear unit modules are supplied with coupling protection. If the gear unit modules were delivered without coupling protection, provide coupling protection to prevent unintentional contact with the coupling during operation.

To avoid damage to the gear unit modules, take the following precautions:

- Remove the transport cover no later than before mounting the shroud sections of the girth gear shroud system and aligning the gear unit modules.
- Due to possible tolerances (dimensional, position and flatness tolerances) of the slide rails relative to the gear unit plate KMRS (foundation), inspect the alignment of the coupling (Page 72) with the foundation after you have mounted the gear unit modules.

5.7.1 Tools required for mounting the gear unit modules

To mount the girth gear, you need the following equipment:

- 2 dial gauges, precision 1/100
- 2 hydraulic jacks 10 t
- 1 machine spirit level 2/100 / m
- Torque spanner, you will find the size in the dimension drawings, which are part of the complete documentation
- 4 heavy duty rollers, you will find the size in the dimension drawings, which are part of the complete documentation

Additional information

Additional information on the equipment required is provided in the documentation provided by the mill manufacturer.

5.7.2 Mounting the shroud sections of the girth gear shroud system

Introduction

Before you push the gear unit modules in front of the girth gear, mount the shroud sections of the girth gear shroud system on the KMRS. To do this, remove the transport cover on the output.

When mounting the shroud sections of the girth gear shroud system on the KMRS carefully observe the general structure of the overall mill manufacturer's documentation.

Removing the transport cover

The transport cover consists of four sections:

- Support bar
- 2 side parts
- Protective cover

The following diagram shows removing the transport cover at the KMRS:



Figure 5-7 Transport cover mounted on the KMRS

The following diagram shows removing the transport cover from the KMRS:

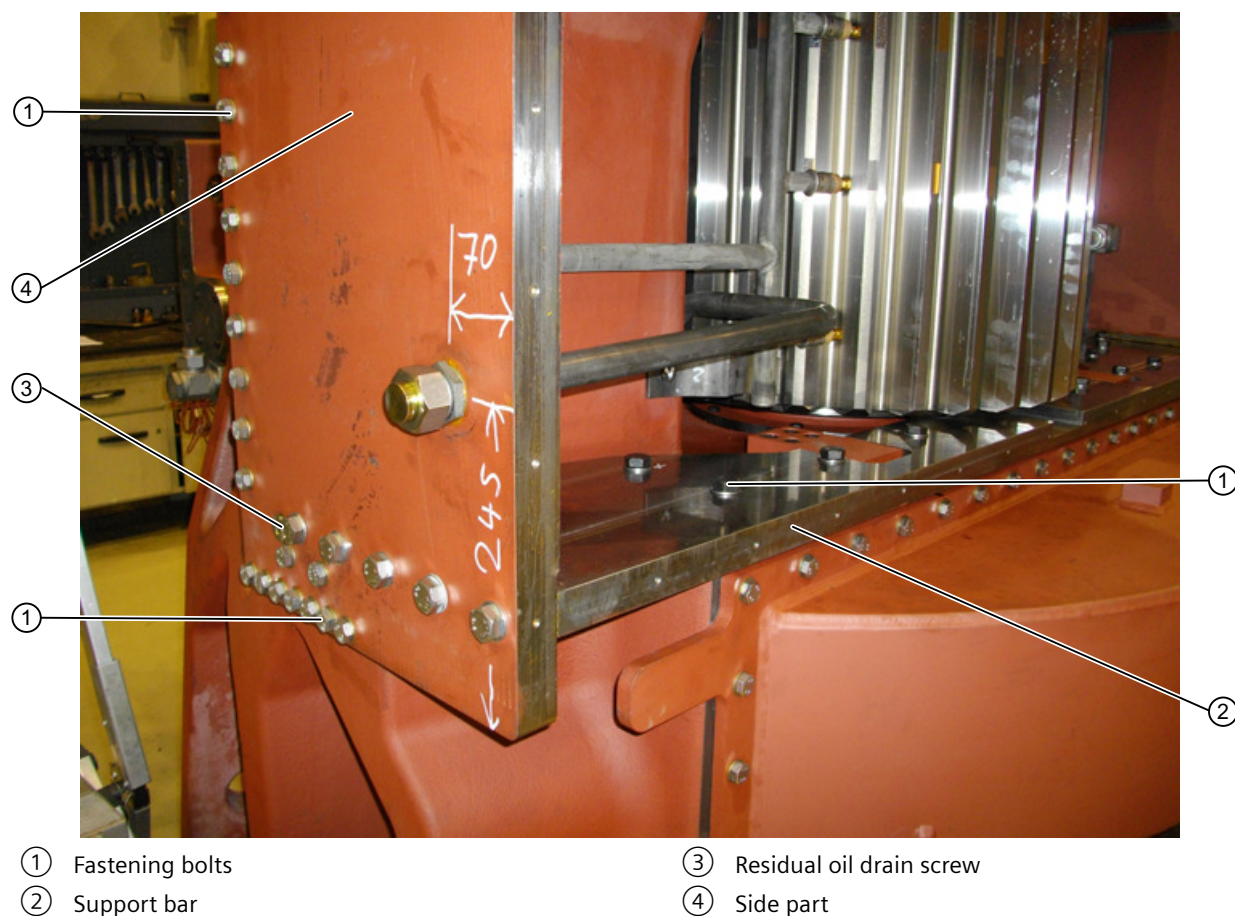


Figure 5-8 Removing the transport cover from the KMRS

To remove the transport cover, proceed as follows:

1. Remove the protective cover.
2. Remove the two side parts.
3. Remove the support bar.
4. Clean sealants and adhesives off the interior of the enclosure, in the region of the mounted parts, the O-ring grooves and the sealing surfaces.
5. Store the transport cover and the bolts carefully because they will be required later for refitting.

⚠ WARNING

Risk of scalding

Serious injury may occur if hot residual oil escapes.

Residual oil may still be in the transport cover and the KMRS. Collect the residual oil and dispose of it according to the valid regulations. Wear suitable protective clothing.

Carefully apply the following measures to protect the KMRS against damage:

- Before you remove the protective cover, clean the region of any loose foreign particles.
- Ensure that no foreign bodies or particles can fall from the mill area above the KMRS into the KMRS itself.

Equipment needed

For each KMRS, you require tools to mount the shroud sections of the girth gear shroud system to the KMRS.

When mounting the shroud sections of the girth gear shroud system on the KMRS carefully observe the general structure of the overall mill manufacturer's documentation.

The following diagram shows the housing bolting surfaces with thread and O-ring grooves:



Figure 5-9 Housing bolting surfaces with thread and O-ring grooves

The following diagram shows pre-mounting of the O-rings in the KMRS: housing

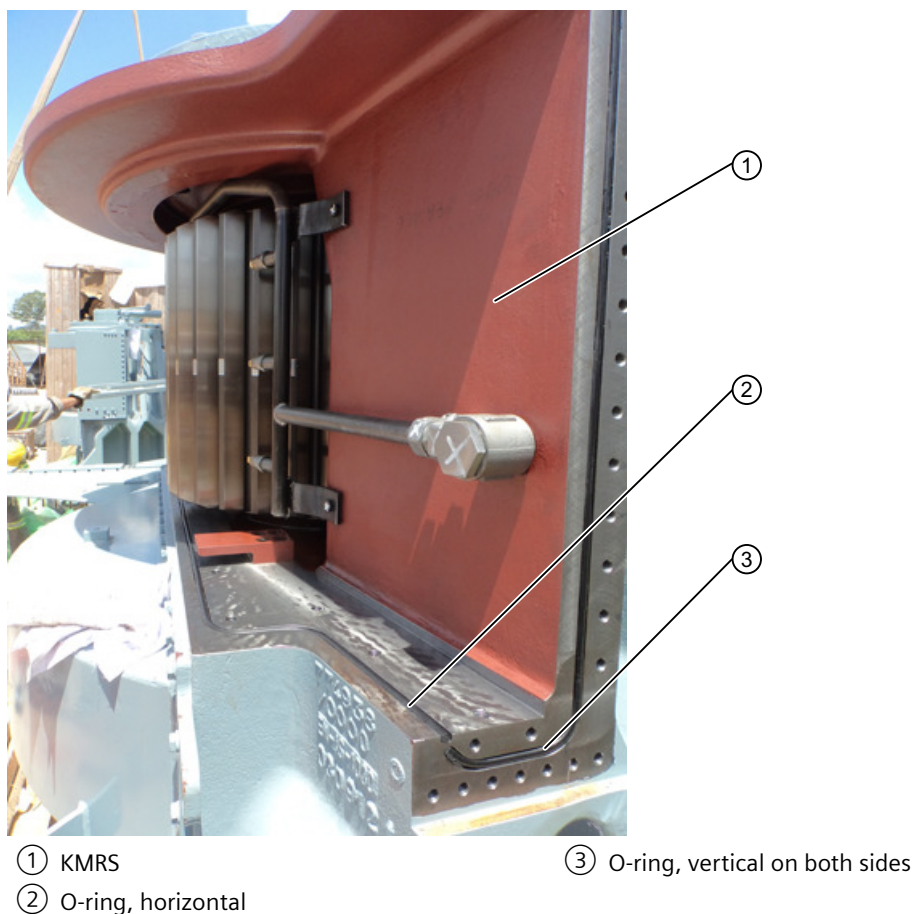


Figure 5-10 Pre-mounting the O-rings in the KMRS housing

Procedure

For the general design and mounting the girth gear shroud system, carefully observe the operating instructions and documentation provided by the mill manufacturer.

5.7.3 Mounting gear unit modules

Procedure

To mount the gear unit modules, proceed as follows:

1. Before you position the gear unit modules in front of the grinding bowl support, insert the two front foundation bolts in the holes of the base plate because this will no longer be possible after alignment because of the lack of space. You can install the other four foundation bolts at any time.
2. Align the gear unit module above the holes of the base plate with the holes of the carriage. Do not yet engage the teeth of the pinion with the girth gear.

3. Take the following steps if the girth gear has not been pinned to the thrust collar:
Turn the girth gear into position in such a way that the highest point previously determined in the radial runout measurement is in the position in which the teeth of the pinion and the girth gear engage.
4. Push the drive to engage the gears completely until the tooth-flank backlash between the girth gear and the pinion is zero. For an additional check and inspection during engagement, there is a hole on the KMRS. Take the following precautions during engagement:
 - For the correct tooth position of the tilting pinion relative to the girth gear, position the tooth position by turning the input shaft (the turning angle is between approx. 40° and 60°, depending on the gear ratio).
 - Monitor the tooth position by visual inspection.
 - Turn the input shaft of the KMRS to position the tilting pinion.
 - The input shaft of the KMRS has plain bearings. Before the input shaft is turned each time to adjust and align the gear unit module, fill with lubrication oil for the input bearings.
 - Fill with lubrication oil up to just below the edge of the inspection opening.
Use the same lubrication oil as for operation. Otherwise, the plain bearing may be damaged.



WARNING

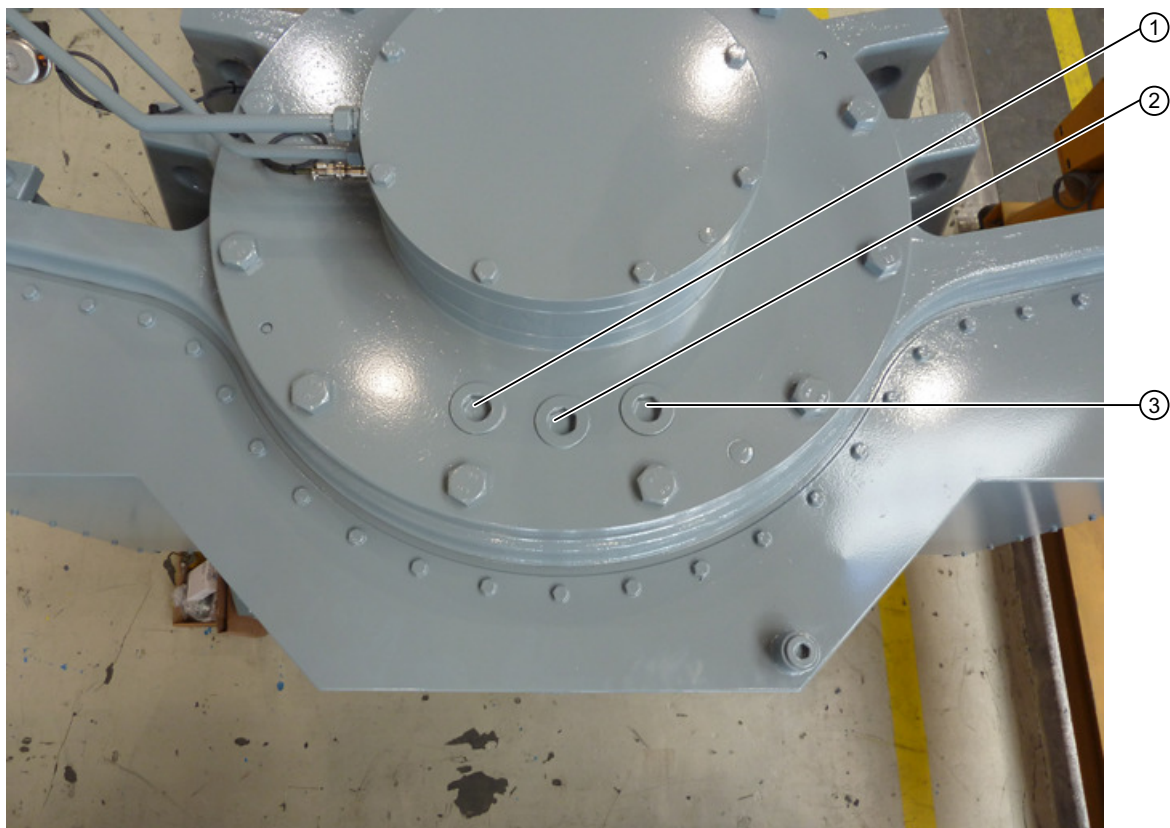
Risk of crushing

There is a risk of being crushed by the gear unit module as it is pushed.
Push the gear unit modules especially carefully.

To avoid damage to the KMRS and other components, take the following precautions:

- To check the position of the girth gear, start up the oil supply system (Page 48) so that the axial and radial plain bearings are supplied with oil and the girth gear can be turned. When the girth gear is in position, switch the oil supply system off again to avoid unintentional rotation of the girth gear.
- To align the tooth position of the KMRS relative to the girth gear, fill with oil for the input bearings.
- Before you remove the two screw plugs, clean this region of any loose foreign particles. Make sure that no foreign particles fall out of the surrounding region into the KMRS. Store the bolts carefully because they will be needed again to seal the KMRS.
- Proceed with the utmost care when engaging the gear teeth up to tooth-flank backlash zero. Constantly check the backlash at the point of tooth engagement. When the tooth-flank backlash of "0" has been reached at the point of tooth engagement, do not push the gear unit module any further because the teeth could otherwise be damaged.

The following figure shows the inspection openings for mounting the gear unit modules:



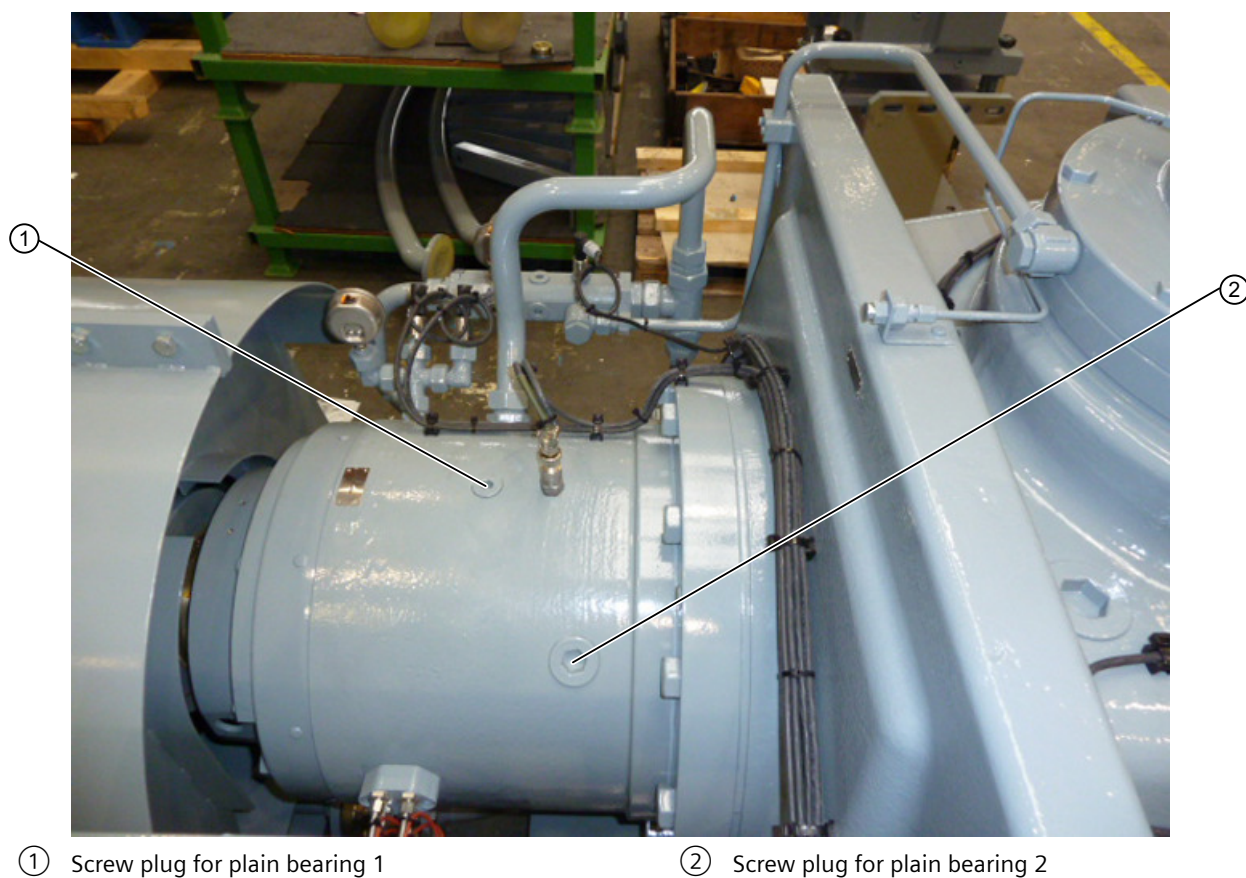
① Inspection opening for parallel drive, on the left

② Inspection opening for single drive, in the centre

③ Inspection opening for parallel drive, on the right

Figure 5-11 Inspection opening for mounting the gear unit modules

The following figure shows the oil filling holes for turning the input shaft (KMRS):



① Screw plug for plain bearing 1

② Screw plug for plain bearing 2

Figure 5-12 Oil filling holes for turning the input shaft (KMRS)

The following diagram shows the tooth engagement of the pinion at the KMRS with the girth gear:



Figure 5-13 Tooth engagement of the pinion at the KMRS with the girth gear

5.7.4 Aligning gear unit modules

Introduction

In an implementation with single drives, align the gear unit modules in such a way that the longitudinal axis of the gear unit intersects the centre of the mill.

This is not the case for parallel drives.

The following figure shows an example sketch of the alignment lines:

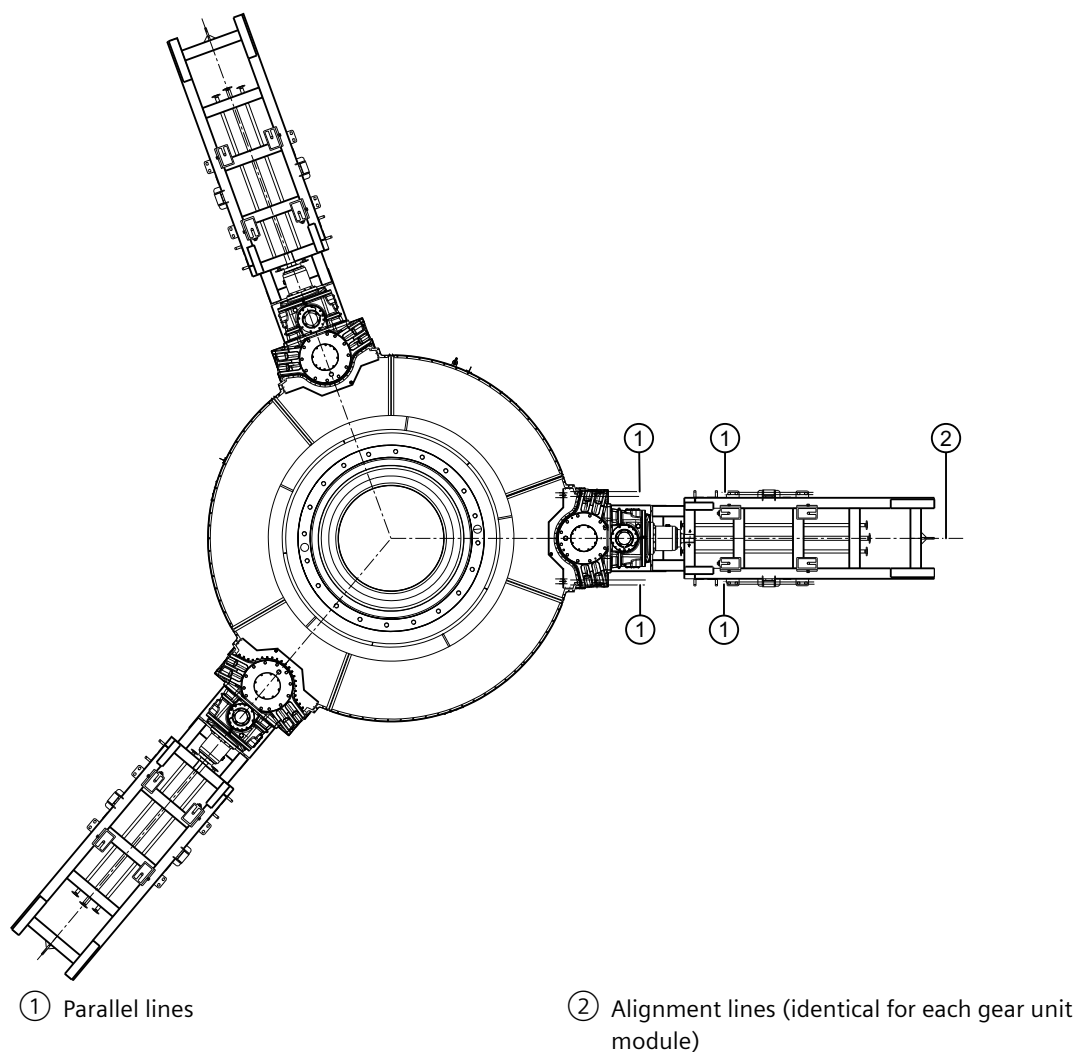


Figure 5-14 Sketch of the alignment lines (example)

Procedure

To align the gear unit modules, proceed as follows:

1. Push the gear unit module towards the girth gear in such a way that the centres of the holes of the carriage and the gear unit plate are located between two parallel lines at the same distance from the centre of the holes.
In addition, the marked centre on the carriage should line up with the marking in the foundation, if both markings are present.
2. Once the gear unit module is aligned with the centre of the mill, withdraw the gear unit module through a defined distance. This results in the tooth-flank backlash required for operation. The distance through which the gear unit module must be withdrawn is specified in the technical data, which is part of the complete documentation of the gear unit.
3. Apply two dial gauges to the carriage while the gear unit module is pulled back with two hydraulic jacks to ensure even pulling motion.

5.7 Mounting and aligning the gear unit modules

4. Then check the alignment of the gear unit module again. The dial gauges are left in place for checking.
5. Optionally weld guide plates at the four positions of the carriage. The guide plates are used for guidance when the gear unit modules are pushed out and in later.

In the end position, the holes in the carriage (gear unit module) must be approximately central above the holes of the gear unit plate.

The following figure shows a sketch with mounting holes, markings, openings and position of the dial gauges:

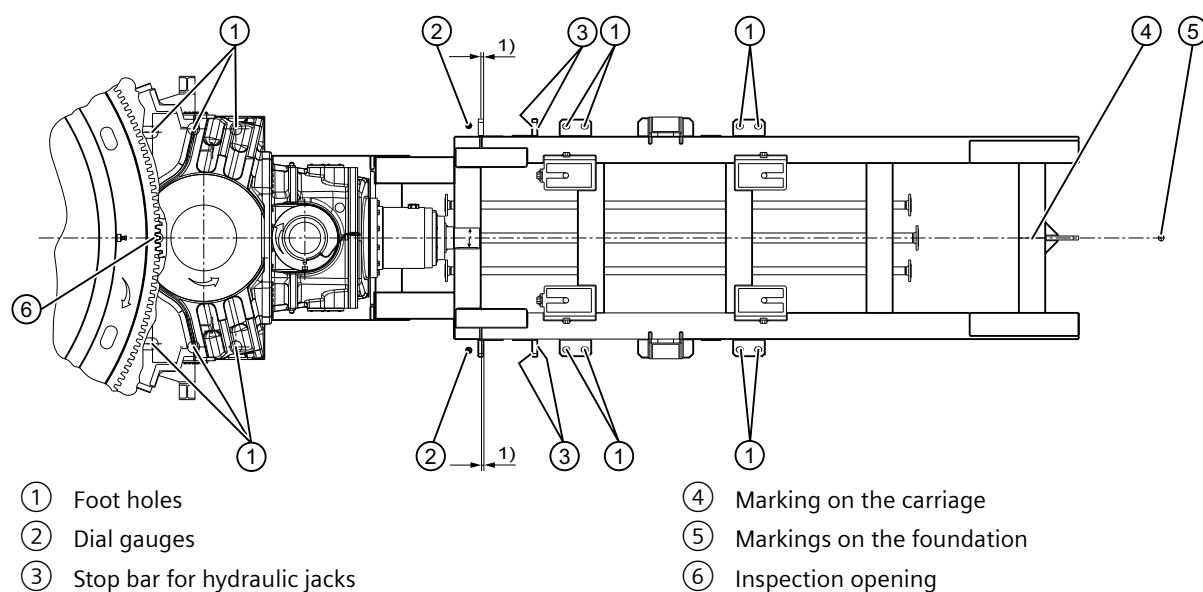


Figure 5-15 Sketch with mounting holes, markings, openings and position of the dial gauges

X¹⁾ Pull-back distance "X"

The following figure shows the alignment (displacement) of the gear unit module with the hydraulic jack:



① Foundation (attachment)

③ Gear unit module (carriage)

② Hydraulic jack

Figure 5-16 Alignment (displacement) of the gear unit module with the hydraulic jack

The following figure shows the alignment (monitoring) of the gear unit module with the dial gauge:



Figure 5-17 Alignment (monitoring) of the gear unit module with the dial gauge

5.7.5 Fastening foundation bolts

Procedure

To fasten the foundation bolts, proceed as follows:

1. Insert the four remaining foundation bolts from above.
2. First provisionally fasten the corresponding nuts and washers from below and above.
3. Tighten the bolts according to the instructions for use.

During this work, leave the dial gauges in place to check whether the gear unit module has settled when the foot bolts are tightened.

NOTICE
Damage due to insufficient stability of the gear unit modules Damage may occur if the gear unit modules do not stand sufficiently stably. Tighten the fastening bolts with the defined tightening torque. Bolting is not part of the scope of delivery. Follow the special operating instructions.

5.7.6 Mounting the oil supply system

Install the oil supply system, including pipes (Page 54).

Do not connect the pipe for lubricating the pinion and girth gear. See Chapter Special instructions for the oil supply system before alignment of the girth gear and gear unit (Page 55).

Further information

Further information about the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

Additional information on the piping is provided in the documentation provided by the mill manufacturer.

5.7.7 Installing further gear unit modules

To install further gear unit modules, proceed in the same way as for the first gear unit module.

Procedure

To install further gear unit modules, proceed as follows:

1. For the girth gear shroud system and the grinding bowl support, observe the documentation provided by the mill manufacturer.
2. Insert the front foot bolts.
3. To align the tooth position of the KMRS relative to the girth gear, fill with oil for the input bearings.
4. Align the gear unit modules.
5. Shift the gear unit module to obtain a backlash of "0".
6. Align the gear unit modules by the foot bolt holes and markings.
7. Pull the gear unit modules back by the defined pull-back distance.
8. Connect the oil supply system.

5.7.8 Inspection of the coupling alignment

5.7.8.1 Gear unit module with highly flexible coupling – variable speed

Introduction

The gear unit modules are always delivered ready mounted and aligned on the base frame (carriage).

Due to possible tolerances (dimensional, position and flatness tolerances) of the slide rails relative to the KMRS gear unit plate (foundation) and transport, you must inspect the alignment of the coupling with the foundation after you have mounted the gear unit modules.

The position at standstill differs from the position in operation as a result of the increased bearing clearance for plain bearings and the geometrical relationships (input shaft with mounted coupling hub tilts in the bearing locations). This is the reason that values for a deliberate misalignment are specified in the operating instructions. Based on these values, the motor must be aligned to the position of the shaft at standstill. The following instructions and procedure have a higher priority than the existing operating instructions of the coupling that is installed. The alignment is with respect to the gear unit housing, and therefore independent of the position of the KMRS input shaft.

To minimise the restoring forces and therefore increase the service life of the rubber elements and bearings of the input shaft of the KMRS and the motor, a precise alignment is made of approximately 20 % of the maximum permissible values for the specific coupling, specified in the operating instructions. Take the maximum permissible limit values from the subsequent "Measured values" table.

The following figure shows the design of the gear unit module:

5.7 Mounting and aligning the gear unit modules

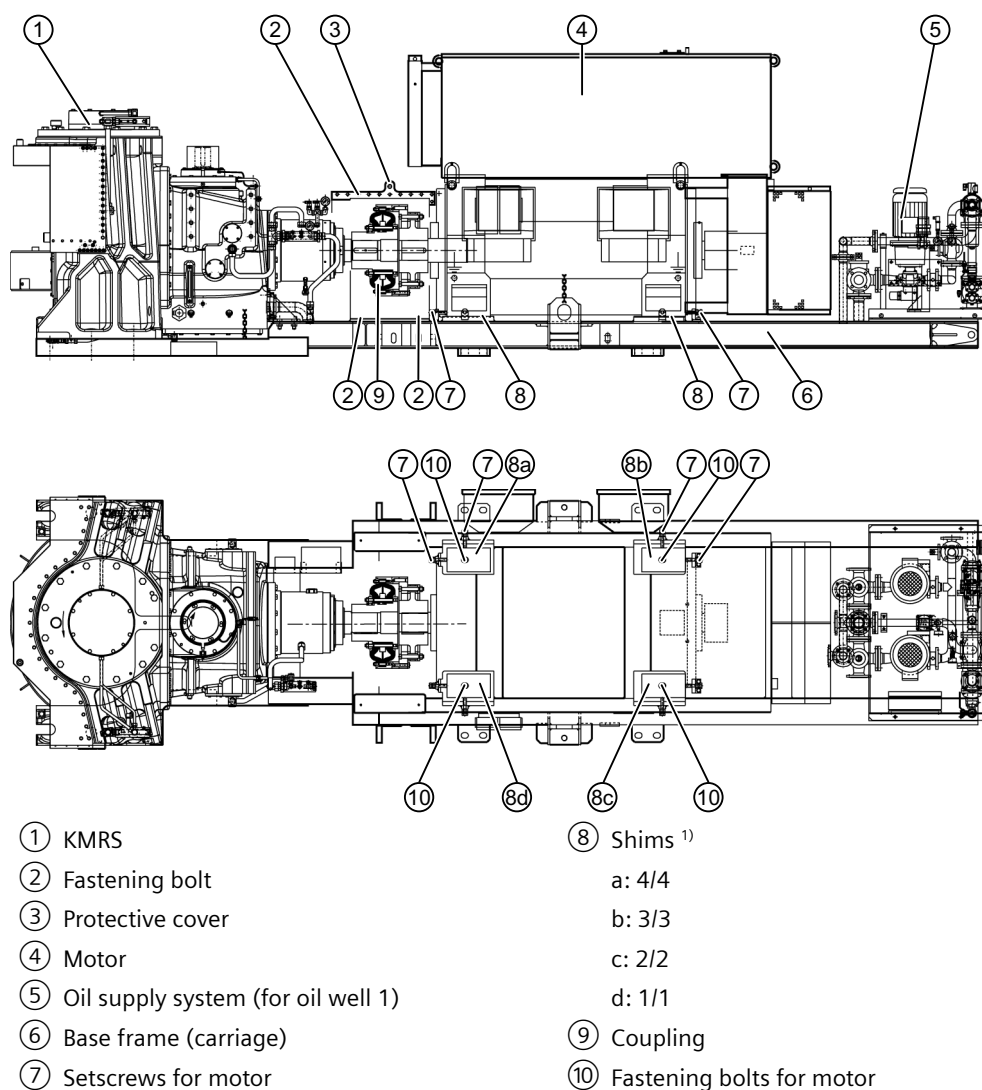


Figure 5-18 Gear unit module (design)

¹⁾ Assignment of the alignment plates with the carriage. (marking on the carriage and shims)

The following figure shows the axial, radial and angular reference dimensions:

5.7 Mounting and aligning the gear unit modules

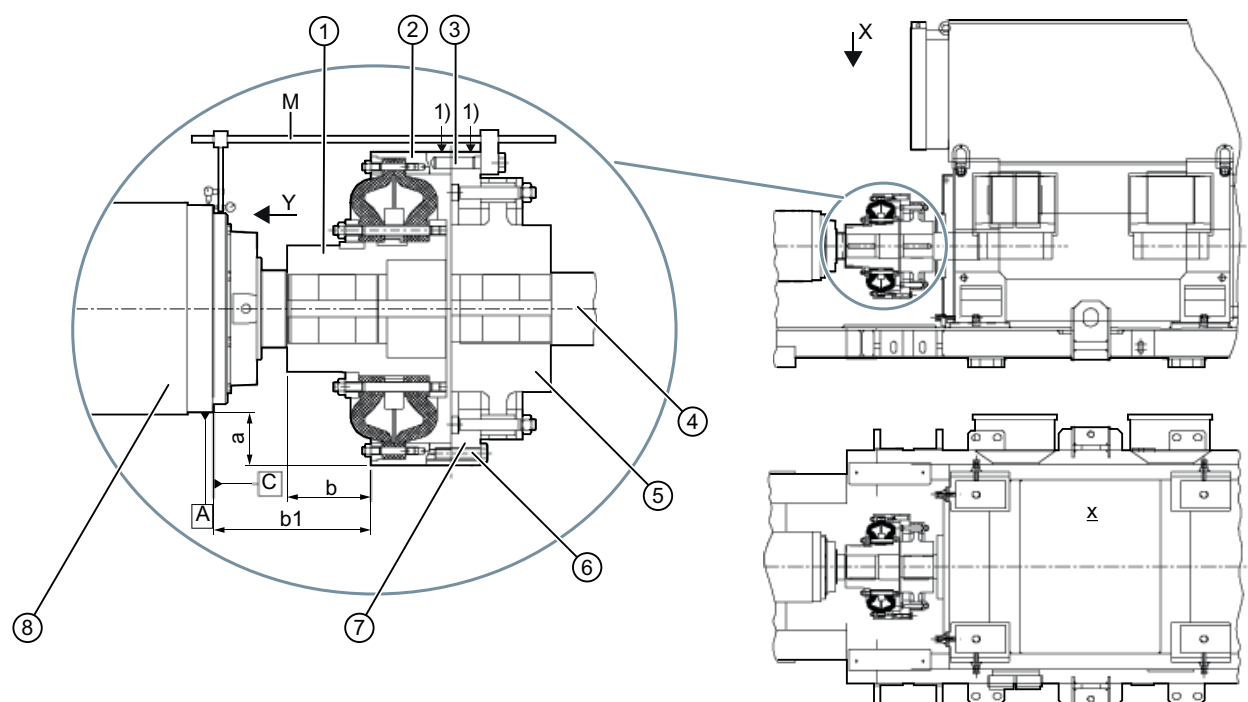
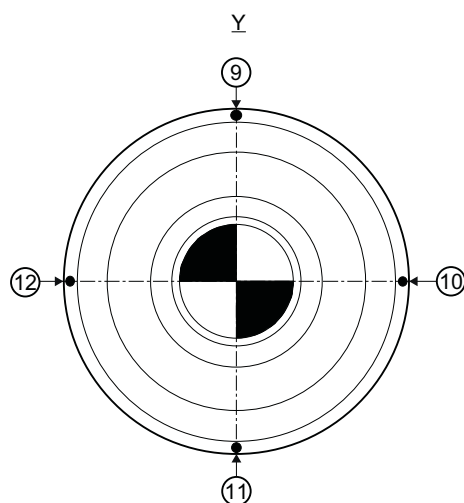


Figure 5-19 Axial, radial and angular reference dimensions

5.7 Mounting and aligning the gear unit modules



- | | |
|---|--|
| ① Coupling part, on the gear unit side (part No. 2) | ⑩ Measuring location 2 |
| ② Coupling ring (part No. 9/19) | ⑪ Measuring location 3 |
| ③ Cylindrical pin (part No. 13) | ⑫ Measuring location 4 |
| ④ Motor | b Axial reference dimension |
| | 1 |
| ⑤ Coupling part, on the motor side (part No. 105 or part No. 1) | A Measuring surface for radial alignment |
| ⑥ Hexagon screw (Part No. 14) | C Measuring surface for axial alignment |
| ⑦ Coupling disk (part No. 110) | b Axial reference dimension |
| ⑧ KMRS | a Radial reference dimension |
| ⑨ Measuring location 1 | M Measuring device |

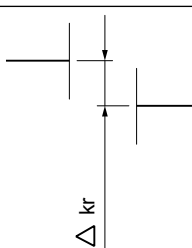
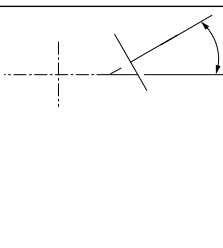
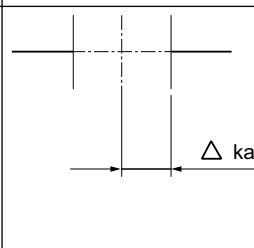
Figure 5-20 Axial, radial and angular reference dimensions

¹⁾ Marking

Table 5-2 Measured values

Measured value [mm]	Measuring location	Radial offset [a]	²⁾ Angular offset [b1]	Axial offset [b]
Measured actual value	1			
Measured actual value	2			
Measured actual value	3			
Measured actual value	4			
Existing actual value	-	$\Delta Kr \approx$	$\Delta b1 \approx$	$\Delta Ka \approx$
Permissible setpoint for type/size	ENG 590	$\Delta Kr \approx 0.84$	$\Delta b1 \approx 0.31$	$\Delta Ka \approx 4.2$
³⁾ b reference dimension				104.8
b _{min perm}				100.6
b _{max perm}				109.0
Permissible setpoint for type/size	ENG 690	$\Delta Kr \approx 0.92$	$\Delta b1 \approx 0.31$	$\Delta Ka \approx 4.6$

5.7 Mounting and aligning the gear unit modules

3) b reference dimension			184.4
b min perm			179.8
b max perm			189.0
			

²⁾ Same starting point to the measuring surface (clearance "b" to the coupling hub) according to the operating instructions of the coupling; however, in this case, to the measuring surface (clearance "b1" to the KMRS) according to the gear unit operating instructions.

³⁾ You can find additional information about the couplings in the drawing and in the coupling operating instructions provided in the complete gear unit documentation.

The following diagram shows shifting mounted components to check the measurement:



Figure 5-21 Shifting mounted components to check the measurement

The following diagram shows turning the motor shaft by hand with mounted measuring equipment:

5.7 Mounting and aligning the gear unit modules



Figure 5-22 Turning the motor shaft by hand with mounted measuring equipment:
The following diagram shows measuring the dimension "b1" (angular offset):

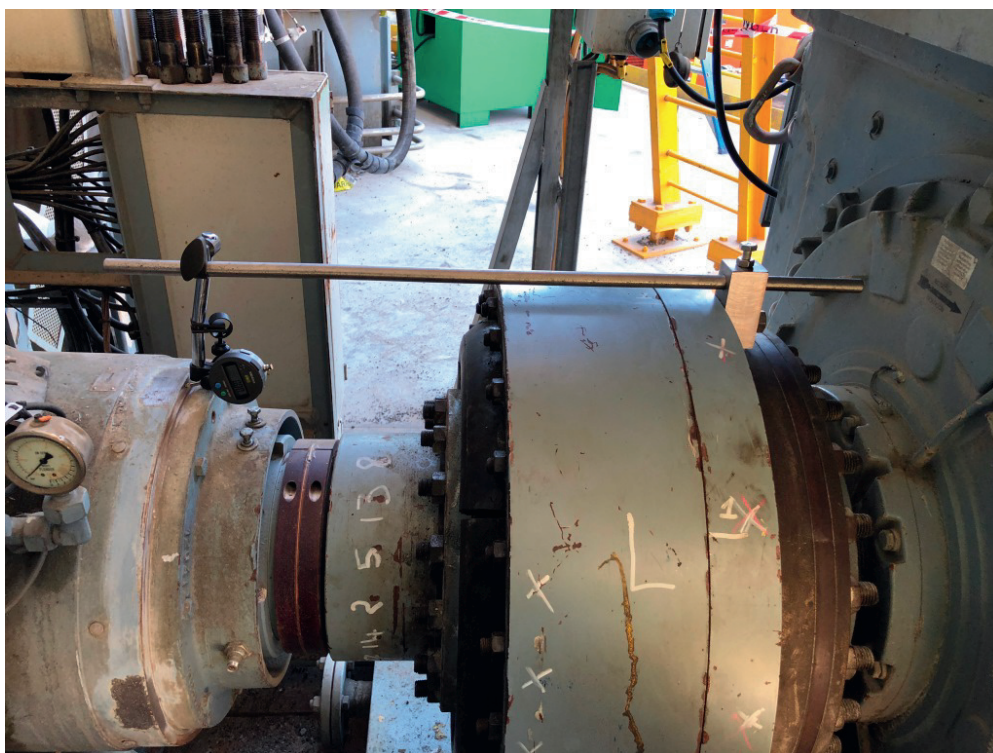


Figure 5-23 Measuring the dimension "b1" (angular offset)

The following diagram shows measuring the dimension "a" (radial offset):



Figure 5-24 Measuring the dimension "a" (radial offset)

Removing the highly flexible coupling and aligning with measuring device

Proceed in the following sequence to align the coupling:

1. Angular alignment
2. Radial alignment
3. Axial alignment.

NOTICE

Damage or destruction of the coupling through incorrect alignment

The coupling may be damaged or destroyed due to incorrect alignment.

Keep the radial offset (axial, vertical and lateral) as low as possible when aligning. A low offset (misalignment) in the coupling minimises the expected wear of the elastic ring. Offset (misalignment) in the coupling results in restoring forces. These can subject adjacent machine parts (e.g. plain and rolling-contact bearings) to an impermissible load.

Procedure

Proceed in the following sequence to remove the coupling:

1. Bring the gear unit to a standstill.
2. Observe the operating instructions for the coupling and the gear unit.
3. Provide access in the area around the coupling.
4. Measuring surfaces (a + c) at the KMRS must be bare metal and clean. If necessary, remove any paint.
5. Define the reference dimension "b" (axial offset) in the mounted state.
 - Measure dimension "b" at four points around the circumference. Observe the data listed in the "Measured values" table.
 - Document the maximum and minimum values " $b_{\max}$ " and " $b_{\min}$ ".
The following applies according to the measured value table:

$$b_{\min} \geq b_{\min \text{ perm}} \text{ ("b" - reference dimension - } \Delta K_a)$$

$$b_{\max} \leq b_{\max \text{ perm}} \text{ ("b" - reference dimension + } \Delta K_a)$$
6. Separate the two coupling parts between motor and KMRS. To do this, remove the screws (part No. 14). Release the pins (part No. 13).
7. Mount the measuring bar at the support thread of the ELPEX coupling on the motor side. Align the dial gauges to the two measuring surfaces (a + c)
8. Turn the motor shaft by hand. Check that all four measuring points are reached. Observe the diagram "Turning the motor shaft by hand with mounted measuring equipment". If required, temporarily move/shift mounted components, e.g. manometer, cable holders. Observe the diagram "Shifting mounted components to check the measurement".
9. Define reference dimension "b1" (angular offset). Observe diagram "Measuring dimension "b1" (angular offset)".
 - Measure dimension "b1" at four points around the circumference. Observe the data listed in the "Measured values" table.
 - Document the maximum and minimum values " $b1_{\max}$ " and " $b1_{\min}$ ".
The following applies according to the measured value table:

$$\Delta b1 \geq b1_{\max} - b1_{\min}$$
10. Define reference dimension "a" (radial offset). Observe diagram "Measuring dimension "a" (radial offset)".
 - Measure dimension "a" at four points around the circumference. Observe the data listed in the measured value table.
 - Document the maximum and minimum values " $a_{\max}$ " and " $a_{\min}$ ".
The following applies according to the measured value table:

$$\Delta K_r \text{ perm} \geq (a_{\max} - a_{\min}) / 2$$
11. Correct the values for any offsets that deviate from the permissible range.
12. Correct any offset (misalignment) by adjusting the shims between the motor mounting feet and the carriage. The position of the four shims is precisely assigned. The positions on the carriage and the shims have the same marking (1/1; 2/2; 3/3; 4/4).
13. Carry out the measurement again after the motor mounting bolts have been tightened. Document the measured values.

14. Keep the document in a safe place together with these operating instructions.
15. Only mount the coupling and the gear unit module if, after the check, all of the values are in the permissible range.

Equipment needed

You require the following equipment for the alignment:

- Tools to release the coupling protection guard
- Tools to release the ELPEX connection
- Measuring bar with fixture to attach the dial gauges with adequate stiffness and two dial gauges
- Tool to attach the measuring equipment to the coupling

Note

Take the geometrical boundary dimensions for the measuring equipment from the dimension drawings of the KMRS and the gear unit module of the overall documentation for the gear unit.



! WARNING

Danger to life due to live system

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Switch off the drive unit before working on the gear unit. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.



! WARNING

Risk of crushing

There is a risk of being crushed by the transported or shifted component if the lifting equipment and load suspension devices used are not suitable and the component becomes detached.

When lifting, please observe the load distribution information on the packaging. Transport and push the components slowly and carefully.

Additional information

You will find further information and the technical data in the operating instructions for the gear unit, which are part of the complete documentation of the gear unit.

Mounting the highly flexible coupling

Procedure

 DANGER
Risk of fatal injury from flying fragments Failure to achieve alignment accuracy can result in shaft breakage. Align the motor exactly. Adhere to the specified values. Always attempt to achieve zero deviation. Follow the operating instructions of the coupling.

To mount the coupling, proceed as follows:

1. Observe the operating instructions for the coupling and the gear unit.
2. Connect the two parts of the coupling parts. Be sure to take the following precautions:
 - Insert the screws (part No. 14). Tighten the screws slightly by hand.
 - Knock in the cylindrical pins offset through 180° with respect to one another (part No. 13).
 - Firmly tighten the screws (part No. 14). Comply with the tightening torques specified in the operating instructions for the coupling.
 - Apply anticorrosion agent to measuring surfaces (a + c), bare metal locations.
 - Re-attach any mounted components that you moved (e.g. manometer, cable holders).
3. Mount the two-part coupling protection. Use the connecting bolts to do this.
4. Check all additional gear unit modules in the same way as you did for the first gear unit module.

NOTICE
Damage due to insufficient stability of the gear unit modules Damage may occur if the gear unit modules do not stand sufficiently stably. Tighten the fastening bolts with the defined tightening torque (Page 94).

Further information

You will find further information on the coupling in the operating instructions for the coupling, which are part of the complete documentation of the gear unit.

5.7.8.2 Gear unit module with hydrodynamic fluid coupling – fixed speed

Introduction

The gear unit modules are always delivered ready mounted and aligned on the base frame (carriage).

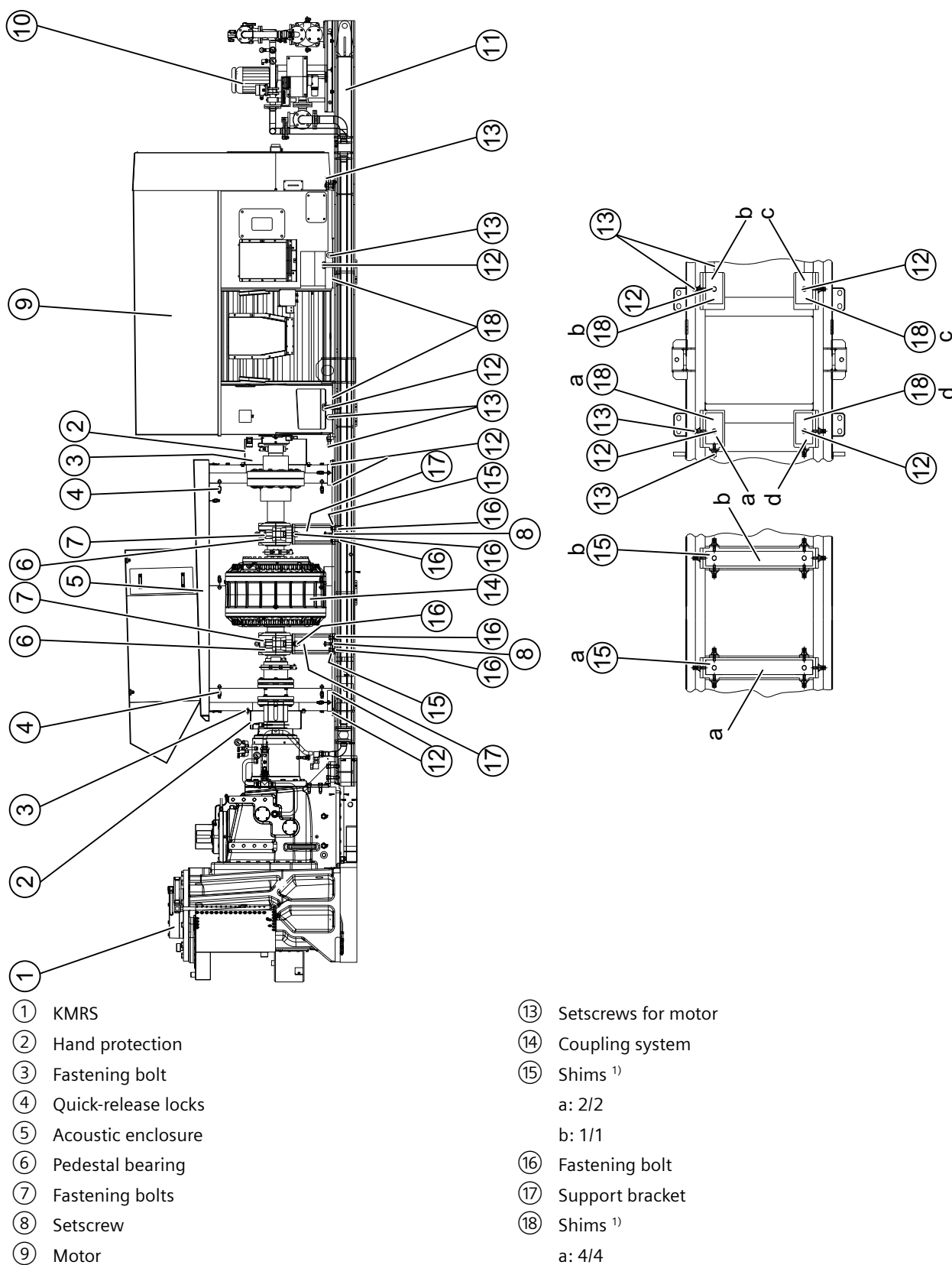
Due to possible tolerances (dimensional, position and flatness tolerances) of the slide rails relative to the KMRS gear unit plate (foundation), you must inspect the alignment of the coupling with the foundation after you have mounted the gear unit modules.

For transport reasons, the connecting components of the couplings (on the motor and gear unit side) are only mounted after final alignment and the direction of rotation test of the motor. Adjusting washers are inserted in the pedestal bearing housing (locating bearing) to prevent axial displacement during transport. These must be removed before the alignment is checked.

Mount the acoustic enclosure with the two hand protection covers on the gear unit and motor sides.

The following figure shows the design of the gear unit module:

5.7 Mounting and aligning the gear unit modules



5.7 Mounting and aligning the gear unit modules

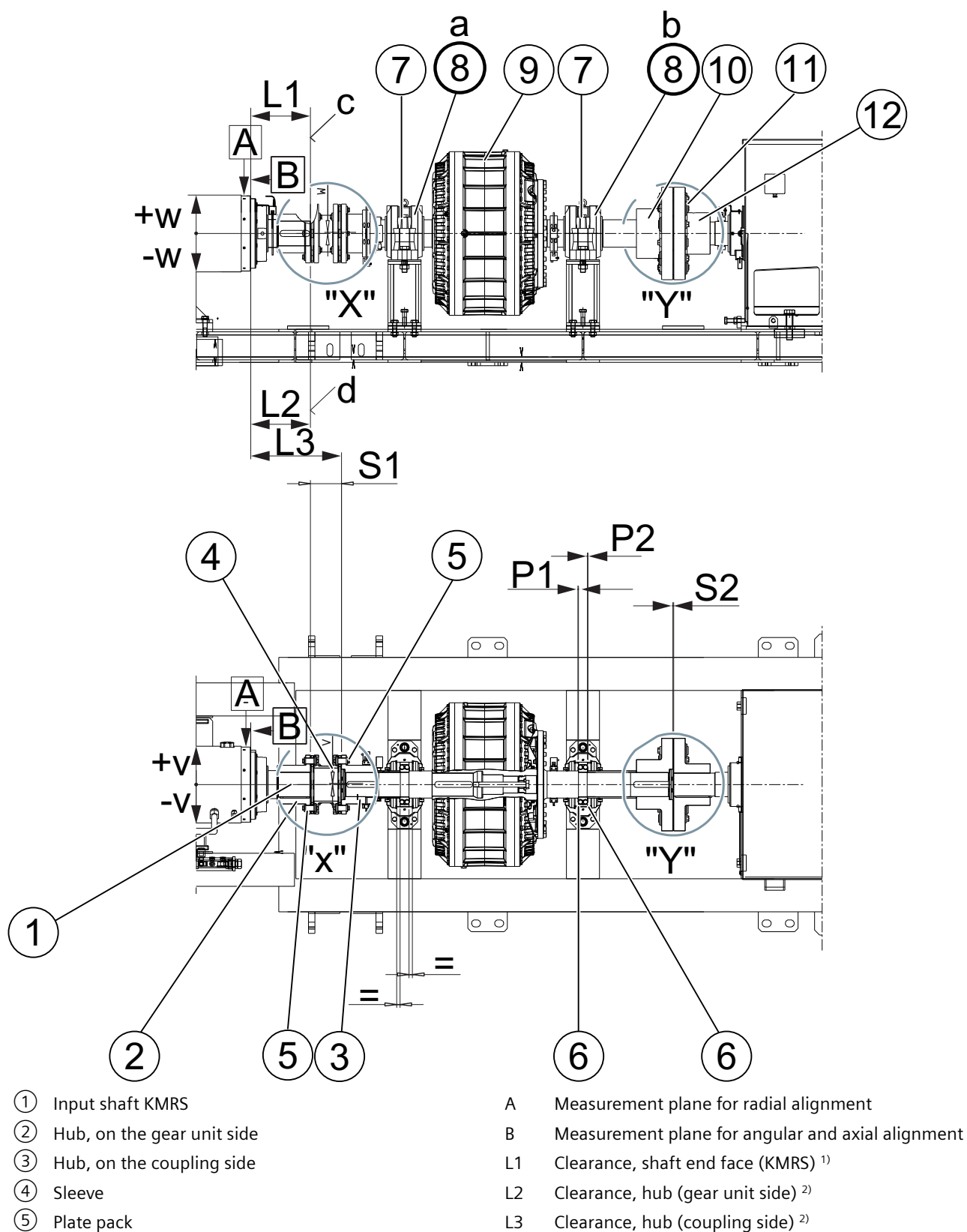
- | | | |
|---|------------------------------------|--------|
| ⑩ | Oil supply system (for oil well 1) | b: 3/3 |
| ⑪ | Base frame (carriage) | c: 2/2 |
| ⑫ | Fastening bolt | d:1/1 |

Figure 5-25 Gear unit module (design) - fixed speed

¹⁾ Assignment of the alignment plates with the base frame (carriage). (marking on the base frame (carriage) and shims)

The following figure shows the alignment planes and axial, radial and angular reference dimensions:

5.7 Mounting and aligning the gear unit modules



5.7 Mounting and aligning the gear unit modules

⑥	Adjusting washers, split (for bracing during transport)	S1	Clearance
⑦	Fastening bolt	S2	Clearance ¹⁾
⑧	Pedestal bearing	P1	Clearance ¹⁾
	a: Housing (floating bearing)	P2	Clearance ¹⁾
	b: Housing (locating bearing)	v	Correction dimension, radial (lateral) ¹⁾
⑨	Coupling	w	Correction dimension, radial (vertical) ¹⁾
⑩	Hub, on the coupling side	c	Shaft face end, input shaft KMRS
⑪	Buffer	d	Hub surface, on the gear unit side
⑫	Hub, on the motor side		

Figure 5-26 Alignment planes and axial, radial and angular reference dimensions

¹⁾ The clearances and the correction dimensions are stated in Chapter 1 "Technical data" of the complete documentation of the gear unit.

²⁾ Shaft face end and hub surface are aligned. If the hub surface is located a little way forward or back, add the difference to or subtract it from the dimensions "L1"

Possible misalignments "X", axial and angular, are stated in the operating instructions of the coupling, which are part of the complete documentation of the gear unit.

Possible misalignments "Y", radial and angular, are stated in the operating instructions of the coupling, which are part of the complete documentation of the gear unit.

Removing the transport braces

Procedure

To remove the transport braces, proceed as follows:

1. Follow the operating instructions of the coupling.
2. Remove the upper bearing shell of the two-part pedestal bearing (locating bearing). To do this, unscrew the fastening bolts.
3. Remove the adjusting washers on both sides of the rolling-contact bearing. Keep the adjusting washers. The adjusting washers will be needed again for subsequent transport of the gear unit module.



WARNING

Danger to life due to live system

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Switch off the drive unit before working on the gear unit. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.



WARNING

Risk of crushing

There is a risk of being crushed by the transported or shifted component if the lifting equipment and load suspension devices used are not suitable and the component becomes detached.

When lifting, please observe the load distribution information on the packaging. Transport and push the components slowly and carefully.

NOTICE

Damage to the gear unit modules

Not removing the adjusting washers can cause damage.

Remove the adjusting washers on both sides of the rolling-contact bearing of the pedestal bearing (locating bearing).

Aligning with the measuring device or the laser alignment device

Introduction

The misalignment values stated in the operating instructions of the coupling are the maximum permissible total values during operation, comprising the residual misalignment due to inaccuracy during alignment and the misalignment caused during operation (e.g. load-induced deformation, thermal expansion).

The angular and radial misalignment values stated in the operating instructions of the gear unit are the maximum permissible total values during operation, comprising the residual misalignment due to inaccuracy during alignment and the misalignment caused during operation (e.g. load-induced deformation, thermal expansion). These values are set in the factory before delivery.

For angular alignment, keep the permissible total value and, for radial (lateral) and radial (vertical) alignment, keep the maximum dimensional deviations substantially smaller (approximately zero).

NOTICE

Damage or destruction of the coupling due to incorrect alignment.

The coupling may be damaged or destroyed due to incorrect alignment.

Keep the radial misalignment (axial, vertical, and lateral) as small as possible during alignment. A small misalignment in the coupling minimises the expected wear of the elastic ring. Misalignment in the coupling results in restoring forces. These can place adjacent machine parts (e.g. plain and rolling-contact bearings) under an impermissible load.

Procedure

To inspect the alignment, proceed as follows:

1. Use the record sheet appended to the operating instructions.
2. Remove the upper bearing shell of the two-part pedestal bearing (locating bearing). To do this, unscrew the fastening bolts.
3. Turn the coupling (rotating part) 1 to 2 revolutions in the pedestal bearings until they are centred.
4. Remove the adjusting washers on both sides of the rolling-contact bearing. Keep the adjusting washers. The adjusting washers will be needed again for subsequent transport of the gear unit module.
5. Measure the radial misalignment (vertical) with respect to measuring plane A, dimensions "w". Be sure to take the following precautions:
 - Record the maximum and minimum values " $w_{\max.}$ " and " $w_{\min.}$ ".
 - Follow the operating instructions of the gear unit and check whether the condition for Δw is met:

$$\Delta w \geq w_{\max.} - w_{\min.}$$
6. Measure the radial misalignment (lateral) with respect to measuring plane A, dimensions "v". Be sure to take the following precautions:
 - Record the maximum and minimum values " $v_{\max.}$ " and " $v_{\min.}$ ".
 - Follow the operating instructions of the gear unit and check whether the condition for Δv is met:

$$\Delta v \geq v_{\max.} - v_{\min.}$$
7. Measure the axial misalignment with respect to measuring plane B, dimensions "L3". Be sure to take the following precautions:
 - Record value "L3".
 - Follow the operating instructions of the gear unit and check that the value matches the specified value.
 - Follow the operating instructions of the coupling and check that the permissible angular misalignment is not exceeded.
8. Measure the axial gap "P1" and "P2". Be sure to take the following precautions:
 - Record value "P1" and "P2".
 - Follow the operating instructions of the gear unit and check that the value matches the specified value.
9. Measure the axial gap "S2". Be sure to take the following precautions:
 - Record value "S2".
 - Follow the operating instructions of the gear unit and check that the value matches the specified value.
 - Follow the operating instructions of the coupling and check that the permissible radial and angular misalignment is not exceeded.

10. If values deviate from the permissible values when they are inspected, correct the deviating misalignments.
Adapt the radial (vertical) misalignment, on the gear unit side, by adjusting the shims between the support bracket and the base frame (carriage).
Adapt the radial (vertical) misalignment, on the motor side, by adjusting the shims between the motor foot and the base frame (carriage). The position of the shims is assigned precisely. The positions on the base frame (carriage) and the shims have the same marking.
11. Keep the record with these operating instructions.
12. If all values are in the permissible range during inspection, mount the support brackets of the pedestal bearings and the motor on the base frame (carriage) with four fastening bolts each.
13. Mount the coupling and the rest on the base frame (carriage).

Further information

You will find further information and the technical data in the operating instructions for the gear unit, which are part of the complete documentation of the gear unit.

Mounting the fluid coupling

Procedure

 DANGER
Risk of fatal injury from flying fragments
Failure to achieve alignment accuracy can result in shaft breakage.
Align the motor exactly. Adhere to the specified values. Always attempt to achieve zero deviation. Follow the operating instructions of the coupling.

To mount the coupling, proceed as follows:

1. Follow the operating instructions of the coupling.
2. Close the pedestal bearing (housing). Use the connecting bolts to do this.
3. Mount the sleeve and the two plate packs on the gear unit side. Follow the operating instructions of the coupling.
4. Assemble the buffers on the motor side. Follow the operating instructions of the coupling.
5. Comply with the tightening torques specified in the operating instructions for the coupling, the motor and the KMRS.
6. Mount the acoustic enclosure and the hand protection covers on the gear unit and motor sides. Use the connecting bolts.
7. Inspect the coupling alignment of all further gear unit modules in the same way as you did for the first gear unit module.

NOTICE**Damage due to insufficient stability of the gear unit modules**

Damage may occur if the gear unit modules do not stand sufficiently stably.

Tighten the fastening bolts with the defined tightening torque (Page 93).

Further information

You will find further information on the coupling in the operating instructions for the coupling, which are part of the complete documentation of the gear unit.

5.8 Final mounting of the girth gear shroud

For the general design of the girth gear shroud system, review the documentation provided by the mill manufacturer.

5.9 Connecting components

Introduction

The grinding bowl support has two lubrication circuits.

- A lubrication circuit supplies the tooth engagement between the pinion and the girth gear with lubricant and is connected to the KMRS.
- The second lubricant circuit supplies the axial and radial bearings (forced lubrication) in the grinding bowl support with lubricant and cooling. The second lubricant circuit is connected directly to the grinding bowl support.
- Because both lubricant circuits are supplied with oil by one pump and the oil sump is located inside the grinding bowl support, the oil has to flow back into the grinding bowl support in the region of the girth gear shroud system.

For the general design of the gear unit modules, consult the dimension drawings and oil flow rate quantities, which are part of the complete documentation of the gear unit.

For the general design of the grinding bowl support and the girth gear shroud system, review the documentation provided by the mill manufacturer.

5.9.1 Installing further mounted components supplied as separate items

Procedure

To install further mounted components that are supplied as separate items, proceed as follows:

1. Seal all loose parts having a threaded connection with liquid sealant.
2. Install any pipe fittings supplied as separate items whose tapped holes at the KMRS are sealed with sealing plugs as shown in the drawings supplied.
3. Connect electrical monitoring devices as shown in the terminal diagrams, lists of equipment and special operating instructions.

Further information

You will find further information on the electrical monitoring devices in the operating instructions for the electrical monitoring devices, which are part of the complete documentation of the gear unit.

Additional information relating to electrical monitoring devices at the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

You will find further information and technical data for the mounted components in the list of equipment drawn up specifically for the order, which is part of the complete documentation of the gear unit.

Additional information and technical data of the components mounted on grinding bowl support and the girth gear shroud system are provided in the documentation provided by the mill manufacturer.

You will find additional information, terminal diagrams and lists of equipment, which are part of the complete documentation of the gear unit.

Additional information, terminal diagrams and equipment lists for the grinding bowl support and the girth gear shroud system are provided in the documentation provided by the mill manufacturer.

5.9.2 Connecting the water/oil cooler

Procedure

Depending on the order specification, the gear unit can be equipped with a mounted water/oil cooler.

To connect the water/oil cooler, proceed as follows:

1. Remove the sealing pipe sleeve from the cooling water connection port.
2. Rinse the water/oil cooler to remove any dirt that may be in it.

3. Connect the supply and return pipes for the cooling water. You will find the direction of flow and the position of the connection ports in the dimension drawing, which is part of the complete documentation.
4. If the gear unit is equipped with pressure monitors, wire them electrically.

NOTICE

Damage to the water/oil cooler

The water/oil cooler may be damaged by force exerted on the connections.

When mounting the pipes, make sure that the connections of the water/oil cooler are not subject to any forces, torques or vibrations.

Further information

You will find information on the mounted components in the relevant operating instructions, which are part of the complete documentation of the gear unit.

You will find the connection dimensions in the dimension drawing, which is part of the complete documentation of the gear unit and the oil supply system.

5.9.3 Connecting the separate oil supply system

Procedure

Depending on the order, the gear unit can be equipped with a separate oil supply system.

To connect the separate oil supply system, proceed as follows:

1. Follow the operating instructions of the oil supply system.
2. Remove the sealing pipe sleeves from the suction and pressure lines.
3. Mount the oil supply system as shown in the dimension drawings in the complete documentation on the gear unit or mount it separately.
While mounting, make sure that the pipes are not under tension.

Further information

You will find further information on the separate oil supply system in the operating instructions for the separate oil supply system, which are part of the complete documentation of the gear unit.

Additional information on the connecting piping is provided in the documentation provided by the mill manufacturer.

5.10 Welding work on the mill

Requirements

Before performing welding work on the mill, take the following precautions:

- Connect the earth of the welding equipment in such a way that welding current does not flow through the KMRS.
- Connect to earth directly at the point to be welded.

Flender provides no warranty for damage to the KMRS caused by welding work carried out on the mill.

5.11 Tightening procedure

5.11.1 Introduction

Bolts

The bolts must have the following properties:

- Made of steel
- Black-annealed or phosphatised
- Lightly oiled (do not add additional oil)

Note

Replacing bolts

Replace any bolts that are no longer fit for use by bolts of the same type and strength class.

Mating threads

The mating threads must have the following properties:

- Made of steel or cast iron
- Dry, cut threads

NOTICE**Damage to the SUPERBOLT nuts due to incorrect tightening torques**

The SUPERBOLT nuts may be damaged if tightening torques are incorrect.

Comply with the specified tightening torques in the dimension drawings in the operating instructions of the SUPERBOLT nuts, which are part of the complete documentation of the gear unit. These take precedence over the table overviews.

Note**Using a lubricant**

Lubricants must never be used because it can result in the bolted connection becoming overloaded.

5.11.2 Bolt connection classes

In order to affix fastening bolts, note the information in the following table:

Table 5-3 Information on affixing fastening bolts

Fastening of	Bolt connection class	Tightening procedure
Girth gear KMRS Motor Swing-base (carriage) Bracket	C	- Torque-controlled tightening with a torque wrench or a signal-emitting torque wrench - Tightening with a precision mechanical screwdriver with dynamic torque measurement
Inspection cover Protective cover Canopy	E	Tightening with pulse screwdriver or impact wrench, without adjustment checking device

Further information

You will find further information on the tightening torques for fastening the motor in the operating instructions of each manufacturer.

Additional information relating to the tightening torques to fasten the grinding bowl support, the girth gear with thrust collar and to fasten the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

5.11.3 Tightening torques and preload forces

Bolt the specified bolted connections with the tightening torques as stated in the following table.

The tightening torques apply to friction values of $\mu_{\text{total}} = 0.14$.

The table below contains the preload forces and tightening torques for bolted connections of strength classes 8.8; 10.9; 12.9:

Table 5-4 Preload forces and tightening torques

Nominal thread diameter	Bolt strength class	Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 94).			Tightening torque for bolt connection classes from the table in chapter Bolted connection classes (Page 94)		
		C	D	E	C	D	E
		$F_{M \text{ min.}}$ N			M_A Nm		
M10	8.8	18 000	11 500	7 200	44.6	38.4	34.3
	10.9	26 400	16 900	10 600	65.4	56.4	50.4
	12.9	30 900	19 800	12 400	76.5	66.0	58.9
M12	8.8	26 300	16 800	10 500	76.7	66.1	59.0
	10.9	38 600	24 700	15 400	113	97.1	86.6
	12.9	45 100	28 900	18 100	132	114	101
M16	8.8	49 300	31 600	19 800	186	160	143
	10.9	72 500	46 400	29 000	273	235	210
	12.9	85 000	54 400	34 000	320	276	246
M20	8.8	77 000	49 200	30 800	364	313	280
	10.9	110 000	70 400	44 000	520	450	400
	12.9	129 000	82 400	51 500	609	525	468
M24	8.8	109 000	69 600	43 500	614	530	470
	10.9	155 000	99 200	62 000	875	755	675
	12.9	181 000	116 000	72 500	1 020	880	790
M30	8.8	170 000	109 000	68 000	1 210	1 040	930
	10.9	243 000	155 000	97 000	1 720	1 480	1 330
	12.9	284 000	182 000	114 000	2 010	1 740	1 550
M36	8.8	246 000	157 000	98 300	2 080	1 790	1 600
	10.9	350 000	224 000	140 000	2 960	2 550	2 280
	12.9	409 000	262 000	164 000	3 460	2 980	2 670
M42	8.8	331 000	212 000	132 000	3 260	2 810	2 510
	10.9	471 000	301 000	188 000	4 640	4 000	3 750
	12.9	551 000	352 000	220 000	5 430	4 680	4 180
M48	8.8	421 000	269 000	168 000	4 750	4 090	3 650
	10.9	599 000	383 000	240 000	6 760	5 820	5 200
	12.9	700 000	448 000	280 000	7 900	6 810	6 080
M56	8.8	568 000	363 000	227 000	7 430	6 400	5 710
	10.9	806 000	516 000	323 000	10 500	9 090	8 120
	12.9	944 000	604 000	378 000	12 300	10 600	9 500

Nominal thread diameter	Bolt strength class	Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 94).			Tightening torque for bolt connection classes from the table in chapter Bolted connection classes (Page 94)		
d mm		C	D	E	C	D	E
		$F_{M \min.}$ N			M_A Nm		
M64	8.8	744 000	476 000	298 000	11 000	9 480	8 460
	10.9	1 060 000	676 000	423 000	15 600	13 500	12 000
	12.9	1 240 000	792 000	495 000	18 300	15 800	14 100
M72x6	8.8	944 000	604 000	378 000	15 500	13 400	11 900
	10.9	1 340 000	856 000	535 000	22 000	18 900	16 900
	12.9	1 570 000	1 000 000	628 000	25 800	22 200	19 800
M80x6	8.8	1 190 000	760 000	475 000	21 500	18 500	16 500
	10.9	1 690 000	1 100 000	675 000	30 500	26 400	23 400
	12.9	1 980 000	1 360 000	790 000	35 700	31 400	27 400
M90x6	8.8	1 510 000	968 000	605 000	30 600	26 300	23 500
	10.9	2 150 000	1 380 000	860 000	43 500	37 500	33 400
	12.9	2 520 000	1 600 000	1 010 000	51 000	43 800	39 200
M100x6	8.8	1 880 000	1 200 000	750 000	42 100	36 200	32 300
	10.9	2 670 000	1 710 000	1 070 000	60 000	51 600	46 100
	12.9	3 130 000	2 000 000	1 250 000	70 000	60 400	53 900

5.12 Final work

Measures

Once all the components have been assembled or connected, perform the following final work:

- After you have installed the gear unit modules, mount the remaining pipe connections between the lubrication station and the gear unit modules. Follow the instructions provided in the documentation from the mill manufacturer.
- Check all bolt connections for tightness after installation of the gear unit has been completed.
- Check the alignment after tightening the fastening elements. Make sure that the alignment has not changed.
- Check whether all devices dismantled for transportation have been reassembled.
- Safeguard the oil drain valves against accidental opening.
- If an oil sight glass is used to monitor the oil level, protect it against damage.
- Protect the gear unit against falling objects.
- Check that the guards over rotating parts are securely fastened.
Contact (accidental or deliberate) with rotating parts is not permitted.

- Perform potential equalisation in accordance with the applicable regulations and guidelines. If no threaded holes are available on the gear unit for an earth connection, please take suitable alternative measures. This work must always be done by specialist electricians.
- Protect all cable entries against penetrating moisture.
- Check whether protection measures have been taken.
- Wire the gear unit modules, lubrication systems and the grinding bowl support (refer to the mill manufacturer documentation) between the individual terminal boxes, valves and the operator's console.

Additional information

You will find additional information in the complete documentation for the gear unit.

You will find further information in the documentation provided by the mill manufacturer.

Displacement sensors

The following diagram (example) shows the displacement sensors on the girth gear:

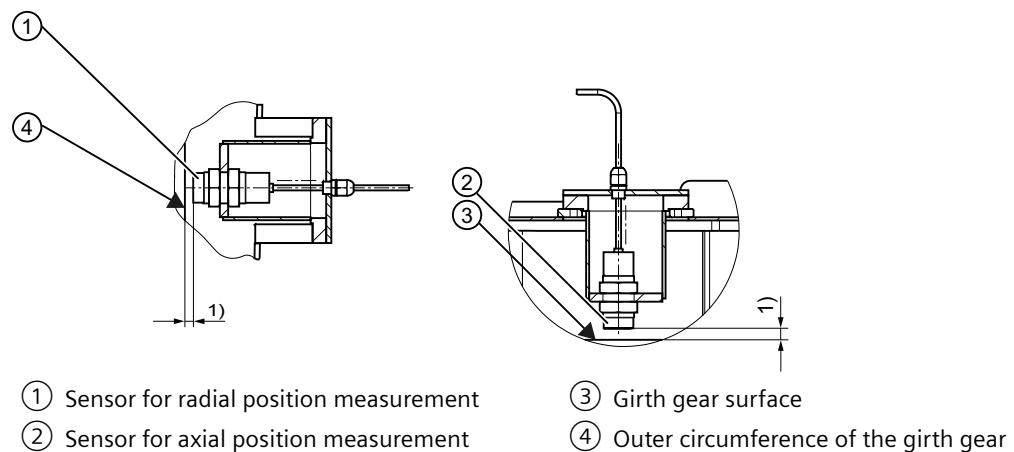


Figure 5-27 Displacement sensors on the girth gear

¹⁾ Setting dimension

Additional information

Refer to the documentation provided by the mill manufacturer for the precise setting dimension.

You will find additional information about the general design in the documentation provided by the mill manufacturer.

Limit switch

One limit switch is mounted to each side of the KMRS – at the right and left.

The precise design, the electrical connection and the setting values are in the documentation provided by the mill manufacturer.

The limit switch provides the following switching pulses:

- No signal = gear unit module engaged (in operation)
- Signal = gear module released (not in operation)

The following diagram shows the position of the connection threads at the housing of the KMRS to attach the end stops for the limit switches:



- ① Connection threads for limit switches (mounted by the customer) at both sides of the housing.

Figure 5-28 The position of the connection threads at the housing of the KMRS to attach the end stops for the limit switches

Further information

You will find further information on the gear unit and all mounted elements in the operating instructions for mounted elements, which are part of the complete documentation of the gear unit.

You will find technical specifications in the separate data sheet, which is part of the complete documentation of the gear unit.

Additional information regarding the design and all of the mounted elements for the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

Commissioning

Introduction

The precondition for the warranty is first commissioning by specialists from Flender or by skilled persons who have been appropriately trained and are authorised by Flender.

Flender urgently recommends that the vertical mill is first driven by the gear unit modules under the supervision of these specialists or skilled persons.

Follow the operating instructions, in particular, for maintenance work on the vertical mill, during which the mill rotates and the gear unit modules rotate with it.

NOTICE
Damage to the gear unit The gear unit may be damaged if it is used improperly. Every time the drive is set in motion, this is commissioning. Do not commission the gear unit without having the operating instructions at hand.

6.1 Measures prior to commissioning

Take the following measures before commissioning the gear unit:

- Read and observe the operating instructions.
- Follow the checking procedure (Page 101).
- Replace the screw plugs with the air filter. Follow the instructions in BA 7300.
- Fill the KMRS with oil.
- Gear unit with oil supply system: Check that the oil supply system is working properly.
- Check the oil level.
- Check the gear unit for leaks.
- Gear unit with oil supply system: Follow the instructions in Measures prior to commissioning with oil supply system (Page 100).
- Ensure that all pipes and components are filled with oil.
- Filter the oil during filling with a nominal filter fineness of 10 µm.

Further information

Further information about oil and replacement of air filters can be found in the operating instructions BA 7300 in the complete documentation for the gear unit.

Further information about individual components can be found in the operating instructions for the components in the complete documentation for the gear unit.

Additional information on the grinding bowl support, the girth gear shroud system and the individual components is listed in the documentation provided by the mill manufacturer.

6.1.1 Flushing the KMRS and the grinding bowl support

There is a difference between "flushing" before first commissioning and "flushing" before and after repair and maintenance work.

When you must flush the system, follow the instructions in BA 7300.

The duration of flushing before first commissioning depends on the temperature of the oil.

For rinsing before first commissioning, note the information in the following table:

Table 6-1 Rinsing duration

Oil temperature	Rinsing duration
20 °C	6 h
30 °C	5 h
40 °C	3.5 h
50 °C	2 h

6.1.2 Gear unit with oil supply system

Take the following measures before commissioning a gear unit with an oil supply system:

- Make sure that the pressure in the oil supply system components does not exceed the maximum permissible pressure.
- Make sure that the temperature of the oil supply system components does not exceed the maximum permissible temperature.
- Using the oil supply system, lubricate the KMRS and the grinding bowl support for 30 minutes in a pre-lubrication phase. During this period, the plain bearings, rolling-contact bearings and gear teeth are supplied with enough oil for starting.

On the oil supply system for the grinding bowl support, make sure that the low-pressure lubrication is switched on first and the high-pressure lubrication only after 2 minutes. This time is necessary to achieve pressure equalisation in the oil circuit.

Switch on the high-pressure pumps no later than 5 minutes before starting the main motors and leave them constantly running during operation.

Further information

You will find information on the oil supply system in the data sheet, in the list of equipment and in the operating instructions for the oil supply system, which are part of the complete documentation of the gear unit.

6.1.3 Checking procedure

Check all drive components after completion of assembly and before the first cold trial run. Remove all material residue, tools and assembly equipment.

If the oil supply system was supplied by Flender, it has already been function-tested. Before the trial run of the mill, test the electrical interlocking between the oil supply system and the drive motors.

To perform the checking procedure, inspect the following items:

- Correct implementation of the foundation
- Foundation bolts tightened as specified
- Oil supply pipes clean
(Dirt in these pipes is routed through the KMRS and the grinding bowl support before it can be removed in the filter of the oil supply system)
- Cleaning inside the girth gear shroud and cleanness of the return pipes
- The girth gear is mounted as prescribed in the assembly instructions
- The fastening bolts of the girth gear have been tightened with the specified tightening torque
- The directions of rotation of the motor and KMRS match (see rotation direction arrow)
- Mounting and cleaning of all pipes as prescribed in the assembly instructions
- Seal all openings in the KMRS, the grinding bowl support, the oil supply systems and connecting pipes
- The correct configuration of the pipes and hoses
- Correct filling of the oil vessels (if there are any), the grinding bowl support and the KMRS up to their markings (check the oil levels with the oil supply system running and the gear unit at standstill)
- Tightness of the pipe and hose connections
- Connection of all monitoring devices as shown in the circuit diagram
- The electrical interlocking between the KMRS, the oil supply system and the drive motors
- Connection of the sensors required for operation on the SIPLUS machine protection or third-party system as prescribed and shown in the terminal diagrams and lists of equipment

- SIPLUS machine protection or third-party system ready for operation
- Records made of the following measurements:
 - Radial runout of the girth gear (if not pinned to the thrust collar)
 - Pull-back distance of the gear unit module
 - Testing of the functions according to the interlocking plan and description
 - Testing of the flow monitors, pressure switches and temperature sensors for correct setting values and function
 - Correct mounting of the inductive sensors for axial eccentricity and radial measurement on the girth gear

You will find further checking procedures in the operating instructions of the following components:

- Three-phase liquid starter
- Frequency converter
- Motors
- Couplings
- Oil supply systems
- SIPLUS machine protection or third-party system of the grinding bowl support and the vertical mill

6.2 Measures during commissioning

Take the following measures when commissioning the gear unit and document them:

- For gear unit with oil supply system: Check that the oil supply system is working properly.
- Check the oil level of the KMRS and the grinding bowl support
- Measure the oil sump temperature after the gear unit has been run in.
- Check the tightness of the shaft seal at the KMRS.
- Check that the rotating parts can rotate without contact.
- On gear units with a water/oil cooler: Make sure that the specified values for pressure and temperature are not exceeded.
- Check whether the shutoff valves are open or closed.
 - Make sure that all oil drainage valves are closed.
 - Make sure that all other shutoff valves are open.
- Check that the connecting pipes are firmly seated and tight.

Further information

Further information about oil can be found in the operating instructions BA 7300 in the complete documentation for the gear unit.

Further information about the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

You will find further information on the water/oil cooler, connection dimensions, the required quantity of cooling water and the maximum permissible inlet temperature in the dimension drawings, the list of equipment and the technical data, which are part of the complete documentation of the gear unit.

Additional information about the grinding bowl support, the girth gear shroud system and the central connecting piping is provided in the documentation provided by the mill manufacturer.

Initial test run

Meet the following requirements before the initial test run:

- Follow the operating instructions.
- Start up the gear unit.

Procedure

To perform the initial test run, proceed as follows:

1. Run the gear unit for several hours at partial load (50 %), if possible.
2. If no faults occur, gradually increase the load at suitable time intervals up to full load while constantly monitoring the gear unit.

3. During this time, pay attention to the following items:

- Synchronisation of the gear unit modules
The SIPLUS machine protection or third-party system monitors individual gear unit modules from asymmetrical loads. If the deviation between individual gear unit modules exceeds 20 %, the system is shut down. During operation, read the synchronisation data from the SIPLUS or third-party system.
- Noise
During this time, listen for anomalous noises at various points on the gear unit using a suitable device.
- Temperature characteristic of the plain bearings
Precisely monitor the temperature curve of the plain bearings of the input shaft of the KMRS and the axial plain bearings in the grinding bowl support and document it.
- Foaming
Check whether the oil in the KMRS, in the tank (if there is one) and in the grinding bowl support on the surface has low foam content. If foaming is found, contact the oil manufacturer if necessary.
- Vibration measurement
The SIPLUS machine protection or third-party system records the frequency of selective vibration data. You should export, evaluate and log these data.
- Oil leaks
Check the screw connections for oil leaks. If necessary, provide extra sealing.

After the first run, the oil level sinks. As the KMRS and the grinding bowl support warm up, the oil level rises to the height of the marking for the operating oil level.

4. Communicate the date of first commissioning in writing to Flender within 4 weeks.

Oil quantity

Fill as much oil into the oil supply system as is needed to reach the specified level on the oil level indicators.

Make sure that the oil pumps (low-pressure and high-pressure circuit on the oil supply system of the grinding bowl support) are in operation when they are filled. Ensure that the gear unit is not rotating.

6.3 Partial commissioning

Introduction

Follow the instructions in Chapter Removing the girth gear (Page 148), turning the thrust collar.

Follow the operating instructions, in particular, for maintenance work on the vertical mill, during which the mill rotates and the gear unit modules rotate with it.

NOTICE**Damage to the gear unit**

The gear unit may be damaged if it is used improperly.

Every time the gear unit is set in motion, this represents partial commissioning. Do not commission the gear unit without having the operating instructions at hand.

Further information

You will find further information in the complete documentation for the gear unit.

You will find further information in the documentation provided by the mill manufacturer.

Operation

7.1 Operating data

Introduction

To ensure correct, trouble-free operation of the system, observe the operating data of the gear unit. The operating data stated in the annex technical data (Page 165) and the data in the operating instructions of the oil supply system apply.

The following operating data apply to the oil:

Table 7-1 Operating data

Maximum operating temperature	50 °C
Maximum operating temperature (briefly)	55 °C
Oil pressure of the oil supply system	> 0.5 bar

Further information

Further information about the technical data of the gear unit can be found in the data sheet and the list of equipment in the complete documentation for the gear unit.

Further information about the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

You will find the control instructions in the list of equipment, which is part of the complete documentation of the gear unit.

Additional information on the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

7.2 Irregularities in operation

Introduction

Switch off the drive assembly immediately if it exhibits irregular behaviour during operation.

A few irregularities are listed below as examples:

- Oil temperature exceeds the maximum permissible value
- Unusual operating noise
- Triggered alarm from a monitoring device

Document continuous changes at the KMRS or at the grinding bowl support by recording the trends.

NOTICE

Damage to the gear unit due to fault conditions

The gear unit can be damaged if it is still operated after fault conditions have occurred.
Switch off the drive assembly immediately if any fault condition develops.

Rectifying irregularities in operation

Proceed as follows to rectify any irregularities in operation:

1. Switch off the drive assembly if it exhibits irregular behaviour during operation.
2. Refer to the Fault information (Page 120) to find the cause of the fault.
3. If you still cannot determine the fault cause, contact Siemens Flender Customer Services (Page 157).

7.3 Taking the unit out of service

If you take the unit out of service for a prolonged period, you must take the following measures depending on the length of time that the gear unit will remain out of service:

- Switch off the gear unit.
- On gear units with an oil supply system, take the following measures:
 - Continue to run the complete oil supply system during short interruptions.
 - Continue to run the oil supply system for approx. 60 minutes during long shutdown times to avoid heat accumulation.
However, damage can be ruled out on a sudden stoppage, e.g. due to power failure.
 - When shutting down the oil supply system of the grinding bowl support, make sure that the high-pressure pumps are shut down first.
- On gear units with a water/oil cooler, take the following measures:
 - Drain the water from the water/oil cooler if there is a risk of frost and remove residual water with compressed air.
 - Close the shutoff valves for the cooling water inlet and drain lines.
- Take measures to preserve the gear unit if it is to be out of service for a prolonged period. Follow the preservation procedure described in operating instructions BA 7300.

**WARNING****Risk of eye injury from compressed air**

Water residue and dirt particles can cause damage to eyes.

Wear suitable safety goggles.

8.1 General maintenance information

The operator must ensure compliance with the stipulated intervals. This also applies if the maintenance activities are included in the operator's internal maintenance schedules.

The gear unit could be damaged if the stipulated intervals for maintenance and servicing work are not observed.

The periods stated in the maintenance schedule largely depend on the conditions of operation of the gear unit. For this reason, it is only possible to state average intervals here. These refer to the following conditions of use:

- Daily operating time 24 h
- Duty cycle "ED" 100%
- For the input speed of the gear unit, the speed stated in the annex of the technical data (Page 165) applies.
- Permissible average oil temperature (Page 107)



WARNING

Danger to life due to live system

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Always shut down the gear unit and any oil supply system (whether separate or mounted on the gear unit) before you carry out any work. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.

8.2 Maintenance schedule

Maintenance, servicing and inspection activities

The inspection includes all measures to determine and assess the current condition.

Use a machine manual (check list) when performing the checking procedure. The machine manual lists all items to be inspected. Record the operating parameters in the machine manual and keep this manual in your "service and maintenance" department.

You can draw up the machine manual to meet the individual requirements of the location. Make sure that the checking procedure listed is always adhered to.

The following tables and the following figure provide an overview of all maintenance, servicing and inspection activities that you are required to perform continuously or at regular intervals.

Table 8-1 General maintenance, servicing and inspection activities

Intervals	Measures	Reference number
1 000 operating hours after commissioning	Check the water content of the oil	10
	Carry out first oil change	11
	Check that the fastening bolts are tight	A
As required	Clean the air filter	1
Daily	General visual inspection for overall condition of the gear unit, and changes, damage and leakage	A
Weekly	Check the girth gear and gear unit	A
	Check the oil filters of the oil supply systems for dirt	2
	Inspect instruments installed in situ	3
	Check oil supply pipes for leaks	B
	If there is an oil vessel, check the oil level in the oil vessel of the oil supply system Oil level of the KMRS	4
Every 2 weeks	Clean filter inserts	2
Every 4 weeks	Visually inspect the condition of tooth flanks and the contact pattern (girth gear)	5
	Inspect noise from the gear unit for any changes	A
	Check the oil temperature	6
	Inspect the protection devices	A
Every 12 weeks	Clean the breather filter of the oil tank	8
	Clean the air filter	1
Every 26 weeks	Take an oil sample from the oil supply system and examine it for lubricity	10
Every 3 000 operating hours, at least every 6 months	Regrease taconite seals	12
Every 12 months	Complete drive: Check the fastening bolts for firm seating and check the drives for alignment errors	A
	Check the water content of the oil	10
Every 10 000 operating hours, at least every 2 years	Change the oil	11
	Inspect the condition of the water/oil cooler (at the same time as the oil change)	15
Every 2 years	Perform a general inspection of the gear unit	A
	Check that the fastening bolts are tight	

Table 8-2 Additional maintenance, servicing and inspection activities with highly flexible coupling - variable speed

Intervals	Measures	Reference number
Every 500 operating hours, at least 1 year after commissioning	Check electrical parameters, check bearing temperatures and smooth running/noise emission Check whether the motor foundation has cracks or dents	D
Every 4 weeks	Perform a visual and wear inspection of the couplings	7
Every 26 weeks	Inspect coupling elements and, if the torsional backlash is too large or the coupling elements are damaged, replace the coupling elements	7
As stated on the motor notice, at least every 12 months	Regrease motor bearings	14
Every 16 000 operating hours, at least every 2 years	Check electrical parameters, check bearing temperatures and smooth running/noise emission Check whether the motor foundation has cracks or dents Check alignment of the motor Check that all bolts for mechanical and electrical connections are firmly seated Check that electrical connections and shielding plates are correctly mounted and insulated Check windings for a sufficiently large insulation resistance Check bearings for correct insulation Check the condition of the cables, insulations and components (look out for discolouration)	D

Table 8-3 Additional maintenance, servicing and inspection activities with hydrodynamic fluid coupling - fixed speed

Intervals	Measures	Reference number
1 week after commissioning	Regrease the motor bearings Check the condition of the sliprings Check the condition and easy movement of the brushes Check alignment of the motor	D
3 months after commissioning	Check the torsional backlash between the coupling parts	7

Intervals	Measures	Reference number
As required	Clean the three-phase liquid starter	16
	Check the filter in the ventilation system for damage and dirt and clean or replace if necessary	18
Every 4 weeks	Check smooth running and operating noise Check the condition and easy movement of the brushes Check the condition of the sliprings Inspect the condition of the air/water cooler and clean it, if necessary	D
Every 8 weeks	Check the filter for impermissible dirt and clean or replace it if necessary	D
Every 6 months and after every time it is mounted or removed	Check doors, gates, hatches, windows / accessories for damage and correct sealing	18
Every 6 months	Check the electrolyte filling level in the three-phase liquid starter; replace evaporation with tap water no later than when the level falls below the MIN indicator Check connecting bolts on the busbars for contact pressure	16
	Clean sliprings Replace filter	D
	Check perfect conditions of the protective gratings, vibration dampers, elastic connections Check that all screws, bolts and nuts are firmly seated Check the impeller for signs of wear and corrosion Check the electrics / lighting for damage	18
Every 3 000 operating hours, at least once per year	Regrease the pedestal bearings	13
Every 5 000 operating hours	Regrease bearings of the mill motors	14
Every 12 months and after every time it is mounted or removed	Check support structure, wall and roof elements for damage and correct bolting / fastening	18

Intervals	Measures	Reference number
Every 12 months	Check the torsional backlash between the coupling parts and visually inspect the couplings	7
	Check the electrolyte filling level in the three-phase liquid starter. Replace evaporation with tap water no later than when the level falls below the MIN indicator Check connecting bolts on the busbars for contact pressure Regrease the input shaft bearings with RENOLIT FG 150	16
	Inspect and clean the entire motor Check the insulation resistance Clean the terminal box Clean the contacts Check the connections to the connection bar Check the pressing force and easy movement of the brushes Clean sliprings	D
	Check the clean condition of the impeller Check the fan for unusual noise emission Check the lubrication condition of the bearings of the motor (see notice on the motor) Check perfect condition of all installed accessories	18
Every 7 000 operating hours, at least every 2 years	Change the lubricant of the fluid couplings completely	17
Every 9 000 operating hours, at least every 2 years	Change the lubricant of the pedestal bearings completely	13
Every 2 years	Clean the vessel of the three-phase liquid starter and the interior Check the vessel and drive for corrosion spots and repaint if necessary Check electrodes for wear and surface coating and replace if necessary Check all bolted connections, in particular contact connections of the electrodes and tighten if necessary. Grease the input shaft and bearing pedestal with RENOLIT FG 150. Check all main contacts for wear and replace if necessary. Check connecting bolts on the busbars for contact pressure Check the response values of all protective and signalling devices	16
Every 10 years	Replace electrodes	16

- Reference number A: Measures apply to the entire gear unit
- Reference number D: Measures apply to the electric motor

The following diagram shows the maintenance, servicing and inspection activities (view 1):

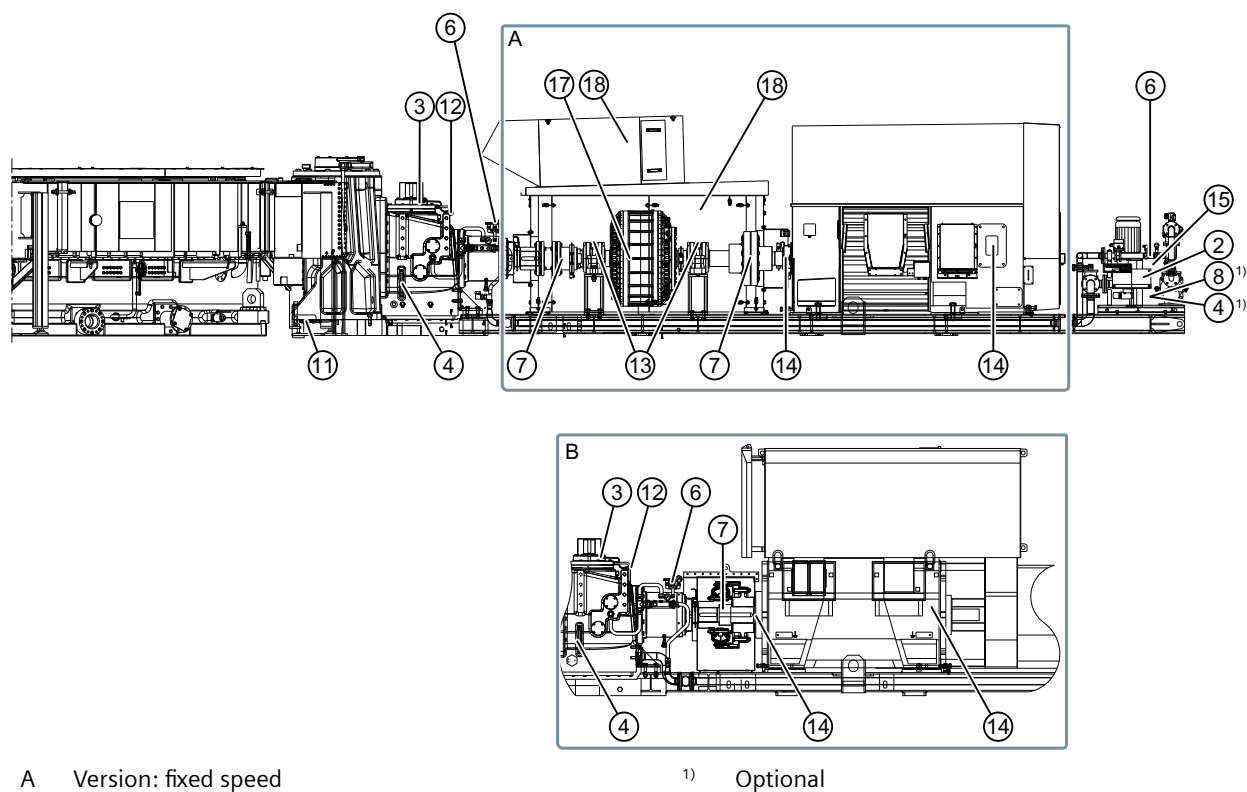
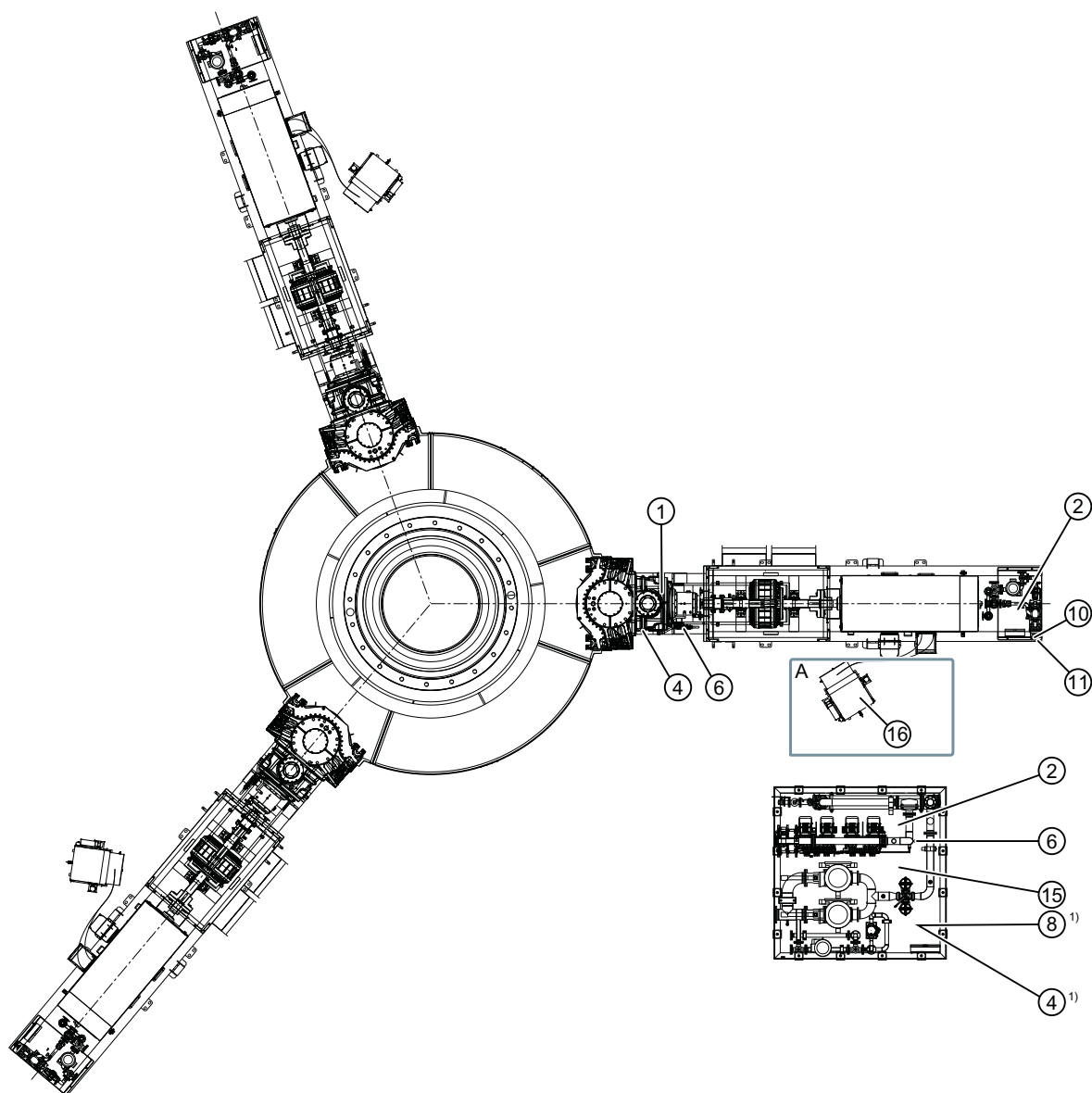


Figure 8-1 Maintenance, servicing and inspection activities (view 1)

The following diagram shows the maintenance, servicing and inspection work (view 2):



A Only for version: fixed speed

¹⁾ Optional

Figure 8-2 Maintenance, servicing and inspection activities (view 2)

Further information

Further information about additional maintenance and servicing activities can be found in the separate data sheet in the overall documentation for the gear unit.

Further information about installed components can be found in the operating instructions for the components in the complete documentation for the gear unit.

Further information about the maintenance work on the oil supply system can be found in the oil supply system operating instructions in the complete documentation for the gear unit.

Additional information relating to maintenance and servicing work carried out on components installed in/at the grinding bowl support and the girth gear shroud system can be found in the documentation provided by the mill manufacturer.

8.3 Maintenance and servicing work

8.3.1 Contamination limits

The following table contains the material-specific contamination values of the oil:

Material	Limit proportion [mg/kg]	Possible source
Iron (Fe)	20	Gear wheels, rolling-contact bearings, KMRS (oil well 1)
Iron (Fe)	40	Girth gear, gear wheels, rolling-contact bearings KMRS (oil well 2), grinding bowl support
Chromium (Cr)	4	Plain and rolling-contact bearings, gear wheels
Aluminium (Al)	4	Oil pump bearings
Copper (Cu)	4	Rolling-contact bearing cages
Lead (Pb)	6	Plain bearings pump, KMRS, grinding bowl support
Tin (Sn)	2	Plain bearings pump, KMRS, grinding bowl support
Nickel (Ni)	2	Gear wheels
Zinc (Zn)	10	Zinc-based primer (sometimes used as an additive). In this case, contact Flender.
Silicon (Si)	20	Cement dust or other environmental influences
Water (H ₂ O)	0.10 %	Condensation, water/oil cooler defective

Note that the deviation in the viscosity of the oil sample from the viscosity of the oil specified in the technical data should not exceed 10 %.

NOTICE
Damage to the gear unit The gear unit may be damaged by dirty operating oil and mixing different oil grades. Replace the oil if the contamination limits stated in the table or the purity class 20/18/15 according to ISO 4406 is exceeded. When changing the oil, fill the KMRS and the grinding bowl support with the oil grade that was previously used. Do not mix oils of different grades or manufacturers.

8.3.2 Cleaning the gear unit

Introduction

Severe contamination of the enclosure can impair heat dissipation through the surface of the gear unit and result in overheating. Depending on the operational circumstances, it may be necessary to clean the gear unit more frequently than stated in the maintenance schedule.

Procedure

To clean the gear unit, please proceed as follows:

1. Use a hard brush to remove any stubborn dirt from the KMRS. Never use a high-pressure cleaning device.
2. Remove any spots of corrosion.
3. Renew or touch up damaged paint immediately.

8.3.3 Welding work on the mill

Preparatory measures

Before welding work is performed on the mill, connect the earth of the welding equipment in such a way that welding current does not flow through the grinding bowl support or the gear unit. Connect to earth directly at the point to be welded.

Flender provides no warranty for damage to the KMRS caused by welding work carried out on the mill.

8.3.4 Servicing

Preparatory measures

Servicing includes all measures to restore the desired condition after faults.

Attach and secure the individual components and large assemblies to the lifting equipment carefully during replacement.



WARNING

Risk of crushing

There is a risk of being crushed by the transported component if the lifting equipment and load suspension devices used are not suitable and the component becomes detached.

When lifting, please observe the load distribution information on the packaging.

When the KMRS is in a raised position, transport it slowly and carefully to avoid injury to persons or damage to the gear unit.

8.3.5 Check that the fastening bolts are tight

Note the following points when checking that the fastening bolts are tight:

- Read the information about bolt connection classes (Page 94), preload forces and tightening torques (Page 94).
- Replace any bolts that are no longer fit for use by bolts of the same strength class and type.

8.3.6 General inspection of the gear unit

Arrange for the Flender customer service department to inspect the gear unit. Thanks to their experience, these engineers are best placed to assess which gear unit components need to be replaced.

8.3.7 Final work

After you have finished all the work listed in the maintenance schedule, replace any bolts that are no longer fit for use by bolts of the same strength class and type.

8.4 Possible faults

The faults listed below are only intended as a troubleshooting guide.

If any faults occur while the unit is still under warranty, do not allow anyone except the Flender customer service department to carry out repairs.

Even after the warranty period has expired, you should still arrange for faults to be rectified by the Flender customer service department.

Note

Loss of warranty

You will invalidate the warranty for the gear unit if you modify it in any way without seeking the approval of Flender beforehand, or if you do not use original spare parts.

Only use original spare parts from Flender. Always arrange for the Flender customer service department to repair any faults that develop while the unit is still under warranty.

Possible faults and their rectification

The following table provides you with an overview of possible faults and indicates how they can be rectified.

Table 8-4 Possible faults and their rectification

Possible faults	Causes	Possible remedies
Pressure switch triggers alarm	Oil pressure too low	- Inspect the oil supply system and, if necessary, replace defective components - Follow the operating instructions of the oil supply system
	Oil filter contaminated	- Inspect the oil filter and clean it, if necessary - Follow the operating instructions of the oil pump and filters
	Pipe leaking	Inspect the pipes
Noise	Damage to the gear teeth	- Contact Customer Services - Inspect the toothed components - If necessary, replace damaged components
	The bearing play is excessive.	- Contact Customer Services - Adjust bearing play
	Plain and rolling-contact bearings defective	- Contact Customer Services - Replace defective plain and rolling-contact bearings
KMRS is covered in oil on the outside	Inadequate sealing of the enclosure cover or joints.	Seal the enclosure cover or joints
	Labyrinth seals covered in oil and/or transport fixture incorrect	- Inspect the oil filling - Clean the labyrinth seals
	Defective rotor shaft sealing rings (KMRS).	Replace rotary shaft sealing rings
Oil is unnaturally light, whitish	Water in oil	- Take test tube sample to examine oil condition for water penetration - Have the oil examined by a chemical lab

8.4 Possible faults

Possible faults	Causes	Possible remedies
Oil is foaming in the KMRS	Preservative agents not completely drained	Change the oil
	Oil supply system was run for too long at low temperatures	- Shut down the oil supply system - Degas the oil
	KMRS is too cold during operation	- Shut down the gear unit and allow gas to escape from the oil - Start up without cooling water during cold restart
	Water in oil	- Examine the condition of a test tube sample of the oil to see if water has entered - Have the oil examined by a chemical lab and change the oil if necessary
	Oil too old (defoamer used up)	Examine the oil and change the oil, if necessary
	Unsuitable mixture of oils	Examine the oil and change the oil, if necessary
Oil escaping from the KMRS	Inadequate sealing of the enclosure cover or joins	- Inspect the seal and replace it, if necessary - Seal the joins
	Leakage at the input shaft	Inspect the oil return pipe and clean it, if necessary
Loud noises in the area of the gear unit module fastening	Gear unit module fastening has worked loose	- Tighten the bolts and nuts with the prescribed tightening torque - Replace damaged bolts and nuts
Fault on the oil supply system	-	Follow the operating instructions of the oil supply system
Temperature increase at the plain bearings of the input shaft at the KMRS	Oil filter contaminated	- Check the oil filters for dirt - Follow the operating instructions of the oil filters
	Monitoring devices defective	- Check all monitoring devices - Follow the operating instructions of the monitoring devices
	This can also be due to changed grinding parameters, for example, increase in the gas temperature	Examine and inspect the grinding parameters
Temperature increase at the bearing points	Oil level in the KMRS too low or too high	- Check the oil level at room temperature - If necessary, replenish or drain oil
	Oil is too old	- Check when the last oil change was performed - If necessary, change the oil
	Oil supply system defective	- Check the oil supply system - If necessary, replace defective components - Follow the operating instructions of the oil supply system
	Plain and rolling-contact bearings defective	- Contact Customer Services - Inspect the plain and rolling-contact bearings and replace them, if necessary

Possible faults	Causes	Possible remedies
Temperature increase during operation	Oil is too old	- Check when the last oil change was performed - If necessary, change the oil
	Oil is severely contaminated	Change the oil
	Oil supply system defective	- Inspect the oil supply system; if necessary, replace defective components - Follow the operating instructions of the oil supply system
	If equipped with an oil cooling system: Coolant flow too low or too high	- Adjust the valves of the supply and return lines completely - Check the water/oil cooler for free flow
	Coolant temperature is too high	Check the temperature; correct if necessary
	Oil flow through the water/oil cooler too low due to severely contaminated oil filters or coarse filters	Check the oil filters and coarse filters and, if necessary, replace the oil filters or clean the coarse filters.
	Oil filter contaminated	- Clean the oil filter - Follow the operating instructions of the oil filter
Increased vibration amplitude at the bearing points	Foot bolts have come loose	- Tighten the foot bolts to the specified torque - Replace damaged bolts and nuts
	Plain and rolling-contact bearings defective	- Contact Customer Services - Replace defective plain and rolling-contact bearings
	Damage to gear teeth	- Contact Customer Services - Check toothed components and, if necessary, replace damaged components
	Effect on the vertical mill due to fault	- Follow the operating instructions of the vertical mill - Involve Customer Service of the vertical mill supplier
Volume flowmeter triggers alarm	Oil too cold	Warm the oil
	Oil filter contaminated	- Clean the oil filter - Follow the operating instructions of the filters
	Pipe leaking	Inspect the pipes and replace them, if necessary

8.5 Special aspects of the gear unit

The individual gear unit modules are designed for a certain load factor and maximum power. Based on this load factor, the maximum power or the minimum grinding bowl speed per gear unit module can be determined.



WARNING

Serious injury due to exceeding the power rating

Serious injury may occur if the gear unit is overloaded.

Make sure that the load factor and the maximum stated power rating are not exceeded on any account.

8.6 Option 1: Pulling the gear unit module out of tooth engagement (emergency 2)

Example: Maximum power

The desired grinding bowl speed of 21.0 rpm is calculated from a maximum power per gear unit module of $21.0 \text{ rpm} \times 98.00 = 2\,058 \text{ kW}$.

The desired power of 2 000 kW per gear unit module yields a minimum permissible grinding bowl speed of $2\,000 \text{ kW} / 98.00 = 20.41 \text{ rpm}$.

The mill power is calculated from the single power rating times the number of gear unit modules.

Example: Minimum permitted grinding bowl speed

Ensure that the gear unit modules are not operated below 70 % of the normal grinding bowl speed, irrespective of the maximum power and the load factor, because the gear unit modules will otherwise be damaged.

The grinding bowl speed in normal operation is 20.00 rpm.

The minimum permitted grinding bowl speed is therefore $20.00 \text{ rpm} \times 0.7 = 14.00 \text{ rpm}$.

Further information

You will find further information on the special aspects of the gear unit in Chapter Technical Data (Page 165).

8.6 Option 1: Pulling the gear unit module out of tooth engagement (emergency 2)

With this option, the gear unit module is pulled back a certain distance, disengaging the teeth of the pinion and girth gear. This action shuts down the gear unit module. You will find the specified pull-back distance in the dimension drawings, which are part of the complete documentation of the gear unit.



DANGER

Danger to life due to gear unit tipping over or falling

Gear units may tip over or fall when bolted connections are unfastened.

When working on the girth gear shroud system, carefully comply the instructions provided in the documentation from the mill manufacturer.

Secure the components. Before restarting, check that the bolts are firmly seated and tightened to the correct tightening torque (Page 93). Carefully observe the documentation provided by the mill manufacturer.

8.6 Option 1: Pulling the gear unit module out of tooth engagement (emergency 2)

**! DANGER****Danger to life due to live system**

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Switch off the drive unit before working on the gear unit. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.

! WARNING**Risk of scalding**

Serious injury may occur if hot operating media escape when the operating media are changed.

Wear suitable protective gloves, safety goggles and protective clothing. Collect the residual oil and dispose of it according to the valid regulations.

NOTICE**Damage to the KMRS and the oil supply system**

Damage to the KMRS and the oil supply system due to incorrect oil distribution.

Make sure that the supply line from the oil supply system of the grinding bowl support to the KMRS (oil well 2) is not sealed because otherwise the oil distribution will no longer be correct. The oil supply system of the disengaged gear unit module (oil well 1) remains out of operation while this gear unit module is not in operation.

Procedure

To pull the gear unit module out of tooth engagement, please proceed as follows:

1. Shut down the main oil supply system.
2. For the next steps involving the girth gear shroud system, observe the documentation provided by the mill manufacturer.
3. Release the six foundation bolts between the carriage and the foundation.
4. Very carefully push the gear unit module back a certain distance in parallel using two hydraulic jacks as when setting the necessary tooth-flank backlash. You will find the specified pull-back distance in the dimension drawings, which are part of the complete documentation of the gear unit.
5. Fasten the carriage to the foundation with the four rear foundation bolts.
6. Store the six front foundation bolts on the gear unit module for subsequent refitting because they are no longer needed now.
7. Start up the other gear unit modules again, considering the load factor and the maximum permissible power (Page 123).

It is not necessary to convert the oil supply lines because there is an intermediate hose element with the appropriate dimensional allowance between the gear unit module and the pipe.

8.7 Option 2: Complete removal of a gear unit module (emergency 1)

Further information

You will find further information in the dimension drawings and the parts lists for this option, which are part of the complete documentation of the gear unit.

Additional information on the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

8.7 Option 2: Complete removal of a gear unit module (emergency 1)

For this option, a gear unit module is removed completely and the girth gear shroud system is closed and sealed at this location.



DANGER

Danger to life due to gear unit tipping over or falling

Gear units may tip over or fall when bolted connections are unfastened.

When working on the girth gear shroud system, carefully comply the instructions in the documentation provided by the mill manufacturer.

Secure the components. Before restarting, check that the bolts are firmly seated and tightened to the correct tightening torque (Page 93).

Carefully observe the documentation provided by the mill manufacturer.



DANGER

Danger to life due to live system

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Switch off the drive unit before working on the gear unit. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.

WARNING

Risk of scalding

Risk of serious injury possible through escaping hot operating media when these are being changed.

Wear suitable protective gloves, safety goggles and protective clothing. Collect the residual oil and dispose of it according to the valid regulations.

8.7 Option 2: Complete removal of a gear unit module (emergency 1)

Improper use can damage the gear unit. Be sure to take the following precautions:

NOTICE
Damage to the KMRS and the oil supply system
Damage to the KMRS and the oil supply system due to incorrect oil distribution.
Make sure that the supply line from the oil supply system of the grinding bowl support to the KMRS (oil well 2) is not sealed because otherwise the oil distribution will no longer be correct. The oil supply system of the disengaged gear unit module (oil well 1) remains out of operation while this gear unit module is not in operation.

Additional information

You will find additional information in the documentation for this option, part of the complete documentation of the gear unit.

Additional information relating to the design of the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

Plug connection

The following figure shows a plug connection:



① Plug connection for connecting to the grinding bowl support

Figure 8-3 Plug connection

The following diagram shows the overall design (example):

8.7 Option 2: Complete removal of a gear unit module (emergency 1)

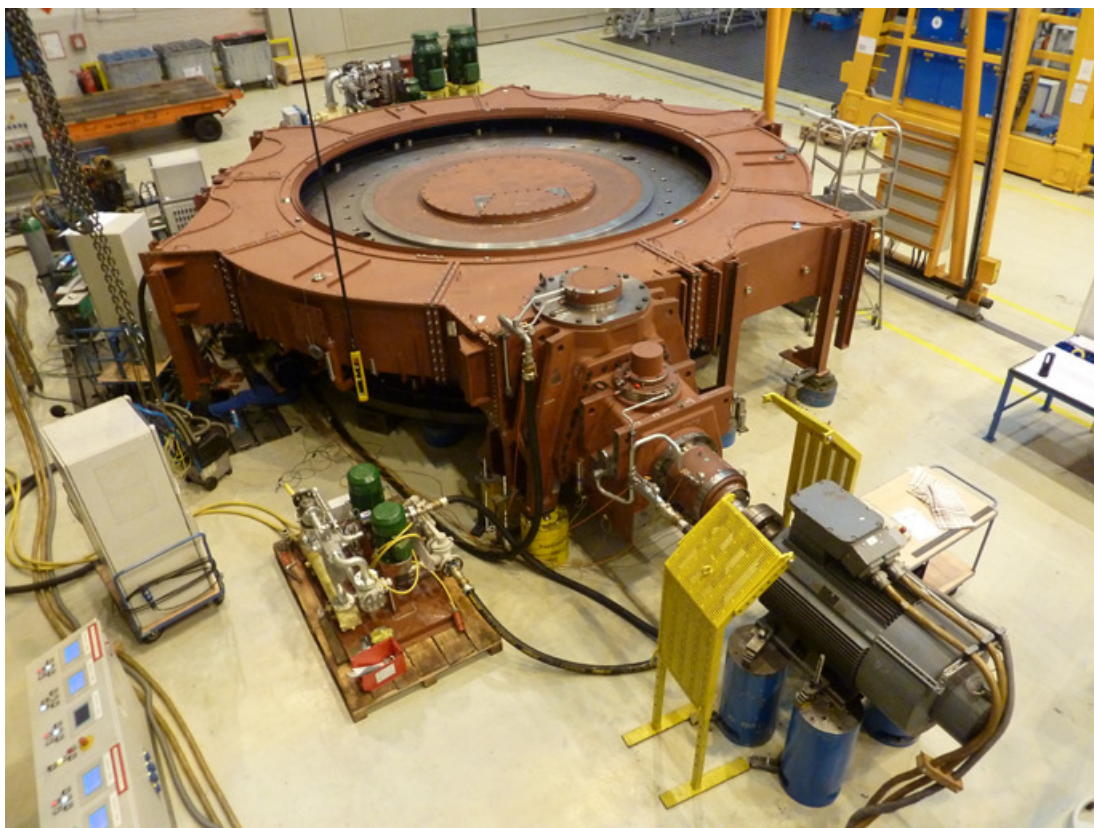


Figure 8-4 Overall design (example)

Improper use can damage the gear unit. Be sure to take the following precautions:

- Before you remove or release the gear unit, clean the region of any loose foreign particles.
- Make sure that no foreign matter falls into the shroud from the mill area above the top cover.
- Carefully store the parts because they will be needed later for refitting.
- Release the six foundation bolts between the carriage and the foundation.
- Using two hydraulic cylinders, push the gear unit module carefully back so that nothing is damaged.
- Reattach the transport cover to the KMRS to protect the output pinion.

NOTICE**Damage to the gear unit and the oil supply system**

Damage to the gear unit and the oil supply system due to incorrect oil distribution.

Make sure that the supply line from the oil supply system of the grinding bowl support to the sealing plate is not closed because otherwise the oil distribution will no longer be correct.

8.7 Option 2: Complete removal of a gear unit module (emergency 1)

Procedure

To remove the gear unit module, please proceed as follows:

1. Shut down the main oil supply system.
2. Close the supply line of the KMRS (oil well 2) at both ends using the shutoff valve.
3. Unfasten and remove the connecting hose.
4. Connect the grinding bowl support with the lower connection of the intake line at the position of the missing KMRS using a pipe or a hose. This is required as otherwise the oil cannot be correctly distributed. Here, observe the documentation provided by the mill manufacturer regarding the removed gear unit module with the threaded hole of the sealing plate that is provided. To do this, proceed as follows:
 - Then reopen the shutoff valve at the lower end.
5. If there is one, disconnect the plug connection between the KMRS and the grinding bowl support.
6. Start up the other gear units again, considering the load factor and the maximum permissible power (Page 123).

Further information

You will find further information in the dimension drawings for this option, which are part of the complete documentation of the gear unit.

Additional information on the grinding bowl support and the girth gear shroud system is provided in the documentation provided by the mill manufacturer.

Dismantling

9.1 General dismantling instructions

The dismantling work must be performed very carefully by authorised, trained and suitably instructed personnel. Liability will be disclaimed for damage caused by the incorrect performance of this work.

Follow the operating instructions, in particular, for maintenance work on the vertical mill, during which the mill rotates and the gear unit modules rotate with it.

Observe the operating instructions of the grinding bowl support and the girth gear shroud system provided by the mill manufacturer.

NOTICE
Damage to the gear unit The gear unit may be damaged if it is used improperly. Every time the gear unit is set in motion, this is commissioning. Do not commission the gear unit without having the operating instructions at hand.

Requirements

Improper use can damage the gear unit. Be sure to take the following precautions:

- Protect the gear unit against falling objects and from becoming covered over.
- Make sure that all the oil has been drained from the KMRS.
- Do not perform any welding work anywhere on the drive.
- Do not use the gear unit as an earthing point for electric-welding operations.
- Use all of the fastening points fitted to the particular unit design.
- Replace any bolts which can no longer be used by bolts of the same strength class and type.
- Replace the seals that have become unusable, installing new seals of the same material and type.
- Make sure that sufficient hoisting gear is available.
- Pay attention to the special rules of the mill manufacturer.
- The opened KMRS is sealed hermetically to protect it against corrosion and the ingress of foreign particles at the output with a transport cover and at the labyrinth seal of the input shaft with adhesive tape.
- Mount the transport cover, the adhesive tape and the V-ring seal as early as possible after removal to ensure corrosion protection.

Position and attachment points

During the actual planning phase, be sure to allow for sufficient space around the gear unit for dismantling and to enable subsequent upkeep and maintenance work. It must be possible to inspect the internal components through the inspection cover openings.

The positions of the attachment points are shown in the dimension drawings.

9.2 Foundation

Properties of the foundation

After removal, place the gear unit modules under the mill on an area of the floor that has the following attributes:

- Flat
- Secure
- Free of vibration
- Rigid

The following diagram shows the overall design (example):

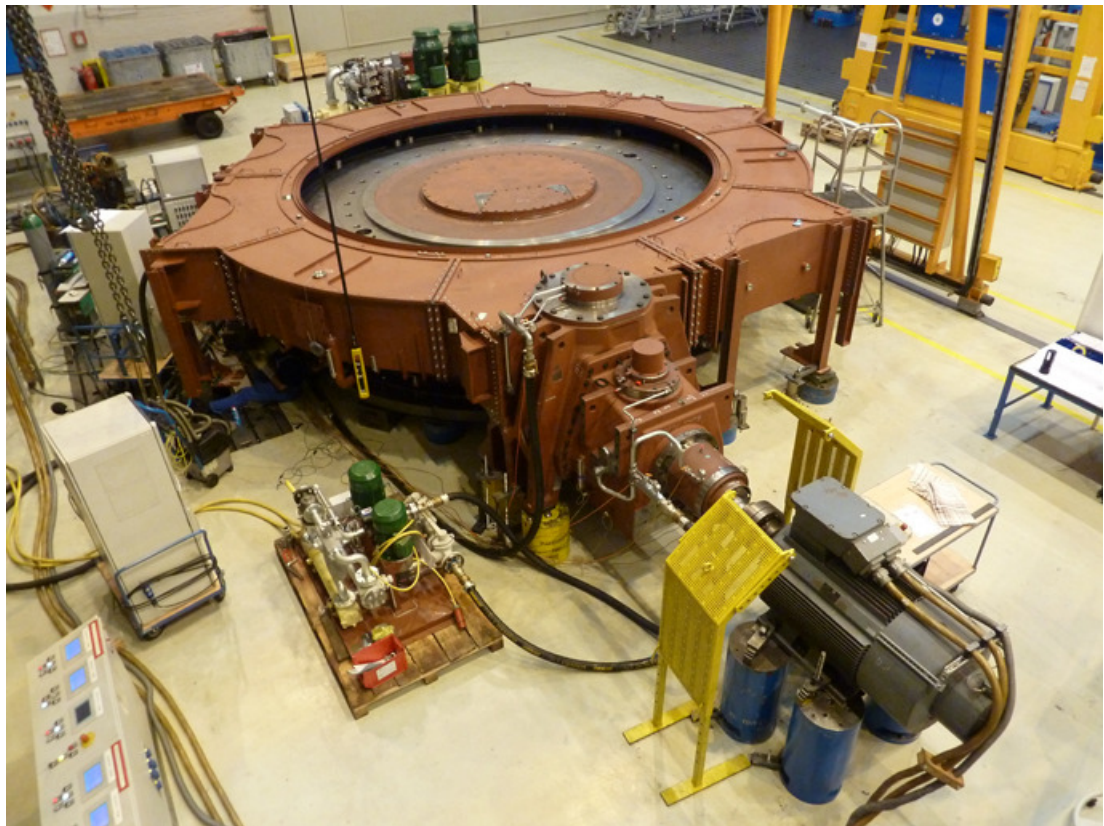


Figure 9-1 Overall design (example)

9.3 Preceding dismantling work

Measures

To remove the components, proceed as follows:

1. Release the wiring between the individual terminal boxes at the gear unit modules and the control console.
2. Remove the limit switches attached to the sides of the gear unit modules.
3. Lock the oil drain valves against accidental opening.

Further information

You will find further information on the gear unit and all mounted elements in the operating instructions for mounted elements, which are part of the complete documentation of the gear unit.

You will find technical specifications in the separate data sheet, which is part of the complete documentation of the gear unit.

Additional information on the grinding bowl support and the girth gear shroud system is provided in the operating instructions provided by the mill manufacturer.

9.4 Removing components

Introduction

The grinding bowl support has two lubrication circuits.

- A lubrication circuit supplies the tooth engagement between the pinion and the girth gear with lubricant and coolant and is connected to the KMRS (oil well 2).
The first lubrication circuit is connected to the KMRS via a ring line.
- The second lubricant circuit supplies the axial and radial bearings (forced lubrication) in the grinding bowl support with lubricant and cooling.
The second lubricant circuit is connected directly to the grinding bowl support.

For the general design, consult the dimension drawings and parts lists, which are part of the complete documentation of the gear unit.

For the general design of the grinding bowl support, the girth gear shroud system and the connecting piping, review the documentation provided by the mill manufacturer.

9.4.1 Removing further mounted components

Procedure

To remove further mounted components, proceed as follows:

1. Remove obstructing fittings and valves from the KMRS as shown in the dimension drawings supplied.
2. Remove obstructing fittings and valves at the girth gear shroud system as described in the documentation provided by the mill manufacturer.
3. Disconnect electrical monitoring devices as shown in the terminal diagrams, lists of equipment and special operating instructions.

Further information

You will find further information on the electrical monitoring devices in the operating instructions for the electrical monitoring devices, which are part of the complete documentation of the gear unit.

You will find further information on the electrical monitoring devices in the operating instructions for the electrical monitoring devices, which are part of the documentation provided by the mill manufacturer.

You will find further information and technical data for the mounted components in the list of equipment drawn up specifically for the order, which is part of the complete documentation of the gear unit.

Additional information and technical data of the mounted components are provided in the documentation provided by the mill manufacturer.

You will find further information, terminal diagrams and lists of equipment, which are part of the complete documentation of the gear unit.

You will find further information, terminal diagrams and lists of equipment in the documentation provided by the mill manufacturer.

9.4.2 Removing the water/oil cooler connection

Procedure

Depending on the order specification, the gear unit can be equipped with a mounted water/oil cooler.

When you remove a gear unit module, the connection of the water/oil cooler must be disconnected. Proceed as follows:

1. Connect the cooling water supply pipes and the cooling water return pipes.
You will find the direction of flow and the position of the connection ports in the dimension drawing, which is part of the complete documentation.
2. Detach the cooling water connection and seal the ports with blind couplings.

NOTICE**Damage to the water/oil cooler**

The water/oil cooler may be damaged by force exerted on the connections.

When removing the pipes, make sure that the connections of the water/oil cooler are not subject to any forces, torques or vibrations.

Further information

You will find the connection dimensions in the dimension drawing, which is part of the complete documentation of the gear unit and the oil supply system.

You will find information on the mounted components in the relevant operating instructions, which are part of the complete documentation of the gear unit.

You will find further information on the mounted components in the documentation provided by the mill manufacturer.

9.4.3 Disconnecting a connected separate oil supply system**Procedure**

Depending on the order, the gear unit can be equipped with a separate oil supply system.

To disconnect the separate oil supply system, proceed as follows:

1. Follow the operating instructions of the oil supply system and the dimension drawings in the complete documentation.
2. Make sure that the oil in the pipes and in the oil supply system has been drained off.
3. For the piping system, carefully observe the documentation provided by the mill manufacturer.
4. Disconnect the suction and pressure pipe from the grinding bowl support and from the KMRS (oil well 2). Replace the openings with blind couplings or the covers intended for this purpose.
5. Remove the connection pipes to the extent necessary to allow space to remove the grinding bowl support.
6. Follow the operating instructions of the mill manufacturer.

Further information

You will find further information on the separate oil supply system in the operating instructions for the separate oil supply system, which are part of the complete documentation of the gear unit.

9.4.4 Preparatory measures before removing the gear unit modules and the girth gear

Proceed as follows to make preparations for removing the gear unit modules:

1. Keep the necessary tools, carrying aids and collection pans with cleaning agents ready at the start of removal work.
2. Before you start removal work, clean the region of any loose foreign particles.
3. Make sure that no foreign matter falls on the gear unit from the part of the mill located above the gear unit.
4. Ensure that all the oil, including residual oil, is drained from the KMRS.
5. Where they exist, remove additional stopper parts from the gear unit module on the gear unit plate (foundation).
6. Remove the connecting bolts, by which the grinding bowl support is fastened to the grinding bowl.
7. Lift the grinding bowl.
8. If necessary for space reasons, remove the tensioning cylinders of the mill for mounting and removing the mounting frame for removing the girth gear.



WARNING

Risk of chemical burns due to chemical substances

There is a risk of chemical burns when handling corrosive cleaning agents.

Please observe the manufacturer's guidelines on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety goggles). Please use binding agents to immediately clear up any spilt solvent.

NOTICE

Damage due to chemically corrosive cleaning agents

Damage due to chemically corrosive cleaning agents is possible.

Avoid all contact of the cleaning agent with gear unit components at risk.

9.5 Disengaging a gear unit module with a mounted gear shroud segment

Introduction

For a single arrangement, push the gear unit modules so that the teeth no longer engage in such a way that the longitudinal axis of the gear unit intersects with the centre of the mill.

This is not the case for parallel drives.

9.5 Disengaging a gear unit module with a mounted gear shroud segment

The following figure shows an example sketch of the alignment lines:

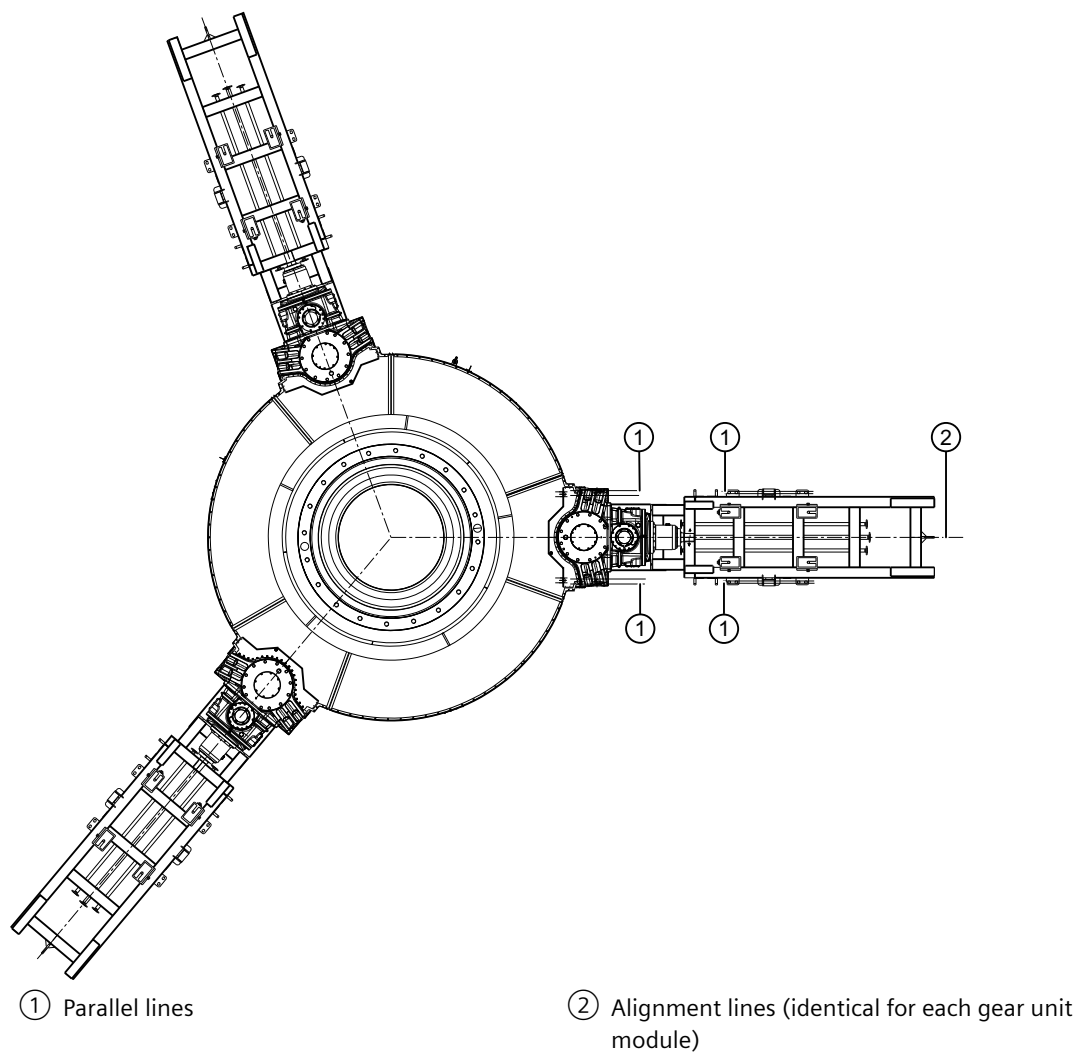


Figure 9-2 Sketch of the alignment lines (example)

In this way, a gear unit module is removed completely. After withdrawal, the opening at the KMRS is closed using a transport cover.



DANGER

Danger to life due to a KMRS tipping over or falling

KMRS may tip over or fall when bolted connections are unfastened.



! DANGER

Danger to life due to live system

Working on a gear unit while it is in operation is hazardous and can result in potentially fatal injuries.

Switch off the drive unit before working on the gear unit. Take measures to prevent the accidental restarting of the drive assembly. Display a warning notice that clearly states that work is being carried out on the gear unit.

! WARNING

Risk of scalding

Serious injury may occur if hot residual oil escapes.

Residual oil may still be in the KMRS. Collect the residual oil and dispose of it according to the valid regulations. Wear suitable protective clothing.

9.5.1 Tools required for removing the gear unit modules

To remove the gear unit module, you need the following equipment:

- 2 hydraulic jacks 10 t
- Torque spanner, you will find the size in the dimension drawings, which are part of the complete documentation
- Torque wrench; the size is specified in the documentation provided by the mill manufacturer
- 4 heavy duty rollers; you will find the size in the dimension drawings, which are part of the complete documentation for the gear unit

Procedure

To pull the gear unit modules back, proceed as follows:

1. Close the supply line of the KMRS (oil well 2) using the shutoff valves at both ends.
2. Unfasten and remove the connecting hose between the shutoff valve and the KMRS (oil well 2).
3. For the girth gear shroud system, observe the documentation provided by the mill manufacturer.
4. If there is one, disconnect the plug connection between the KMRS and the grinding bowl support.
5. Unscrew the two front foundation bolts in the holes of the base plate and remove all the remaining eight or, where present, ten foundation bolts.
6. Store all fastening elements carefully because they will be needed again when the mill is reassembled.
7. Push the gear unit module out of tooth engagement using the two hydraulic jacks.

9.5 Disengaging a gear unit module with a mounted gear shroud segment

8. Push the gear unit module evenly back at least 100 mm on a parallel trajectory using two hydraulic jacks. It is not permissible that the gear teeth are engaged. Refer to the operating instructions provided by the mill manufacturer for the shortest withdrawal distance required for the girth gear shroud system.
9. After this, using four heavy duty rollers inserted under the base frame and an attached pulley block, pull the gear unit module back enough to make enough space for subsequent removal of the remaining parts.

9.5.2 Removing foundation bolts

Procedure

To remove the foundation bolts, proceed as follows:

1. Remove the bolts according to the instructions for use of the mill manufacturer.



WARNING
Risk of crushing
There is a danger of being crushed by the gear unit module as it is pushed.
Push the gear unit modules slowly and carefully to avoid injury to persons or damage to the gear unit.

The following diagram shows the connection pipe (hose) for the KMRS (oil well 2):

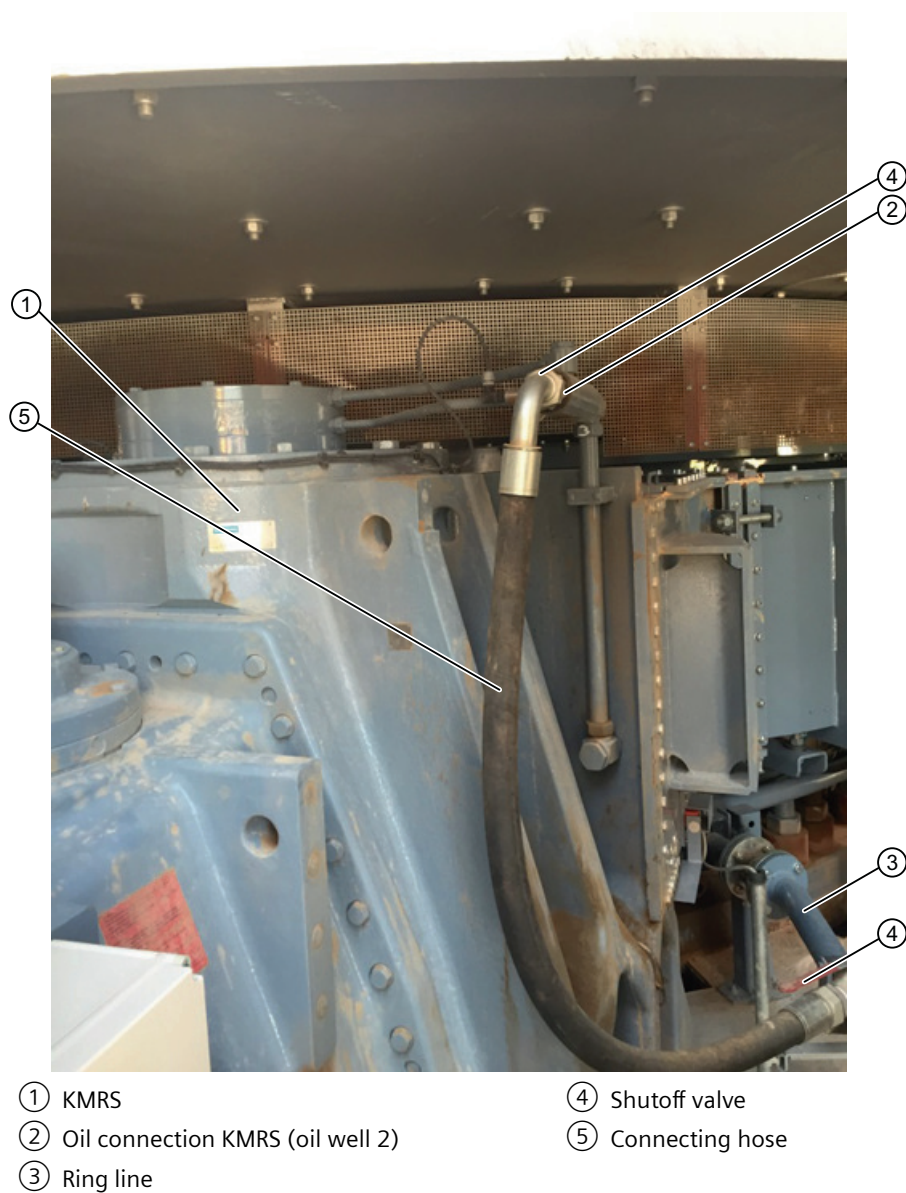


Figure 9-3 Connecting pipe (hose) for the KMRS (oil well 2)

The following figure shows a sketch with mounting holes, markings, openings and position of the dial gauges:

9.5 Disengaging a gear unit module with a mounted gear shroud segment

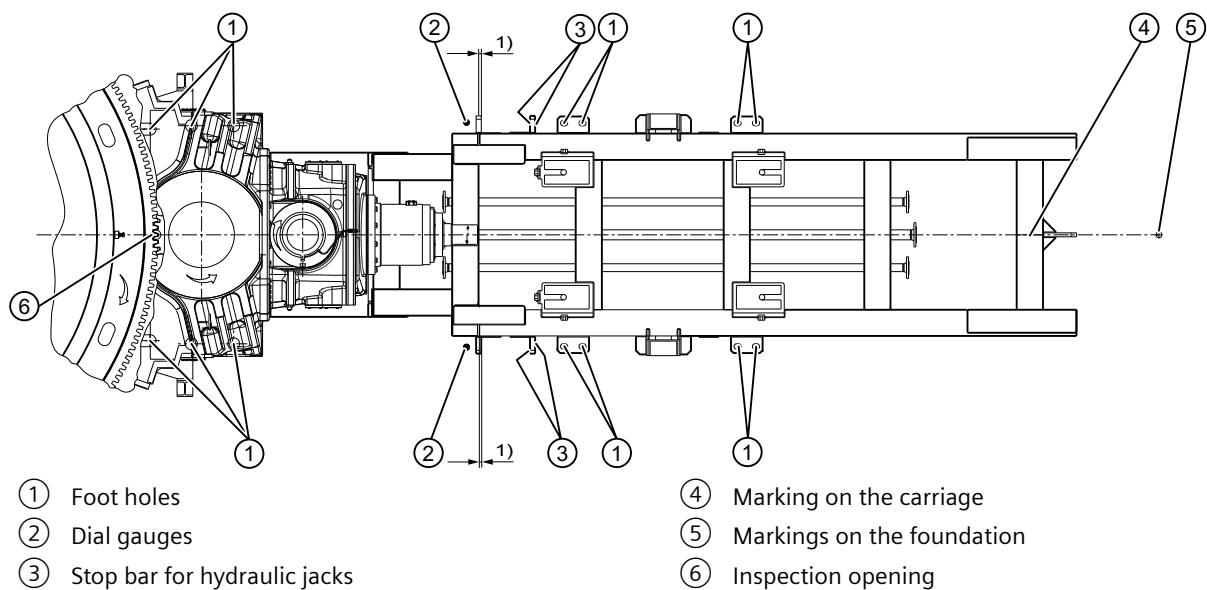


Figure 9-4 Sketch with mounting holes, markings, openings and position of the dial gauges

X¹⁾ Pull-back distance "X"

The following figure shows the alignment (displacement) of the gear unit module with the hydraulic jack:



Figure 9-5 Alignment (displacement) of the gear unit module with the hydraulic jack

9.5.3 Removing further gear unit modules

To remove further gear unit modules, proceed in the same way as for the first gear unit module.

Further information

You will find further information in the dimension drawings and the parts lists, which are part of the complete documentation of the gear unit.

9.5.4 Mounting the transport cover on the KMRS

Mounting the transport cover on the KMRS

The transport cover consists of four sections with connecting elements:

- Support bar
- 2 side parts

9.5 Disengaging a gear unit module with a mounted gear shroud segment

- Protective cover
- O-rings
- Connecting elements

**WARNING****Risk of scalding**

Serious injury may occur if hot residual oil escapes.

Residual oil may still be in the KMRS. Collect the residual oil and dispose of it according to the valid regulations. Wear suitable protective clothing.

Carefully apply the following measures to protect the KMRS against damage:

- Before you remove the girth gear shroud system clean the region of any loose foreign particles.
- Make sure that no foreign matter falls into the shroud from the mill area above the girth gear shroud system.

Equipment needed

To mount the transport covers on the KMRS, you require the following materials:

- Sealant Loctite 574
- Liquid adhesive Loctite 401
- Acid-free grease
- O-rings
- Screw plugs
- Connecting bolts with washers

You will find further information about the O-rings and the connecting bolts with washers in the dimension drawings, which are part of the complete documentation of the gear unit.

The following diagram shows the housing bolting surfaces with thread and O-ring grooves:



Figure 9-6 Housing bolting surfaces with thread and O-ring grooves

The following diagram shows mounting the transport cover on the KMRS:

9.5 Disengaging a gear unit module with a mounted gear shroud segment

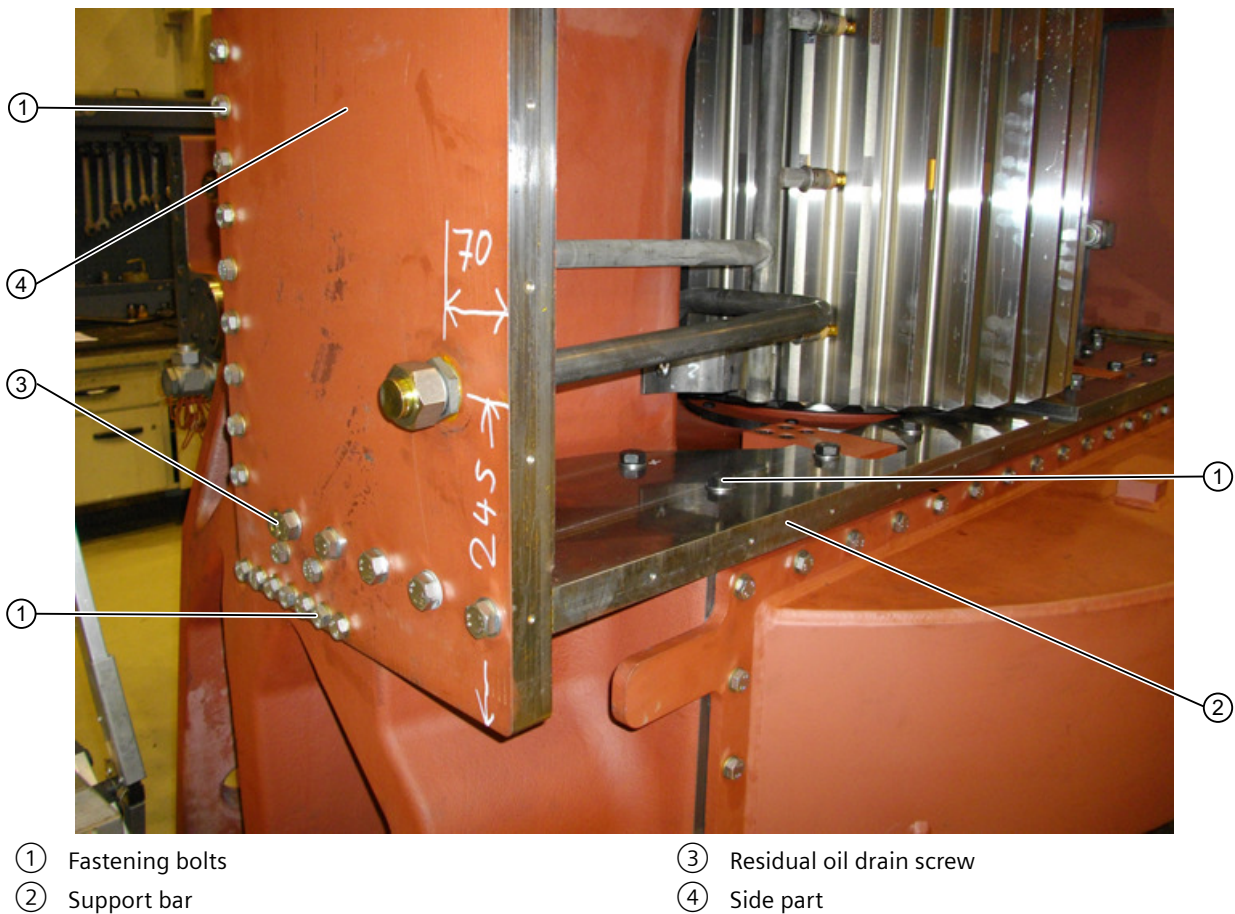


Figure 9-7 Mounting the transport cover on the KMRS

To mount the transport cover, proceed as follows:

1. Clean sealants and adhesives off the interior of the enclosure, in the region of the mounted parts, the O-ring grooves and the sealing surfaces.
2. Install the O-rings in the slots of the two vertical and horizontal surfaces of the KMRS.
3. Mount the support bar.
4. Mount the two side parts on the right and left.
5. Mount the protective cover with Loctite 574 used on the sealing surfaces.
6. When subsequently removing the transport cover and all of the connecting elements, carefully store all of these parts as these will be required when refitting the system.

The figure below shows mounting the O-rings for the transport covers:

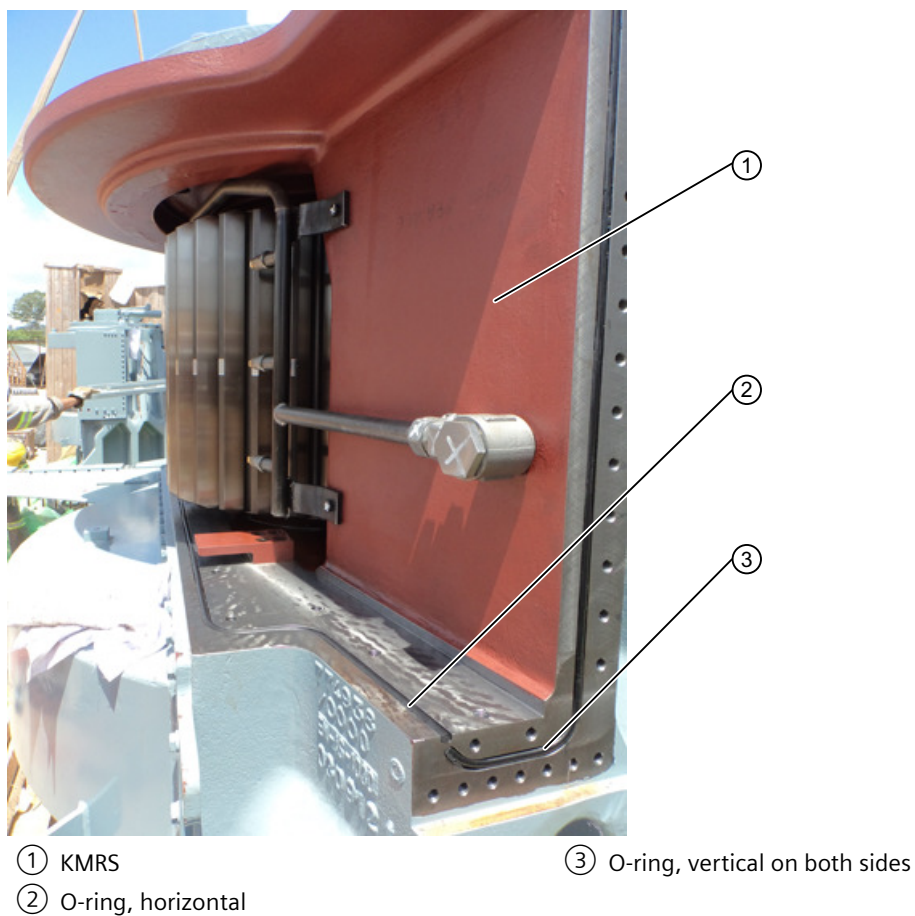


Figure 9-8 Mounting the O-rings for the transport covers

The following diagram shows the transport cover mounted on the KMRS:



Figure 9-9 Transport cover mounted on the KMRS

9.6 Final disassembly of the girth gear shroud system

9.6.1 Removing the girth gear shroud system

Introduction

After the gear unit modules have been withdrawn far enough, disassemble the girth gear shroud system. The pull-back distance depends on the space available under the mill.

The pull-back distance must be adequate for subsequent disassembly of the girth gear shroud system and mounting and removal of the mounting frame. Depending on the particular mill, it is not possible to remove the girth gear because there is not enough space.

For the general design, observe the documentation provided by the mill manufacturer.

Requirements

Comply with the following requirements before disassembling the girth gear shroud system:

- Make sure that no oil is in the girth gear shroud system before the girth gear shroud system is released. A residual quantity of oil may still be present. Provide collection pans for the residual oil.
- Ensure that the gear unit modules have been adequately withdrawn.
- Make sure that the mounted components have been removed.

9.7 Removing the girth gear

9.7.1 Special instructions for the oil supply system during rotation of the thrust collar, for positioning, before the girth gear is removed with a mounting frame

Requirements

The instructions in this chapter only apply under the following conditions:

- Removal or mounting of the two girth gear halves under the mill with a mounting frame from the customer mounted.

Once this work has been completed, set the oil supply system as described in the operating instructions of the oil supply system.

Introduction

Before rotation of the girth gear, perform the following steps:

Before aligning the girth gear, perform the following steps:

- Connect the oil supply system for the grinding bowl support.
- Check that the oil supply system works.

Fill the grinding bowl support with oil before you start up the oil supply system.

To rotate the thrust collar, start up the oil supply system so that the axial and radial plain bearings are supplied with oil and the thrust collar (girth gear) can be turned.

NOTICE
Damage to the axial and radial plain bearings
Damage to the axial and radial plain bearings is possible.

Special instructions for the oil supply system

To remove the girth gear, the following special instruction applies to the oil supply system:

- Close the shutoff valve (part no. 86).
- The pipe to the KMRS (oil well 2) is removed and the connections at the grinding bowl support and at the gear unit modules are closed.
- The pipes to the KMRS (oil well 1) are usually already mounted complete and connected to the associated oil supply system on the carriage (gear unit module).
- Set the shutoff valve (part no. 85) in such a way that a volume flow measuring instrument is set as follows:
Volume pumped by the main pump minus the number of high-pressure lines times 3.3.

Further information

You will find further information, data on the pumped volume and the part no. in the lubrication diagram, which is part of the complete documentation of the gear unit.

To avoid damage to the gear unit modules, take the following precautions:

- Mount the transport cover as early as possible after removing the girth gear shroud segments on the KMRS.
- Seal the labyrinth seal of the KMRS input shaft with adhesive tape.
- Make sure that the pressure line (hose) to the oil well 2 has been removed. The ends of the pipe are shut off by a ball valve and sealed with screw plugs.

9.7.2 Removing the girth gear

Introduction

The girth gear transmits the torque required for grinding by means of friction.



WARNING

Danger of injury from the girth gear, thrust collar and defective tools

There is a danger of injury from the girth gear, thrust collar and defective tools.

Strictly adhere to the specified torques and protection measures. Only use tools that are calibrated and in perfect technical condition to unscrew the bolts.

9.7.3 Equipment needed to remove the girth gear

To remove the girth gear, you need the following equipment:

- Hydraulic tightening tool (e.g. HYTORC, HY-¹⁾ XLT or an equivalent tool)
- Torque spanner for hex-socket bolts of the SUPERBOLT clamping elements, TA = ¹⁾

- Extractor threaded rod for cylindrical pins with inside thread M24
- Hydraulic device for pulling off the cylindrical pins

¹⁾ You will find the required size, further data on the design and technical data in the dimension drawings and data sheets, which are part of the complete documentation of the gear unit and the documentation provided by the mill manufacturer.

9.7.4 Removing the girth gear from the grinding bowl support under the mill

The girth gear comprises two parts.



WARNING

Risk of falling

Serious injury may occur if temporary storage is incorrectly performed.

If the girth gear is set down again between removal of the grinding bowl support and storage, ensure it remains in a horizontal position.

The girth gear is equipped with the holes and lifting threads required for transport. You need four lifting ropes for this.

The following figure shows the attachment points and transport of the girth gear:



Figure 9-10 Attachment points and transport of the girth gear

Procedure

To remove the girth gear from the grinding bowl support, proceed as follows:

1. Turn the thrust collar (girth gear) into position. To do this, switch the oil supply (high-pressure part) for the axial and radial plain bearings on for 15 minutes first.
2. On the girth gear joints, first remove the fitted stud bolts and then the remaining stud bolts.
3. Mount the mounting frame as described in the documentation provided by the mill manufacturer.
4. Tighten the two cylindrical pins of the first girth gear half between the girth gear and the thrust collar with an M24 threaded rod.
5. Remove the connecting bolts between the girth gear and thrust collar of the first girth gear half.
6. Remove the first girth gear half above the mounting frame as described in the documentation provided by the mill manufacturer.
7. Turn the thrust collar 180°. To do this, switch the oil supply (high-pressure part) for the axial and radial plain bearings on for 15 minutes first.
8. Repeat these steps for the second half of the girth gear.
9. Remove the mounting frame as described in the documentation provided by the mill manufacturer.



DANGER

Falling load

A danger to life is posed by a falling load due to bolts not being tightened finger-tight.
Do not release the lifting ropes until both bolts have been tightened finger-tight.

To avoid serious physical injury and damage to the gear unit, take the following precautions:

- When pulling out each of the halves of the girth gear, make sure that the thrust collar is not rotated and that the contact surfaces are not damaged. These surfaces must be clean before bolting together.
- Only use lifting gear and load suspension devices with sufficient load bearing capacity during transport.
- When lifting, please observe the load distribution information.
- Transport the girth gear in such a way that personal injury and damage to the girth gear are avoided.
For example, shocks on free ends of shafts can damage the girth gear.
- When removing the girth gear under the mill using a holding device (supplied by the mill manufacturer), comply with the mill manufacturer's own regulations.
- Keep all removed parts. They will be needed again for mounting later on.

9.7.5 Detaching girth gear halves

Introduction

The two girth gear halves are pinned and bolted together. These consist of the following single items:

- Fitted stud bolts
- Stud bolts
- SUPERBOLT nuts
- Washers to match.

The following figure shows an example of a bolt arrangement:

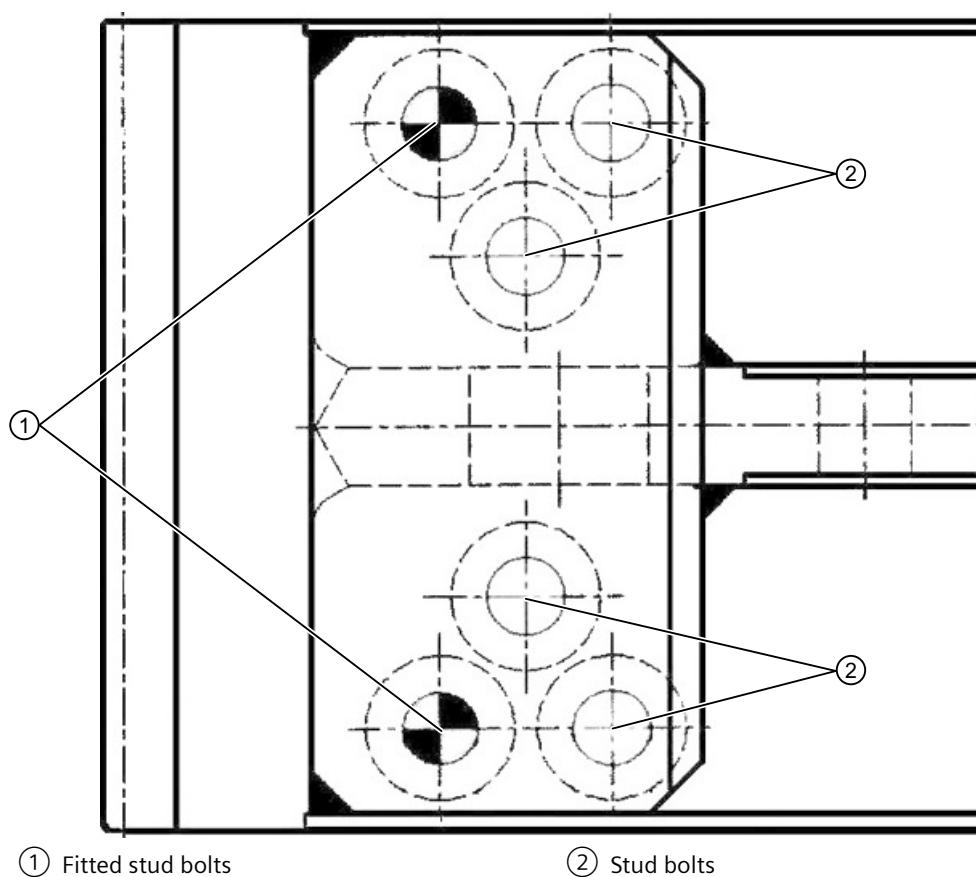


Figure 9-11 Bolt arrangement (example)

Removing fitted stud bolts and threaded bolts

To remove the fitted stud bolts on the outside and the stud bolts, proceed as follows:

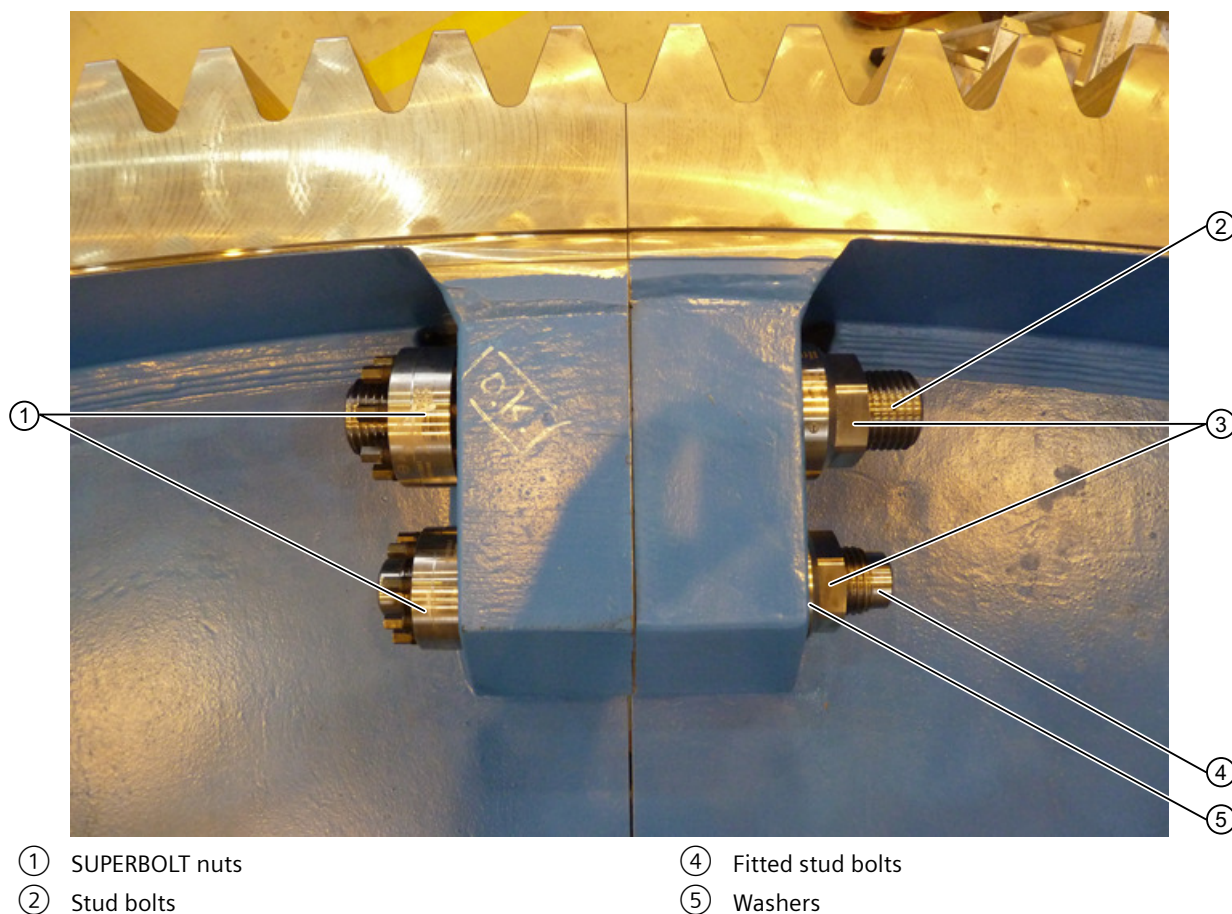
1. Remove the fitted stud bolts.
2. Remove the stud bolts.

Removing SUPERBOLT nuts

To avoid damage to the fastening elements, take the following precautions:

- Follow the separate instructions on SUPERBOLT nuts in the appendix of the complete documentation of the gear unit.

The following figure shows the bolted halves of the girth gear:



① SUPERBOLT nuts

② Stud bolts

③ SUPERBOLT flex nuts

④ Fitted stud bolts

⑤ Washers

Figure 9-12 Bolted halves of the girth gear

Cylindrical pins

Remove the four cylindrical pins before removing the connecting bolts. The cylindrical pins have an M24 internal thread on the face end for removal. Using a threaded rod and a hydraulic device, the cylindrical pins can be pulled out.

The following figure shows the mounted cylindrical pins between the thrust collar and the girth gear:



① Cylindrical pins for positioning

Figure 9-13 Mounted cylindrical pins (4x) between the thrust collar and the girth gear

9.8 Information about the tools required for removal

The following table contains a selection of the most important tools required to remove the girth gear and the gear unit modules:

Table 9-1 Tools for removal

Tool	Assembly specialist	Customer
2 load rings for transporting the gear unit module		X
Torque spanner for hex-socket nuts of the Superbolt clamping elements $T_A = 1^1$ Nm		X
2 hydraulic jacks 10 t		X
4 chain hoists 10 t		X
Loctite 574 sealant for sealing the transport cover on the KMRS		X
Solvent		X
Liquid adhesive Loctite 401		X
4 heavy duty rollers ¹⁾		X

¹⁾ You will find the required size, further data on the design and technical data in the dimension drawings and data sheets, which are part of the complete documentation of the gear unit.

Further information

You will find information on the weight and dimensions and further technical data in the dimension drawings and the data sheet drawn up specifically for the order, which are part of the complete documentation of the gear unit.

Information and data on the connecting pipes between the grinding bowl support, gear unit modules, oil supply systems and the screw connections between the girth gear and the thrust collar are provided in the documentation provided by the mill manufacturer.

9.9 Preparatory measures

Every opened KMRS, e.g. open labyrinth seal at the input shaft or removed cover section of the girth gear shroud system at the output of the KMRS, opening the oil supply systems, piping and releasing a cover or a screw plug must be closed as soon as possible. Otherwise, the guaranteed preservation duration is reduced.

Apply the following measures if the KMRS is opened:

- Mount the transport covers on the KMRS as early as possible, within a week, after disengaging the gear unit modules and removing the girth gear shroud system and seal the labyrinth seal on the input shaft with suitable adhesive tape.
- Apply preservation agent to the KMRS as described in Chapter Application planning (Page 35).

Service & Support

Contact

When ordering spare parts, requesting a customer service technician or if you have any technical queries, contact our factory or one of our Customer Service addresses:

Flender GmbH

Am Industriepark 2

46562 Voerde

Germany

Tel.: +49 (0)2871 / 92-0

Fax: +49 (0)2871 / 92-1544

Further information

Further information about service and support can be found on the Internet.

Service & Support (<https://www.flender.com/service>)

Disposal

Disposal of the gear unit

When disposing of the gear unit after its useful life, please observe the following measures:

- Remove operating oil, preservative agents and coolant from the gear unit and dispose of it according to regulations.
- Dispose of the gear unit parts according to applicable national regulations or recycle them.

Environmental protection

Observe the following environmental protection measures for disposal:

- Dispose of or recycle packaging material according to applicable national regulations.
- When changing the oil, collect the used oil in suitable containers. Use oil-binding agents to clean up any oil spillages immediately.
- Store preservative agents separately from used oil.
- Dispose of used oil, anti-corrosion agents, oil binding agents and oil-soaked cloths according to the applicable environmental protection regulations.

Spare parts

By stocking the most important spare parts at the installation site you can ensure that the gear unit is ready for use at any time.

Note

Damage to the gear unit due to use of unsuitable spare parts

Only use original spare parts from Flender. Flender shall not accept any warranty claims for spare parts that are not supplied by Flender.

Other spare parts are not tested and approved by Flender. Non-approved spare parts may possibly change the design characteristics of the gear unit and thus impair its active or passive safety.

Flender will accept no liability or warranty whatsoever for damage occurring as a result of the use of non-approved spare parts. The same applies to any accessories that were not supplied by Flender.

The contact address of the Flender customer service department can be found under Service & Support (Page 157).

Information required when ordering spare parts

To order spare parts, refer to the spare-parts list. Only use original spare parts from Flender.

When ordering spare parts, please provide the following information:

- Order number with item
- Type and size
- Part number
- Quantity

Declaration of incorporation

Declaration of incorporation

Company name and full address of the manufacturer:

Flender GmbH
Am Industriepark 2
46562 Voerde
Deutschland - Germany

Name and address of the person authorised to compile the relevant technical documentation:

Mark Zundel
Flender GmbH
Am Industriepark 2
46562 Voerde
Deutschland - Germany

Description and identification of the partly completed machinery:

Vertical mill gear unit MultipleDrive® for driving machines

The following "Essential health and safety requirements" of – Directive 2006/42/EC
pages 24-86, Annex I, are applied and are met:

Official Journal L 157, June 9, 2006,

1.1, 1.1.2, 1.1.3, 1.1.5; 1.2.4.4, 1.2.6; 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.6, 1.3.7, 1.3.8, 1.3.8.1; 1.4.1, 1.4.2.1;
1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.5.13, 1.5.15;
1.6.1, 1.6.2; 1.7.1, 1.7.1.1, 1.7.2, 1.7.4, 1.7.4.1, 1.7.4.2, 1.7.4.3

The special technical documentation as described in Annex VII Part B have been prepared.

The manufacturer undertakes to transmit, in response to a reasoned request by national authorities, the relevant technical documents on the partly completed machinery electronically.

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated is declared to be in conformity with the provisions of Directive 2006/42/EC.

Person authorised to issue this declaration of incorporation on behalf of the manufacturer:

Flender GmbH

Voerde, 2020-06-01

Mark Zundel, Vice President, Applications Plant Voerde

Original declaration of incorporation

Technical data

B.1 General technical data

Rating plate

The rating plate of the gear unit contains the most important technical data.

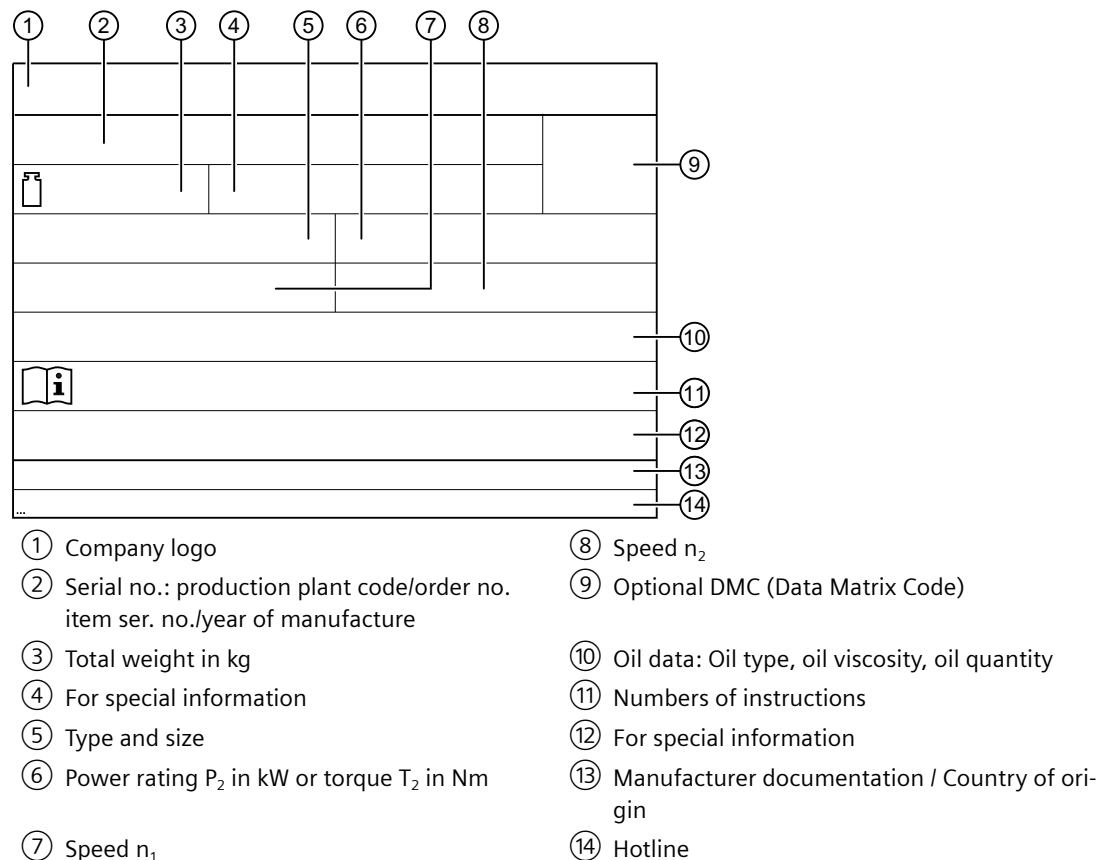


Figure B-1 Rating plate

The limits of the intended use of the gear unit are defined on the basis of these data and the contractual agreements concerning the gear unit concluded between Flender and the customer.

Further information

Further information about these technical data can be found in the separate data sheet in the complete documentation for the gear unit.

Further information about all major accessories including their technical data can be found in the order-specific list of equipment in the complete documentation for the gear unit.

B.2 Enveloping surface sound pressure level

The gear unit has an enveloping surface sound pressure level of $L_{pA} < 100$ dB(A) at 1 m distance.

The measurement is performed using the sound-intensity method according to DIN EN ISO 9614 Part 2.

B.3 Ambient temperature

Damaging effects

Make sure that the gear unit is not exposed to any damaging effects, unless otherwise agreed.

The following circumstances are examples of damaging effects:

- Chemically corrosive products
- Environments with high air pollution
- Environments with high air humidity

Further information

You will find further information on the design of the gear unit for an ambient temperature range in the separate data sheet drawn up specifically for the order, which is part of the complete documentation of the gear unit.

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[Flender GmbH](#)
Alfred-Flender-Straße 77
46395 Bocholt
GERMANY