FLENDER GEAR UNITS

Double-screw-extruder gear unit

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FLENDER

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Introduction 1

1.1 Legal information

Warning system

These instructions contain information you must observe for your own personal safety as well as to avoid damage to property and persons. The information regarding your personal safety is highlighted with a warning triangle. Information exclusively regarding property damage alone is not marked with a warning triangle. Depending on the hazard class, the warnings shall be depicted as follows, in descending order.

⚠ DANGER

means that death or severe physical injury **will** occur if the relevant precautionary measures are not taken.

⚠ WARNING

means that death or severe physical injury **may** occur if the relevant precautionary measures are not taken.

⚠ CAUTION

means that mild physical injury may occur if the relevant precautionary measures are not taken.

NOTE

means that damage to property may occur if the relevant precautionary measures are not taken.

If multiple hazard classes come into play, the warning for the highest level in question shall always be used. If a warning containing the warning triangle warns of harm to individuals, the same warning may also include a warning regarding damage to property.

Information



Information

Information offers additional notes, assistance and tips for handling the product.

Qualified personnel

The product/system associated with this documentation may only be used by **qualified personnel** trained to perform the relevant tasks, taking into account the associated documentation for the relevant tasks, particularly the safety information and warnings included therein. Due to their qualification and experience, qualified personnel are capable of detecting risks and avoiding potential hazards when dealing with these products/systems.

Intended use of Flender products

Please note the following:

⚠ WARNING

Flender products are only suitable for the uses set out in the catalogue and associated technical documentation. If third-party products and components are used, these must be recommended and/or authorised by Flender. Safe and flawless operation of the products requires proper transport, proper storage, setup, assembly, installation, commissioning, operation and maintenance. The permissible environmental conditions must be adhered to. Instructions in the associated documentation must be followed.

Trademarks

All designations marked with the trademark symbol ® are registered trademarks of Flender GmbH. Other designations in this document may be trademarks whose use by third parties for their own purposes may violate the rights of the owner.

Liability disclaimer

We have assessed the contents of these instructions for compliance with the hardware and software described. However, deviations cannot be ruled out, so we are unable to accept liability for full compliance. The details in these instructions are regularly reviewed and necessary corrections are contained in subsequent editions.

1.2 General information

Purpose of the operating instructions

These instructions describe the gear unit and inform you about its handling, from installation to maintenance.

Keep these instructions for later use. Read the instructions before handling the gear unit. Follow the instructions.

Information

Liability disclaimer

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

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

The described gear unit represents the state of the art at the time these instructions were printed.

In the interest of further development, Flender reserves the right to make such changes to the individual assembly units and accessories that increase performance and safety whilst maintaining the essential features.

Required basic knowledge

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

- Application planning
- Assembly
- Commissioning
- Maintenance

Documentation landscape

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

These 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
- Instructions 7300 on gear unit lubrication and preservation
- Instructions for mounted components
- Instructions for third-party devices

Copyright

The copyright for these instructions is held by Flender.

Without the authorisation of Flender, these 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 the Customer Services address (Page 79).

1.3 Lubricants

The quality of the oil used must meet the requirements of the instructions 7300, which is provided as a separate item, otherwise the warranty provided by Flender will be void. Flenderurgently recommends that one of the oil types listed in instructions 7300, which have been appropriately tested and comply with the requirements, is used.

To avoid misunderstandings, 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 actual quantity of oil required is determined by the marking on the oil dipstick or oil sight glass.

The instructions for the current lubricant recommendations of Flender can also be viewed on 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

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.

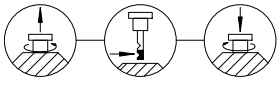
2.3 General information

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:

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		
Do not unscrew		
Alignment surface, horizontal		
Alignment surface, vertical		
These symbols indicate the oil level checking procedure using the oil dipstick.		

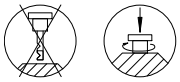
Points labelled on the gear unit	Symbol	Coloured markings
These symbols indicate that the oil dip-stick must be firmly screwed in.		

Table 2-1: Symbols and markings

2.4 General warnings and symbols

The following table contains general warnings and their associated symbols.

ISO	ANSI	Warning
		Warning – hazardous electrical voltage
		Warning – explosive substances
	---	Warning – entanglement hazard
	---	Warning – hot surfaces
	---	Warning – corrosive substances
	---	Warning – suspended load
	---	Warning – hand injuries

Table 2-2: General warnings

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 work on the gear unit when it is stopped.
- 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
- Protective gloves
- Safety glasses

⚠ 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 glasses.

Dangers during operation

Damage to the gear unit is possible.

Stop the gear unit immediately by switching off the drive aggregate if inexplicable changes are noticed during operation. Such changes may include unusual gear unit noise or increased 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 or its mounted components for maintenance and repair work during gear unit downtime. Do not walk or stand on shaft ends, protective covers, mounted components or pipework.



⚠ WARNING

Danger to life due to rotating or moving parts

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

Secure rotating and/or moving parts against contact using safeguards.

Surface temperature

Depending on operating conditions, the gear unit may reach extreme surface temperatures.



⚠ WARNING

Risk of burns

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

Wear appropriate protective gloves and protective clothing.

⚠ WARNING

Danger of scalding

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

Wear suitable protective gloves, safety glasses, and protective clothing.

⚠ WARNING

Danger due to cold temperatures

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

Wear appropriate protective gloves and protective clothing.

Chemical substances

Injuries can be sustained when using chemical substances.



⚠ WARNING

Risk of chemical burns from chemical substances

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

Please observe the manufacturer's instructions on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety glasses). Remove any spilled solvent immediately with binding agents.

⚠ CAUTION

Risk of injury due to chemically aggressive operating materials

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

Please observe the safety information in the data sheets of the oil used. Wear suitable protective equipment (gloves, safety glasses). Immediately clean up any spilt oil using a binding agent.

Danger of explosion

An explosion might occur in a potentially explosive atmosphere.



⚠ DANGER

Danger of explosion though ignition of a potentially explosive atmosphere

Danger to life though 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 in the Annex (Page 87). Deviating operating conditions are considered improper use. The user or operator 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 instructions. This also applies to the guards designed to prevent accidental contact.
- Only ever use original replacement parts.
  Other replacement parts are not tested and approved by Flender. Non-approved replacement 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 replacement parts. The same applies to any accessories which were not supplied by Flender.

If you have any questions, please contact Customer Service (Page 79).

⚠ WARNING

Risk of falling

Risk of serious injury through falling.

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

Using the gear unit

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

- Ensure that the gear unit is operationally safe.
- The gear unit must only be operated, maintained and repaired by authorised, trained, instructed and qualified personnel.
- The relevant occupational safety and environmental protection provisions must be taken into account in transport, assembly and dismantling, operation, servicing and maintenance.
- Cleaning the outside of the gear unit with a high-pressure cleaning device is not permitted.

- Do not perform any welding work anywhere on the gear unit or connected parts. Do not use the gear unit or connected parts as an earthing point for electric-welding operations. Gear parts and rolling-contact bearings may be irreparably damaged by welding.
- Perform potential equalisation in accordance with the applicable regulations and directives.
  If there are no threaded holes on the gear unit for an earth connection, other suitable measures must be taken. This work must be carried out by specialists in electrical engineering.
- 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 flowing through the gear unit can result in irreparable damage to rolling-contact bearings and gears. 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.
- When removing any guards, store their fixings in a safe place.
- Removed guards must be re-fitted prior to starting.
- Observe the notices mounted on the gear unit, e.g. rating plate, direction of rotation arrow symbol, etc. The notices must be kept free from paint or dirt. Replace any missing, illegible or damaged plates.
- Screws which have become unusable during assembly and dismantling must be replaced with new screws of the same strength class and design.

⚠ DANGER

Danger to life when the system is switched on

Death or serious injury will occur.

Always shut down the gear unit and any oil supply system (whether separate or attached to the gear unit) before you perform any work. Secure the drive aggregate against being operated accidentally as follows:

- Turn off the key-operated switch.
- Remove the fuses in the power supply.
- Attach an information notice to the start switch, clearly stating that work is being carried out on the gear unit.
- Ensure that the entire system is not under a load to avoid danger during dismantling work.

Further use of the gear unit

When integrating the gear unit in machines or systems, the machine or system manufacturer is obliged to include the provisions, instructions and descriptions contained in this set of instructions in their machine instructions.

Description 3

3.1 General description

The FLENDER® gear unit (referred to below simply as "gear unit") described in these operating instructions has been developed to drive twin-screw extruders.

The gear unit has been approved for only one direction of rotation. The direction of rotation of the motor must match the direction of rotation arrow marked on the input shaft of the gear unit.

3.2 Housing

Introduction

The housing is made of cast iron. When specified, the housing can also be manufactured out of steel.

The housing is a multiple-part component.

The standard version of the gear unit housing has the following features:

- Attachment points for moving the gear unit
- Inspection and assembly cover for inspection and oil filling
- Oil sight glass for checking the oil level
- Oil drain screw for changing the oil
- Air filter for ventilation and bleeding

More information

Further information and a detailed illustrated description of the gear unit can be found in the drawing in the complete documentation for the gear unit.

3.3 Lubrication and cooling

The gear unit is lubricated and cooled by pressure lubrication provided by a mounted or separate oil supply system.

For gear units with an oil supply system, all of the monitoring devices must be connected up and function-tested before commissioning.

NOTE
Damage to the gear unit due to insufficient oil The gear unit or parts of the gear unit can sustain irreparable damage if they are not supplied with a sufficient quantity of oil. The oil supply line must be monitored by a separate pressure monitor.

Principle of operation

The gear unit has the capacity to hold all of the oil required to provide lubrication and cooling. The external oil supply system draws in the oil and pumps the cooled and cleansed oil back to the gear unit. The oil passes to the rolling-contact bearings and gearing via lube oil holes.

Further information

You can find additional information about separate oil supply systems in the oil supply system operating instructions in the complete documentation for the gear unit.

You can find additional information about the components of the oil supply system in the operating instructions for the components in the complete gear unit documentation.

You can find additional technical data in the separate data sheet and in the list of equipment in the complete documentation for the gear unit.

3.3.1 Mounted oil supply system

3.3.1.1 Mounted oil supply system with water-oil cooler

Introduction

Depending on the order specification, an oil supply system with water-oil cooler can be used. This oil cooling system is mounted on the gear unit.

Principle of operation

The water-oil cooler is used to cool the gear unit oil; water is used as coolant.

For certain applications, a motor pump can be used instead of a flange pump. Switch on the motor pump five minutes before you start up the gear unit.

A mounted oil supply system with water-oil cooler can include the following components:

- Water-oil cooler
- Flange or motor pump
- Oil filter (coarse filter or a double change-over filter)
- Pressure monitor
- Pipes

The operating company must establish the cooling water connection required.

Information

Observe the flow direction of the pump

When connecting the valves, observe the actual flow direction of the pump.

Refer to the pump operating instructions in the complete gear unit documentation to ascertain whether the flow direction of the pump used depends on the direction of rotation.

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

- Make sure that the cooling water pressure does not exceed 8 bar.
- Maintain the specified flow direction of the water-oil cooler so that an optimum cooling power is achieved. Do not interchange the cooling water intake and outlet.
- If there is a risk of freezing temperatures or the gear unit is to remain out of service for a prolonged period, drain the cooling water out of the coil and blow the coil out with compressed air to remove any water residue.

⚠ WARNING

Risk of eye injury from compressed air

Water residue and dirt particles can cause damage to eyes.

Wear suitable safety goggles.

Further information

You can find additional information, such as connection dimensions and a detailed illustrated description of the gear unit and the oil supply system with water-oil cooler, in the drawing, which is part of the complete documentation of the gear unit.

You can find additional information about the oil supply system, control notes, the required cooling water quantity and the maximum permissible water intake temperature in the separate data sheet, in the list of equipment and in the oil supply system operating instructions in the complete gear unit documentation.

3.3.1.2 Pump

Requirements placed on the medium being pumped

The pump being used is suitable for pumping lubricating oil. It is not permissible that the oil contains abrasive components and must not chemically attack the materials used in the pump. Clean oil with good lubricating properties is a precondition for ensuring the correct function, high operational reliability and long service life of the pump.

3.3.1.3 Oil filter

Introduction

The oil filter protects downstream units, measuring and control devices against dirt and pollution.

Principle of operation

The oil filter comprises a housing with connections and a filter cartridge. The medium flows through the filter housing, where, depending on the filter gauge, most of the dirt particles larger than a defined size in the oil are filtered out. Dirty filter cartridges must be cleaned or replaced.

3.3.2 Separate oil supply system

A separate oil supply system can be used for cooling the oil.

Further information

You can find additional information about separate oil supply systems in the oil supply system operating instructions in the complete documentation for the gear unit.

You can find additional information about the components of the oil supply system in the operating instructions for the components in the complete gear unit documentation.

You can find additional technical data in the separate data sheet and in the list of equipment in the complete documentation for the gear unit.

3.4 Bearing arrangement of the shafts

All shafts are mounted in rolling-contact bearings.

Thrust bearings are integrated in the gear unit to absorb the axial forces generated by the worm gears.

Supplementary cylindrical roller thrust bearings apply preload to the main thrust bearings for no-load operation and fix the extruder shafts axially in the discharge direction.

3.5 Shaft seal

Introduction

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

3.5.1 Rotary shaft sealing rings

Rotary shaft sealing rings are the standard seal used. Wherever possible, rotary shaft sealing rings are equipped with an additional dust lip which protects the actual sealing lip against external contaminants.

Hardened rings or protective sleeves are provided for all rotary shaft sealing rings.

NOTE
Irreparable damage to the rotary shaft sealing ring caused by high concentration of dust A damaged rotary shaft sealing ring might not be able to effectively seal the gear unit. In very dusty atmospheres, do not use rotary shaft sealing rings unless they have additional protection.

The diagram below shows a rotary shaft sealing ring

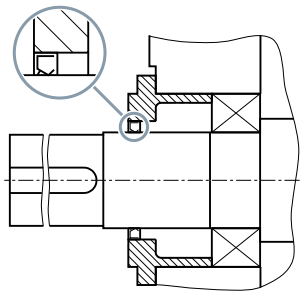


Figure 3-1: Rotary shaft sealing ring

3.5.2 Taconite seal

The taconite seal is a combination of two sealing elements:

- Rotary shaft sealing ring 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

The taconite seal is ideal for use in dusty environments.

NOTE

Gear unit leaks caused by poor sealing

Regrease the labyrinth seals at the specified regreasing intervals. The regreasing intervals are specified in the Maintenance schedule (Page 71).

A taconite seal is illustrated in the diagram below:

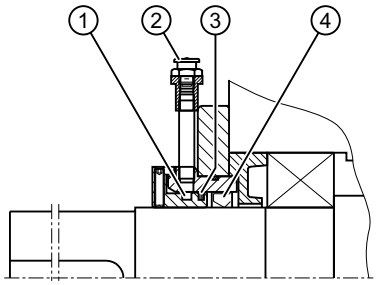


Figure 3-2: Taconite seal

① Labyrinth, filled with grease, can be re-greased
② Grease nipple
③ Lamellar seal
④ Rotary shaft sealing ring

NOTE

Sparking, inadmissible temperature rise and shaft seal wear due to insufficient gap dimension

An insufficient gap dimension can cause sparking, inadmissible temperature rise and shaft seal wear.

If the shaft is sealed by Taconite seals, ensure that the set gap dimension of $1^{+0.5}$ mm on the grease labyrinth is not changed when the input and output elements (e.g. coupling parts) are mounted. Rotating and stationary parts must not touch.

3.6 Couplings

Flexible couplings or safety couplings are generally used at the input end of the gear unit.

Use of rigid couplings or other input or output elements that generate additional radial or axial forces (e.g. gear wheels, belt pulleys, flywheels or hydraulic couplings) must be agreed contractually.

Couplings with circumferential velocities on the outer diameter of up to 30 m/s must be statically balanced. Couplings with circumferential velocities above 30 m/s require dynamic balancing.

When installing the drives, align the individual components with each other precisely to minimise restoring forces due to angular and axial misalignments and to prevent premature wear of flexible coupling elements.

Further information

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

3.7 Heating

Introduction

At low temperatures, it may be necessary to preheat the gear oil before the drive is switched on or also during operation.

Heating elements

Depending on the order specification, the gear unit can be fitted with heating elements. Heating elements convert electricity into heat and transfer this to the oil in which they are immersed.

Make sure that the heating elements are fully immersed in the oil bath by ensuring the correct mounting position as shown in the drawings in the complete documentation and by maintaining the prescribed oil level.



⚠ WARNING

Explosion and 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.

If heating elements are retrofitted, the heat output at the outer surface of the heating element must not exceed the maximum values stated in the table below.

The following table contains information about the specific heat output P_{HO} as a function of ambient temperature:

P_{HO} in W/cm^2	Ambient temperature in °C
0.9	10 to 0
0.8	0 to -25
0.7	-25 to -50

Table 3-1: Information about the specific heat output

Control of the heating elements

The heating elements can be controlled by a temperature monitor or an oil-temperature monitoring system (Page 29). The temperature monitor provides a signal to be amplified when the minimum and maximum temperatures are reached.

More information

You can find additional information about the position of the mounted components and a detailed illustration of the gear unit in the 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.

You can find additional information about the temperature monitor as well as control instructions in the list of equipment and the temperature monitor operating instructions in the complete documentation for the gear unit.

3.8 Oil temperature monitoring

Depending on the order specification, the gear unit can be fitted with a Pt 100 resistance thermometer for measuring the oil temperature in the oil sump.

To measure temperatures or temperature differences, connect the Pt 100 resistance thermometer to an evaluation unit (to be supplied by the customer). The resistance thermometer is fitted with a connector head for the wiring. A two-wire circuit is provided by the manufacturer, but customers can also configure a three or four-wire circuit.

Further information

Further information and a detailed illustration of the gear unit and the position of the mounted components can be found in the 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.

3.9 Oil level indicator

For visual monitoring of the oil level, an oil sight glass is mounted on the gear unit.

Check the oil level during gear unit downtime.

Further information

You can find further information about the oil level indicator in the instructions 7300 in the complete documentation for the gear unit.

You can find further information and a detailed illustration of the gear unit and the position of the mounted components in the drawing in the complete documentation for the gear unit.

3.10 Oil level monitoring system

Introduction

Depending on the order specification, the gear unit can be equipped with an oil level monitoring system based on a level monitor, a level switch or a filling-level limit switch.

The oil level monitoring system has been designed to check the oil level when the gear unit is at a standstill before it starts.

Mounting position

When an oil level monitoring system is used, particularly ensure that the gear unit is mounted in the specified position.

Principle of operation

Connect the signal so that the drive motor cannot start when the "oil level too low" signal is active.

Further information

You can find additional information and a detailed illustration of the gear unit and the position of the mounted components in the drawing in the complete documentation for the gear unit.

You can find additional information on the oil temperature monitoring system and technical data in the operating instructions for the oil temperature monitoring system and in the list of equipment, which are part of the complete documentation of the gear unit.

3.11 Axial load monitoring

Introduction

Depending on the order specification, the gear unit can be equipped with an axial load monitoring system.

The axial load from the worm shaft is monitored by a built-in load cell. Connect this to an evaluation unit provided by the customer.

Further information

You can find additional information and a detailed illustration of the gear unit and the position of the mounted components in the drawing in the complete documentation for the gear unit.

You can find additional information about axial load monitoring and technical data in the operating instructions for the axial load monitoring system and in the list of equipment in the complete documentation for the gear unit.

3.12 Bearing monitoring

3.12.1 Bearing monitoring by shock-pulse transducer

Depending on the order specification, the gear unit can be equipped with measuring nipples for monitoring the bearings.

These measuring nipples are used to attach shock-pulse transducers with quick-release coupling and are mounted on the housing close to the rolling-contact bearings to be monitored.

Further information

You can find additional information and a detailed illustration of the gear unit and the position of the mounted components in the drawing in the complete documentation for the gear unit.

You can find additional information about the components in the component operating instructions in the complete documentation for the gear unit.

You can find additional information about the technical data in the separate data sheet or in the list of equipment in the complete documentation for the gear unit.

3.13 Speed monitoring

Depending on the order specification, an incremental speed encoder can be fitted.

Customers must establish the wiring and provide the evaluation unit required.

Further information

You can find additional information and a detailed illustration of the gear unit and the position of the mounted components in the drawing in the complete documentation for the gear unit.

You can find additional information on the incremental speed encoder (such as control instructions) and technical data in the operating instructions for the incremental speed encoder and in the list of equipment provided in the complete documentation for the gear unit.

Application planning 4

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 79) 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 is delivered fully assembled. Additional items such as auxiliary drive, couplings, oil supply system, pipework and valves may be delivered separately packaged, as necessary.

Transportation instructions and the positions of the attachment points can be found in the transport drawing or the dimension drawing. This drawing is attached to the gear unit.

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

- The gear unit may only be transported using suitable means of transport.
- Transport the gear unit emptied of oil and leave the gear unit on the transport packaging.
- Do not use incorrect attachment points.
  The threads in the front shaft ends must not be used for attaching lifting equipment.
- Do not use the pipework for moving the gear unit.
- Ensure that the lifting equipment is able to bear the weight of the gear unit plus a safety margin.



⚠ 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.

- Watch for damage while transporting the gear unit.

NOTE

Damage to the gear unit

When transporting the gear unit, the packing and/or the gear unit paint coating can be damaged.

When the product is in a raised position, transport it slowly and carefully to avoid damaging the packing and/or the paint coating.

NOTE

Damage to the gear unit caused by shock/blows applied to the free shaft ends

The gear unit can be damaged due to shock/blows applied to the free shaft ends.

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

Avoid that the free shaft ends are subject to any shock or load.

Attaching the load

For transport, only attach the gear unit at the marked attachment points intended for this purpose.

Ensure the following measures are taken when attaching, lifting, lowering and moving the load:

- Keep within the load limits
- When using loading suspension devices with several load hooks, ensure the load is evenly distributed
- Be aware that the centre of gravity may not be in the centre
- Ensure that lifting equipment is correctly secured
- Move the equipment slowly
- Load sway and attachment of the load to objects or parts of buildings is not permissible
- Load hooks must not be loaded at the tip
- Only set down products on a flat, non-slip and strong 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 is delivered fully assembled. Any additional equipment is supplied in separate packaging where applicable.

The way the gear unit is packaged may vary, depending on the transport route and size.

The symbols which appear on the packaging must be observed.

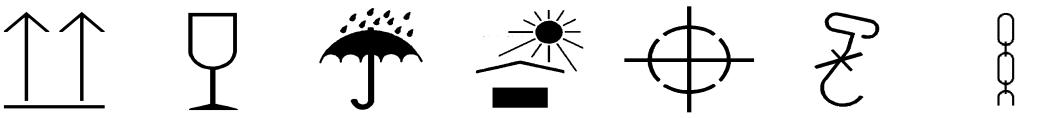


Figure 4-1: Transport symbols

4.3 Attachment points

Lifting eyes

Lifting eyes are fitted to the individual housing sections and used to transport the unit during assembly.

Carefully ensure that the angle of the vertical load at the gear units lifting eyes does not exceed 45°.

Sling swivels

Gear units have tapped holes to specifically attach lifting eyes so that they can be transported during assembly.

The shear pulling must not exceed 45° when the lifting equipment is attached to sling swivels.

Information

Damage to the gear unit during transport

If incorrect attachment points are used, gear units can be damaged when they are transported.

Eye bolts

The use of sling swivels instead of eye bolts is generally recommended.

When using eye bolts, please note that their load-bearing capacity may be reduced if they are alternately attached to different components that require moving.

It is not permitted to load eye bolts through lateral pulling contrary to the direction of the eye plane.

The following figure shows the permissible shear and lateral pulling when using eye bolts:

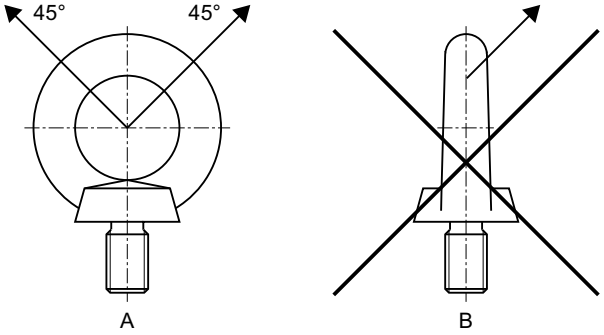


Figure 4-2: Shear and lateral pulling when using eye bolts

A Permitted shear pulling in direction of eye plane (maximum angle of 45°)

B Non-permitted lateral pulling contrary to direction of eye plane

Further information

You will find further information and a detailed illustration of the gear unit, the position of the attachment points, the centre of gravity and data on the weight in the transport drawing and the dimension drawing in the complete documentation of the gear unit.

Drive units with additional components mounted on the gear unit (such as drive motor, coupling, etc.) may require an extra attachment point owing to the displacement in the centre of gravity caused by the mounted components.

Assembly 5

5.1 General assembly instructions

Assembly work must be performed very carefully by authorised, trained and suitably instructed personnel. Liability is excluded for damage caused by the incorrect performance of this work.

Requirements

Improper use can damage the gear unit. 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 the fastening points provided in the particular unit design.
- Replace any bolts that can no longer be used with bolts of the same strength class and type.
- Make sure that sufficient hoisting gear is available.
- Observe the foundation and installation plan as well as the installation instructions for the Extruder.

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. Take suitable measures to ensure that unhindered convection across the housing surface is possible so that the gear unit does not overheat.

Do not use incorrect attachment points (Page 35). The position of the attachment points is shown in the dimension drawing or the transport drawing in the complete documentation for the gear unit. To ensure that the unit is properly lubricated during operation, please observe the mounting position specified in the dimension drawings.

More information

Further information about dimensions, space requirements and arrangement of supply connections can be found in the drawings in the complete documentation of the gear unit.

NOTE

Heating of the gear unit by external heat sources

The gear unit must not be heated by external heat sources (exposure to direct sunlight, for example) while it is in operation and measures must be taken where necessary to protect it.

You can take the following measures to protect the gear unit against this hazard:

- A sun shield
- An additional cooling device
- A temperature monitoring device with trip function in the oil sump

If you use a sun shield, this may cause a build-up of heat.

If you use a temperature monitoring device, it must be capable of issuing an alarm when the maximum permissible oil sump temperature is reached. It must also be capable of tripping the drive when the maximum permissible oil sump temperature is exceeded. The operator's process might be interrupted when the drive is shut down.



⚠ WARNING

Ignition of vapours emitted from solvents.

There is a risk of injury due to ignition of vapours emitted from solvents when carrying out cleaning work.

Please note the following:

- Ensure adequate ventilation.
- Do not smoke.

5.2 Unpacking the gear unit

Introduction

The scope of delivery is listed in the shipping documents.

⚠ WARNING

Severe injury caused by the content of the packing sliding

There is a risk of being crushed when opening the packing in which the part is transported.

While being transported, the content of the packing can slide.

Carefully open the packing.

Wear suitable protective equipment (gloves, safety goggles).

⚠ WARNING

Risk of serious injury due to defective product

A defective gear unit can result in serious injury.

Do not put the gear unit into operation if any damage is visible.

Contact Customer Services (Page 79).

Requirements

Check that everything has been delivered immediately upon receipt.

NOTE

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. Immediately report any damaged and/or missing parts to Customer Services (Page 79).
4. Dispose of packaging material and transport devices in accordance with regulations.

5.3 Gear unit assembly

5.3.1 Foundation

Properties of the foundation

The foundation must have the following properties:

- Horizontal and level
- Stable
- The foundation must be designed for torsional rigidity
- Reaction forces from the gear unit must be braced

Requirements of the foundation

The foundation must meet the following requirements:

- Construct the foundation in such a way that it does not produce any resonance vibrations and that it is isolated against the transmission of vibrations from adjacent foundations.
- Design the foundation according to the relevant weight and torque, taking into account the forces acting on the gear unit.
- Align the foundation carefully with the equipment installed on the input and output sides of the gear unit.
- Take any elastic deformation that may be caused by operating forces into account.
- Install lateral stops to prevent displacement if external forces are acting on the gear unit.

NOTE

Lack of stable foundation for the gear unit

Damage to the gear unit is possible if it is not mounted on a stable foundation.

Use bolts of at least strength class 8.8. Information and guidance on the tightening torque can be found in chapter Tightening procedure (Page 59). Tighten the fastening bolts and nuts to the specified tightening torque. When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.

5.3.2 Description of assembly work



⚠ CAUTION

Risk of chemical burns from chemical substances

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

Please observe the manufacturer's instructions on how to handle cleaning agents and solvents. Wear suitable protective equipment (gloves, safety glasses). Remove any spilled solvent immediately with binding agents.

Improper use can damage the gear unit. Take the following precautions:

- Use a suitable cleaning agent to remove the corrosion protection from the shafts and mounting surfaces.
- Do not allow the cleaning agent to come into contact with the shaft sealing rings.
- Remove the sealing plugs and locking flanges.
- Install the separately supplied valves in accordance with the drawings in the complete documentation for the gear unit.
- Mount the input and output elements (e.g. coupling parts) on the shafts and lock them securely. See the Couplings (Page 51) chapter.
- Use suitable hoisting gear to place the gear unit in position.

More information

Further information about removing the corrosion protection can be found in the instructions 7300 in the complete documentation for the gear unit.

You can find more information on attaching gear units to hoisting gear in cases where the weight of the gear unit necessitates the use of hoisting gear in the Application planning (Page 33) chapter.

If the gear unit is to be transported with mounted parts and components, then it may be necessary to use additional attachment points. The position of these attachment points can be found in the order-specific transport drawing or dimension drawing in the complete documentation for the gear unit.

Gap dimension at grease labyrinth

The following figure shows the gap dimension at the grease labyrinth:

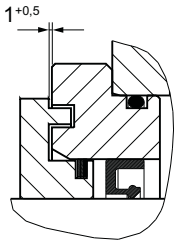


Figure 5-1: Gap dimension at grease labyrinth

NOTE
Sparking, inadmissible temperature rise and shaft seal wear due to insufficient gap dimension An insufficient gap dimension can cause sparking, inadmissible temperature rise and shaft seal wear. In the case of a shaft seal with Taconite seals, ensure that the set gap dimension of $1^{+0.5}$ mm on the grease labyrinth is not changed when the input and output elements (e.g. coupling parts) are mounted. Rotating and stationary parts must not touch.

5.3.2.1 Aligning

Introduction

Depending on the order specification, the top of the housing has machined surfaces (alignment surfaces) to assist with provisional alignment of the gear unit in the horizontal direction.

⚠ DANGER

Risk of fatal injury from flying fragments

Failure to align the unit with the required degree of accuracy can cause the shaft to rupture. A ruptured shaft can result in serious or even fatal injuries.

Align the gear unit exactly so that it conforms to the specified alignment values.

Damage to the gear unit or its components or mounted parts is possible.

The accuracy of the alignment between the shaft axes largely determines the service life of the shafts, rolling-contact bearings and couplings. Please therefore always endeavour to achieve zero deviation in the alignment of the shaft axes (does not apply to ZAPEX couplings or cardan shafts). In this context, please also refer to the relevant operating instructions for further information about, for example, the requirements of couplings.

Procedure

The gear unit can be equipped with alignment threads in the housing feet to make it simpler to align.



Figure 5-2: Alignment surface

To align the gear unit by its alignment surface, proceed as follows:

1. For the precise position of the alignment surfaces, refer to the drawings (alignment record) in the complete documentation.
2. Note the values inscribed in the alignment surfaces.
3. Use these surfaces as a guide for aligning the gear unit horizontally to ensure that it will run smoothly.

Tools

The following tools are needed to perform the final fine alignment (Page 53) work on the shaft axes of the gear unit and the equipment installed on the input and output sides.

- Rulers
- Spirit level
- Dial gauge
- Laser alignment system
- Feeler gauge etc.

Once the gear unit is finely aligned, tighten the foundation bolts and check the settings again. Record the alignment dimensions and keep the alignment record in a safe place together with these operating instructions.

5.3.2.2 Installation on a foundation frame

Requirements

The following requirements must be fulfilled before the assembly work commences:

- The foundation must be horizontal and level.

- When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.

NOTE

Poor stability

Damage to the gear unit is possible if it is not mounted on a stable foundation.

Make sure that the foundation frame is horizontal and level. It is particularly important that the surface on which the gear unit is mounted is level because this determines the contact pattern of the teeth and the load on the rolling-contact bearings, and so has an influence on the service life of the gear unit. All points on the gear unit mounting surface must lie between two imaginary parallel planes that are 0.1 mm per 1 m apart.

Design the foundation frame according to the relevant weight and torque, taking into account the forces acting on the gear unit. The feet of the gear unit must be properly supported. Base frames or substructures that are too soft can result in radial or axial displacement during operation. This displacement is not measurable when the drive is at a standstill.

Procedure

To install the gear unit on a foundation frame, proceed as follows:

1. Clean the underside of the gear unit feet.
2. Use suitable hoisting gear to set the gear unit down on the foundation frame.
3. Tighten the foundation bolts to the specified tightening torque (Page 59). If necessary, install stops to prevent displacement.
4. Align the gear unit precisely with the input and output equipment (Page 41).
5. Record the alignment dimensions.
6. Keep the report in a safe place together with these operating instructions.

NOTE

Damage caused by unevenly tightening the fastening bolts

The gear unit can be damaged by unevenly tightening the fastening bolts.

Evenly tighten the fastening bolts. When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.

5.3.2.3 Mounting on a concrete foundation using stone bolts or foundation blocks

Requirements

The lower side of the gear unit mounting feet must be clean.

Mounting a gear unit using stone bolts

The following diagram shows a stone bolt:

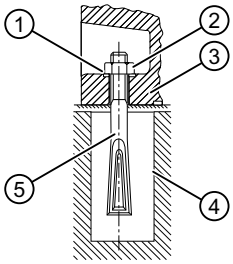


Figure 5-3: Stone bolt

① Washer
② Hexagon nut
③ Gear unit foot
④ Foundation
⑤ Stone bolt

Proceed as follows to mount the gear unit using stone bolts:

1. Attach the stone bolts with washers and hexagon nuts in the foundation mounting points in the gear unit housing.
2. Using a suitable crane or lifting gear, place the gear unit down on the concrete foundation.
3. Align the gear unit so that the input and output shafts are horizontal using shims (Page 41).
4. For higher external forces, if necessary, use lateral stops to prevent the gear unit shifting.
5. Pour concrete into the recesses in the concrete foundation for the stone bolts.
6. After the concrete has set, tighten the hexagon nuts of the stone bolts with the specified tightening torque (Page 59).
7. Record the alignment dimensions and keep the report in a safe place together with these operating instructions.

NOTE

Damage caused by unevenly tightening the hexagon nuts

The gear unit can be damaged by unevenly tightening the hexagon nuts.

Evenly tighten the hexagon nuts. Ensure that the gear unit is not deformed or distorted when tightening the fastening bolts.

Mounting gear units using foundation blocks

The following diagram shows a foundation block:

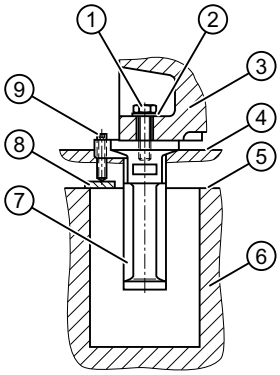


Figure 5-4: Foundation block

① Fastening bolt	⑥ Foundation
② Washer	⑦ Foundation block
③ Gear unit foot	⑧ Flat steel plate
④ Height of the completed foundation	⑨ Set screw
⑤ Height of the prepared foundation	

Proceed as follows to mount the gear unit using foundation blocks:

1. Attach the foundation blocks with washers and fastening bolts in the foundation mounting points in the gear unit housing.
2. Tighten the fastening bolts until the housing feet are lying flat on the foundation blocks.
3. Using a suitable crane or lifting gear, place the gear unit down on the concrete foundation.
4. Align the gear unit so that the input and output shafts are horizontal using the set screws (if available) (Page 41).
5. For higher external forces, if necessary, use lateral stops to prevent the gear unit shifting.
6. Before casting the foundation, close the openings in the foundation blocks using a suitable material (e.g. using polystyrene).
7. Pour concrete into the recesses in the concrete foundation for the foundation blocks.
8. After the concrete has set, tighten the fastening bolts of the foundation blocks with the specified tightening torque (Page 59).
9. Record the alignment dimensions and keep the report in a safe place together with these operating instructions.

NOTE

Damage caused by unevenly tightening the fastening bolts

The gear unit can be damaged by unevenly tightening the fastening bolts.

Evenly tighten the fastening bolts. Ensure that the gear unit is not deformed or distorted when tightening the fastening bolts.

5.3.2.4 Mounting on a concrete foundation using anchor bolts

Requirements

The lower side of the gear unit mounting feet must be clean.

Inserting the anchor bolt

The following diagram shows the inserted anchor bolt:

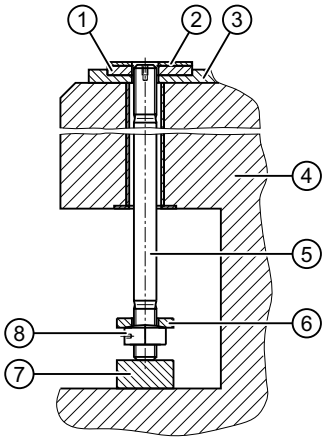


Figure 5-5: Inserted anchor bolt

① Baseplate	⑤ Anchor bolt
② Support	⑥ Pressure plate
③ Fine-grout concrete	⑦ Wood
④ Raw foundation	⑧ Hexagon nut

Proceed as follows to insert the anchor bolt:

1. Place the support on the baseplate embedded in the fine-grout concrete.
2. Insert the anchor bolt.
3. Attach the pressure plate and tighten the nuts.
4. Place a piece of wood under the anchor bolt so that it is approximately 10 mm from the upper edge of the support.
5. Using suitable lifting gear, set the gear unit down in position.

Mounting the gear unit using anchor bolts

The following diagram shows a tightened anchor bolt:

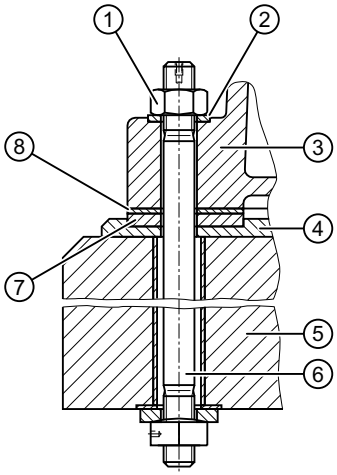


Figure 5-6: Tightened anchor bolt

① Hexagon nut
② Washer
③ Housing foot
④ Fine-grout concrete
⑤ Raw foundation
⑥ Anchor bolt
⑦ Baseplate
⑧ Support

Proceed as follows to mount the gear unit using anchor bolts:

1. Pull the anchor bolts upwards. To do this you can use a screw or threaded bar that you screw into the thread on the end face.
2. Attach the washer.
3. Screw on the hexagon nut by hand a few turns.
4. Align the gear unit with the supports (Page 41).
   - Observe the values on the alignment strips.
   - Maintain the alignment tolerances to the units connected at the input and output according to the permissible angular and axial displacements of the couplings.
5. Document the alignment dimensions in the form of a report, and archive this together with these instructions.
6. Keep the anchor bolts in their position by tightening the nuts by hand.
7. Locate the protective sleeve.
8. Attach the hydraulic clamping device.
9. Tighten the screws alternating, taking into account the preload forces (Page 59).
10. Tighten the hexagon nuts to their end stops using a suitable tool.
11. Document the tensioning pressures and preload forces, and archive this report together with these instructions.

⚠ CAUTION

Incorrect use of the preload tool

Incorrectly using the preload tool can result in injury.

To ensure correct handling and adjustment of the preload tool, you must carefully comply with the instructions provided in the manufacturers operating instructions for the preload tool.

NOTE

Inadequate concrete hardness and strength

Damage caused by inadequate stability of the gear unit as a result of inadequate concrete hardness and strength is possible.

The fine-grout concrete must be allowed to harden for at least 28 days before tensioning the anchor bolts.

5.4 Installing the extruder unit

5.4.1 Assembly

5.4.1.1 Introduction

Measures to be taken prior to assembly

⚠ CAUTION

Risk of injury due to chemical substances

Observe the manufacturer’s guidelines on how to handle lubricants and solvents.

Wear suitable protective clothing.

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

- Use a suitable cleaning agent to remove the corrosion protection from the shafts and the contact surface at the connecting flange.
- Inspect the seats and edges at the output and worm shafts to check for any damage.
- If necessary, rework the components with an appropriate tool and then clean them again.
- Apply an appropriate lubricant to the contact surfaces to protect them against fretting corrosion.

NOTE
Risk of damage to shaft sealing rings from cleaning agent Aggressive chemical cleaning agents may cause damage to shaft sealing rings. Do not allow the cleaning agent to come into contact with the shaft-sealing rings.

5.4.1.2 Check position of output shafts

Procedure

Proceed as follows to check the preset shaft position (timing):

1. Keep turning the drive shaft in the working direction of rotation until the output has rotated 1 to 2 revolutions depending on the transmission ratio. You can also rotate the drive shaft by hand.
2. Then place the template on the left-side output shaft as seen when looking at shaft end face D2



Figure 5-7: Right-rotating gear unit at 4 o'clock

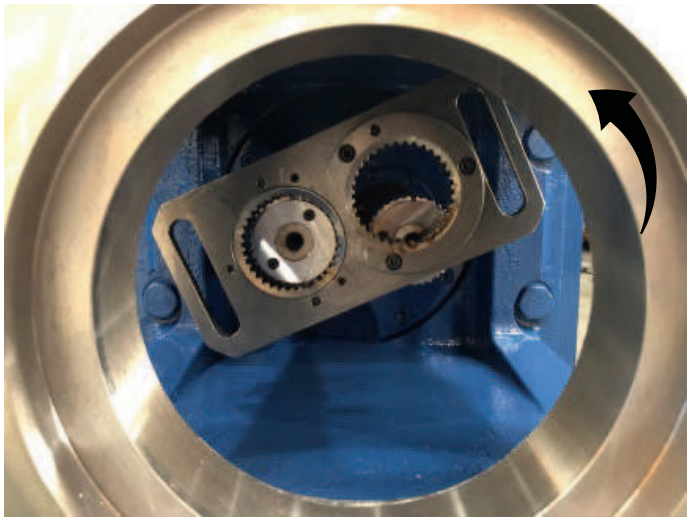


Figure 5-8: Left-rotating gear unit at 2 o'clock

Now turn the shaft by the template in the opposite direction to the working direction of rotation until the template is pushed on in the horizontal plane. The load edges in the gear unit are then flush.

You can also rotate the drive shaft in the working direction of rotation.

5.4.1.3 Assembly

Procedure

NOTE
Damage to the gear unit The gear unit or individual components can be damaged if the unit is poorly aligned. When installing the drives, make sure that the individual components are precisely aligned with one another. Inadmissibly high alignment errors of the shaft ends to be connected as a result of angular or axial offset result in premature wear and material damage. Base frames or substructures that are too soft can cause the coupling parts to become radially and axially displaced during operation. This displacement is not measurable when the drive is at a standstill.

To install the extruder unit, proceed as follows:

1. Push the coupling sleeves onto the gear unit output shafts.
2. Lock the coupling sleeves to prevent axial displacement.
3. Use appropriate hoisting gear to position the extruder unit in front of the connecting flange.

5.4.1.4 Axial locking

The extruder cylinder is axially locked to the gear unit by means of a bolt connection at the gear unit flange. Make sure that the depth of insertion of the bolts is at least 1.25 x d. Other aspects of this bolt connection are implemented in accordance with the customer specification and therefore fall outside the responsibility of Flender.

NOTE

Damage caused by unevenly tightening the fastening bolts or inadequate strength of the bolt connection

The gear unit can be damaged by unevenly tightening the fastening bolts or by a bolt connection that is not strong enough.

Evenly tighten the fastening bolts. When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress. Always use bolts with a minimum strength class (property class) of 8.8. Information and guidance on the tightening torque can be found in chapter Tightening procedure (Page 59). Tighten fastening bolts and nuts with the specified tightening torque. When tightening the fastening bolts, make sure that the gear unit is free of mechanical stress.

5.5 Couplings

Introduction

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

- If necessary, carry out the following preparatory work in accordance with the operating instructions for the coupling:
  - Machine the finished bore
  - Mill the parallel keyway
  - Fit the axial locking element
  - Balance
- Align the individual components precisely with one another.
- Refer to the operating instructions for the coupling for instructions on how to install, maintain and operate the coupling.

⚠ WARNING

Danger of injury due to coupling rupture

Flying fragments can cause fatal injury.

Observe the operating instructions for the couplings.

NOTE

Serious or irreparable damage to the gear unit and coupling caused by inaccurate or incorrect alignment

Failure to accurately or correctly align the gear unit and coupling may result in serious or irreparable damage to both components.

Align the individual components precisely with one another when installing the drives. Make sure that the maximum permissible displacement values are not exceeded during operation.

Further information

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

5.5.1 Assembling the coupling

Introduction

The method used to mount the coupling varies according to model. The procedure described in these operating instructions is general rather than specific to one type of coupling.

Assemble the coupling as described in the operating instructions or the installation instructions for the specific coupling.

Improper use can damage the gear unit. Take the following precautions:

- Do not use force (hammer blows, etc.) to fit the coupling components as this can cause internal damage to the gear unit.
- Take care not to damage the shaft sealing rings or shaft running surfaces when fitting the coupling components.

Procedure

To fit the coupling, proceed as follows:

1. Carefully clean the shaft ends and the coupling parts.
2. Use a suitable fixture to mount the coupling parts on the shaft ends.
3. Lock the coupling parts to prevent axial displacement.
4. Move the machines to be coupled close to one another and then align them (Page 53).
5. Join the coupling parts together.

Heating coupling parts prior to mounting

Depending on the order specification, it may be necessary to heat the coupling parts before mounting them.



⚠ WARNING

Risk of burns

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

Wear appropriate protective gloves and protective clothing.

Improper use can damage the gear unit. Take the following precautions:

- The required joining temperatures can be found in the drawings in the operating instructions for the coupling.
- Unless otherwise instructed, heat the coupling parts by an induction burner, with a torch or in an oven.
- Use heat shields designed to protect against radiant heat in order to safeguard the shaft sealing rings against damage or heating to above 100 °C.

- Quickly fit the coupling parts on the shafts. The mounting dimensions can be found in the drawings in the operating instructions for the coupling.

Gear units with hollow output shaft or output flange shaft

There is no need to install the output-side coupling for gear units with a hollow output shaft or flanged output shaft.

Mount gear units with hollow output shaft onto the shafts of the customer's driven machine. Use a mating flange to mount gear units with output flange shaft onto the shaft of the customer's driven machine.

More information

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

5.5.2 Aligning the coupling

Introduction

The coupling parts might become misaligned as a result of:

- Failure to accurately align the parts during assembly
- During operation:
  - Due to thermal expansion
  - Due to shaft deflection
  - Due to machine frames that are too soft

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

- Make sure that the maximum permissible displacement values are not exceeded during operation.
  - If you are using couplings supplied by Flender, you will find the maximum permissible misalignment values in the operating instructions for the coupling.
  - If you are using couplings supplied by other manufacturers, contact them and ask them for the maximum permissible displacement values, making sure that you specify the potential radial loads for your application. Keep the operating instructions for the coupling together with these operating instructions.
- Angular and radial displacement might occur simultaneously.
  Make sure that the total value of both displacements does not exceed the maximum permissible angular or radial displacement value.

The diagram below illustrates the potential displacements:

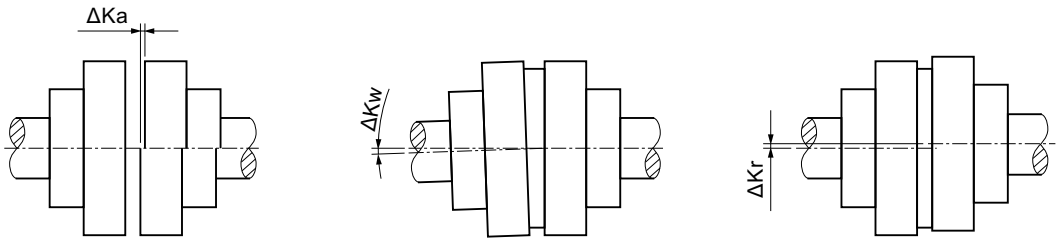


Figure 5-9: Possible displacements

Alignment

Align the individual components in two mutually perpendicular axial planes. The following can be used as alignment tools:

- Ruler (radial displacement)
- Feeler gauge (angular displacement)
- Spirit level
- Dial gauge
- Laser alignment system

You will achieve a greater degree of alignment accuracy by using a dial gauge or laser alignment system.

The diagram below shows the alignment process based on the example of a flexible coupling:

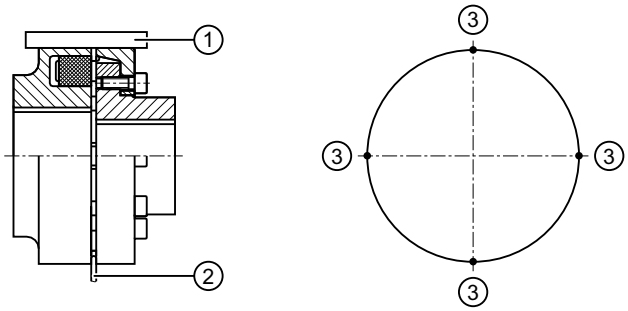


Figure 5-10: Alignment process based on the example of a flexible coupling

① Ruler
② Feeler gauge
③ Measuring points

Information

It is advisable to insert shims or metal sheets under the mounting feet in order to align the drive components in the vertical direction. It is helpful to use support paws with adjusting screws on the foundation to adjust the drive components laterally.

Gear unit with motor bell housing

If the gear unit and the motor are connected through a motor bell housing, no alignment of the couplings is necessary.

Further information

Further information about the permissible alignment errors can be found in the coupling operating instructions in the complete documentation for the gear unit, or contact the manufacturer in question.

5.6 Connecting components

5.6.1 Gear units with mounted components

Depending on the order specification, the gear unit can be equipped with various components.

Connect the closed-loop control and open-loop control electrical devices corresponding to the specifications of the device supplier.

Further information

You can find additional information on operation and maintenance in the associated operating instructions, provided in the complete gear unit documentation.

You can find the technical data of the mounted components in the contract-list of equipment provided in the complete gear unit documentation.

5.6.2 Connecting the water-oil cooler

NOTE

Damage to the water-oil cooler

When installing the piping, it is not permissible that the connections of the water-oil cooler are subject to force, torque or vibration.

Procedure

To connect the water-oil cooler to the gear unit, proceed as follows:

1. Remove the connecting bushes from the cooling water connection before connecting the water-oil cooler.
2. Flush the water-oil cooler to remove any dirt and pollution.
3. Connect up the cooling water inlet and drain lines.
   Refer to the drawing for the direction of flow and the position of the connections.
4. Electrically connect the pressure monitor (only for appropriately equipped gear units).

Further information

You can find additional information on the water-oil cooler in the water-oil cooler unit operating instructions, provided in the complete gear unit documentation.

Information

Observe the information provided in chapter of the Mounted oil supply system with water-oil cooler (Page 24).

5.6.3 Installing a separate oil supply system

Procedure

To connect the oil supply system to the gear unit, proceed as follows:

1. Remove the dummy flange from the suction and delivery line before connecting the system.
2. Connect the system to the gear unit in accordance with the drawings in the complete documentation and install it as a separate system.
3. When installing the system, make sure that the pipework is not subjected to mechanical stresses.

More information

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

5.6.4 Connecting the heating element

Procedure

To connect heating elements to the gear unit, proceed as follows:

1. Check that the heating element connection is not damaged.
2. Connect up the oil temperature monitoring system in the oil sump.
3. Install the electrical wiring for the heating elements.



⚠ WARNING

Explosion and fire hazard

Exposed heating elements pose a fire hazard.

Do not put heating elements into service until you have checked that they are completely immersed in the oil bath.

Further information

You can find additional information about the heating in the heating operating instructions in the complete documentation for the gear unit.

5.6.5 Connecting the oil-level monitoring system

Procedure

To connect the oil level monitoring system to the gear unit, proceed as follows:

1. Ensure that the filling level limit switch connection is not damaged.
2. Electrically connect the filling level limit switch.
3. Connect the signal so that the drive motor cannot start when the "oil level too low" signal is active and so that an alarm is output.
   Bypass this signal in operation.

Further information

You can find additional information about the oil level monitoring system in the operating instructions for the oil level monitoring system components provided in the complete gear unit documentation.

You can find technical data in the separate data sheet and in the list of equipment in the complete gear unit documentation.

5.6.6 Connecting the pressure monitor

For gear units with a pressure monitor, you must connect the pressure monitor so that it functions correctly.

Bypass the pressure monitor signal for around 20 seconds during commissioning.

Further information

You can find additional information on pressure monitoring in the pressure monitor operating instructions, provided in the complete gear unit documentation.

5.6.7 Connecting the Pt 100 resistance thermometer

Procedure

To connect the Pt 100 resistance thermometer, proceed as follows:

1. Check that the Pt 100 resistance thermometer connection is not damaged.
2. Install the electrical wiring between the Pt 100 resistance thermometer and the evaluation unit. The customer is responsible for providing the evaluation unit.

Further information

Further information about the Pt 100 resistance thermometer can be found in the Pt 100 resistance thermometer operating instructions in the complete documentation for the gear unit.

5.6.8 Connecting up the axial load monitoring system

Procedure

To connect the axial load monitoring system to the gear unit, proceed as follows:

1. Check that the connection of the axial load monitoring system is not damaged.
2. Install the electrical wiring for the load cell.

Further information

You can find additional information about the axial load monitoring system in the operating instructions for the axial load monitoring system in the complete documentation for the gear unit.

5.6.9 Connecting the bearing monitoring system

Procedure

To connect the bearing monitoring system to the gear unit, proceed as follows:

1. Make sure that the connections provided for holding the bearing monitoring equipment are undamaged.
2. Install the bearing monitoring equipment at the customer's site.

Further information

You can find additional information about the bearing monitoring system in the operating instructions for the bearing monitoring system components provided in the complete gear unit documentation.

5.6.10 Connecting a speed encoder

Procedure

To connect the air-oil cooler to the gear unit, proceed as follows:

1. Ensure that the speed encoder connection is not damaged.
2. Electrically connect the speed encoder.

Further information

You can find additional information on the speed encoder in the speed encoder operating instructions, provided in the complete gear unit documentation.

5.6.11 Electrical connections

Requirements

Do not use any motor that exceeds the specified speeds of the gear unit as otherwise the gear unit may become damaged. The speeds are displayed on the rating plate.

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

- Before connecting the motor, determine the phase sequence of the three-phase power system using a phase-sequence indicator.
- Connect the motor corresponding to the predefined direction of rotation.

Procedure



⚠ DANGER

Electric shock

Live parts can cause electric shock.

Ensure that the entire plant is de-energised before starting electrical installation work. Carefully observe the five safety rules (Page 15).

To connect the motors and monitoring devices, proceed as follows:

1. Ensure that the connections of the motors and monitoring devices are not damaged.
2. Connect up the motors and monitoring devices according to the terminal diagram and the relevant operating instructions.
3. Insulate all cable entry points (glands) at electrical equipment as required for the environment in which the equipment will operate.

Further information

You can find additional information about the electrical connections in the terminal diagrams and lists of equipment provided in the complete gear unit documentation.

5.7 Tightening procedure

5.7.1 Introduction

Bolts

The bolts must have the following properties:

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

Information

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

Information

Using a lubricant

As a rule, lubricants may not be used, because this can result in the bolt connection becoming overloaded.

5.7.2 Bolt connection classes

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

Mounting	Bolt connection class	Scatter of the torque emitted on the tool	Tightening procedure
Gear unit Motor Brake Torque arm	C	± 5 % to ± 10 %	• Hydraulic tightening with mechanical screwdriver • Torque-controlled tightening with a torque wrench or a signal-emitting torque wrench • Tightening with a precision mechanical screwdriver with dynamic torque measurement
	D	± 10 % to ± 20 %	• Torque-controlled tightening with mechanical screwdriver
Protection cover Sun shield	E	± 20 % to ± 50 %	• Tightening with pulse screwdriver or impact wrench, without adjustment checking device • Tightening by hand, using a wrench without torque measuring device

Table 5-1: Information on tightening fastening bolts

Always tighten the foundation, hub and bearing cover bolts in accordance with bolt connection class "C".

Further information

You can find additional information about tightening torques when mounting motor and brake in the operating instructions from the particular manufacturer.

5.7.3 Tightening torques and preload forces

The specified bolted connections must be tightened to the torques stated in the table below:

The tightening torques apply to friction values of μ_{total} = 0.14.

The following table lists the preload forces and tightening torques for bolt connections, strength classes 8.8; 10.9; 12.9:

Nominal thread diameter	**Bolt strength class**	**Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 60)**			**Tightening torque for bolt connection classes from the table in chapter Bolt connection classes (Page 60)**		
d		**C**	**D**	**E**	**C**	**D**	**E**
mm		**$F_{M\ min.}$ 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

Nominal thread diameter	Bolt strength class	Preload force for bolt connection classes from the table in chapter Bolt connection classes (Page 60)			Tightening torque for bolt connection classes from the table in chapter Bolt connection classes (Page 60)		
d		C	D	E	C	D	E
mm		$F_{M\,min.}$ N			M_A Nm		
M36	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
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

Table 5-2: Preload forces and tightening torques

5.8 Final work

Measures

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

- Check whether all devices dismantled for transportation have been reassembled.
- Check all bolt connections for tightness after installation of the gear unit has been completed.
- Check the alignment after tightening the fastening elements. The alignment must not have changed in any way.
- Lock the oil drainage valves against accidental opening.
- 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 directives. If no threaded holes are available on the gear unit for an earth connection, please take suitable alternative measures. This work must be carried out by specialists in electrical engineering.
- Protect the cable entries against penetrating moisture.

More information

You can find additional information about the gear unit and all mounted or separately supplied components in the operating instructions of the relevant components included in the complete documentation for the gear unit.

You can find more technical specifications in the separate data sheet in the complete gear unit documentation.

Commissioning 6

6.1 Measures prior to commissioning

Take the following measures before commissioning the gear unit:

- Read and observe the instructions.
- Replace the screw plug with the air filter or the wet-air filter. Note the instructions 7300 for this.
- Fill the gear unit 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.
- Check whether the monitoring devices are connected and switched on.
- Gear unit with oil supply system: Take the appropriate measures before commissioning gear units with an oil supply system (Page 65).
- Ensure that all pipes and components are filled with oil.
- Restarting: Make sure that the drive cannot be restarted after safety equipment has responded unless the restarting lockout is cancelled.

NOTE
Low ambient temperatures If the ambient temperature is below the minimum startup temperature (Page 69), contact Customer Services (Page 79) for advice or take suitable measures to warm up the gear unit to the minimum startup temperature. Use the heating elements (if these are integrated) to warm up the gear unit, or alternatively use heat plates, heat radiator or similar devices.

More information

You can find additional information on oil and changing the air filter in the instructions 7300, which are part of the complete documentation of the gear unit.

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

6.1.1 Gear units with an oil supply system

Implement the following measures before commissioning the gear unit with oil supply system:

- Ensure that the maximum permissible pressure in the oil supply system components is not exceeded.
- Ensure that the maximum permissible temperature of the oil supply system components is not exceeded.

- Using the oil supply system, lubricate the gear unit for 2 minutes using a pre-lubrication phase. During this time, the rolling-contact bearings and gearing are supplied with sufficient oil for starting.
  Ensure that the pre-lubrication phase is not longer than 5 minutes as the oil can foam up at low temperatures.

NOTE
Damage to the gear unit caused by inadequate or complete loss of lubrication or insufficient cooling The gear unit can sustain damage as a result of inadequate or complete loss of cooling or lubrication. Open wide the shutoff valves in the coolant inflow and outflow lines of the coolant system. Check that the connecting pipes are firmly seated and tight.

Further information

You can find additional 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 included in the complete documentation for the gear unit.

6.2 Measures during commissioning

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

- Gear unit with oil supply system: Check that the oil supply system is working properly.
- Check the oil level.
  The oil level drops slowly after the gear unit starts up. As the gear unit continues to warm up, the oil will settle around the correct oil level.
- Measure the oil sump temperature (Page 73) after the gear unit has run in.
- Check the tightness of the shaft seal on the gear unit (Page 26).
- Check that all rotating parts are free to move.
- Check whether the shutoff valves are open.
  - Check that all of the oil drain valves are closed.
  - Ensure that all of the other shutoff valves are open.
- Check that the connecting pipes are firmly seated and tight.
- Gear unit with bearing monitoring based on vibration measurement: Measure the vibration levels of the rolling-contact bearings (Page 73) to create initial and comparison values. Record and archive these values.
- Bypass the pressure monitor signal for around 20 seconds during commissioning. This is necessary as the pressure in the gear unit must first stabilise.
- Limit the period of no-load operation on the gear unit to a minimum. If the gear unit does not heat up because the load applied is too low, throttle the cooling water supply. in order to reduce the formation of oil foam.

More information

You can find additional information on the topic of oil in Instructions 7300, which are part of the complete documentation of the gear unit.

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

6.2.1 Initial test run

Restrict the period of no-load operation of the gear unit to a maximum of 15 minutes.

When the gear unit is put into operation for the first time, monitor it closely for the first two hours in operation under load so that you can shut down the main motor immediately if unforeseeable complications develop.

6.2.2 Gear unit with heating

Please observe the following measures to commission the gear unit with heating:

- Ensure that the heating elements are not exposed.
- Check the switching points of the temperature monitor.

⚠ WARNING

Fire hazard

Exposed heating elements pose a fire hazard.

Do not put heating elements into service until you have checked that they are completely immersed in the oil bath.

Further information

You can find additional information about heating elements in the heating element operating instructions in the complete documentation for the gear unit.

6.2.3 Oil level monitoring system

The gear unit can be equipped with an oil level monitoring system that uses a filling-level limit switch.

The oil level monitoring system has been designed to check the oil level when the gear unit is at a standstill before it starts.

Information

Connect the signal so that the drive motor cannot start when the "oil level too low" signal is active and so that an alarm is output. Bypass this signal in operation.

Operation 7

7.1 Operating data

Introduction

To ensure correct, trouble-free operation of the system, observe the operating values of the gear unit and, depending on the order specification, the data in the operating instructions for the oil supply system.

The operating values specified in the Annex Technical data (Page 87) apply.

The following operating data apply to the oil:

Startup temperature of gear unit	≥ 10 °C	
Operating temperature	40 - 70 °C	is applicable for mineral oil, API groups I or II and saturated synthetic ester
		is applicable for semi-synthetic oils, API group III, PAO and PG oils
Maximum operating temperature (for brief periods)	90 °C	is applicable for mineral oil, API groups I or II and saturated synthetic ester
	100 °C	is applicable for semi-synthetic oils, API group III, PAO and PG oils
Oil pressure of the oil supply system	> 0.5 bar	
Water pressure of the cooling coil or the water-oil cooler	< 8.0 bar	

Table 7-1: Operating data

10 °C above the ambient temperature is the minimum permissible temperature, but this must not be lower than 40 °C.

Further information

You can find additional information about the technical data of the gear unit in the data sheet and the list of equipment in the complete documentation for the gear unit.

7.2 Irregularities in operation

Introduction

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

A few irregularities are listed below as examples:

- Oil temperature exceeds the maximum permissible value

- Alarm tripped by the pressure monitor in the oil cooling system or oil supply system
- Unusual operating noise

NOTE

Faults can cause damage to the gear unit

The gear unit might sustain damage if it is not shut down when a fault occurs.

Switch off the drive assembly immediately if any fault condition develops.

NOTE

The gear unit can sustain damage if it becomes misaligned.

Operating a gear unit when it is misaligned can result in gear unit damage.

If you notice changes at the active tooth flanks, carry out another alignment check even if the shafts were positioned correctly when the gear unit was initially installed.

Rectifying irregularities in operation

Proceed as follows to rectify any irregularities in operation:

1. Switch off the drive aggregate if it exhibits irregular behaviour during operation
2. Refer to the “Fault information” (Page 75) to find the cause of the fault.
3. If you still cannot determine the cause of the fault, contact Flender Customer Service (Page 79).

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 drive aggregate.
- For gear units with a cooling coil or a water-oil cooler:
  - If there is a risk of frost or the unit is to be taken out of service for a prolonged period, drain the water from the cooling coil or the water-oil cooler and remove residual water with compressed air.
  - Close the shutoff valves for the cooling water inlet and drain lines.
- Start up the gear unit briefly (5 to 10 minutes) at intervals of approximately 3 weeks (if it is taken out of service for up to 6 months).
- Take measures to preserve the gear unit if it is to be out of service for a prolonged period. Follow the procedure described in instructions 7300.
- For gear units with a separate oil supply system or separate oil cooling system, perform the following steps before you preserve the gear unit:
  - Disconnect the gear unit from the separate oil supply system or separate oil cooling system.
  - Seal the openings in the gear unit, separate oil supply system and separate oil cooling system so that they are air-tight.

Servicing 8

8.1 General maintenance information

The operator must ensure compliance with the stipulated time limits. 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.

Document all maintenance and servicing activities that are carried out.

The time limits stipulated in the maintenance schedule are largely dependent on the conditions of use of the gear unit. For this reason, it is only possible to state average time limits here. These refer to the following conditions of use:

- Daily operating time 24 h
- Duty cycle "ED" 100%
- Gear unit input speed 1500 rpm
- Average oil temperature in the oil sump (see Instructions 7300)



⚠ WARNING

Danger to life when the system is switched on

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 aggregate. Attach a notice stating clearly that work is being performed on the gear unit.

8.2 Maintenance schedule

Maintenance and servicing activities

The following table provides an overview of all maintenance and servicing activities which you are required to perform continuously or at regular intervals.

Intervals and time limits	Measures
As required	Clean the gear unit housing Replace the rolling-contact bearings Replace the wet-air filter
Daily	Check the oil temperature Check for changes in the gear unit noise
Weekly	Check the oil level Check for leaks

Intervals and time limits	Measures
400 operating hours after commissioning	Check the water content of the oil Change the oil (or depending on results of the oil sample test) Check that the fastening bolts are tight
Every 3 months	Clean the air filter
Every 3,000 operating hours, at least every 6 months	Regrease Taconite seal
Every 12 months	Inspect the hose lines Check the water content of the oil
Every 10,000 operating hours, at least every 2 years	Change the oil if using API Groups I or II mineral oils, or saturated synthetic ester (or depending on the result of oil sample test) Check the condition of the water-oil cooler (the same time as you change the oil)
Every 2 years	Carry out a general inspection of the gear unit Check that the fastening bolts are tight Clean the gear unit housing
Every 20,000 operating hours, at least every 4 years	Change the oil if using semi-synthetic oil of API Group III, PAO or PG oil (or depending on the result of the oil sampling)
6 years after the stated date of manufacture	Change the hoses
At the end of the bearing service life	Replace the rolling-contact bearings

Table 8-1: Maintenance and servicing activities

More information

You can find more information on additional maintenance and servicing activities in the separate data sheet and in instructions 7300 in the complete documentation for the gear unit.

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

8.3 Maintenance and servicing work

Introduction

You can find maintenance and servicing measures relating to gear unit lubrication and preservation, which are not provided in this chapter, in instructions 7300 in the complete documentation for the gear unit.

8.3.1 Checking the oil temperature

Damage to the gear unit due to excessively high oil sump temperatures

The gear unit can sustain damage due to insufficient lubrication if you allow it to operate at oil sump temperatures above the maximum permissible temperature.

Do not operate the gear unit above the maximum permissible oil sump temperature.

Procedure

Proceed as follows to check the oil temperature:

1. Allow the gear unit to reach its normal operating temperature.
2. Operate the gear unit with the maximum driven machine power.
3. Measure the temperature of the oil in the oil sump.
4. Compare the measured value with the maximum permissible oil temperature (Page 69).
5. Immediately stop the gear unit if the maximum permissible oil temperature is exceeded. Contact Flender Customer Service (Page 79).

8.3.2 Measuring the vibration levels of the rolling-contact bearings

Procedure

Proceed as follows to measure the vibration levels of the rolling-contact bearings:

1. Measure the vibrations at the rolling-contact bearings.
2. Document the measurement results.
3. Compare the measured values with the comparison values that were documented when commissioning the gear unit.
4. Replace defective rolling-contact bearings.
5. Archive the report together with these instructions.

NOTE
Damage to the gear unit A defective rolling-contact bearing may cause damage to the gear unit. Replace the rolling-contact bearings at the latest when they reach the end of their service life.

Further information

You can find additional information on measuring the vibration levels at rolling-contact bearings in the operating instructions of the measurement sensor provided in the complete gear unit documentation.

8.3.3 Cleaning the gear unit

Introduction

Layers of dust may affect the dissipation of heat through the surface of the gear unit, resulting in overheating. Depending on the operating conditions, it may therefore be necessary to clean the gear unit more frequently than stated in the maintenance schedule.

Procedure

To clean the gear unit, proceed as follows:

1. Use a hard brush to remove any stubborn dirt from the gear unit. Never use a high-pressure cleaning device.
2. Remove any spots of corrosion.

8.3.4 Inspecting the rotary shaft sealing ring

Service life of rotary shaft sealing rings

Rotary shaft sealing rings are wearing parts that need to be replaced after the wear limit is reached. The service life of rotary shaft sealing rings is influenced by many different parameters:

- Circumferential speed at the sealing lip
- Temperature
- Internal pressure in the gear unit
- Lubricant viscosity
- Chemical composition of and additives in lubricants
- Mounting position (supply of lubricant to sealing lip)
- Dirt particles or metal abrasion dust in the lubricant
- Shaft sealing ring material

As a result of these many influencing parameters, it is not possible to make a definitive statement about the likely service life of rotary shaft sealing rings. It is therefore important to inspect them regularly. Only in this way is it possible to detect the signs of lubricant loss in the gear unit.

8.3.5 General inspection of the gear unit

Arrange for Flender Customer Services to perform a general inspection on the gear unit. Thanks to their experience, these engineers are best placed to assess whether and which gear unit components need to be replaced.

8.3.6 Check that all of the fastening bolts are tight

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

- Observe the data regarding connection classes (Page 60), preload forces and tightening torques (Page 61).
- Replace any bolts that are no longer fit for use by bolts of the same strength class and type.

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 Flender Customer Services to attempt a repair.

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

Information

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 Flender Customer Services 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.

Possible faults	Causes	Possible remedies
Pressure switch triggers alarm	Oil pressure has dropped below minimum value	• Check the oil level at room temperature • Top up with oil if necessary • Check the oil pump • If required, replace the oil pump • Check the oil filter • If required, replace the oil filter
Noise	Damage to gearing	• Contact Customer Services • Inspect toothed components • Replace damaged components if necessary
	The bearing play is excessive.	• Contact Customer Services • Adjust bearing play

Possible faults	Causes	Possible remedies
Noise	Defective rolling-contact bearings	• Contact Customer Services • Replace defective rolling-contact bearings
	Gear unit fastening has worked loose	• Tighten bolts and nuts to the specified tightening torque • Replace damaged bolts and nuts
Outer surface of gear unit soiled with oil	Inadequate sealing of the housing cover or joints	• Seal housing cover or joints
	Labyrinth seals soiled with oil, incorrect transport position	• Check oil filling • Clean the labyrinths
Main drive motor does not start	Motor direction of rotation incorrect	• Change polarity of motor
	Backstop cage with sprags incorrectly installed or defective	• Contact Customer Services • Install the backstop cage, rotated through 180° - or replace
Leaks	Defective rotary shaft sealing rings	• Inspect the rotary shaft sealing rings and replace if necessary
Wet-air filter is severely discoloured	Wet-air filter is spent	• Replace the wet-air filter
Wet-air filter is becoming discoloured from the top downwards	Water in the oil	• Take test tube sample to examine oil condition for water penetration • Have the oil examined by a chemical lab • Change the oil if necessary
Oil is foaming in the gear unit	Preservation agent not completely drained off	• Change the oil
	Oil supply system left in operation for too long at low temperatures	• Switch off the oil supply system • Degas the oil
	Gear unit too cold in operation	• Switch off the gear unit • Degas the oil • Start up without cooling water during cold restart
	Water in the oil	• Take test tube sample to examine oil condition for water penetration • Have the oil examined by a chemical lab • Change the oil if necessary
	Oil defoamer has run out	• Examine the oil • Change the oil if necessary
	Unsuitable mixture of oils	• Examine the oil • Change the oil if necessary

Possible faults	Causes	Possible remedies
Oil escaping from the gear unit	Inadequate sealing of the housing cover or joints	• Check the seals and replace if necessary • Seal housing cover or joints • Check the compression seals and retighten screws if necessary
	Leaking pipes	• Check the pipes, and replace or seal if necessary
Oil supply system malfunction	-	• Read the operating instructions for the oil supply system
Elevated temperature during operation	Oil level in the gear unit housing too high	• Check the oil level • If required, correct the oil level
	Oil is too old	• Check when the last oil change was done • Change the oil if necessary
	Oil is severely contaminated	• Change the oil
	Oil supply system or cooling coil defective	• Check the oil supply system or cooling coil • Replace defective components if necessary • Read the operating instructions for the oil supply system
	Gear unit with oil cooling system: Cooling liquid flow rate too low or too high	• Fully open the valves in the intake and outlet pipes • Check that water and oil can freely flow through the water-oil cooler
	Gear unit with oil cooling system: Inadequate oil flow through the oil cooler	• Check the oil filter • If required, replace the oil filter
	Gear units with cooling coil: Deposits in the cooling coil	• Clean, or if necessary, replace the cooling coil
	Coolant temperature too high	• Check the temperature • Correct the temperature if necessary
	Defective oil pump	• Check the oil pump function • Repair or replace oil pump if required
Elevated temperature at bearing points	Oil level in the gear unit housing too low or too high	• Check the oil level at room temperature • If required, correct the oil level
	Inadequate oil flow rate through the gear unit housing	• Inspect the separate oil supply system and top up with oil if necessary • Check the oil pressure at the inlet
	Oil is too old	• Check when the last oil change was done • Change the oil if necessary
	Oil supply system defective	• Inspect the oil supply system • Replace defective components if necessary • Read the operating instructions for the oil supply system

Possible faults	Causes	Possible remedies
Elevated temperature at bearing points	Defective rolling-contact bearings	• Contact Customer Services • Inspect the rolling-contact bearings and replace if necessary
Elevated vibration amplitude at bearing points	Defective rolling-contact bearings	• Contact Customer Services • Inspect the rolling-contact bearings and replace if necessary
	Gear wheels defective	• Contact Customer Services • Inspect the gear wheels and replace if necessary
Contamination indicator of the double change-over filter triggers an alarm	Double change-over filter clogged	• Change over the double change-over filter corresponding to the separate operating instructions • Clean the filter element
Water in the oil	Oil supply system or cooling coil defective	• Check the oil supply system or cooling coil • Replace defective components if necessary • Read the operating instructions for the oil supply system
	Engine room fan is blowing cold air onto gear unit: Water condenses	• Install suitable thermal insulation to protect gear unit housing • Close the air outlet or change the direction of the air outlet using structural measures.
	Climatic conditions	• Contact Customer Services • Use wet-air filter if necessary
	Oil foams in the oil sump	• Take test tube sample to examine oil condition for water penetration • Have the oil examined by a chemical lab

Table 8-2: Possible faults and their rectification

Service & Support 9

9.1 Contact

When ordering replacement 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

More information

Further information about service and support can be found on the Internet:

Service & Support (https://www.flender.com/service)

Disposal

10

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, preservative agents, oil binding agents and oil-soaked cloths according to the applicable environmental protection regulations.

Spare parts

11

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.

Information

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 are not supplied from Flender.

The contact address of Flender Customer Services can be found under Service & Support (Page 79).

Information required when ordering spare parts

To order spare parts, refer to the spare-parts list. Only use original Flender spare parts.

When ordering spare parts, please provide the following information:

- Order number with item
- Type and size
- Part number
- Quantity

Declaration of incorporation

A

Declaration of Incorporation

Business name and full address of manufacturer:

Flender GmbH
Am Industriepark 2
46562 Voerde
Germany

Name and address of the person authorised to compile the relevant technical documentation:

Mark Zundel
Flender GmbH
Am Industriepark 2
46562 Voerde
Germany

Description and identification of the partly completed machine:

Double-screw-extruder gear units
T1FL size 1 to 550,
T1FR size 1 to 550,
22 F 11.9, 57 F 1400, 70 F 2400, 76 F 850, 174 F 1200
to drive machines

The following “Essential Health and Safety Requirements” from – Directive 2006/42/EC Official Journal L 157, 9 June 2006, pages 24-86, Annex I, are applied and are fulfilled:

1.1.1; 1.1.2; 1.1.3; 1.1.5; 1.1.6; 1.2.2; 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; 1.4.2.2; 1.4.3; 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; 1.6.1; 1.6.2; 1.6.4; 1.6.5; 1.7.1; 1.7.1.1; 1.7.1.2; 1.7.2; 1.7.3; 1.7.4; 1.7.4.1; 1.7.4.2; 1.7.4.3;

The relevant technical documentation according to Annex VII Part B has been created.

The manufacturer undertakes to send national authorities electronic copies of the relevant technical documentation for the partly completed machine following a reasoned request.

The partly completed machine may only be put into operation if it has been determined where applicable that the machine in which the partly completed machine is to be incorporated meets the specifications of the Directive 2006/42/EC.

Representative for issuing this Declaration of Incorporation on behalf of the manufacturer:

Flender GmbH



Voerde, 2024-03-14

Mark Zundel, Vice President, Industrial Gears, Plant Voerde

Translation of the Declaration of Incorporation

Technical data

B

B.1 General technical data

Rating plate

The rating plate of the gear unit contains the most important technical data.

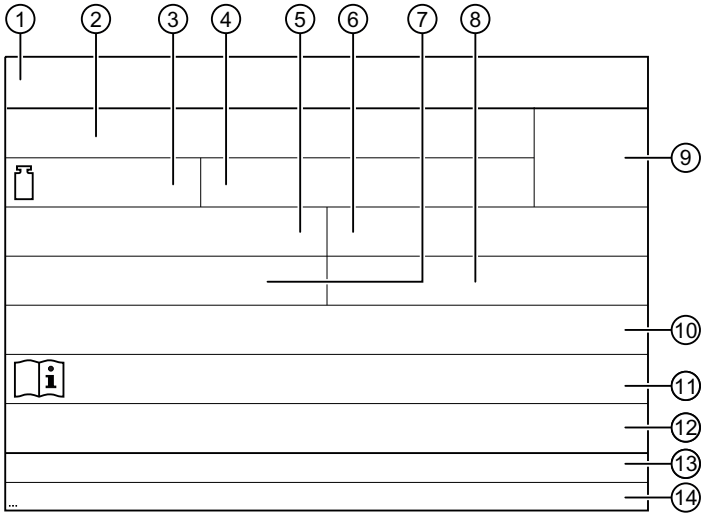


Figure B-1: Rating plate

①	Company logo	⑧	Speed n_2
②	Serial no.: Plant code / order no. - Item - Serial no. / Year of manufacture	⑨	Optional DMC (Data Matrix Code)
③	Total weight in kg	⑩	Oil data: Oil type, oil viscosity, oil quantity
④	For special information	⑪	Number(s) of instructions, including issue date
⑤	Model, size	⑫	For special information
⑥	Power rating P_2 in kW or torque T_2 in Nm	⑬	Manufacturer documentation / Country of origin
⑦	Speed n_1	⑭	Hotline

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.

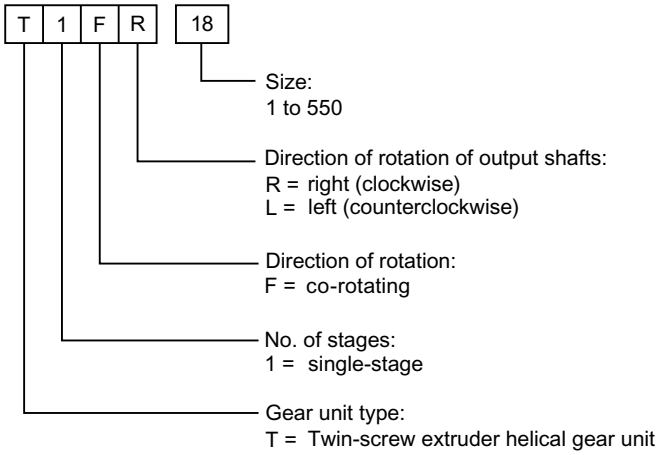
More information

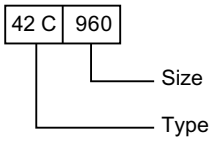
You can find additional information about these technical data in the separate data sheet and the drawings in the complete documentation for the gear unit.

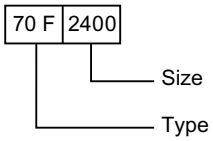
You can find additional information about all major accessories including their technical data and control instructions in the order-specific list of equipment in the complete documentation for the gear unit.

Example code

The following codes are examples of the code printed in line 5 of the rating plate and explain the meaning of the individual letters and numbers.







More information

You can find more information on the weights and the enveloping surface sound pressure levels in chapters Weights (Page 89) and Enveloping surface sound pressure level (Page 89).

You can find additional information about these technical data in the separate data sheet and the drawings in the complete documentation for the gear unit.

B.2 Ambient temperature

Unless otherwise contractually agreed, the gear unit must not be exposed to any harmful atmospheres or substances such as aggressive chemical products. By applying various suitable measures, the gear unit can be used in the ambient temperature range extending from -40 °C up to 60 °C. However, this must always be authorised by Flender and specified in the order text.

B.3 Weights

The precise weights are specified in the drawings in the complete documentation for the gear unit, or on the rating plate.

All stated weights refer to units without oil filling.

B.4 Enveloping surface sound pressure level

You will find information about the enveloping surface sound pressure level in the drawings or the separate data sheet in the complete documentation for the gear unit.

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FLENDER GEAR UNITS

Double-screw-extruder gear unit
Assembly and operating instructions A5109-01en
Version 03/2024

Flender GmbH
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46395 Bocholt
Germany

FLENDER