

FLENDER SUPPLIES

Gear unit lubrication and gear unit preservation

Assembly and operating instructions 7300en
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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 these instructions

These instructions describe the gear unit lubrication and preservation and provide information about how to go about it – from application planning through to maintenance.

Please keep these instructions for later use. Please read these instructions prior to handling the gear unit and observe the information they contain.



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 personal injury.

Flender accepts no liability for damages and disruption to operations that result from non-adherence to the instructions.

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

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

Required basic knowledge

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

- Application planning
- Assembly
- Commissioning
- Maintenance

Conventions

Please note the following naming convention:

- The term gear unit will be used for Flender gear unit in the following.

Documentation landscape

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

- Gear unit instructions
- Data sheet
- Connecting element instructions
- Instructions for third-party devices

Copyright

The copyright of 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 65).

Validity

The information provided in these instructions will only apply providing that no conflicting information is contained in the product-related instructions or in the order-related documentation.

1.3 Definitions

Term	Description
Storage	Proper storage of the gear unit, and thus protection against corrosion before commissioning
Gear unit oil	Fluid for the lubrication, cooling, and removal of harmful particles from machine elements, consisting of base oils and additives
Base oil type	Type of base oil from which the gear unit oil was produced (e.g., mineral oil or PAO oil)
Commissioning	First rotation of the input shaft of the closed and oil-filled gear unit
Preservation	Protection of gear unit components against corrosion and impairment of function and visual appearance
Preservative oil	Oil that has special preservative properties (e.g., forming a protective layer or with VCI additive), used for running in gear units (end-of-line test) at Flender
Leakage	Leakage of gear unit oil into the environment and thus potential contamination of the environment
Oil analysis	Inspection and assessment of the oil state, using an oil sample, by a qualified laboratory or the oil manufacturer
Oil service life	The oil service life prescribed by Flender, depending on the type of oil, which may vary when using Flender condition monitoring systems
Oil sample	Professionally collected small amount of oil from the gear unit oil circuit
Oil type	Base oil type or product name of the gear unit oil
Oil temperature	Temperature of the gear unit oil measured in the oil sump of the gear unit or in the oil tank
Product name (of the lubricant)	Trade name (of the lubricant), assigned by the manufacturer
Lubricating grease	Substance intended for lubrication, sealing, and preservation of gear unit components, consisting of base oils, thickeners, and additives
Lubrication	Measures to reduce friction and wear in machine elements such as gears, bearings, or seals, usually by using oils or greases
Flushing oil	Single-use oil for cleaning and decontaminating the gear unit interior

Table 1-1: Definition

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 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

2.2 General information

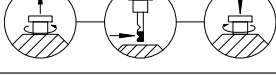
Points labelled on the gear unit	Symbol	Coloured markings
Oil level indicator		red
Oil level measurement		red
Oil overflow		
Connection point for vibration monitoring		
Lubrication point		red
Apply grease		
Lifting eye		
Eye bolt		
Do not unscrew		
Alignment surface, horizontal		
Alignment surface, vertical		
These symbols indicate the oil level checking procedure using the oil dipstick.		
These symbols indicate that the oil dipstick must be firmly screwed in.		

Table 2-1: Symbols and markings

Protective equipment

In addition to the generally prescribed personal protective equipment (safety shoes, overall, helmet etc.), also wear suitable safety gloves and safety goggles when handling the gear unit. Be sure to use suitable body protection (skincare products, hearing protection etc.).

Chemical substances

NOTE

Aggressive acids due to polyglycols with sodium chloride and water

If polyglycols are contaminated with sodium chloride and water, this can cause aggressive acids. Such acids corrode the unprotected metallic parts in the gear unit.

Avoid contamination of this kind.

2.3 General warnings and symbols

The following table contains general warnings and their associated symbols.

ISO	ANSI	Warning
	---	Warning – corrosive substances

Table 2-2: General warnings

2.4 Regulations and documents

Read and observe the following regulations and documents:

- Regulations concerning workplace safety and environmental protection
- Product datasheets for the oils used, including the flushing oil as necessary
- Safety datasheets for the oils and equipment used
- Operating and maintenance instructions for the gear unit used, including the oil supply system
- Documentation sheet for oil change (Page 69)
- Check list for oil filling and oil change (Page 71)

Description

3

General description

These instructions are valid for industrial gear units and for geared motors.

These instructions cover the following topics:

- Gear unit lubrication
- Gear unit preservation
- Information on maintenance
- Information on maintenance

4.1 Gear oils

Introduction

Only use approved oils for the gear unit which meet the specifications (Page 24).

Mixing oil types

Mixing different types of oil may damage the gear unit due to the lack of lubrication caused by the possible incompatibility of the oils.

As a rule, fill the gear unit using the same type of oil previously used. It is not permitted to mix different types of oil or oil from different manufacturers.

Further information

Further information on the specifications and the properties of the gear oils is available from the oil manufacturer's technical datasheets and safety datasheets.

4.1.1 Oil groups and base oils

Oil groups

Flender makes a distinction between the following oil groups with regard to gear oils:

- Standard oils
- Readily biodegradable oils (BIO)
- Physiologically safe oils (PHY) approved in accordance with NSF-H1, known as food grade oils

Oil types

The tested and recommended gear oils can be manufactured on the basis of the following oil types:

- API Group I and II mineral oils
- Semi-synthetic oils
- API Group IV poly- α -olefins (PAO)
- API Group V polyglycols (PG or PAG)
- API Group V synthetic esters



Information

All oil types can theoretically occur in every oil group.

4.1.2 Flushing oil

To prevent incompatibilities, Flender recommends that the oil type to be used later should be used for flushing. If you do not wish to use polyglycol as gear unit oil after flushing, you can use low-viscosity and low-alloy mineral oils.

Do **not** use the flushing oil as gear unit oil.



Information

Special flushing oils (e.g., flushing oils with low viscosity)

It is possible and sometimes essential to use special flushing oils.

Consult the oil manufacturer and Flender prior to using special flushing oils.

In this case the gear unit may not be run during the flushing procedure.

CAUTION

Risk of scalding from escaping oil

If the oil is overheated, it may cause scalding.

- Do not heat the oil over 50 °C to avoid scalding.

In the following situations you must perform a flushing procedure (Page 56) before filling with gear unit oil to start up the system:

- Requirement prescribed in the gear unit instructions
- Changing the oil type
- In the case of heavier accumulations of soiling in the gear unit or in the oil supply system
- Following major repairs to the gear unit

4.1.3 Oil temperatures

Overview

Compared to mineral oils, synthetic gear oils have a larger operating temperature range and a higher viscosity index, i.e., a flatter viscosity temperature profile. The operating temperature range of gear unit oils depends not only on the oil type (Page 21), but also on the nominal viscosity and the lubrication type (with or without the use of pumps), and may vary. Special additives can be used to extend the operating temperature range.

The operating temperature range is estimated as follows for the most commonly used gear oils for nominal viscosity ISO VG 320:

- Mineral oils -10 °C to 90 °C (for brief periods 100 °C)
- Semi-synthetic oils -30 °C to 100 °C (for brief periods 110 °C)
- Poly- α -olefins (PAO) -30 °C to 100 °C (for brief periods 110 °C)
- Polyglycols (PG or PAG) -25 °C to 105 °C (for brief periods 115 °C)
- Synthetic esters -30 °C to 90 °C
- Motor oils -10 °C to 100 °C

In practice, the upper and lower limit values of individual gear oils can deviate significantly from the specified values. Particularly if oil pumps are used, the permissible minimum temperatures are often pushed considerably in the direction of 0 °C or higher.

Flash point and pour point provide indications for special operating conditions, which are usually not understood as being operating limits.

The oil manufacturer can inform you of the possible oil-dependent operating temperature range of the gear unit oil.



Information

Recommended oil temperature during operation

If the oil temperature is too high during operation, the viscosity of the oil can fall so drastically that the load-bearing capacity of the oil is reduced to an unacceptable level. High temperatures cause ageing of oil.

If the oil temperatures are too low during operation, this can retard or stop the efficacy of some oil additives, thereby deteriorating the properties of the oil. Oil tends to foam at low temperatures.

In standard situations, Flender recommends an operating temperature range of between 60 °C and 85 °C for the gear unit oil. Note any contrary information provided in the product instructions.

You must not change the agreed operating temperatures of the gear unit or the type of oil without consulting Flender.

Further information

Further information on the specifications and the properties of the gear oils is available from the oil manufacturer's technical datasheets and safety datasheets.

4.1.4 General service lives of oils

Operating conditions

The service lives of the various types of oil specified below are valid for the following operating conditions:

- Daily operating time 24 h
- ON duration "ED" 100%
- Gear unit input speed 1500 rpm
- Average oil temperature in the oil sump 80 °C
- Medium capacity
- With no harmful environmental influences

Service life

Under the aforementioned operating conditions, the oil manufacturers guarantee that the gear oils approved (Page 25) by Flender will fulfil the following service lives without significant changes in the quality of the oil:

4.1 Gear oils

- API Groups I or II mineral oils, synthetic esters: 10,000 operating hours, 2 years maximum
- Semi-synthetic oils, poly- α -olefins, and polyglycols: 20,000 operating hours, 4 years maximum

**Information****The Arrhenius Law**

The actual service life may vary. The rule of thumb applicable here is the formula for the temperature dependence of reaction rates (Arrhenius equation), which states that a temperature increase of 10 K will reduce the service life by about one-half, and that a 10 K temperature reduction will roughly double it.

**Information****Possible extension of oil service life**

Various parameters can influence oil ageing. If the gear unit is equipped with an AIQ product, it is possible to recommend oil change intervals based on the actual performance. Information on AIQ products and their use can be found online (<https://www.flender.com/aiq>). If you have any questions about the service life of the oil, contact Flender at lubricants@flender.com.

4.1.5 Quality, code numbers, approval lists

4.1.5.1 Required quality of the gear oils to be used

Warranty

Adhere to the oil group, base oil, and viscosity class as per the specifications on the rating plates and observe the information contained in the complete documentation for the gear units. Failure to do so will invalidate the warranty obligations of Flender.

If you use an oil filter with a grade $< 25 \mu\text{m}$, obtain the oil manufacturer's confirmation that the oil filters will not negatively affect the characteristics of the oil.

If you use oils that do not meet the specified quality requirements (see table "Quality tests (Page 25)"), the warranty obligations of Flender will be rendered invalid. Consult Flender in the event of any deviations.

Subsequently modified operating conditions that do not conform to those stated in the customer's order require the gear oil used to be approved in writing by Flender.

Quality tests

The only oils approved for the gear units are CLP quality oils, which contain substances in accordance with DIN 51517-3 for improving corrosion protection and resisting ageing, as well as reducing wear in the mixed friction area.

The following table provides an overview of the tests which oils must pass in order to be approved, as well as the limits to be achieved. You can request the detailed release specification from Flender at lubricants@flender.com.

Test	Limits to be achieved
Scuffing load capacity in the FZG test according to DIN ISO 14635-1 under the A/8.3/90 test conditions	Scuffing load stage > 12 (for motor oils ≥ 12)
FE-8 rolling-contact bearing test according to DIN 51819-3 under the D-7.5/80-80 test conditions	Rolling-element wear $m_{w50} < 30$ mg Maximum rolling-element wear < 60 mg Cage wear: Forward value to Flender
Micro-pitting resistance as per FVA 54 VII	Micro-pitting (GF) scuffing load stage ≥ 10 micro-pitting resistance (GFT) = high (for motor oils: micro-pitting (GF) scuffing load stage ≥ 9 micro-pitting resistance (GFT) = medium)
Flender foam test as per ISO 12152	Increase in total volume 1 minute after shutdown $\leq 15\%$ Increase in oil-air dispersion 5 minutes after shutdown $\leq 10\%$
Static and dynamic Flender Freudenberg test for shaft sealing rings	Required limits for the static test in accordance with test description Evaluation of results by test laboratory
Oil compatibility with liquid seals	Evaluation of results by test laboratory
Paint/oil compatibility test (interior and exterior coat)	Required limits as per test description. Evaluation of results by test laboratory
Filterability test	Required limits as per test description. Evaluation of results by test laboratory
Lubricating oils used in marine gear units with integrated multi-disc couplings must additionally pass the Ortlinghaus disc test.	Test performance and approval by Ortlinghaus
Gear oils used in gear units with worm gear sets must pass the worm gear test G-722.	Test performance and assessment by the Ruhr University in Bochum, Germany

Table 4-1: Quality tests

Further information

Further information and specifications for the approval of gear oils and the table of approved and recommended lubricants for gear unit applications are available in the T 7300 approval list on the internet (<https://www.flender.com/lubricants>).

4.1.5.2 Lists of approved lubricants

Introduction

To make it easier for gear unit users to select lubricants, Flender recommends products which have been properly tested and satisfy Flender requirements.

4.1 Gear oils

To help its customers, Flender has grouped oils in the T 7300 in approval lists (<https://www.flender.com/lubricants>). The oil manufacturers have verified to Flender that these oils fulfil the aforementioned test results; see Chapter “Required quality of the gear oils to be used (Page 24)”. The oil manufacturers guarantee that the characteristics, features and minimum requirements specified by Flender are globally observed.

Warranty

The approval of these gear oils for use in gear units and their consequent inclusion in the relevant lists does not mean that Flender accepts any liability for the suitability and quality of these oils. Nor will Flender be liable for any damage sustained by the gear units as a result of using these gear oils. The gear oil manufacturer is liable for the suitability and quality of his product.

Using a non-listed lubricant

The user is responsible for selecting the lubricants. Flender does not oblige gear unit users to use the listed products.

The gear unit user assumes all risks associated with using a non-listed lubricant. In the event of damage occurring, the user must prove that the properties of the product used meet Flender requirements; see Chapter “Required quality of the gear oils to be used (Page 24)”.

Using a lubricant that does not satisfy the requirements of Flender will result in the loss of the warranty provided by Flender.

NOTE**Damage to gear units**

The use of unsuitable lubricants can result in malfunctions, increased wear, damage to gear teeth, rolling-contact bearings and/or plain bearings or even the complete failure of the gear unit.

- Flender recommends the use of approved lubricants.

If one of the listed lubricants is used, Flender does not demand that it be immediately replaced in the gear unit by another lubricant if said lubricant is deleted from the T 7300 approval list.

If you use one of the listed oils, before every oil change check whether the selected lubricant can still be used without any further verification. If the selected lubricant is no longer approved, use an approved lubricant of the same type and viscosity.

Any remaining stocks of the previously used lubricant held by the gear unit user may still be used up, provided it has not exceeded its permissible service life and no negative anomalies in the oil have been experienced during the time it was used.

4.1.5.3 Code numbers

The code numbers in the approval list provide the assignment of the approved oils to their oil groups, their base oils and their viscosity. The code number A13, for example, designates all standard mineral oils with the viscosity ISO VG 460.

The following table provides an overview of the code numbers for the lubricant assignment of standard oils:

Base oils	Gear unit	ISO VG 100	ISO VG 150	SAE 40	ISO VG 220	ISO VG 320	ISO VG 460	ISO VG 680	ISO VG 1000
Mineral oils	Marine gearbox with multiple-disc coupling		E 76	E 66					
	Worm gear unit	B 17	B 16		B 15	B 14	B 13	B 12	B 11
	All other gear units	A 17	A 16	E 66	A 15	A 14	A 13	A 12	A 11
Polyglycols	Worm gear unit	B 27	B 26		B 25	B 24	B 23	B 22	B 21
	All other gear units	A 27	A 26		A 25	A 24	A 23	A 22	A 21
Poly- α -olefins	Marine gearbox with multiple-disc coupling		E 86						
	All other gear units	A 37	A 36		A 35	A 34	A 33	A 32	A 31
Semi-synthetic oils:	All other gear units	A 77	A 76		A 75	A 74	A 73	A 72	A 71

Table 4-2: Code numbers of standard oils

The following table provides an overview of the code numbers for the lubricant assignment of biodegradable oils:

Base oils	Gear unit	ISO VG 100	ISO VG 150	ISO VG 220	ISO VG 320	ISO VG 460	ISO VG 680	ISO VG 1000
Synthetic esters	Marine gearbox with multiple-disc coupling		E 96					
	All other gear units	A 47	A 46	A 45	A 44	A 43	A 42	A 41

Table 4-3: Code numbers of easily biodegradable oils

The following table provides an overview of the code numbers for the lubricant assignment of physiologically safe oils (approval in accordance with NSF-H1):

Base oils	Gear unit	ISO VG 100	ISO VG 150	ISO VG 220	ISO VG 320	ISO VG 460	ISO VG 680	ISO VG 1000
Polyglycols	Worm gear unit	B 57	B 56	B 55	B 54	B 53	B 52	B 51
	All other gear units	A 57	A 56	A 55	A 54	A 53	A 52	A 51
Poly- α -olefins	All other gear units	A 67	A 66	A 65	A 64	A 63	A 62	A 61

Table 4-4: Code numbers of physiologically safe oils (approval in accordance with NSF-H1)

4.2 Lubricating grease

Introduction

For special applications, grease lubrication of the rolling-contact bearings may be necessary.

4.2 Lubricating grease

**Information****Use of greases**

Greases may only be used if specified in the operating instructions of the gear units.
Observe the intervals for subsequent lubrication.

Lubricating grease

Apart from lubrication, lubricating grease can also be used as a sealant, e.g. for vertical gear unit connecting shafts or can also be applied to counter the environmental impact of dust or splash water.

**Information****Mixture of oil and grease**

In closed gear units with internal oil lubrication, the gear oil and rolling-contact bearing grease must not be allowed to mix.

Further information

Further information on the lubricating greases approved and recommended for use in gear units can be found on the internet (<https://www.flender.com/lubricants>).

When using greases, Flender recommends an annual check to ascertain whether the selected lubricating grease is still approved by Flender.

The following table provides an overview of the code numbers for the lubricant classification of rolling-contact bearing greases for use in gear units:

NLGI grade	2	3
Standard greases	H 14	H 13
Physiologically safe greases	H 24	H 23
Biodegradable greases	H 34	H 33

Table 4-5: Code numbers of rolling-contact bearing greases

Preservation

5.1 Preservation of the gear unit

Preservation state

When delivered, the gear units have the following preservation state as standard:

- The interior preservation with preservative oil is performed depending on the gear unit oil used:
 - Mineral oil, PAO-based oil, synthetic esters: Castrol Alpha SP 150 S or Castrol Alpha SP 220 S
 - Polyglycol: Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)
 - Deviations from this standard regulation will be specified in the product-specific instructions, where relevant.
- The metallic bright exterior surfaces of the gear units, such as shaft ends, are preserved with Tectyl 846 K-19.
- The remaining exterior surfaces of the gear unit are coated with a paint system. The properties for exterior coating depend on the environmental conditions for the transport route and location specified in the order.

NOTE

Risk of corrosion if there is no top coat

The gear unit may be damaged by corrosion if no top coat has been applied or the coating has been damaged. The undercoat does not by itself offer any durable corrosion protection.

It can be contractually agreed on a case-by-case basis that the gear unit is shipped only with the undercoat applied.

- If the top coat is missing or damaged, a coating must be applied shortly after delivery in accordance with the guidelines applicable to the application. If the top coat is missing or damaged, contact customer service, see chapter "Service & support".
- Note that signs, connections, monitoring devices and similar accessories as well as shaft sealing rings must not be coated with top coat when this is being applied.

Storage

When making the inquiry and placing the purchase order with Flender, please stipulate special environmental conditions during transport and storage. Special environmental conditions for example include tropical climate or sea transport. The gear unit may be damaged by corrosion if it is packaged or stored incorrectly.

Storage must take place in the position of the original packaging or in the position of use.

Prevent the corrosion protection layers from becoming damaged.

⚠ WARNING

Risk of crushing through falling gear unit

Persons are at risk of being crushed or struck by a gear unit that falls down.

- Do not stack gear units on top of each other.

With indoor storage, the following applies:

- Select a dry room with vibration-free base.
- Cover the gear unit.

With outdoor storage the rule is:

- Select a vibration-free and dry base.
- Store the gear unit in a location which is protected against the impact of weather.
- Cover the gear unit very carefully.
- Ensure that neither moisture nor foreign bodies can accumulate on the gearbox.
- Avoid waterlogging.

The following regulations apply to your incoming goods control where sea transport packaging has been applied and the gear unit is not scheduled to be used straight away:

- Only open the outer part of the packaging where possible, and check the condition of the film.
- Keep the film open for no longer than 10 minutes.
- Do not remove any preservation agent such as VCI products and desiccants.
- Reseal the film making it airtight.

NOTE

Damage caused by external sources

The gear unit could be damaged if exposed to harmful effects such as aggressive chemical products.

Do not expose the gear unit to harmful effects such as aggressive chemical products.

5.2 Interior preservation of the gear unit

5.2.1 Special aspects of Tacolab seals

In the case of gear units with Tacolab seals, the air gaps on the shafts are usually sealed with adhesive tape or V-ring seals to provide an optimum level of corrosion protection.

NOTE

Risk of corrosion

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

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

The following diagram provides an overview of the Tacolab seal:

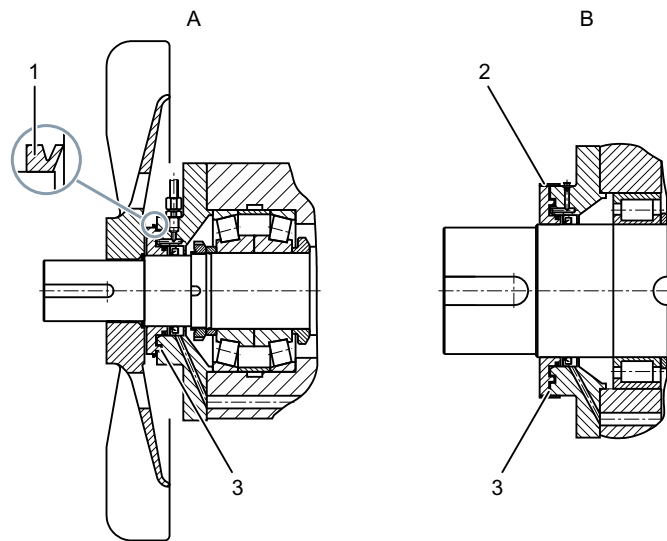


Figure 5-1: Tacolab seal

A Input shaft
B Output shaft

① V-ring
② Adhesive tape
③ Air gap



Information

Adhesive tape

Adhesive tape denotes a taut, waterproof adhesive tape that seals airtight.

5.2.2 Durability of interior preservation prior to commissioning

5.2.2.1 Introduction

The starting date of the initial preservation of the gear unit is the date of notification of readiness for shipment of the gear unit or, if no notification was issued, the date on which the gear unit was shipped.

Without any additional measures, the corrosion protection for gear units with standard packaging will keep for up to 6 months when it is transported and stored in a dry, draught-free, closed room that is not subject to significant temperature fluctuations. The durability period of the corrosion protection after delivery will vary depending on:

- Installation site, for example, outdoors, in closed rooms
- Climatic or corrosion category at the installation site
- Packaging of gear unit

The packaging used for the gear unit has a strong influence on the durability of the interior preservation:

- Sealed airtight

An airtight sealed gear unit must fulfil the following criteria for interior preservation:

5.2 Interior preservation of the gear unit

- Gear unit sealed against ingress of air from outside, for example, by using labyrinth seals with adhesive tape, Tacolab seals with V-ring seal, labyrinth seals with V-ring and adhesive tape, or gear-unit-specific seals that are described in the instructions of the gear unit.
- Existing air filters or wet-air filters replaced by screw plugs.
- Gear unit sealed with wet-air filter
A gear unit sealed with a wet-air filter must fulfil the following criteria for interior preservation:
 - The gear unit is sealed against ingress of air from outside, for example, by using labyrinth seals with adhesive tape, Tacolab seals with V-ring seal, labyrinth seals with V-ring and adhesive tape or gear-unit-specific seals that are described in the instructions of the gear unit.
 - The wet-air filter must be the only means of exchanging air with the outside.

NOTE

Danger of corrosion if standard air filters are used instead of wet-air filters during the time that preservation is applied.

If standard air filters are used, moisture may enter the interior of the gear unit and result in corrosion.

- Seal the gear unit so that it is completely airtight or use a wet-air filter.

- Sealed weatherproofing packing
Sealed weatherproofing packing must fulfil the following criteria for interior preservation:
 - Sealed weatherproofing packing creates a protective environment at all entry points in the gear unit and prevents the ingress of ambient air, for example, seaworthy packing.
 - The wooden crate contains climate-proof packaging with composite aluminium film.
 - The composite aluminium film contains desiccants packed alongside the gear unit.

5.2.2.2 Basic durability period

The following tables provide an overview of the basic durability period HD_0 of the interior preservation of gear units at the time of supply. Refer to Chapter “Preservation of the gear unit (Page 29)”.

Table for corrosivity category C1 or C2

The table shall apply subject to the following conditions:

Air with low or no saline content and low or medium humidity, as well as low or medium air pollution as per Annex C of DIN EN ISO 9223 corrosivity category C1 or C2

Packing/siting of the unit	Case	Basic durability period of the interior preservation HD ₀ Maximum extension of the durability period of the interior preservation in months	
		Castrol Alpha SP 150 S or Castrol Alpha SP 220 S	Castrol Opti-gear Synthetic 1390/220 formerly Castrol Tribol 1390/220
Sealed weatherproofing packing	8	24	36
Airtight, without packaging or in basic packaging in a closed, temperature-controlled room Temperature differences (day to night) < 10 K; condensation unlikely	7	20	30
Airtight, without packaging or in basic packaging outdoors Temperature differences (day to night) > 10 K; condensation likely, VCI cannot escape	6	17	25.5
Equipped with wet-air filters; without packaging or in basic packaging in a closed, temperature-controlled room; seals bonded with tight adhesive tape Temperature differences (day to night) < 10 K; condensation unlikely but low; VCI can escape	5	15	22.5
Equipped with wet-air filters; without packaging or in basic packaging outdoors; seals bonded with tight adhesive tape Temperature differences (day to night) > 10 K; condensation likely but low; VCI can escape	4	10	15
Equipped with normal air filter or not airtight, without packaging or in basic packaging in a closed, temperature-controlled room Temperature differences (day to night) < 10 K; condensation unlikely. VCI can escape	3	6	9
Equipped with normal air filter or not airtight, without packaging or basic packaging simply covered Temperature differences (day to night) > 10 K; condensation likely, VCI can escape	2	2	3
Equipped with normal air filter or not airtight, without packaging or basic packaging simply covered Temperature differences (day to night) > 10 K; condensation likely, VCI can escape	1	0.5 ^{*)}	0.75 ^{*)}
*) Must only be used for basic durability period and not to ascertain the preservation time for reapplication of the preservation agent.			

Table 5-1: Basic durability period HD₀ and extension of the service life of the gear unit interior preservation

At the end of the preservation period, corrosion protection must be reapplied to the gear unit, or the gear unit must be put into operation for at least 1 hour with preservative oil.

5.2 Interior preservation of the gear unit

Table for corrosivity category C3 or higher

The table shall apply subject to the following conditions:

Air with medium or high saline content and/or high humidity and/or high air pollution as per Annex C of DIN EN ISO 9223 corrosivity category C3 or higher

Packing/siting of the unit	Case	Basic durability period of the interior preservation HD ₀ Maximum extension of the durability period of the interior preservation in months	
		Castrol Alpha SP 150 S or Castrol Alpha SP 220 S	Castrol Optigear Synthetic 1390/220 formerly Castrol Tribol 1390/220
Sealed weatherproofing packing	8	24	36
Airtight, without packaging or in basic packaging Temperature differences (day to night) < 10 K; condensation unlikely	7	14	21
Airtight, without packaging or in basic packaging outdoors Temperature differences (day to night) > 10 K; condensation likely, VCI cannot escape	6	13	19.5
Equipped with wet-air filters; without packaging or in basic packaging; seals bonded with tight adhesive tape Temperature differences (day to night) < 10 K; condensation unlikely but low; VCI can escape	5	11	16.5
Equipped with wet-air filters; without packaging or in basic packaging outdoors; seals bonded with tight adhesive tape Temperature differences (day to night) > 10 K; condensation likely but low; VCI can escape	4	7	10.5
Equipped with normal air filter or not airtight, without packaging or in basic packaging Temperature differences (day to night) < 10 K; condensation unlikely. VCI can escape	3	4	6
Equipped with normal air filter or not airtight, without packaging or basic packaging simply covered Temperature differences (day to night) > 10 K; condensation likely, VCI can escape	2	1	1.5
Equipped with normal air filter or not airtight, without packaging or basic packaging simply covered Temperature differences (day to night) > 10 K; condensation likely, VCI can escape	1	0.25 ¹⁾	0.375 ¹⁾

Packing/siting of the unit		Case	Basic durability period of the interior preservation HD ₀ Maximum extension of the durability period of the interior preservation in months	
			Castrol Alpha SP 150 S or Castrol Alpha SP 220 S	Castrol Optigear Synthetic 1390/220 formerly Castrol Tribol 1390/220
		*) Must only be used for basic durability period and not to ascertain the preservation time for reapplication of the preservation agent.		

Table 5-2: Basic durability period HD_0 and extension of the service life of the gear unit interior preservation

At the end of the preservation period, corrosion protection must be reapplied to the gear unit, or the gear unit must be put into operation for at least 1 hour with preservative oil.

Durability period of preservation

If the gear unit is sealed using labyrinth seals and only one V-ring seal, the applicable preservation time is half the calculated value (upper limit value 12 months).

HD_0	Basic durability period of the preservation
HD_x	Durability period of the preservation depending on the elapsed transportation and storage phase
X	Consecutive number of the transportation and storage phase

5.2.3 Effects of changing packaging or type of storage on the durability period of the preservation

Any change to the packaging or the type of storage will also affect the durability period (HD) of the preservation. This chapter describes how you can calculate or graphically determine the change in the durability period of the preservation.

Calculation of the remaining durability period

If the type of packaging or storage is changed during the applicable durability period of the preservation HD_1 , you must calculate a new applicable, equivalent remaining durability period from the time of the change HD_{2eq} according to the following equation:

$$HD_{2eq} = (HD_0 - LD_1) \frac{HD_1}{HD_0}$$

LD_1 Storage duration to date using previously available preservation

HD_{2eq} Equivalent remaining durability period following change of the type of storage or packaging

If the type of packaging or storage is further changed during the applicable equivalent remaining durability period of the preservation HD_{2eq} , you must calculate a new applicable, equivalent remaining durability period from the time of the change HD_{x+1eq} according to the following equation:

5.2 Interior preservation of the gear unit

$$HD_{X+1eq} = (HD_{Xeq} - LD_X) \frac{HD_{X+1}}{HD_X}$$

X Sequential number of transport/storage phase

Sample calculation

Following a test run with “Castrol Alpha SP 220 S”, a gear unit is packed in sealed weather-proofing packing and shipped to the customer. The transport takes 8 months. Finally, the gear unit is unpacked at the destination and stored outdoors (corrosivity category C3). The seals remain sealed with adhesive tape and the gear unit is equipped with a wet-air filter.

HD₀ = 24 months (from the basic durability period table HD₀)

LD₁ = 8 months (storage and transport)

New durability period after unpacking:

HD₁ = 7 months (from the durability period table HD_x)

What is the remaining durability period at the destination under the new conditions?

$$HD_{2eq} = (HD_0 - LD_1) \frac{HD_1}{HD_0}$$

$$HD_{2eq} = (24 - 8) \frac{7}{24}$$

$$HD_{2eq} = 4,666 \text{ approx. 4.7 months}$$

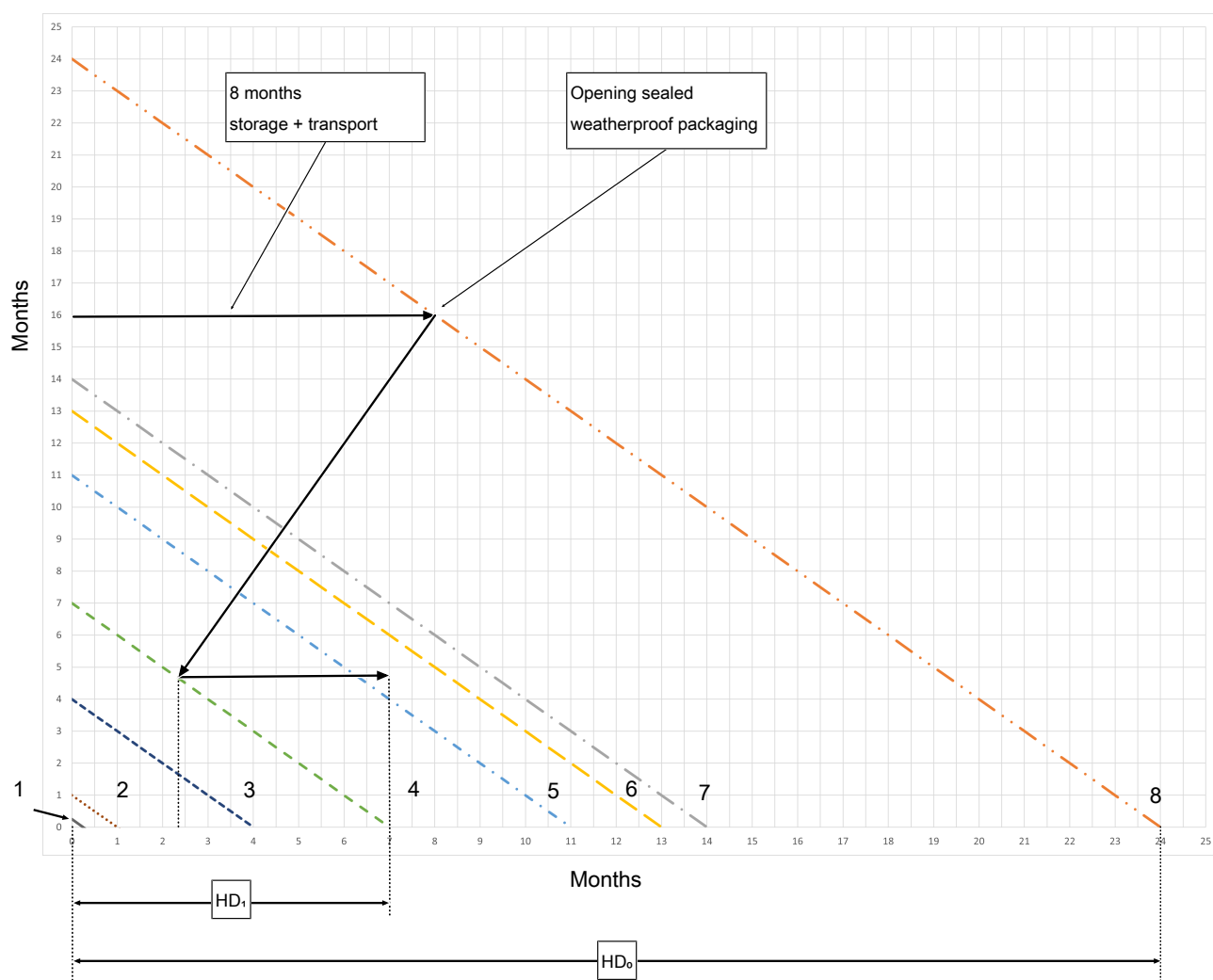


Figure 5-2: Change in basic durability period (corrosivity category C3)

- | | | | |
|---|--------|---|--------|
| 1 | Case 1 | 2 | Case 2 |
| 3 | Case 3 | 4 | Case 4 |
| 5 | Case 5 | 6 | Case 6 |
| 7 | Case 7 | 8 | Case 8 |

Refer also to the tables in the chapter Basic durability period (Page 32).

5.2.4 Extension of the interior preservation

NOTE

Risk of corrosion

The gear unit is prone to corrosion if it is not properly preserved over a shutdown period in excess of 1 week.

- With shutdown periods in excess of 1 week, preserve the gear unit interior as described in this chapter. Installed air filters must be replaced with screw plugs or wet-air filters.

Extension of the interior preservation during longer periods of storage of gear units that have not been commissioned yet

You can usually see the durability period of the HD_x interior preservation in the tables in Chapter "Durability of interior preservation prior to commissioning (Page 32)".

You must extend the preservation if the gear unit is scheduled for commissioning at a later point in time.

Record the renewal of the interior preservation and keep the document with these instructions.

Extension of the interior preservation following shutdown of the gear unit

To preserve the gear unit for a storage period of more than 1 week following shutdown, follow the procedure described in chapter Extension of the interior preservation through complete oil filling (Page 38).

5.2.4.1 Extension of the interior preservation through complete oil filling

Introduction

Gear units solely fitted with contacting shaft seals or shafts sealable with special additional devices can be filled with oil during storage. In doing so, all interior bare metal surfaces must be covered with oil.

To assess whether you can use the oil for preservation, ask your oil manufacturer the following:

- How often and from which point you need to take an oil sample
- When the oil can no longer be used for preservation

NOTE

Corrosion damage to the gear unit due to loss of preservation effectiveness

Filled gear units may not be leak-tight, and gear oil may leak.

- Perform a check every 4 weeks to make sure the filled gear unit is leak-tight. Fix any leaks. Flender assumes no liability whatsoever for damage occurring due to an oil leakage during storage.

Oils as interior preservation

NOTE

Risk of blockage to oil lines

High-viscous deposits may occur due to incompatibilities.

- For preservation, use the same type of oil that was most recently in the gear unit.
- Ask Flender about the oil type used for the test run.
- If the test run was conducted using Castrol Optigear Synthetic 1390/220, formerly Castrol Tribol 1390/220, and if the gear unit is to be preserved by filling it with a mineral oil, PAO or synthetic ester, before filling you first have to remove the remaining test run oil from the gear unit by flushing it using a mineral oil.

Flender recommends the following oils to fill gear units in order to preserve the interior:

- The same oil that will later be used as gear unit oil
- The same oil that will later be used as gear unit oil, only with a lower viscosity
- Approved oils from the T7300,
- Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)
- Castrol Alpha SP 150S
- Castrol Alpha SP 220S

Shaft seal

The durability of the preservation depends also on the shaft seals used.

Rotary shaft sealing rings are used as shaft seals. Protect the rotary shaft sealing rings against UV light so that the material remains durable.

Foreseeable durability of rotary shaft sealing rings:

- NBR material with mineral oil fill, at least 5 years
- NBR material with synthetic oils, at least 2 years
- FKM material, up to 10 years

If you have extended the preservation time, replace the rotary shaft sealing rings before commissioning.

Sealing the gear unit

You must seal the oil filling point after filling the gear unit with preservative oil.

The use of a wet-air filter is recommended which enables pressure equalisation with the environment and prevents the intrusion of water during respiration of the gear unit. The wet-air filter is not included in the standard scope of supply. You have to purchase wet-air filters separately or expressly order them as additions to the gear unit.

If you use a screw plug, make sure that the internal pressure of the gear unit does not exceed 0.5 bar due to the maximum expected temperature rise during storage. This means that the free space inside the gear unit should be at least 20% of the volume of oil.

5.2 Interior preservation of the gear unit

Procedure

To preserve the gear unit with an oil filling, proceed as follows:

- If you want to use a different oil for preservation than the oil in the gear unit, flush (Page 56) the oil residue out of the gear unit.
1. Remove any soiling from around the oil filling point.
 2. Open the oil filling point.
 3. Fill the gear unit with oil, ensuring that all metallic bright parts are covered with oil.
 4. If you use a screw plug, make sure that the internal pressure of the gear unit does not exceed 0.5 bar.
 5. Alternatively, you can use a wet-air filter instead of the screw plug.
 6. Close the oil filling point.
 7. Ensure that the storage temperature remains constant.

5.2.4.2 Extending the interior preservation with Castrol Alpha SP 150S or Castrol Alpha SP 220S

Introduction

To extend the durability period of the interior preservation, Flender recommends the VCI out-gassing preservative oil Castrol Alpha SP 150S or Castrol Alpha SP 220S for airtight gear units.

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, such as protective gloves and eye protection.
- Immediately clean up any spilt oil using a binding agent.

CAUTION

Risk of burns

When opening gear units filled with Castrol Alpha SP 150S or Castrol Alpha SP 220S, any fumes present may ignite.

- Keep naked flames, sparks and hot objects at a distance.

Proportion of Castrol Alpha SP 150S or Castrol Alpha SP 220S in the oil

Flush (Page 56) the gear unit after draining the preservative oil. For flushing, use the gear unit oil type that will be used later. This will help you prevent incompatibilities. Do **not** use the flushing oil as gear unit oil.

NOTE**Risk of corrosion**

There is a risk of corrosion if the gear unit is left open for a longer period of time.

- Seal the gear unit airtight again at the very latest one hour after it was opened.

Procedure

To extend the durability period of the interior preservation, proceed as follows:

1. Remove any soiling from around the oil filling point.
2. Open the oil filling point.
3. Fill the preservative oil at a recommended ambient and gear unit temperature $\geq 5\text{ }^{\circ}\text{C}$.
4. Use 12.5 litre of preservative oil per cubic metre of clear chamber volume.
You can determine the approximate gear unit chamber volume using the following formula:
Gear unit chamber volume $\approx (\text{length} \times \text{width} \times \text{height}) \times 0.65$
5. Close the oil filling point.
6. Use adhesive tape or another suitable material to make the air gaps of any labyrinth seals airtight.

Result

The durability period of the interior preservation of the gear unit is extended.

The table “Basic durability period HD_0 and extension of the durability period of the gear unit interior preservation” in chapter Durability of interior preservation prior to commissioning provides an overview of the durability period of the gear unit interior preservation extension in airtight sealed gear units.

If a vibration-free storage environment is not achievable, you must turn the input shaft a little each month to prevent corrosion damage. After turning, the input and output shaft must be in a new turned position. Make sure that the gear unit is still sealed airtight after turning the output shaft. You may have to take appropriate measures to seal the gear unit airtight.

5.3 Exterior preservation of metallic bright surfaces

5.3.1 Preservative agents and durability period of exterior preservation

The following table specifies the durability period for the exterior preservation of shaft ends and other metallic bright surfaces.

Durability period	Preservative agent	Layer thickness	Remarks
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5.3 Exterior preservation of metallic bright surfaces

Storage in dry rooms, up to 3 years	Tectyl 846 K-19	approx. 50 µm	Long-term preservation on wax basis: • Seawater resistant • Suitable for use in tropical climates • Soluble in CH compounds
Outdoor storage, up to 1 year			

Table 5-3: Durability period of exterior preservation

5.3.2 Extension of exterior preservation

Introduction

If you intend to store the gear unit for longer than shown in the table in Chapter Preservative agents and durability period of exterior preservation (Page 41), you must renew the preservation of the exterior bare metal surfaces. The exterior bare metal surfaces include, for example:

- Shaft ends
- Flanges
- Contact surfaces for components on the housing

NOTE**Damage to the shaft sealing ring**

The shaft sealing ring can get damaged on contact with chemically aggressive preservation or cleaning agents.

- Coat the shaft in the area of the sealing lip with grease before reapplying the preservation.

Procedure

To extend the preservation of the exterior bare metal surfaces, proceed as follows:

1. Clean the bare metal surfaces and remove any existing preservative.
2. Apply the appropriate preservative (Page 41).
3. Record the renewal of the exterior preservation and keep the document with these instructions.

Introduction

The following describes the lubrication and preservation measures for commissioning.

6.1 Necessary oil filling measures for commissioning

Requirements

Make the following preparations on the gear unit:

- Ensure there is sufficient space within the workplace and that it is clean.
- Provide the following aids and parts:
 - Suitably sized devices for draining and collecting the oil
 - Suitably cleaned devices and containers for oil sampling (Page 49)
 - Suitable devices for marking the oil sample
 - Sufficient quantity of clean flushing oil (where required)
 - Correct type and sufficient quantity of fresh oil for refilling the gear unit (Page 60)
 - Cleaned filling system and further aids, including oil filters
 - New seals (if required)
 - Oil binding agents and cleaning agents
 - Sufficient quantities of lint-free and clean cleaning cloths

Procedure

To fill the gear unit with the gear unit oil for the first time, proceed as follows:

1. Drain off the preservative oil (Page 54) and close the oil draining point.
2. Remove any adhesive tape used for sealing.
3. If it is necessary to flush the gear unit, carry out a flushing procedure (Page 56).
4. Take a sample of the fresh oil (Page 49), have it tested in a laboratory and keep the results with the gear unit documentation.
5. Remove any soiling found around the oil filling point.
6. Open the oil filling point.
7. Fill the prescribed amount of new gear unit oil (Page 60).
8. Correctly close and seal the oil filling point.
9. Replace the attached screw plug with the applicable air filter.

6.1 Necessary oil filling measures for commissioning

Commissioning of gear units that have not yet been commissioned

The following table provides an overview of the measures necessary prior to commissioning the gear unit, depending on the preservation and the extension of the preservation:

Gear unit oil	Preservation extension	Measures prior to commissioning
Castrol Alpha SP 220 S Castrol Alpha SP 150 S	None	- If the gear unit oil is a PG-based oil, drain remaining oil and flush (Page 56) thoroughly. - Fill to operating oil level with gear unit oil.
Castrol Alpha SP 220 S Castrol Alpha SP 150 S	Filled with an oil (no PG-based oil)	- If the gear unit oil is a PG-based oil, drain the oil and flush (Page 56) thoroughly. - Replace rotary shaft sealing rings. - Fill with the gear unit oil to the operating oil level. If the oil used to extend preservation is also the gear unit oil, drain to the operating oil level.
Castrol Alpha SP 220 S Castrol Alpha SP 150 S	Castrol Alpha SP 220 S Castrol Alpha SP 150 S	- If the gear unit oil is a PG-based oil, drain the preservative oil and flush (Page 56) thoroughly. - Replace rotary shaft sealing rings. - Fill to operating oil level with gear unit oil.
Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)	None	- If the gear unit oil is not a PG-based oil, drain remaining oil and flush (Page 56) thoroughly. - Fill to operating oil level with gear unit oil.
Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)	Filled with a PG-based oil	- If the gear unit oil is not a PG-based oil, drain the oil and flush (Page 56) thoroughly. - Replace rotary shaft sealing rings. - Fill with the gear unit oil to the operating oil level. If the oil used to extend preservation is also the gear unit oil, drain to the operating oil level.
Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)	Filled with a mineral oil	- Drain oil and flush (Page 56) thoroughly. - Replace rotary shaft sealing rings. - Fill to operating oil level with gear unit oil.
Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)	Castrol Alpha SP 220 S Castrol Alpha SP 150 S	- If the gear unit oil is not a PG-based oil, drain the preservative oil and flush (Page 56) thoroughly. - Replace rotary shaft sealing rings. - Fill to operating oil level with gear unit oil.

Table 6-1: Measures prior to commissioning

Recommissioning preserved and already commissioned gear units

The following table provides an overview of the measures necessary prior to recommissioning the gear unit, depending on the preservation and the extension of the preservation:

Gear unit oil	Preservation extension	Measures prior to recommissioning
---------------	------------------------	-----------------------------------

Mineral oil, PAO-based oil, synthetic esters	Filled with gear unit oil, Castrol Alpha SP 220 S or Castrol Alpha SP 150 S	- Analyse the oil. Depending on the oil analysis, drain the oil to the operating oil level or replace the oil. - If necessary, renew rotary shaft sealing rings. - If required, fill to the operating oil level with gear unit oil.
Polyglycol oil	Filled with gear unit oil	- Drain oil to the operating oil level or drain fully. - If necessary, renew rotary shaft sealing rings. - If required, fill to the operating oil level with gear unit oil.
Polyglycol oil	Filled with oil of a different type to the gear unit oil	- Drain oil. - If necessary, renew rotary shaft sealing rings. - Flush (Page 56) with oil of the same type as the gear unit oil. - Fill to operating oil level with gear unit oil.
Polyglycol oil	Castrol Alpha SP 220 S Castrol Alpha SP 150 S	- Drain oil. - If necessary, renew rotary shaft sealing rings. - Flush (Page 56) with oil of the same type as the gear unit oil. - Fill to operating oil level with gear unit oil.

Table 6-2: Measures prior to recommissioning

6.2 Information on initial filling and oil change

Please note the following information on the initial filling of a gear unit and during an oil change:

- Always make sure that the oil in the gear unit is clean.
- The purity level of the operating oil has an impact on operational safety and the service life of the gear unit and the gear oil.
- When performing an oil fill or an oil change no contaminants such as foreign bodies, water or other fluids may be allowed to enter the gear unit.
- With larger quantities of oil, perform an oil analysis (Page 52) first. Perform an oil change (Page 54) as and when needed.
- Use the Checklist for oil filling and oil change (Page 71) to document these procedures.
- After the first oil filling, the gear unit must be operated for a reduced operating time of 400 h. Change the oil after this time or check the condition of the oil using an oil analysis to continue using the oil.

Further information

Where required, further information about the initial filling and about changing oil can also be found in the gear unit instructions.

6.3 Removing exterior preservation

Introduction

Prior to assembly, you must remove all the preservative from the metallic bright exterior surfaces.

CAUTION

Risk of injury from solvents

Lengthy and repeated contact with skin can result in brittle, chapped skin.

- Please observe the manufacturer's instructions on how to handle solvents.
- Wear suitable protective equipment, such as protective gloves.

NOTE

Damage to the shaft sealing ring

The shaft sealing ring can get damaged on contact with chemically aggressive preservatives or cleaning agents.

- Coat the shaft in the area of the sealing lip with grease when reapplying the preservative.

Procedure

To remove the exterior preservation, proceed as follows:

- Remove the preservative agent from the metallic bright exterior surfaces.
- You can use white spirit, special solvents or wax remover as the solvent.

Introduction

The following describes the lubrication and preservation measures for servicing.

7.1 General maintenance information

Use a service and maintenance schedule to document all servicing and maintenance activities. The service and maintenance schedule can be found in the operating instructions for the gear unit.

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.

7.2 Checking the oil level

7.2.1 Checking the oil level using the oil dipstick

Requirements

The oil level may only be checked when the gear unit is at a standstill and the oil is foam-free. Shut down the gear unit for 5 to 10 minutes.



Information

Checking the oil level in the case of planetary gear units

With planetary gear units, the oil level is affected by the position of the planetary drives. Observe the marking on the input shaft to ensure that the position can be reproduced.

Procedure

To check the oil level using the oil dipstick, proceed as follows:

1. Remove the oil dipstick.
2. Clean the measuring surface.
3. Reinsert the oil dipstick into the oil filling point.
4. Check the oil level.
5. Reattach the oil dipstick.

Result

The oil level is correct if it lies between the MIN and MAX marks of the oil dipstick.

If the oil level is above the MAX mark, this may indicate the intrusion of a foreign liquid, e.g., water. Check the water content (Page 52) of the oil.

If the oil level is below the MIN marking, this may indicate there is a leakage.

Both situations can result in gear unit damage. Before filling with new oil, identify the cause of the fault and eliminate it.

7.2.2 Checking the oil level with the oil sight glass

Requirements

The oil level may only be checked when the gear unit is at a standstill and the oil is foam-free. Shut down the gear unit for 5 to 10 minutes.



Information

Checking the oil level in the case of planetary gear units

With planetary gear units, the oil level is affected by the position of the planetary drives.

Observe the marking on the input shaft to ensure that the position can be reproduced.

Procedure

To check the oil level using the oil sight glass, proceed as follows:

1. Clean the oil sight glass where necessary.
2. Check the oil level in the oil sight glass.

Result

The oil level is correct if it lies in the middle of the oil sight glass.

If the oil level is above the oil sight glass, this may indicate the intrusion of a foreign liquid, e.g., water. Check the water content (Page 52) of the oil.

If the oil level is below the oil sight glass, this may indicate there is a leakage.

Both situations can result in gear unit damage. Before filling with new oil, identify the cause of the fault and eliminate it.

7.2.3 Controlling the oil level with the oil level indicator

Requirements

The oil level may generally only be checked when the gear unit is at a standstill and the oil is more or less foam free. Shut down the gear unit for 5 to 10 minutes.



Information

Checking the oil level in the case of planetary gear units

With planetary gear units, the oil level is affected by the position of the planetary drives. Observe the marking on the input shaft to ensure that the position can be reproduced.

Procedure

To check the oil level using the oil level indicator, proceed as follows:

1. Clean the oil level indicator as necessary.
2. Check the oil level in the oil level indicator.

Result

The oil level is correct if it lies between the Min and Max marks of the oil level indicator.

If the oil level is above the Max mark, this may indicate the intrusion of a foreign liquid, e.g. water. Check the water content (Page 52) of the oil.

If the oil level is below the Min mark, this may indicate there is a leakage.

Both situations can result in gear unit damage. Before filling with new oil, identify the cause of the fault and eliminate it.

7.3 Oil samples

The test results of oil samples provide not only information about the condition of the oil, they also frequently enable conclusions to be made about the condition of the gear unit parts.

As an alternative to observing the fixed interval for oil changes, you have the option of arranging for the technical services of the oil manufacturer to regularly examine an oil sample, and approve the oil for further use. In this case, the oil manufacturer guarantees that the properties of the oil will comply with Flender specifications.

7.3.1 Taking oil samples

Introduction

Before filling the gear unit, arrange for a fresh sample of the lubricating oil to be tested in the laboratory for reference purposes. Also have the used oil samples tested in the same laboratory.

Record and keep the test results for later comparisons.



Risk of scalding

Risk of serious injury possible through escaping hot operating media (> 50 °C) during sampling.

Wear suitable protective gloves, safety goggles and protective clothing.

Requirements

Take the oil sample in a manner to ensure it is representative:

- Ensure that oil filling is performed as homogenously as possible. Where possible, take the oil sample when the gear unit is running and has achieved operating temperature.
- If it is necessary to bring the gear unit to a standstill, take the sample within 10 minutes after the gear unit has been shut down. This will largely prevent any separation or depositing.
- Arrange for sampling to be consistently performed at the same point, according to the same method and by the same staff.

Sample container

Suitable sample containers are clean, dry receptacles with tight seals. The sample containers must be resistant to the specimen product up to the gear oil temperature. Transparent, tightly sealable glass or PE-HD wide-neck bottles are particularly suitable.

⚠ CAUTION

Selection of unsuitable sample containers

Swallowing oil can result in physical injury.

Residue in the sample container can distort the oil sample.

Do not use milk, wine, beer, or mineral water bottles or any other containers used to store foodstuffs, even if these have been cleaned and labelled appropriately.

Test interval and oil quantity

In the following situations, follow the information provided in FVA-Richtlinie 616 „Entnahme von Ölproben“ (FVA Guideline 616 “Taking oil samples”, only available in German) as a guideline for the intervals for taking oil samples:

- Operating under normal conditions
- No significant environmental contaminants
- Installation in a hall

The following table provides an overview of the test intervals for taking an oil sample under the conditions described. Samples should be taken more frequently in the event of unfavourable conditions, significant levels of environmental contaminants or outdoor installation.

Condition		Interval for taking samples
A	1. High drive availability requirements and/or 2. High gear unit costs and/or 3. Thermal load of the gear unit continuously > 80 °C for mineral oils and >90 °C for synthetic oils	1 500 operating hours, at least every three months

Condition		Interval for taking samples
B	1. Low drive availability requirements and 2. Low gear unit costs and 3. Thermal load of the gear unit continuously <60 °C for mineral oils and <70 °C for synthetic oils	6 000 operating hours, at least once a year
C	For all conditions not covered under A or B	3 000 operating hours, at least every six months

Table 7-1: Test intervals for taking oil samples

The requisite amount of the oil sample depends on the scope of the testing needed. 250 ml is usually sufficient for routine testing.

Procedure

To take an oil sample, proceed as follows:

1. When selecting a sampling point, be sure to choose one at which flowing oil is accessible. Avoid points with non-flowing oil or taking samples of the immediate surface or very bottom of the oil. If an oil filter is located in the oil circuit, take the sample upstream of the filter location.
2. Clean the sampling point before taking the oil sample.
3. When taking the sample, avoid the intrusion of moisture (water) and contaminants (e.g., dust) from the environment.
4. Fill the oil sample into a transparent and tightly sealable glass or PE-HD wide-neck bottle.
5. If it is necessary to clean the sample container, it is recommended you do this by thoroughly flushing it several times on-site using the gear unit oil. Dispose of the flushing oil afterwards.
6. Label the sample container using an indelible pen or with a captive label. Note the following information:
 - Company / plant operator
 - Designation and, if applicable, serial number of the system
 - If applicable, the point at which the sample was taken
 - Oil type / commercial designation
 - Batch number of the oil
 - Date on which sample was taken
7. In addition to the data on the sample container, complete a sample consignment note which can be clearly assigned to the sample.
8. A copy of the sample consignment note should be kept with the gear unit documentation.
9. After the sample has been taken, the oil level must be checked and, if necessary, the oil topped up by adding fresh oil.

Further information

Further information on the properties of a suitable sample container can be found in ISO 3722 "Hydraulic fluid power-Fluid sample containers-Qualifying and controlling cleaning methods".

Further information on the required size of the oil sample can be obtained by consulting the analysing laboratory.

7.3.2 Evaluating oil sample test results

Introduction

NOTE

Usability of the oil

The gear unit can get damaged if the oil properties of the oil used no longer meet Flender specifications.

- Take an oil sample.
- Perform an oil analysis.
- The oil manufacturer must decide on the usability of the oil. The oil properties must be guaranteed in accordance with the Flender specification.

Note the following points when analysing the oil:

- Determine the water content of the oil using the indirect Karl Fischer Method.
- The kinematic oil viscosity at 40 °C may only deviate from the nominal viscosity by a maximum of 10% in accordance with DIN 51517-3. The nominal viscosity is specified in the technical data of the oil manufacturer.
- The purity of the oil should not be less than -/19/16 in accordance with ISO 4406. Notify the test laboratory that for the purposes of measurement, the oil must be thinned with **toluol** to ensure that no air bubbles or soft substances are included in the measurement.
- Trend analyses of the measured element constituents are generally of greater importance than the magnitude of the absolute values. Compared to systems with filtration, higher contaminant values are of course to be expected without filtration.

Measurement results

The following table provides an overview of the evaluation of the results of the measurement of the water content:

Water content measured for mineral oils, PAO, and non-water-dissolving PC and synthetic esters	Water content measured for water-dissolving PC	Note
< 300 ppm = 0.03%	< 15000 ppm = 1.5%	The water content of the oil is within the tolerance range.

Water content measured for mineral oils, PAO, and non-water-dissolving PC and synthetic esters	Water content measured for water-dissolving PC	Note
300 ppm ... 600 ppm = 0.03% ... 0.06%	15000 ppm ... 20000 ppm = 1.5% ... 2.0%	The water content of the oil is still in the tolerance range. Note the change in the water content of the oil. Contact Customer Service.
> 600 ppm = 0.06%	> 20000 ppm = 2.0%	The water content of the oil is no longer within the tolerance range. Identify the cause for the high water content of the oil. Eliminate the cause. If necessary, change the oil. (Page 54).

Table 7-2: Water content measurement results

Changes to the test results

The following table provides an overview of the possible causes for changes to the test results (trend analysis):

Change	Possible causes
Viscosity ↑	Short-chain constituents volatilised
	Intrusion of high-viscosity foreign fluids / greases
Viscosity ↓	Long-chain constituents split
	Viscosity Index improvers sheared / exhausted
	Intrusion of low-viscosity foreign fluids
TAN (NN) ↑	Oil aged, acids produced
PQ Index ↑	Wear caused by magnetisable substances (particularly Fe)
Fe ↑	Wear and oxidation to gears and rolling-contact bearings, corrosion to housing
Cr ↑	Wear to rolling-contact bearings and gears
Ni ↑	Wear to rolling-contact bearings and gears
Al ↑	Wear to oil pump bearings
Cu ↑	Wear to rolling-contact bearings, and plain bearings
Zn ↑	Washed out of primer
Zn ↓	Additive with Zn content used up
Sn ↑	Wear to plain bearings
Si ↑	Contamination from outside (dust)
Si ↓	Anti-foaming additive used up
Ca ↑	Contamination from outside (e.g. chalk dust)

Change	Possible causes
Oil cloudy	Contamination from water and/or other foreign fluids (including oils)
Oil darker in colour	Oil aged

Table 7-3: Trend analysis

7.4 Topping up with oil

Topping up the gear unit oil is subject to the same conditions that apply to the initial filling with gear unit oil (Page 60). This applies particularly to the use of the oil filter.

Only fill the gear unit with the oil type previously used. If it is not possible to top up the gear unit with the previously used oil type, a complete oil change (Page 54) including flushing of the gear unit (Page 56) will be necessary.

7.5 Oil change

7.5.1 Conditions and comments

Implement the following measures before performing an oil change:

- Prior to the oil change, take an oil sample (Page 49) from the gear unit while the oil is still at operating temperature. Document this oil sample for subsequent checks, and keep it for later reference.
- Perform the oil change shortly after shutting down the gear unit in order to prevent any solid materials from depositing. If this is not possible, start up the gear unit for a short period before draining the oil.

7.5.2 Draining used oil

Before you can fill up the fresh oil, you must drain the old oil and perform a flushing procedure (Page 56) if necessary.

You can drain off or suck out the oil.

Observe the information in the gear unit instructions about draining off the used oil. This particularly also applies to central lubricating systems and other oil supply equipment.

If no relevant information is given, use the lowest possible point to drain off or suck out the oil.

Requirements

 CAUTION
Risk of scalding due to hot oil Risk of injury from leakage of hot oil. • Do not heat the oil above 50 °C. • Open the oil drain screw or the oil drain valve carefully. • Wear suitable protective gloves, safety glasses and protective clothing. • Use an oil-binding agent to immediately clean up any oil spillage.

Drain off the oil while it is still warm with a temperature of approx. 50 °C.

Procedure

To drain off the used oil, proceed as follows:

1. Shut down the gear unit and ensure that it cannot be restarted.
2. Check and record the oil level (Page 47).
3. Check the gear unit for leakages (Page 63). If there is a leakage, check and eliminate the cause before refilling.
4. Open all vent holes provided before draining the oil.
Unscrew the air filter or the wet-air filter or, where relevant, the screw plug.
5. Position the oil collector under the oil drain.
6. Drain off the oil. Also empty any oil pockets.
7. Ancillary units (such as oil supply systems, oil filters), pipes and attachments must likewise be emptied.
8. Collect the drained oil in accordance with regulations.
9. On gear units equipped with an oil circulation system and oil supply systems, the oil-conducting system must be emptied in accordance with the manufacturer's instructions in the operating and maintenance instructions.
10. In the case of gear units with oil drain screw, check the condition of the sealing ring vulcanised onto the screw. Replace the oil drain screw where required.
11. Now close the oil draining point.

7.5.3 Flushing procedure

7.5.3.1 Compatibility of preservative and gear unit oil

Observe the following information concerning the necessary flushing of the gear unit, depending on the compatibility of the preservative and gear unit oil:

Preservation using	Gear unit oil based on	
	Polyglycol (PG)	Mineral oil, PAO or synthetic esters
Castrol Alpha SP 150 S	Rinse required	Flushing not required
Castrol Alpha SP 220 S	Rinse required	Flushing not required
Castrol Optigear Synthetic 1390/220 (formerly Castrol Tribol 1390/220)	Flushing not required	Rinse required

Table 7-4: Flushing requirements dependent on the preservative

NOTE**Do not use the flushing oil as gear unit oil**

For flushing, use the gear unit oil type that will be used later. This will help you prevent incompatibilities.

Do **not** use the flushing oil as gear unit oil.

7.5.3.2 Flushing the gear unit

**Information****Do not use the flushing oil as gear unit oil**

Observe any information concerning flushing in the gear unit instructions. Adapt the following example procedure to suit local conditions.

For flushing, use the gear unit oil type that will be used later. This will help you prevent incompatibilities.

Procedure

⚠ CAUTION**Risk of scalding from escaping oil**

If the oil is overheated, it may cause scalding.

- Do not heat the oil over 50 °C to avoid scalding.

To perform a flushing procedure, proceed as follows:

1. Ensure the gear unit is not in operation, and secure it against being unintentionally started up.
2. Prior to use, perform a visual check of the flushing oil for homogeneity and impurities. Do not use impure flushing oil.
3. Fill the system with flushing oil until a short run without load or in the part-load range is possible without disruptions and the pump does not suck in air.
If no pump is installed, you can use a separate filter unit with its own pump. This unit is

not included in the standard scope of supply of the gear unit.

Heated flushing oil improves the flushing action and reduces the necessary flushing time. Do not exceed 50 °C, otherwise there is a risk of scalding.

4. Take any existing ancillary units into consideration when filling with flushing oil. If necessary, these should be filled separately before being emptied after the flushing run.
5. If possible, operate the gear unit for a short time while it is filled with flushing oil. This way the flushing oil is mixed intensively with the residual oil remaining in the system and impurities are dissolved as far as possible. If this is not possible, you must extend the flushing procedure as required.
If no flushing time is specified in the gear unit instructions, it is recommended that you flush for the time needed to allow the flushing oil to perform 10 circuits. You can calculate this time for the gear unit with piping and oil supply system by multiplying amount of the flushing oil by 10 and dividing this by the pump flow rate.
The greater the quantity of gear unit oil and the worse the degree of contamination, the longer you should allow the gear unit to flush.
6. Clean the flushing oil in the bypass flow during the flushing procedure using an oil filter with a 25 µm filter mesh and a filtration quotient of $\beta_{25(c)} \geq 75$.
7. Drain off the flushing oil (Page 54).
8. Perform a visual check of the flushing oil (Page 57).

Result

If there are any impurities in the oil or the gear unit, repeat the flushing procedure until the desired result is achieved.

You can reuse the cleaned flushing oil as flushing oil after an oil analysis and in consultation with the oil manufacturer. If the flushing oil is no longer suitable for a flushing procedure, dispose of it properly.

7.5.4 Checks and tasks to be performed prior to a new oil refill

You must perform the following checks and tasks prior to refilling the gear unit with the gear unit oil.

7.5.4.1 Comparing the oil quantity

To compare the oil quantity, proceed as follows:

1. Compare the drained oil quantity with the manufacturer's nominal fill quantity.
If the quantity of oil drained is significantly less than this, despite the oil level having been correct, you may assume there are considerable residual amounts of used oil in the gear unit or in the ancillary units.
2. Perform a flushing procedure (Page 56).

7.5.4.2 Performing a visual check of the oil

To check the oil, proceed as follows:

1. Perform a visual check of the drained oil for the following characteristics:
 - Appearance
 - Colour
 - Soiling

2. If there is serious contamination (e.g. water, metal particles, sludge), contact Flender Customer Services to identify the cause.
3. Flush (Page 56) the lubricating oil system out thoroughly before refilling.

7.5.4.3 Checking gear unit components

To check the gear unit parts, proceed as follows:

1. Check oil drain screws with a magnet or, if available, magnetic extractors or oil filters for metal abrasion.
2. Clean the oil drain screw if necessary.
If there is a large amount of abrasion, contact Flender Customer Services to identify the cause.
3. Thoroughly clean the gear unit area around the inspection hole before opening to prevent dirt from getting into the interior of the gear unit from the outside when the inspection cover is opened.
4. Open the inspection cover.
5. Check the gear unit interior for deposits and the gear teeth, the rolling-contact bearings and/or the plain bearings for damage.
6. Arrange for any damage to be repaired by Flender Customer Service.
7. If heavy deposits or other high levels of impurities are present, perform a flushing procedure (Page 56).
If it is evident that the impurities cannot be removed by flushing alone, you should remove them mechanically. Use a rubber scraper to remove residues from storage containers.

7.5.4.4 Cleaning the oil filter or replacing the filter element

The oil filter may be cleaned or the filter element replaced, depending on the type of filter.

To clean the oil filter, proceed as follows:

1. Clean and replace the existing oil filter in accordance with regulations.
2. Dispose of the used oil in accordance with regulations.
With certain synthetic oils or impurities, different disposal methods may be required compared to those used for normal used oils. Note the oil datasheets.

Further information

Further information on the filter type can be found in the gear unit instructions.

7.5.4.5 Cleaning the air filter

WARNING

Compressed air can cause injuries

Water residue and dirt particles can cause damage to eyes.

- Wear suitable eye protection.

If a layer of dust has accumulated on the air filter, clean the air filter even if the prescribed time limit has not yet expired.

To clean the air filter, proceed as follows:

1. Clean the area around the filter and disassemble the filter cap of the air filter, where necessary.
2. Unscrew the air filter and filter cap.
3. Clean the air filter using a suitable cleaning agent, such as white spirit, or replace the filter element (paper filter) where applicable.
4. **Optional:** Blast the air filter with compressed air.
5. Allow the air filter to dry.
6. Screw the air filter back into the bore.
7. Reattach the filter cap of the air filter where necessary.

7.5.4.6 Replacing wet-air filters

If a wet-air filter has been mounted on the gear unit, and the silica gel in the wet-air filter has undergone a complete colour change compared to when it was new, you should replace the filter.

To replace the wet-air filter, proceed as follows:

1. Unscrew the old wet-air filter.
2. Open 2 of the 8 closed holes on the bottom of the new wet-air filter.
3. Screw the new wet-air filter back into the hole.

7.5.4.7 Checking the air-oil cooler

WARNING

Compressed air can cause injuries

Water residue and dirt particles can cause damage to eyes.

- Wear suitable eye protection.

To check the air-oil cooler, proceed as follows:

1. Remove any dirt from the cooler block.
2. Check the condition of the cooler block.
3. Check the bolt connections and pipework for leakages, and replace them if necessary.

7.5.4.8 Checking the water-oil cooler

WARNING

Compressed air can cause injuries

Water residue and dirt particles can cause damage to eyes.

- Wear suitable eye protection.

To check a water-oil cooler, proceed as follows:

1. Check the water pipes of the water-oil cooler for leakages.
2. Check the bolt connections and pipework for leakages, and replace them if necessary.

7.5.5 Filling with new oil

Introduction

When performing an oil change, as a rule fill the gear unit only with fresh oil of the type previously used. Note any information in the instructions detailing the stipulated purity class. Important reasons must exist to change the type of oil. Perform a flushing procedure (Page 56) if there are incompatibilities between the previously and subsequently used oils.

For future comparisons, keep a sample of the fresh oil taken prior to filling as a reference sample.



Information

Initial filling

When performing an initial filling, note the information from No. 27 onwards in the "Checklist for oil filling and oil change".

You will find the "Checklist for oil filling and oil change" in the annex to these instructions (Page 71).

Filling with oil filter

Fresh oil can contain impurities. Fill in the oil through an oil filter. If no information is available on the oil filter, you should normally use an oil filling filter with a 25 µm mesh and a filtration quotient of $\beta_{25(c)} \geq 75$. When using high-viscosity oils, you will usually need a filter unit with its own pump to fill the oil using a filter. This unit is not included in the standard scope of supply of the gear unit.

If you want to filter with a filter mesh of $< 25 \mu\text{m}$, ask the oil manufacturer before filtering whether the oil may be filtered with an oil filter of the planned mesh size. During filling, the oil should not be too cool because the maximum permissible viscosity for the units is frequently $1,000 \text{ mm}^2/\text{s}$.

Procedure

To fill in new gear oil, proceed as follows:

1. Clean the air filter (Page 58) or replace the wet-air filter (Page 59).
2. Perform a flushing procedure if necessary.
3. Perform a visual check of the fresh oil for the following parameters:
 - Homogeneity
 - Solid impurities and water (turbidity)
 - Colour and appearance according to the oil manufacturer's product-specific data
4. Clean the oil filling point and open it. Note the information in the dimension drawing.

5. Fill the fresh oil, using an oil filter if necessary, until the prescribed fill level is reached. The oil quantity specified on the rating plate serves as a guide only. The decisive factors for the quantity of oil to be put in are the marks on the oil dipstick or the other oil level indicator systems (Page 47).
6. Document the purity class.
7. **Optional:** For gear units with an add-on flange pump, use the screw-turn filling point to fill the flange pump and suction pipe with oil.
8. **Optional:** For gear units with pressure lubrication or oil cooling systems, you also have to fill the oil circuit. To do this, briefly start up the gear unit with attached pump.
9. **Optional:** If present, fill any oil pockets with oil. The gear teeth should also be lubricated with oil.
10. Ensure that the gear unit and all the components of the oil supply system, the oil filters and pipes are filled with oil.
11. Use an oil-binding agent to immediately clean up any oil spillage.
12. Check the oil level (Page 47) once again after a short operating time of approx. 10 minutes and an idle period of at least 15 minutes. Fill or drain off oil as necessary.
13. Close the oil filling point.

Result

The oil change or the initial filling have now been carried out.

Complete the documentation sheet for the oil change (Page 69) and keep it safely.

Check the oil filter (if fitted) for deposits after a maximum of a week. Clean or replace the oil filter if necessary. Any impurities still remaining in the system may have dissolved and may be blocking the oil filter.

Approx. 5 operating hours after the oil change take another oil sample (Page 49) from the gear unit; this will be documented and kept for later checking.

7.6 Changing the oil type

Introduction

You should only change the oil type if there are important reasons for doing so or in exceptional cases after having consulted with Flender.



Information

Flushing the gear unit

No flushing procedure is generally necessary when changing the oil type to a different type with a similar composition. However, as incompatibilities may occur with different additive technologies, the oil manufacturers must be consulted as to whether a flushing procedure (Page 56) needs to be carried out.

Changing to another oil type

Incompatibilities can arise particularly when changing to another oil type or to an oil with a very different additive technology. This may particularly be the case when changing to or from a polyglycol. Changing mineral oils and poly- α -olefins (PAO) among themselves hardly ever results in incompatibilities. The compatibility of different gear oils can only be assessed by oil manufacturers. You should, therefore, include the manufacturer when deciding whether flushing is necessary.

After draining the used oil, you must thoroughly clean and flush (Page 56) the entire system. In this case you can, at the most, use the flushing oil a second time for flushing out the same gear unit. Then dispose of the flushing oil.

Note the following additional points when changing the type of oil:

- Check the compatibility of other gear unit components, e.g., sealing materials or varnishes and paints, with the new oil. We recommend the oils approved by Flender (Page 24).
- Cavitation problems may arise with oils with a higher viscosity; larger suction line cross-sections may be required.

7.7 Checking the hose lines

Even hoses and hose lines that are properly stored and exposed only to permissible wear are subject to a natural ageing process. This limits their service life.

Changing the hose lines

Hose lines can become damaged due to excessive ageing or external influences. Check hose lines before initially commissioning the system, and at least once a year thereafter, to ensure these are in good working order.

Ensure that hose lines are replaced at appropriate intervals, even if the hose line does not show any technical/safety defect. Do not use hose lines that are **more than 6 years old**. The date of manufacture is printed on the hose lines.

Taking account of the operating conditions, you can determine the foreseeable service life based on tested and empirical values.

Procedure

To check the hose lines, proceed as follows:

1. Check the hose lines for tightness and leaks.
2. Check the date of manufacture printed on the hose lines.
3. Replace leaking or excessively old hose lines in good time, but at least every 6 years.

7.8 Re-greasing grease-lubricated labyrinths

Introduction

Only use lubricating greases approved by Flender (Page 27).

The exact designation of the grease nipples and the refilling interval can be found in the complete documentation for the gear unit.

Procedure

WARNING

Risk of slipping as a result of grease that has escaped

There is a risk of slipping if the grease escapes from the labyrinth.

- Immediately remove any grease that has escaped from the labyrinth.
- Properly dispose of grease that has escaped.

To re-grease a labyrinth, proceed as follows:

1. Clean the grease nipples.
2. Connect the lubrication device to the grease nipple.
3. Re-grease with 30 g of grease on each grease nipple.
4. Remove the lubrication device from the grease nipple.

7.9 Leakage and leak-tightness

The following table provides an overview of possible leaks in shaft seals, descriptions, necessary measures and more detailed information:

Condition of the sealing edge	Description	Actions	Notes
Leak-tight, dry	No moisture to be seen on the rotary shaft sealing ring	• None	
Leak-tight, moist	Moisture film formed as a result of operation in the region of the sealing edge, but not extending beyond the bottom of the rotary shaft sealing ring	• If dirt adheres, wipe the sealing edge down underneath the sealing lip. • Do not soil the sealing lip. • Monitor the leakage.	The rotary shaft sealing ring often dries out by itself during further operation. No reason for complaint
Leak-tight, wet	Moisture film formed extending beyond the bottom of rotary shaft sealing ring, but not dripping	• Wipe the sealing edge down underneath the sealing lip. • Do not soil the sealing lip. • Monitor the leakage.	The rotary shaft sealing ring often dries out by itself during further operation. No reason for complaint

7.9 Leakage and leak-tightness

Condition of the sealing edge	Description	Actions	Notes
Measureable leakage	Noticeable small trickle at the bottom of the rotary shaft sealing ring, dripping	• Change the rotary shaft sealing ring, if necessary. • Identify and eliminate the cause of the rotary shaft sealing ring failure. • Inform Flender customer service about the incident.	Possibly a reason for complaint; one drop of oil per day is acceptable.
Short-term leakage	Short malfunction of the sealing system	• Wipe the sealing edge down underneath the sealing lip. • Do not soil the sealing lip. • Monitor the leakage.	Caused by small dirt particles at the sealing edge, for example, which are removed again during subsequent operation. No reason for complaint
Apparent leakage	Temporary leakage	• Wipe the sealing edge down underneath the sealing lip. • Do not soil the sealing lip.	Usually attributable to excessive grease filling between sealing lip and dust lip, or to oil secretions from the grease filling of labyrinth seals. No reason for complaint

Table 7-5: Condition of the sealing edge

**Information****Escaping oil mist**

If oil mist escapes through a vent valve or a labyrinth seal, this is function-related and is therefore **no reason for complaint**.

Further information

Further information on the subject of "Leakages in gear units" can be found in DIN 3761.

8.1 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

Alfred-Flender-Straße 77

46395 Bocholt

Germany

Tel.: +49 (0)2871 / 92-0

Fax: +49 (0)2871 / 92-2596

Further information

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

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

Disposal of gear units

When disposing of the gear unit after its useful life, please observe the following measures:

- Remove gear unit oil, preservation agent and coolant from the gear unit and dispose of them 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 spillage 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.

Documentation sheet for oil change

A

Oil change/Oil fill record			
System:		Gear unit:	
Date:	Operating hours:	Last oil change:	
according to nameplate Oil to be used:		Quantity according to Nameplate:	
Condition before oil change			
Name of oil:		Oil fill level:	
Gear unit / oil supply system leak-tight? yes ☐ no ☐		Filter choked? yes ☐ no ☐	
Operating temperature: °C			
Other anomalies:			
.....			
Used oil			
Code of used oil sample:		Laboratory number:	
Quantity:			
Result of visual oil check:			
Gear unit / oil supply system			
Deposits? yes ☐ no ☐			
Result of visual oil check:			
Fresh oil			
Name of oil:			
Designation of fresh oil:		Laboratory number:	
Filtered during filling yes ☐ no ☐		Filter mesh: µm Filled quantity:	
Result of visual oil check:			
Was the gear unit and/or the oil supply system flushed prior to filling with fresh oil?			
yes ☐ with no ☐			
Anomalies (where relevant):			
.....			
Designation of 5-hour operating oil sample:		Laboratory number:	
Recorded by:		Department:	
Date:		Signature:	

Check list for oil filling and oil change

B

Note the points in the following oil change checklist.

1	Oil change record ready for completion?	☐	2	Sufficient fresh oil available?	☐
3	Sufficiently large oil collector and used oil receptacle(s) available?	☐	4	Sufficient oil binding agents and cleaning agents available?	☐
5	Sufficient room for oil change available?	☐	6	Oil samples (used and fresh oil) taken and stored?	☐
7	Protective clothing (goggles, protective gloves, etc.) available and worn?	☐	8	Oil change performed by specialist personnel?	☐
9	Have maintenance instructions of the gear unit and oil supply system manufacturers been read?	☐	10	Leakages in the input or output recorded following visual inspection?	☐
11	Used oil heated to between 30 and 50 °C and drive started?	☐	12	Drive shut down and secured against restarting?	☐
13	Vent hole opened?	☐	14	Oil collector placed under the oil drain?	☐
15	Drain carefully opened? (Risk of scalding!)	☐	16	Used oil drained completely?	☐
17	Ancillary units, oil pockets and pipework empty (if present)?	☐	18	Oil spillages immediately cleaned up using oil-binding agent?	☐
19	Used oil analysed and recorded?	☐	20	Gear unit and other units thoroughly cleaned?	☐
21	Gear unit's internal components inspected for damage, repaired or replaced (if necessary)?	☐	22	Gear unit and oil supply system with pipework flushed out (if necessary)?	☐
23	Oil filter cleaned or replaced (if necessary)?	☐	24	Seals changed?	☐
25	Opened vent and drain points closed again?	☐	26	Causes of leakages eliminated (see item 10)?	☐
27	Fresh oil visually checked?	☐	28	Oil filling openings opened?	☐
29	Fresh oil filled through oil filter up to mark on the oil level check point?	☐	30	Oil filling opening closed?	☐
31	Drive operated for short time (approx. 10 minutes)?	☐	32	Oil level checked (after min. 15 minutes idle time)?	☐
33	Oil topped up or drained off until the oil level is correct (if necessary)?	☐	34	Oil change record filled out completely?	☐
35	Used oil sample checked?	☐	36	Used oil properly disposed of?	☐
37	Oil sample of the new gear unit oil taken after approx. 5 hours and stored (for checking whenever there is a change of oil type)?	☐	38	Binding agents and cleaning cloths properly disposed of?	☐
39	Drive put back into operation?	☐	40	Oil filter checked and cleaned or replaced (after one week's operation at most)?	☐

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