

Gear-unit lubrication

for
marine gearboxes

Assembly and operating instructions
BA 7301 en 09/2012

FLENDER supplies

SIEMENS

Gear-unit lubrication

for
marine gearboxes

Assembly and operating instructions

Translation of the original assembly and operating instructions

Lubricating oils

1

Lubricating greases

2

Check list for
oil filling and oil change

3

Documentation sheet
for oil change

4

Notes and symbols in these assembly and operating instructions

Note: The term "Assembly and operating instructions" will in the following also be shortened to "instructions" or "manual".

Legal notes

Warning note concept

This manual comprises notes which must be observed for your personal safety and for preventing material damage. Notes for your personal safety are marked with a warning triangle or an "Ex" symbol (when applying Directive 94/9/EC), those only for preventing material damage with a "STOP" sign.



WARNING! Imminent explosion!

The notes indicated by this symbol are given to prevent **explosion damage**.
Disregarding these notes may result in serious injury or death.



WARNING! Imminent personal injury!

The notes indicated by this symbol are given to prevent **personal injury**.
Disregarding these notes may result in serious injury or death.



WARNING! Imminent damage to the product!

The notes indicated by this symbol are given to prevent **damage to the product**.
Disregarding these notes may result in material damage.



NOTE!

The notes indicated by this symbol must be treated as general **operating information**.
Disregarding these notes may result in undesirable results or conditions.



WARNING! Hot surfaces!

The notes indicated by this symbol are made to prevent **risk of burns due to hot surfaces** and must always be observed.
Disregarding these notes may result in light or serious injury.

Where there is more than one hazard, the warning note for whichever hazard is the most serious is always used. If in a warning note a warning triangle is used to warn of possible personal injury, a warning of material damage may be added to the same warning note.

Qualified personnel

The product or system to which these instructions relate may be handled only by persons qualified for the work concerned and in accordance with the instructions relating to the work concerned, particularly the safety and warning notes contained in those instructions. Qualified personnel must be specially trained and have the experience necessary to recognise risks associated with these products or systems and to avoid possible hazards.

Intended use of Siemens products

Observe also the following:



Siemens products must be used only for the applications provided for in the catalogue and the relevant technical documentation. If products and components of other makes are used, they must be recommended or approved by Siemens. The faultfree, safe operation of the products calls for proper transport, proper storage, erection, assembly, installation, start-up, operation and maintenance. The permissible ambient conditions must be adhered to. Notes in the relevant documentations must be observed.

Trademarks

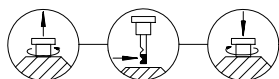
All designations indicated with the registered industrial property mark ® are registered trademarks of Siemens AG. Other designations used in these instructions may be trademarks the use of which by third parties for their own purposes may infringe holders' rights.

Exclusion of liability

We have checked the content of the instructions for compliance with the hard- and software described. Nevertheless, variances may occur, and so we can offer no warranty for complete agreement. The information given in these instructions is regularly checked, and any necessary corrections are included in subsequent editions.

Symbols

Earth connection point		Air relief point		yellow	
Oil-filling point		yellow	Oil-draining point		white
Oil level		red	Oil level		red
Oil level		red	Connection for vibration-monitoring device		
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 always be firmly screwed in.

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1. Lubricating oils for marine gearboxes



These assembly and operating instructions do not apply to gear units made by WINERGY AG and Flender Graffenstaden S.A.S. These plants provide different instructions.



For "FLENDER gear units" not referred to in these assembly and operating instructions the following manuals will apply:

**Helical-gear, bevel-gear, bevel-helical
and planetary-gear units and geared motors: BA 7300**
Worm-gear unit: BA 7303

1.1 Oil groups and base oils

Siemens Mechanical Drives (MD), Bocholt, distinguishes between the following oil groups in regard to gear oils for "FLENDER marine gearboxes":

- Standard oils
- Motor oils
- Biologically degradable oils (also called "BIO" for short)

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

- Mineral oils
- Poly- α -olefins (also called "PAO" for short)
- synthetic esters



Theoretically all base oil types may occur in each oil group.

1.2 Quality, code numbers, approval lists

1.2.1 Required quality of the gear oils to be used

For "FLENDER marine gearboxes", Siemens approves only CLP quality oils which contain constituents to DIN 51517-3 for improvement of corrosion prevention and resistance to ageing and which reduce wear in mixed-friction areas.

Furthermore, monograde motor oils (DIN 51502) in CKC quality to ISO 12925 may in special cases be permitted.

The oils must have passed the following tests (see also Specification of gear-oil approvals for "FLENDER gear units"):

- | | |
|--|---|
| • Scuffing resistance in the FZG-test to DIN ISO 14635-1 under A/8.3/90 test conditions | Fail stage > 12
(for motor oils ≥ 12) |
| • FE-8 rolling-bearing test to DIN 51819-3 under the D-7.5/80-80 test conditions | Rolling-element wear < 30 mg
Cage wear: state value |
| • Resistance to grey staining to FVA 54 I-IV | GS fail stage ≥ 10
Resistance to grey staining
GFT = high
(for motor oils:
GF fail stage ≥ 9
Resistance to grey staining
GFT = medium) |
| • Flender foam test | - Increase in total volume 1 minute after switching off ≤ 15 %

- Increase in oil-air dispersion 5 minutes after switching off ≤ 10 % |
| • Static and dynamic "FLENDER-Freudenberg test" for shaft sealing rings | Approval by Messrs. Freudenberg |
| • Compatibility with liquid seals | Approval by Messrs. Loctite |
| • "FLENDER-Mäder-Farbttest" (colour test) | Approval by Messrs. Mäder |
| • Lubricating oils used in "FLENDER marine gearboxes" with multiple-disk couplings must in addition meet the requirements specified for the Ortlinghaus-plates compatibility test. | Approval by Messrs. Ortlinghaus |



Oil group, base oil and viscosity class as stated in the specifications on the rating plates and information in the gear unit documentation must be adhered to! Failure to do so will result in invalidation of the guarantee.

If oil filters are used in the system the oil supplier should be requested to confirm that the filters do not negatively affect the characteristics of the oil.

The unapproved use of oils which do not comply with the above quality requirements will invalidate the Siemens product guarantee obligation. In addition adherence to the instructions given in these operating instructions are conditional for any claims under warranty.

Deviations are permitted only after consultation with Siemens!

If the operating conditions have been subsequently modified and differ from those stated in the customer's order, the gear oil to be used must be approved by Siemens in writing.

1.2.2 Code numbers

To help its customers Siemens MD, Bocholt, has grouped oils in approval lists. The above-mentioned test results have been verified to Siemens for these oils by the oil manufacturers. Also worldwide adherence to the characteristics, features and minimum requirements required by Siemens has been guaranteed by the oil manufacturers.



Assignment of the approved oils to the oil groups, the base oils and the viscosities is indicated by code numbers in the approval lists.

Code number E 15 indicates e.g. all standard mineral oils with the viscosity ISO VG 220.

Table 1: Code numbers of lubricant assignment
Oils for "FLENDER-marine gearboxes" **without multiple-disk clutch**

ISO VG/ SAE*	150	220	40*
Mineral oils	E 16	E 15	
Poly- α -olefins	E 36	E 35	
Biologically degradable CLP oils – Synthetic esters	E 46	E 45	
Motor oils*			E 66

*) Viscosity indication "**SAE**" applies to motor oils.

Table 2: Code numbers of lubricant assignment
Oils for "FLENDER-marine gearboxes" **with multiple-disk clutch**

ISO VG/ SAE*	150	40*
Mineral oils	E 76	
Poly- α -olefins	E 86	
Biologically degradable CLP oils – Synthetic esters	E 96	
Motor oils*		E 66

*) Viscosity indication "**SAE**" applies to motor oils.

Table 3: Code numbers of lubricant assignment
Rolling-bearing greases for use in "FLENDER gear units"

NLGI class	2	3
Mineral oil base	H 14	H 13

1.2.3 Lists of approved lubricants



The approval lists "T 7300" with the current gear-oil recommendations for "FLENDER gear units" are available as "FAQ" on the Internet under the following link:

<http://support.automation.siemens.com/WW/view/en/44231658>

We recommend checking before any oil change whether the chosen lubricant is still approved by Siemens.

The approval of these gear oils for use in "FLENDER gear units" and their consequent inclusion in the relevant lists does not mean that Siemens is liable for the suitability and quality of the oils. Nor is Siemens liable for any damage caused to "FLENDER gear units" by the use of these gear oils. Each gear-oil manufacturer is always responsible for the suitability and quality of his own product.

1.3 Oil temperatures

Synthetic gear oils have a wider temperature range and a higher viscosity index (i.e. a flatter viscosity-temperature gradient) than mineral oils.

The operating-temperature range of the base oils most frequently used can be approximately specified as follows:

- Mineral oils approx. - 10 °C to + 90 °C (short term + 100 °C)
- Poly- α -olefins approx. - 20 °C to + 100 °C (short term + 110 °C)
- Synthetic esters (biologically degradable) approx. - 15 °C to + 90 °C
- Motor oils approx. - 10 °C to + 100 °C



The upper and lower operating temperatures of certain gear oils may deviate widely from the values indicated. For operating conditions outside the above-mentioned temperature ranges the flash point and pour point provide information which must normally not be understood to represent operating-limit values. For data on and characteristics of the gear oils please see the oil manufacturers' technical data sheets and safety data sheets.



The operating temperatures of the gear unit and the type of base oil must not be changed without consulting Siemens!

1.4 General oil-service lives

The service lives set out below are guaranteed by the oil manufacturers for the gear oils approved by Siemens (see also item 1.2) without substantial changes in oil qualities.

These specifications apply to an average oil temperature of 80 °C in the oil sump of the gear unit.

- Mineral oils, motor oils and synthetic esters: 2 years or 10 000 operating hours
- Poly- α -olefins 4 years or 20 000 operating hours



The actual service lives may differ. Here the rule applies that a temperature rise of 10 K will roughly halve and a temperature reduction of 10 K will roughly double the service life.

1.5 Information about initial filling and oil change

The purity level of the gear oil affects the operational reliability and service life of the oil and the gear unit. Accordingly, care should be taken to use only clean oil in the gear unit. For initial filling and oil changes the supplementary specifications, if any, in the gear unit instructions must also be observed.

Careful initial filling and careful oil changing contribute considerably to an increase in the operational reliability and service life of both the gear unit and the oil.



When putting in and changing oil no impurities such as foreign bodies, water or other liquids must be allowed to get into the interior of the gear unit.



In the case of large quantities of oil it is recommended to carry out an oil analysis to determine whether the oil needs to be cleaned or changed.



For recording purposes it is recommended to use table 6 (see section 4).

1.6 Safety at work, environmental protection and general information

All work carried out on the gear unit must be carried out carefully and by qualified personnel only (see also "Qualified Personnel" on page 3 of these instructions).

The following regulations and documents must be adhered to:

- Regulations for safety at work and environmental protection.
- Regulations for the disposal of used oil.



Gear oils are recyclable materials. Local legal requirements must be observed when disposing of them.

- Product data sheets for the oils used, including flushing oil, if necessary
- Safety data sheets for the oils and aids used
- Operating and maintenance instructions for the gear units scheduled for initial filling or oil change, including the oil supply system
- Documentation sheet for oil change (see table 6)

The following preparations must be made on the gear unit:

- Suitable body protection must be used (skin care media, gloves, work shoes, safety glasses, ear protectors, etc.).
- Sufficient space and cleanliness in the work place must be ensured.
- Provision of following aids and parts:
 - suitable oil-collecting and/or extraction equipment of a sufficient size
 - suitable, cleaned equipment and containers for oil sampling (see item 1.11)
 - suitable equipment for marking the oil sample
 - sufficient quantity of clean flushing oil (if necessary)
 - correct type and sufficient quantity of fresh oil for refilling the gear unit
 - cleaned filling system and further aids, including filling filters
 - fresh seals (if necessary)
 - oil binding and cleaning media
 - lintfree, clean cleaning cloths in sufficient quantity



For initial filling the procedure set out in item 1.8 must be adhered to.

1.7 Procedure for emptying the gear unit



It is recommended to use the check list in table 5 as an aid.

Before the oil is changed, a sample of the oil still warm from operation should be taken from the gear unit in an adequate manner and documented and kept for later reference (see item 1.11).

1.7.1 Draining off the used oil filling

- Note information given in the operating instructions for draining off the used oil. This also applies particularly to central lubricating systems and other oil supply equipment. If no relevant information is given, the lowest possible point must be used to drain off or suck out the oil.
- Shut down gear unit and ensure that it cannot be started up.
- Check and record oil level.



An oil level above the max mark may indicate that a foreign liquid (e.g. water) has got in. An oil level below the min mark may indicate that there is a leak. Both conditions must be rated as a fault and may result in damage to the gear unit. The cause must be found and, if necessary, rectified before refilling!



After shutting off the gear unit the oil should be changed as soon as possible to prevent any solid matter from settling. Should this not be possible, the gear unit must be run again for a short while before draining off the oil. The oil should as far as possible be drained off while it is still hot (approx. 50 °C).



Risk of scalding from escaping hot oil!

- Visual check for possible leakage. If there is leakage, the cause must be found and rectified before refilling.
- Before draining off or sucking out the oil open all vent holes provided.
- Position the oil collector under the oil drain.
- Drain off or suck out oil and, if necessary, also empty all oil pockets.



Risk of scalding from escaping hot oil! Open drain carefully.

- The oil draining off must be collected in accordance with regulations. If necessary, ancillary units (such as oil supply systems, filters) and pipework must likewise be emptied.
- On gear units with an oil-circulation system and on oil supply systems the oil-conducting system must be emptied in accordance with the manufacturer's instructions in the operating and maintenance instructions.



Any spilled oil must be immediately bound with oil binding material and disposed of in accordance with regulations!

1.7.2 Checks and work to be done before refilling the gear unit

- The quantity of oil drained off must be compared with the manufacturer's rated quantity. If despite a correct oil level the quantity is considerably less than the rated quantity, it must be assumed that there are considerable quantities of used oil remaining in the gear unit and/or the ancillary units.



In this case the flushing procedure set out in item 1.9 must be followed.

- The oil drained off must be checked visually (appearance, colour, impurities, etc).
- If there is serious contamination (e.g. by water, metal particles, sludge), a specialist (preferably a Siemens specialist) must be called in to trace the cause.



The lubricating-oil system must then be thoroughly flushed out before refilling (see item 1.9).

- Oil-drain plugs with a magnet or magnetic extractors provided must be inspected for and freed of abraded metal. If a large amount of abraded metal is suspected, a specialist (preferably a Siemens specialist) must be called in to trace the cause.
- On gear units with inspection holes the interior of the gear unit must be checked for deposits and the teeth and bearings checked for damage. Any damage must be repaired. If there are heavy deposits or other impurities, the flushing procedure set out in item 1.9 must be followed. If it is evident that the impurities cannot be removed by flushing alone, they must be removed mechanically. Residues may be removed from storage containers by using a rubber scraper.



Before opening inspection covers on gear units the area around the inspection hole must be thoroughly cleaned to prevent dirt from getting into the interior of the gear unit from outside when the cover is opened.

- Oil filters and seals provided must be cleaned or changed in accordance with regulations.
- The used oil must be disposed of in accordance with regulations.



Certain synthetic oils or impurities may have to be disposed of by different means from that for normal used oils. The oil data sheets must be observed.

1.8 Putting in the fresh gear oil



For initial filling it is recommended to use table 5, "Oil-change check list", from point 27 on as an aid.



For oil changing the gear unit must be filled only with fresh oil of the type and make previously used. If necessary, the specifications for the required purity class in the operating instructions must be observed. The make of oil or even the type of base oil must not be changed without very good reasons. If the oils previously used and those subsequently used are incompatible, a flushing procedure must be followed (see item 1.9).



It is recommended to keep a sample of the fresh oil before filling as a reference sample for later comparison.

The following steps must be carried out:

- Clean the seats of the vent covers, drain plugs, etc).
- If necessary, fit previously new seals on previously opened vent covers, drain plugs, etc., and close.
- If necessary, a flushing procedure must be followed at this point. Unless otherwise prescribed by the gear-unit and/or oil manufacturer, the procedure as set out in item 1.9 is recommended.
- Check fresh oil visually for the following parameters:
 - Homogeneity
 - Freedom from solid impurities and water (clouding)
 - Colour and appearance in compliance with the oil manufacturer's product-specific data
- Put in fresh oil up to the prescribed fill level.



The oil quantity specified on the rating plates is only a guide value. Decisive for the quantity of oil to be put in are the marks on the oil dipstick or the other oil level indication systems.

- Fresh oil may be contaminated. The oil should therefore be put in through a filter as set out in the operating and maintenance instructions. If no specifications are available for this, filling filters with a filter mesh of 10 µm have proved highly effective. It is recommended to preheat the oil to between 35 and 40 °C. It sometimes also suffices to store the oil to be used to fill the gear unit with for approx. 2 to 3 days in a room at a temperature of approx. 25 °C before putting it in.
- If necessary, also fill ancillary units (oil systems, filters, etc.) and pipework.
- After a short operating time (approx. 10 minutes) and a rest time of at least 15 minutes the oil level must be rechecked and, if necessary, more oil put in or oil drained off.



It is recommended to take an oil sample approx. 5 operating hours after changing the oil and to record and keep it for later checking.

- Fill out and keep the documentation sheet for the oil change (see table 6).
- After a week at most check the oil filter (if provided) for deposits and, if necessary, clean or replace it. Impurities still remaining in the system may have dissolved and may be blocking the filters.

1.9 Flushing procedure



When changing the oil make, particularly the base oil type, if the gear oil put in is badly contaminated or major repairs have been carried out on the gear unit, a flushing procedure is necessary before finally filling the system with the operating oil.

If necessary, specifications for flushing included in the gear unit operating instructions must be adhered to. The following procedure is given only as an example and must be adjusted to suit local conditions.



The described procedure must be scheduled **in addition** to the activities specified for oil changing and must be integrated at the appropriate point in the procedure plan.

- Ensure that the gear unit cannot be started up.
- To prevent incompatibilities the same type of lubricating oil as that to be used later should be used for flushing. To achieve a better flushing and dissolving effect a lower viscosity level of the same type of oil may have to be selected. Here the lubrication requirements of all components, including the pumps, must be taken into consideration.



The use of special cleaning or flushing oils is possible and is sometimes unavoidable.



If special cleaning or flushing oils are used, prior agreement with the oil supplier and Siemens is necessary.

- As with oil changing for the fresh oil as set out in item 1.8, the flushing oil must be visually checked before use.
- The system must be filled with the oil designated for flushing until a short run without load or in the part-load range is possible without disruptions



Heated flushing oil improves the flushing action and shortens flushing time. Because of the risk of scalding 50 °C must not be exceeded.



Risk of scalding from escaping hot oil!

- When filling with flushing oil any ancillary units provided must be taken into consideration. If necessary, these should be filled separately and emptied again after the flushing run.
- The gear unit must be operated for a short time with the flushing oil filling to ensure that it is mixed intensively with the residual oil remaining in the system and to as far as possible dissolve impurities. If no flushing time is specified in the operating and maintenance instructions, at least 10 to 60 minutes are recommended. The greater the operating oil quantity and the worse the contamination, the longer the time taken for flushing should be.



It is recommended to clean the flushing oil in the bypass flow during the flushing operation.

- The flushing oil must then be drained off. The procedure is identical to that followed for draining off the used oil (see item 1.7.1).
- The flushing oil must be visually checked. If there are still unacceptable impurities in the oil and/or the gear unit, this flushing procedure must be repeated until the desired result is achieved.

Depending on its condition, the flushing oil may be cleaned and re-used as flushing oil or must be disposed of.



The flushing oil must not be used as operating oil.

1.10 Procedure when changing the type of oil



The type of oil should be changed in exceptional cases only for important reasons. When changing to another base oil type or to an oil with very different additive technology, incompatibilities may result.

Ultimately only oil manufacturers can judge the compatibility of different gear oils. It is therefore urgently advisable to involve them in the decision process.



When changing to a lubricating oil with another base oil type or with different additive technology, the entire system must be thoroughly cleaned and flushed after draining off the used oil (see item 1.9). In this case the flushing oil may be used at most a second time to flush out the same gear unit. The flushing oil must then be disposed of.



When changing to a new type of oil of similar composition a flushing procedure as set out in item 1.9 is likewise to be recommended.

The following points must be **additionally** observed when changing the type of base oil:

- The compatibility of the new oil with other gear unit components, e.g. sealing materials or varnishes and paints, must be checked. To be recommended are the oils approved by Siemens (see item 1.2).
- Cavitation problems may arise with oils of a higher density. Larger suction line cross-sections may be required.

1.11 Oil samples

1.11.1 Taking an oil sample

- For reference purposes a fresh oil sample of the operating lubricating oil must, before the gear unit is filled, be analysed by the laboratory, in which the samples of the used oil are also to be inspected later. The test results must be recorded and kept for later comparisons.
- The oil sample must be taken so that it is representative. A precondition for this is that the oil filling is as homogeneous as possible. For this reason the oil sample should be taken, if possible, while the gear unit is running, when the oil is still warm from operation, from the same point and always by the same method and by the same specialist. If the gear unit has to be stationary, the sample must be taken no later than 10 minutes after the gear unit is taken out of operation. In this way demixture or deposition is largely avoided.
- When choosing the sampling point, it is important that the agitated oil is accessible. Places where the oil has not been agitated or samples of the immediate oil surface or from the bottom must be avoided. If there is a filter in the oil circuit, the sample must be taken from a point upstream of the filter.
- The sampling point must be cleaned before the oil sample is taken. While the sample is being taken, moisture (water) and contaminants (e.g. dust) from the environment must be prevented from entering.
- The required size of the sample is determined by the required scope of the analysis. In case of doubt it is recommended that the analysing laboratory be consulted. Normally, 250 ml are sufficient for routine analyses. The sample containers must be suitable, clean, dry vessels with tight closures (see standard ISO 3722: Hydraulic fluid power - Fluid sample containers - Qualifying and controlling cleaning methods <4>). They must be resistant to the sample material up to operating oil temperature. Transparent and tightly sealable wide-neck bottles of glass or HD-PE have proved suitable. If it should be necessary to clean the sample containers, it is recommended that they be thoroughly flushed out several times on site with the operating oil. The flushing oil must then be disposed of.



Milk, wine, beer, mineral-water bottles or other containers used to store foodstuffs must not be used as sample containers, even if they have been properly cleaned and marked.

- The sample container must be marked with an indelible pencil or unlosable label. It is recommended that the following data be given:
 - Company / system operator
 - Designation and, if applicable, serial number of the system
 - If applicable the point at which the sample has been taken
 - Oil type, commercial designation
 - Date at which sample has been taken

In addition to the data on the sample container a sample-consignment note which can be clearly assigned to the sample must be completed. A copy of the sample-consignment note should be kept with the gear-unit documentation.

- After the sample has been taken, the oil level must be checked and, if necessary, the oil topped up by adding fresh oil.

1.11.2 Assessing the test results

The water content of the oil must be assessed as follows:

- Mineral oils, PAOs, non-water-dissolving polyglycols, esters:

< 300 ppm	= 0.03 %	⇒ In order
300 ppm – 600 ppm	= 0.03 % – 0.06 %	⇒ Observation, check trend behaviour; if necessary, consult Siemens.
> 600 ppm	= 0.06 %	⇒ Not in order; determine and rectify cause; if necessary, change oil.

- Water-dissolving polyglycols:

< 15 000 ppm	= 1.5 %	⇒ In order
15 000 ppm – 20 000 ppm	= 1.5 % – 2.0 %	⇒ Observation, check trend behaviour; if necessary, consult Siemens.
> 20 000 ppm	= 2.0 %	⇒ Not in order; determine and rectify cause; if necessary, change oil.

- The deviation in the viscosity of the oil sample from the viscosity of the oil specified in the technical data should not exceed 10 %.
- The purity of the oil should not be less than specified in the following:
–/20/15 acc. to ISO 4406
 The test laboratory must be informed that for measurement the oil must be thinned with **toluol**.
- Trend analyses of the measured element contents are mostly more important than the magnitude of the absolute values. Without filtration higher contamination levels are naturally to be expected than are found in the case of systems with filtration.

Table 4: Possible cause of changes in test results (trend analysis)

Change		Possible causes
Viscosity ↑	–	Short-chain constituents volatilised
	–	High-viscosity foreign fluids / greases got in
Viscosity ↓	–	Long-chain constituents cracked
	–	Viscosity-index improvers cut or used up
	–	Low-viscosity foreign fluids got in
TAN (NZ) ↑	–	Oil aged, acids produced
PQ-Index ↑	–	Wear caused by magnetisable substances (particularly Fe)
Fe ↑	–	Wear and oxidation on gears and rolling bearings, corrosion on housing
Cr ↑	–	Wear on rolling bearings and gears
Ni ↑	–	Wear on rolling bearings and gears
Al ↑	–	Wear on oil-pump bearings
Cu ↑	–	Wear on rolling-bearing cages and slide bearings
Zn ↑	–	Washed out of priming coat
Zn ↓	–	Additive with Zn content used up
Sn ↑	–	Wear on slide bearings
Si ↑	–	Contamination from outside (dust)
Si ↓	–	Anti-foaming additive used up
Ca ↑	–	Contamination from outside (e.g. chalk dust)
Oil clouded	–	Contamination from water and/or other foreign fluids (including oils)
Oil darker	–	Oil aged



The oil supplier must decide about the further usability of the oil. He must guarantee that the properties of the oil conform to the Siemens specification.

2. Lubricating greases for gear units and rolling bearings

For special gear-unit applications, grease lubrication of the bearings may be necessary.



Greases may be used only if their use is specified in the operating instructions for the gear unit. The relubrication periods must be adhered to.

As well as lubrication, rolling-bearing greases are used for the special sealing of bearing points, e.g. with vertical gear-unit connection shafts or against environmental action such as dust or water spray.



In closed gear units with internal oil lubrication the gear oil must not be allowed to mix with bearing grease.



The approval lists "T 7300" with the current grease recommendations for "FLENDER gear units" are available as "FAQ" on the Internet under the following link:

<http://support.automation.siemens.com/WW/view/en/44231658>

When using greases, we recommend checking every year whether the chosen lubricant is still approved by Siemens.

3. Check list for oil filling and oil change

Table 5: Oil-change check list

1	Oil-change record ready for completion?	<input type="checkbox"/>	21	Gear unit internal parts inspected for damage, repaired or replaced (if necessary)?	<input type="checkbox"/>
2	Sufficient fresh oil available?	<input type="checkbox"/>	22	Gear unit and oil supply system with pipework flushed out (if necessary)?	<input type="checkbox"/>
3	Sufficiently large oil collector and used oil receptacle(s) available?	<input type="checkbox"/>	23	Oil filter cleaned or replaced (if necessary)?	<input type="checkbox"/>
4	Sufficient oil binding and cleaning materials available?	<input type="checkbox"/>	24	Seals changed?	<input type="checkbox"/>
5	Sufficient room available for oil change?	<input type="checkbox"/>	25	Opened vent and drain points closed again?	<input type="checkbox"/>
6	Oil samples (used and fresh oil) taken and stored?	<input type="checkbox"/>	26	Cause(s) of leaks removed (see item 10)?	<input type="checkbox"/>
7	Protective clothing (glasses, gloves, etc.) available and used?	<input type="checkbox"/>	27	Fresh oil visually checked?	<input type="checkbox"/>
8	Oil change by specialist personnel?	<input type="checkbox"/>	28	Oil filling hole(s) opened?	<input type="checkbox"/>
9	Gear unit and/or oil supply system manufacturers' maintenance instructions read?	<input type="checkbox"/>	29	Fresh oil put in through filter up to mark on the oil-level check point?	<input type="checkbox"/>
10	Leaks in the drive and/or output recorded after visual check?	<input type="checkbox"/>	30	Oil-filling hole closed?	<input type="checkbox"/>
11	Used oil at a temperature of between 30 and 50 °C and drive started?	<input type="checkbox"/>	31	Drive started and run for a short while (approx. 10 minutes)?	<input type="checkbox"/>
12	Drive shut down and prevented from restarting?	<input type="checkbox"/>	32	Oil level checked (after min. 15 minutes rest time)?	<input type="checkbox"/>
13	Vent hole opened?	<input type="checkbox"/>	33	Oil topped up or drained off until the oil level is correct (if necessary)?	<input type="checkbox"/>
14	Oil collector placed under the oil drain?	<input type="checkbox"/>	34	Oil-change record completed?	<input type="checkbox"/>
15	Drain opened carefully? Caution - risk of scalding!	<input type="checkbox"/>	35	Sample of used oil checked?	<input type="checkbox"/>
16	Used oil completely drained off?	<input type="checkbox"/>	36	Used oil correctly disposed of?	<input type="checkbox"/>
17	Ancillary units, oil pockets and pipework emptied (if any)?	<input type="checkbox"/>	37	Sample of new operating oil taken after approx. 5 hours and stored (for checking when changing type of oil)?	<input type="checkbox"/>
18	Spilled oil immediately bound with suitable material?	<input type="checkbox"/>	38	Binding material and cleaning cloths correctly disposed of?	<input type="checkbox"/>
19	Used oil assessed and recorded?	<input type="checkbox"/>	39	Drive re-started?	<input type="checkbox"/>
20	Gear unit and other units thoroughly cleaned?	<input type="checkbox"/>	40	Filter checked and cleaned or replaced (after one week's operation at most)?	<input type="checkbox"/>

4. Documentation sheet for oil change

Table 6: Oil-change oil-filling record

Oil-change oil-filling record		
System:	Gear unit:	
Date:	Operating hours:	Last oil change
Oil to be used according to rating plate:	Quantity according to rating plate:	
Condition before oil change		
Designation of oil:	Oil level:	
Gear unit/oil supply system leaktight? yes <input type="checkbox"/>	no <input type="checkbox"/>	Filter dirty? yes <input type="checkbox"/> no <input type="checkbox"/>
Operating temperature: °C		
Other noticeable features:		
.....		
Used oil		
Identification mark of used-oil sample:	Laboratory number:	
Quantity:		
Result of visual check of oil:		
Gear unit / oil supply system		
Deposits? yes <input type="checkbox"/> no <input type="checkbox"/>		
Result of visual check of oil:		
Fresh oil		
Designation of oil:		
Designation of fresh-oil sample:	Laboratory number:	
Filtered during filling? yes <input type="checkbox"/>	no <input type="checkbox"/>	Filter mesh: µm Quantity put in:
Result of visual check of oil:		
Was/were the gear unit and/or the oil-supply system flushed before being filled with fresh oil?		
yes <input type="checkbox"/> with		
no <input type="checkbox"/>		
Noticeable features (if applicable):		
.....		
Designation of 5-hour operating oil sample:		Laboratory number:
Name of recorder:		Department:
Date:	Signature:	

Further Information:

"FLENDER gear units" on the Internet

www.siemens.com/gearunits

"FLENDER couplings" on the Internet

www.siemens.com/couplings

Service & Support:

<http://support.automation.siemens.com/WW/view/en/10803928/133300>

Lubricants:

<http://support.automation.siemens.com/WW/view/en/42961591/133000>

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