Operating instructions

BA 7300 EN 12.08

Recommended lubricants
for FLENDER helical-gear, bevel-helical gear and planetary-gear units
and geared motors

ADDINOL	AMSOIL	ANDEROL	anglomoil	ARAL	AVIA
Bharat Petroleum	BECHEM	BEL-RAY	bp	Brugarolas	B&L
Castrol	CEPSA	Chevron	cognis	DELTA OIL	Eni
FAG	LUBRIPLATE	FRAGOL	FUCHS	FUCHS LUBRITECH	galp energia
HP	IndianOil	KLÜBER LUBRICATION	LE	LOTOS Oil	LUKOIL
MEGUIN	Mobil	MOTOREX	NYCO	OMV	ORLEN OIL
PETRO-CANADA	Petrol Ofisi	Q8	REPSOL YPF	Shell	SINOPEC
SRS	STATOIL	TOTAL	WISURDA	VECO	Verkol

FLENDER

A. Friedr. Flender AG • D-46393 Bocholt • Tel. 02871/92-0 • Telefax 02871/92-2596 • www.flender.com

Translation of the original operating instructions

Contents

Notes and symbols used in this manual

WARNING! Imminent **personal injury!**

The information indicated by this symbol is given to prevent **personal injury.**

WARNING! Imminent **damage to the product!**

The information indicated by this symbol is given to prevent **damage to the product**.

NOTE!

The information indicated by this symbol must be treated as general **operating information**.

1. Lubricants for helical-gear, bevel-helical gear and planetary-gear units and geared motors

These lubricant recommendations do not apply to gear units from the companies WINERGY AG and FLENDER Graffenstaden SA, as they require different lubricants.

For gear units not referred to in these operating instructions the following lubricant recommendations must be adhered to:

Ship's gearbox:	**BA 7301**
Tram- and railway gear unit:	**BA 7302**
Worm-gear unit:	**BA 7303** (Siemens Geared Motors GmbH)
ZAPEX and FLUDEX couplings:	**BA 7304**

The oil indications relating to geared motors apply only to FLENDER deliveries made until 30.09.2007. After this date the specifications issued by Siemens Geared Motors GmbH will apply.

According to manufacturer's information the gear oils listed in these operating instructions are manufactured and/or supplied **world-wide** to the quality required by FLENDER. **Exceptions:** Observe footnotes in the following tables.

1.1 Required quality of gear oils

For its gear units, FLENDER 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. The scuffing resistance in the FZG test to DIN ISO 14635-1 must comply with stage 12 or higher under A/8,3/90 test conditions. In the FE-8 rolling bearing test to DIN 51819-3 rolling element wear must be < 30 mg and cage wear < 100 mg under D-7,5/80-80 test conditions.

In addition, the gear oils must meet the following quality requirements demanded by FLENDER:

- Sufficiently high grey-staining resistance in accordance with FVA 54 grey-staining test
  a) for helical-gear, bevel-gear and planetary-gear units, GS-criteria stage 10 or higher applies, and grey-staining resistance GST = high
- Low degree of foaming with less than 15 % foam formation in the FLENDER foam test
- Compatibility with elastomer materials of the radial shaft-sealing rings used in FLENDER gear units
- Compatibility with residues of corrosion-protection agent and run-in oils used by FLENDER
- Compatibility with the paints used by FLENDER in its gear-unit interiors
- Compatibility with liquid seals between bolted-joint surfaces

The oil group and oil viscosity indicated on the rating plates as well as the instructions in the gear-unit operating instructions must be adhered to! Failure to do so will result in invalidation of the guarantee.

The use of gear oils which do not comply with the above quality requirements will invalidate the FLENDER 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 FLENDER!

If the operating conditions have been subsequently modified and differ from those stated in your order, the lubricant to be used must be approved by FLENDER in writing.

The lubricants listed in BA 7300 EN operating instructions are approved for use in FLENDER gear units. The lubricant manufacturers guarantee worldwide that the gear oils listed here have the properties and characteristics and meet the minimum requirements specified by FLENDER. Approval is based on confirmation by lubricant manufacturers that the CLP quality complies with DIN 51517-3 and/or CKC with ISO 12925 and on verifications based on oil samples in tests of adherence to the suitability criteria specified by FLENDER.

The approval of these lubricants for use in FLENDER gear units and the consequent inclusion in the BA 7300 EN operating instructions does not mean that FLENDER is liable for the suitability and quality of the lubricants or is liable in the event of damage to FLENDER gear units arising from the use of these lubricants. Each lubricant manufacturer is always responsible for the suitability and quality of his own product.

These BA 7300 EN operating instructions, including FLENDER's current lubricant recommendations, are available in the latest edition on the Internet at http://www.flender.com. We recommend regularly checking whether the selected lubricant is still approved by FLENDER.

1.1.1 Oil groups

In table A, five oil groups are distinguished:

- Mineral oils (MIN oil)
- Polyglycols (PG oil)
- Poly-α-olefins (PAO oil)
- Biologically degradable oils (BIO oil)
- Physiologically safe oils approved in accordance with NSF-H1 (PHY oil).

1.1.2 Oil temperatures

The synthetic oils have a wider temperature range and a higher viscosity index, i. e. a flatter viscosity-temperature gradient, than the mineral oils. Guideline values for temperature range:

– mineral oils approx. - 10 °C to + 90 °C (short term + 100 °C);

– polyglycols and poly-α-olefins approx. - 20 °C to + 100 °C (briefly + 110 °C);

– bio-degradable oils (synthetic esters) approx. - 15 °C to + 90 °C.
(does not apply to natural esters - rape seed oils, etc. -).

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 or pour point of the oils must be observed. For these and other data and properties of the gear oils, refer to the oil manufacturers' technical data sheets (for this purpose FLENDER must be consulted).

1.1.3 General oil service lives

According to the manufacturers, the following are the minimum periods during which the oils can be used without undergoing any significant change in quality. They are calculated on the basis of an average oil temperature of 80 °C:

– for mineral oils, biologically degradable oils and physiologically safe (synthetic esters) oils 2 years or 10 000 operating hours **(does not apply to natural esters - rape seed oils, etc. -)**.

– for poly-α-olefins and polyglycols: 4 years or 20 000 operating hours.

The actual service lives may be higher or lower for temperatures over 80 °C. The general rule is that an increase in temperature of 10 K will halve the service life.

1.1.4 Oil change

The degree of purity of the oil affects the operating reliability and life span of the oil and the gear units. It should therefore be ensured that the oil in the gear unit is clean. For the first oil change after start-up as well as for subsequent oil changes follow the instructions in the gear-unit operating manual. In the case of larger oil quantities an analysis should be carried out before cleaning or changing the oil.

When changing oil of the same type, the quantity of oil remaining in the gear unit should be kept as low as possible. Generally speaking, a small residual quantity will cause no particular problems. Gear oils of different types and manufacturers must not be mixed. If necessary, the manufacturer should confirm that the new oil is compatible with residues of the old oil. When changing to very different types of oil or oils with very different additives, especially when changing from polyglycols to another gear oil or vice versa, the gear unit must always be well flushed out with the new oil. Residues of old oil must be completely removed from the gear unit.

FLENDER should be consulted or the suitability should have been confirmed in writing by the lubricant manufacturer.

Gear oils must never be mixed with other substances. Flushing with paraffin or other solvents is not permitted, as traces of these substances always remain inside the gear unit (see also any instructions in the product-related operating manuals).

Table A	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant			ADDINOL	AMSOIL The First in Synthetics	ANDEROL® Specialty Lubricants	anglomoil SUPERIOR LUBRICANTS
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680	CLP 680 S ECO GEAR 680 M			
	A13	VG 460	CLP 460 S ECO GEAR 460 M			
	A14	VG 320	CLP 320 S ECO GEAR 320 M			
	A15	VG 220	CLP 220 S ECO GEAR 220 M			
	A16	VG 150	CLP 150 S ECO GEAR 150 M			
	A17	VG 100	ECO GEAR 100 M			
Polyglycols (PG oil)	A21	VG 1000				
	A22	VG 680				
	A23	VG 460				
	A24	VG 320				
	A25	VG 220				
	A26	VG 150				
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000		Amsoil Power Transmission EP1000	4111 XEP 5999 XEP	
	A32	VG 680	ECO GEAR 680 S	Amsoil Power Transmission EP 680	4680 XEP 5680 XEP	Indsyn EP 680
	A33	VG 460	ECO GEAR 460 S	Amsoil Power Transmission EP 460	4460 XEP 5460 XEP	Indsyn EP 560
	A34	VG 320	ECO GEAR 320 S	Amsoil Power Transmission EP 320	4320 XEP 5320 XEP	Indsyn EP 320
	A35	VG 220	ECO GEAR 220 S	Amsoil Power Transmission EP 220	4220 XEP 5220 XEP	Indsyn EP 220
	A36	VG 150	ECO GEAR 150 S		4150 XEP 5150 XEP	Indsyn EP 150
	A37	VG 100	ECO GEAR 100 S		4100 XEP	
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

Table A Lubricant	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
			ARAL	AVIA	Bharat Petroleum	BECHEM
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680	Degol BG 680 Plus / Degol BMB 680 1)	GEAR RSX 680		
	A13	VG 460	Degol BG 460 Plus / Degol BMB 460 1)	GEAR RSX 460		
	A14	VG 320	Degol BG 320 Plus / Degol BMB 320 1)	GEAR RSX 320		
	A15	VG 220	Degol BG 220 Plus / Degol BMB 220 1)	GEAR RSX 220		
	A16	VG 150	Degol BG 150 Plus / Degol BMB 150 1)	GEAR RSX 150		
	A17	VG 100	Degol BG 100 Plus / Degol BMB 100 1)	GEAR RSX 100		
Polyglycols (PG oil)	A21	VG 1000	Degol GS 1000			
	A22	VG 680	Degol GS 680	GEAR VSG 680		BERUSYNTH EP 680
	A23	VG 460	Degol GS 460	GEAR VSG 460		BERUSYNTH EP 460
	A24	VG 320	Degol GS 320	GEAR VSG 320		BERUSYNTH EP 320
	A25	VG 220	Degol GS 220	GEAR VSG 220		BERUSYNTH EP 220
	A26	VG 150	Degol GS 150	GEAR VSG 150		BERUSYNTH EP 150
	A27	VG 100		GEAR VSG 100		BERUSYNTH EP 100
Poly-α-olefins (PAO oil)	A31	VG 1000		SYNTOGEAR PE 1000		
	A32	VG 680		SYNTOGEAR PE 680 / EVOGEAR SX 680	MAK Syngear 680	
	A33	VG 460	Degol PAS 460	SYNTOGEAR PE 460 / EVOGEAR SX 460	MAK Syngear 460	
	A34	VG 320	Degol PAS 320	SYNTOGEAR PE 320 / EVOGEAR SX 320	MAK Syngear 320	
	A35	VG 220	Degol PAS 220	SYNTOGEAR PE 220 / EVOGEAR SX 220	MAK Syngear 220	
	A36	VG 150	Degol PAS 150	SYNTOGEAR PE 150		
	A37	VG 100		SYNTOGEAR PE 100		
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

1) with solid content MoS_2

Table A	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant			BEL-RAY TOTAL PERFORMANCE LUBRICANTS	bp	Brugarolas	B&L
Mineral oils (MIN oil)	A11	VG 1000		Energol GR-XP 1000	Beslux Gear XP 1000	
	A12	VG 680		Energol GR-XP 680	Beslux Gear XP 680	
	A13	VG 460		Energol GR-XP 460	Beslux Gear XP 460	
	A14	VG 320		Energol GR-XP 320	Beslux Gear XP 320	
	A15	VG 220		Energol GR-XP 220	Beslux Gear XP 220	
	A16	VG 150		Energol GR-XP 150		
	A17	VG 100				
Polyglycols (PG oil)	A21	VG 1000			Beslux Sincart W 1000	
	A22	VG 680		Enersyn SG-XP 680	Beslux Sincart W 680	
	A23	VG 460		Enersyn SG-XP 460	Beslux Sincart W 460	
	A24	VG 320		Enersyn SG-XP 320	Beslux Sincart W 320	
	A25	VG 220		Enersyn SG-XP 220	Beslux Sincart W 220	
	A26	VG 150		Enersyn SG-XP 150	Beslux Sincart W 150	
	A27	VG 100		Enersyn SG-XP 100		
Poly-α-olefins (PAO oil)	A31	VG 1000	Bel-Ray Synth. Gear Oil 6698		Beslux Gearsint XP 1000	
	A32	VG 680	Bel-Ray Synth. Gear Oil 6696		Beslux Gearsint XP 680	
	A33	VG 460	Bel-Ray Synth. Gear Oil 6694	Enersyn EP-XF 460	Beslux Gearsint XP 460	
	A34	VG 320	Bel-Ray Synth. Gear Oil 6692	Enersyn EP-XF 320	Beslux Gearsint XP 320	
	A35	VG 220	Bel-Ray Synth. Gear Oil 6690	Enersyn EP-XF 220	Beslux Gearsint XP 220	
	A36	VG 150	Bel-Ray Synth. Gear Oil 6688	Enersyn EP-XF 150	Beslux Gearsint XP 150	
	A37	VG 100		Enersyn EP-XF 100		
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				RIVOLTA S.G.L. 680
	A43	VG 460				
	A44	VG 320				RIVOLTA S.G.L. 320
	A45	VG 220				RIVOLTA S.G.L. 220
	A46	VG 150				
	A47	VG 100				RIVOLTA S.G.L. 100 *)
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

*) synthetic esters

Table A	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant			Castrol classic	Castrol performance	CEPSA	Chevron
Mineral oils (MIN oil)	A11	VG 1000	Alpha SP 1000	Optigear BM 1000 Tribol 1100 / 1000	CEPSA AEROGEAR 1000	
	A12	VG 680	Alpha SP 680	Optigear BM 680 Tribol 1100 / 680	CEPSA AEROGEAR 680	
	A13	VG 460	Alpha SP 460 Alpha MAX 460	Optigear BM 460 Tribol 1100 / 460	CEPSA AEROGEAR 460	Meropa WM 460
	A14	VG 320	Alpha SP 320 Alpha MAX 320	Optigear BM 320 Tribol 1100 / 320	CEPSA AEROGEAR 320	Meropa WM 320
	A15	VG 220	Alpha SP 220 Alpha MAX 220	Optigear BM 220 Tribol 1100 / 220	CEPSA AEROGEAR 220	Meropa WM 220
	A16	VG 150	Alpha SP 150 Alpha MAX 150	Optigear BM 150 Tribol 1100 / 150		Meropa WM 150
	A17	VG 100	Alpha MAX 100	Optigear BM 100 Tribol 1100 / 100		Meropa WM 100
Polyglycols (PG oil)	A21	VG 1000		Tribol 1300 / 1000		Synlube WS 1000
	A22	VG 680		Tribol 1300 / 680		Synlube WS 680
	A23	VG 460		Tribol 1300 / 460		Synlube WS 460
	A24	VG 320		Tribol 1300 / 320		Synlube WS 320
	A25	VG 220		Tribol 1300 / 220		Synlube WS 220
	A26	VG 150				Synlube WS 150
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000		Optigear Synth. X 1000		
	A32	VG 680	Alphasyn EP 680	Optigear Synth. X 680	AEROGEAR SYNT 680	
	A33	VG 460	Optigear Synth. A 460 Alphasyn EP 460	Optigear Synth. X 460 Tribol 1710 / 460	AEROGEAR SYNT 460	
	A34	VG 320	Optigear Synth. A 320 Alphasyn EP 320	Optigear Synth. X 320 Tribol 1710 / 320	AEROGEAR SYNT 320	
	A35	VG 220	Optigear Synth. A 220 Alphasyn EP 220	Optigear Synth. X 220 Tribol 1710 / 220	AEROGEAR SYNT 220	
	A36	VG 150	Alphasyn EP 150 2)	Optigear Synth. X 150		
	A37	VG 100		Optigear Synth. X 100		
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460		Tribol BioTop 1418 / 460 *)		
	A44	VG 320		Tribol BioTop 1418 / 320		
	A45	VG 220		Tribol BioTop 1418 / 220		
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680		Optileb GT 680 3)		
	A53	VG 460		Optileb GT 460		
	A54	VG 320		Optileb GT 320		
	A55	VG 220		Optileb GT 220		
	A56	VG 150		Optileb GT 150		
	A57	VG 100		Optileb GT 100		

2) use only up to 95 °C
3) PAO oil
*) synthetic esters

Table A Lubricant	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
			cognis	DELTA OIL	Eni	LUBRIPLATE
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680				
	A13	VG 460		EP Industrial G 460	AGIP Blasia FMP 460	
	A14	VG 320		EP Industrial G 320	AGIP Blasia FMP 320	
	A15	VG 220		EP Industrial G 220	AGIP Blasia FMP 220	
	A16	VG 150			AGIP Blasia FMP 150	
	A17	VG 100				
Polyglycols (PG oil)	A21	VG 1000	Breox SL 1000			
	A22	VG 680	Breox SL 680			
	A23	VG 460	Breox SL 460			
	A24	VG 320	Breox SL 320			
	A25	VG 220	Breox SL 220			
	A26	VG 150	Breox SL 150			
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000				
	A32	VG 680				
	A33	VG 460				
	A34	VG 320				
	A35	VG 220				
	A36	VG 150				
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000	Breox FGL 1000 [4)]			
	A52	VG 680	Breox FGL 680 [4)]			Lubriplate PGO / FGL 680 [4)]
	A53	VG 460	Breox FGL 460 [4)]			Lubriplate PGO / FGL 460
	A54	VG 320	Breox FGL 320 [4)]			Lubriplate PGO / FGL 320
	A55	VG 220	Breox FGL 220 [4)]			Lubriplate PGO / FGL 220
	A56	VG 150	Breox FGL 150 [4)]			Lubriplate PGO / FGL 150
	A57	VG 100				

4) PG oil

Table A		Viscosity	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant	Code no.	ISO-VG DIN 51519 at 40 °C (mm^2/s)	FRAGOL	FUCHS	FUCHS LUBRITECH	galp energia
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680		RENOLIN CLP 680 / RENOLIN CLP 680 PLUS	GEARMASTER CLP 680	
	A13	VG 460		RENOLIN CLP 460 / RENOLIN CLP 460 PLUS	GEARMASTER CLP 460	
	A14	VG 320		RENOLIN CLP 320 / RENOLIN CLP 320 PLUS	GEARMASTER CLP 320	
	A15	VG 220		RENOLIN CLP 220 / RENOLIN CLP 220 PLUS	GEARMASTER CLP 220	
	A16	VG 150		RENOLIN CLP 150 / RENOLIN CLP 150 PLUS	GEARMASTER CLP 150	
	A17	VG 100		RENOLIN CLP 100 / RENOLIN CLP 100 PLUS	GEARMASTER CLP 100	
Polyglycols (PG oil)	A21	VG 1000	Ucolub BSL-IG 1000	RENOLIN PG 1000	GEARMASTER PGP 1000	
	A22	VG 680	Ucolub BSL-IG 680	RENOLIN PG 680	GEARMASTER PGP 680	
	A23	VG 460	Ucolub BSL-IG 460	RENOLIN PG 460	GEARMASTER PGP 460	
	A24	VG 320	Ucolub BSL-IG 320	RENOLIN PG 320	GEARMASTER PGP 320	
	A25	VG 220	Ucolub BSL-IG 220	RENOLIN PG 220	GEARMASTER PGP 220	
	A26	VG 150	Ucolub BSL-IG 150	RENOLIN PG 150	GEARMASTER PGP 150	
	A27	VG 100	Ucolub BSL-IG 100	RENOLIN PG 100	GEARMASTER PGP 100	
Poly-α-olefins (PAO oil)	A31	VG 1000			GEARMASTER SYN 1000	
	A32	VG 680		RENOLIN UNISYN CLP 680	GEARMASTER SYN 680	
	A33	VG 460	Ucolub N-PA 460	RENOLIN UNISYN CLP 460	GEARMASTER SYN 460	Galp Transgear SMP 460
	A34	VG 320	Ucolub N-PA 320	RENOLIN UNISYN CLP 320	GEARMASTER SYN 320	Galp Transgear SMP 320
	A35	VG 220	Ucolub N-PA 220	RENOLIN UNISYN CLP 220	GEARMASTER SYN 220	Galp Transgear SMP 220
	A36	VG 150		RENOLIN UNISYN CLP 150	GEARMASTER SYN 150	Galp Transgear SMP 150
	A37	VG 100		RENOLIN UNISYN CLP 100	GEARMASTER SYN 100	
Biologically degradable oils (BIO oil)	A41	VG 1000		PLANTOGEAR 1000 S *)	GEARMASTER ECO 1000 *)	
	A42	VG 680		PLANTOGEAR 680 S	GEARMASTER ECO 680	
	A43	VG 460		PLANTOGEAR 460 S	GEARMASTER ECO 460	
	A44	VG 320		PLANTOGEAR 320 S	GEARMASTER ECO 320	
	A45	VG 220		PLANTOGEAR 220 S	GEARMASTER ECO 220	
	A46	VG 150		PLANTOGEAR 150 S	GEARMASTER ECO 150	
	A47	VG 100		PLANTOGEAR 100 S	GEARMASTER ECO 100	
Physio-logically safe oils (PHY oil)	A51	VG 1000	Ucolub BSL 1000 5)			
	A52	VG 680	Ucolub BSL 680 5)			
	A53	VG 460	Ucolub BSL 460 5)			
	A54	VG 320	Ucolub BSL 320 5)			
	A55	VG 220	Ucolub BSL 220 5)			
	A56	VG 150	Ucolub BSL 150 5)			
	A57	VG 100				

5) PG oil
*) synthetic esters

Table A		Viscosity	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant	Code no.	ISO-VG DIN 51519 at 40 °C (mm^2/s)	HP	IndianOil	KLÜBER LUBRICATION	
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680			Klüberoil GEM 1 - 680 N	609 ALMASOL Vari-Purpose Gear Lubricant
	A13	VG 460			Klüberoil GEM 1 - 460 N	608 ALMASOL Vari-Purpose Gear Lubricant
	A14	VG 320			Klüberoil GEM 1 - 320 N	605 ALMASOL Vari-Purpose Gear Lubricant
	A15	VG 220			Klüberoil GEM 1 - 220 N	607 ALMASOL Vari-Purpose Gear Lubricant
	A16	VG 150			Klüberoil GEM 1 - 150 N	604 ALMASOL Vari-Purpose Gear Lubricant
	A17	VG 100			Klüberoil GEM 1 - 100 N	606 ALMASOL Vari-Purpose Gear Lubricant
Polyglycols (PG oil)	A21	VG 1000			Klübersynth. GH 6 - 1000	
	A22	VG 680			Klübersynth. GH 6 - 680	
	A23	VG 460			Klübersynth. GH 6 - 460	SYNPAG™ 460
	A24	VG 320			Klübersynth. GH 6 - 320	SYNPAG™ 320
	A25	VG 220			Klübersynth. GH 6 - 220	SYNPAG™ 220
	A26	VG 150			Klübersynth. GH 6 - 150	
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000				
	A32	VG 680		Servosyngear Plus 680	Klübersynth. GEM 4 - 680 N	
	A33	VG 460	Parthan SL 460 Parthan EP SA 460	Servosyngear AMP 460 Servosyngear Plus 460	Klübersynth. GEM 4 - 460 N	
	A34	VG 320	Parthan SL 320 Parthan EP SA 320	Servosyngear AMP 320 Servosyngear Plus 320	Klübersynth. GEM 4 - 320 N	
	A35	VG 220	Parthan SL 220 Parthan EP SA 220	Servosyngear AMP 220 Servosyngear Plus 220	Klübersynth. GEM 4 - 220 N	
	A36	VG 150	Parthan SL 150	Servosyngear AMP 150	Klübersynth. GEM 4 - 150 N	
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320			Klübersynth. GEM 2 - 320 *)	
	A45	VG 220			Klübersynth. GEM 2 - 220	
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680			Klübersynth UH 1 6-680	
	A53	VG 460			Klübersynth UH 1 6-460	
	A54	VG 320			Klübersynth UH 1 6-320	
	A55	VG 220			Klübersynth UH 1 6-220	
	A56	VG 150			Klübersynth UH 1 6-150	
	A57	VG 100			Klübersynth UH 1 6-100	

*) synthetic esters

Table A	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant			LOTOS Oil	LUKOIL	MEGUIN	Mobil
Mineral oils (MIN oil)	A11	VG 1000				
	A12	VG 680		LUKOIL STEELO 680		Mobilgear XMP 680 / Mobilgear 600 XP 680
	A13	VG 460		LUKOIL STEELO 460		Mobilgear XMP 460 / Mobilgear 600 XP 460
	A14	VG 320		LUKOIL STEELO 320		Mobilgear XMP 320 / Mobilgear 600 XP 320
	A15	VG 220		LUKOIL STEELO 220		Mobilgear XMP 220 / Mobilgear 600 XP 220
	A16	VG 150		LUKOIL STEELO 150		Mobilgear XMP 150 / Mobilgear 600 XP 150
	A17	VG 100				Mobilgear XMP 100 / Mobilgear 600 XP 100
Polyglycols (PG oil)	A21	VG 1000				
	A22	VG 680	Transmil Synthetic Extra PG 680			
	A23	VG 460	Transmil Synthetic Extra PG 460			
	A24	VG 320	Transmil Synthetic Extra PG 320			
	A25	VG 220	Transmil Synthetic Extra PG 220			
	A26	VG 150	Transmil Synthetic Extra PG 150			
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000				Mobil SHC 639
	A32	VG 680			megol Gearoil Synth 680	
	A33	VG 460			megol Gearoil Synth 460	Mobil SHC 634
	A34	VG 320	Transmil Synthetic 320		megol Gearoil Synth 320	Mobil SHC 632
	A35	VG 220	Transmil Synthetic 220		megol Gearoil Synth 220	Mobil SHC 630
	A36	VG 150				Mobil SHC 629
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

Table A			Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant	Code no.	**Viscosity** ISO-VG DIN 51519 at 40 °C (mm^2/s)	MOTOREX	NYCO	OMV	ORLEN OIL
Mineral oils (MIN oil)	A11	VG 1000			OMV gear HST 1000	
	A12	VG 680	GEAR COMPOUND PLUS 680		OMV gear HST 680	TRANSOL PREMIUM 680
	A13	VG 460	GEAR COMPOUND PLUS 460		OMV gear HST 460	TRANSOL PREMIUM 460
	A14	VG 320	GEAR COMPOUND PLUS 320	Nycolube 8360	OMV gear HST 320	TRANSOL PREMIUM 320
	A15	VG 220	GEAR COMPOUND PLUS 220	Nycolube 8350	OMV gear HST 220	TRANSOL PREMIUM 220
	A16	VG 150	GEAR COMPOUND PLUS 150	Nycolube 8340	OMV gear HST 150	
	A17	VG 100	GEAR COMPOUND PLUS 100		OMV gear HST 100	
Polyglycols (PG oil)	A21	VG 1000				
	A22	VG 680				
	A23	VG 460				
	A24	VG 320				
	A25	VG 220				
	A26	VG 150				
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000	GEAR SINTEC CLP 1000			TRANSGEAR PE 1000
	A32	VG 680	GEAR SINTEC CLP 680			TRANSGEAR PE 680
	A33	VG 460	GEAR SINTEC CLP 460			TRANSGEAR PE 460
	A34	VG 320	GEAR SINTEC CLP 320			TRANSGEAR PE 320
	A35	VG 220	GEAR SINTEC CLP 220			TRANSGEAR PE 220
	A36	VG 150	GEAR SINTEC CLP 150			
	A37	VG 100	GEAR SINTEC CLP 100			
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

Table A	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant			PETRO-CANADA	Petrol Ofisi	Q8	REPSOL YPF
Mineral oils (MIN oil)	A11	VG 1000		PO Gravis MP 1000		
	A12	VG 680		PO Gravis MP 680		
	A13	VG 460		PO Gravis MP 460		Super Tauro FND 460
	A14	VG 320		PO Gravis MP 320	Q8 Goya NT 320	Super Tauro FND 320
	A15	VG 220		PO Gravis MP 220	Q8 Goya NT 220	Super Tauro FND 220
	A16	VG 150		PO Gravis MP 150	Q8 Goya NT 150	
	A17	VG 100		PO Gravis MP 100		
Polyglycols (PG oil)	A21	VG 1000				Super Tauro PAG 1000
	A22	VG 680				Super Tauro PAG 680
	A23	VG 460				
	A24	VG 320				
	A25	VG 220				
	A26	VG 150				
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000		PO Gravis SP 1000		
	A32	VG 680		PO Gravis SP 680		
	A33	VG 460	Enduratex Synthetic 460	PO Gravis SP 460	Q8 El Greco 460	Super Tauro Sintetico 460
	A34	VG 320	Enduratex Synthetic 320	PO Gravis SP 320	Q8 El Greco 320	Super Tauro Sintetico 320
	A35	VG 220	Enduratex Synthetic 220	PO Gravis SP 220	Q8 El Greco 220	Super Tauro Sintetico 220
	A36	VG 150			Q8 El Greco 150	
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

Table A		Viscosity	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
Lubricant	Code no.	ISO-VG DIN 51519 at 40 °C (mm^2/s)	Shell	SINOPEC 长城润滑油	STATOIL	TOTAL
Mineral oils (MIN oil)	A11	VG 1000				KASSILLA GMP 1000 / CARTER EP 1000
	A12	VG 680			LoadWay EP 680	KASSILLA GMP 680 / CARTER EP 680
	A13	VG 460	Shell Omala F 460		LoadWay EP 460	KASSILLA GMP 460 / CARTER EP 460
	A14	VG 320	Shell Omala F 320		LoadWay EP 320	KASSILLA GMP 320 / CARTER EP 320
	A15	VG 220	Shell Omala F 220		LoadWay EP 220	KASSILLA GMP 220 / CARTER EP 220
	A16	VG 150			LoadWay EP 150	
	A17	VG 100				
Polyglycols (PG oil)	A21	VG 1000	Shell Tivela S 1000 / Shell Cassida WG1000			
	A22	VG 680	Shell Tivela S 680 / Shell Cassida WG 680			
	A23	VG 460	Shell Tivela S 460 / Shell Cassida WG 460			
	A24	VG 320	Shell Tivela S 320 / Shell Cassida WG 320			
	A25	VG 220	Shell Tivela S 220 / Shell Cassida WG 220			
	A26	VG 150	Shell Tivela S 150 / Shell Cassida WG 150			
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000		Great Wall Synth. AP-HD 1000		CARTER SH 1000
	A32	VG 680	Shell Omala HD 680	Great Wall Synth. AP-HD 680		CARTER SH 680
	A33	VG 460	Shell Omala HD 460	Great Wall Synth. AP-HD 460		CARTER SH 460
	A34	VG 320	Shell Omala HD 320	Great Wall Synth. AP-HD 320	MERETA 320	CARTER SH 320
	A35	VG 220	Shell Omala HD 220	Great Wall Synth. AP-HD 220	MERETA 220	CARTER SH 220
	A36	VG 150	Shell Omala HD 150		MERETA 150	CARTER SH 150
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460	Shell Naturelle Gear Fluid EP 460 6)			
	A44	VG 320	Shell Naturelle Gear Fluid EP 320 6)			
	A45	VG 220	Shell Naturelle Gear Fluid EP 220 6)			
	A46	VG 150	Shell Naturelle Gear Fluid EP 150 6)			
	A47	VG 100	Shell Naturelle Gear Fluid EP 100 6)			
Physio-logically safe oils (PHY oil)	A51	VG 1000	Shell Cassida WG1000 7)			
	A52	VG 680	Shell Cassida WG 680 7)			
	A53	VG 460	Shell Cassida WG 460 7)			Keystone Nevastane SY 460 7)
	A54	VG 320	Shell Cassida WG 320 7)			Keystone Nevastane SY 320 7)
	A55	VG 220	Shell Cassida WG 220 7)			Keystone Nevastane SY 220 7)
	A56	VG 150				
	A57	VG 100				

6) PAO oil
7) PG oil

Table A Lubricant	Code no.	Viscosity ISO-VG DIN 51519 at 40 °C (mm^2/s)	Oils for FLENDER helical-gear, bevel-helical gear and planetary-gear units and geared motors			
			BP	VECO	Verkol Lubricantes	
Mineral oils (MIN oil)	A11	VG 1000		VECO MATRANOL XP 1000		
	A12	VG 680	TUNGEAR 680 8)	VECO MATRANOL XP 680	COMPOUND MP 680	
	A13	VG 460	TUNGEAR 460 8)	VECO MATRANOL XP 460	COMPOUND MP 460	
	A14	VG 320	TUNGEAR 320 8)	VECO MATRANOL XP 320	COMPOUND MP 320	
	A15	VG 220	TUNGEAR 220 8)	VECO MATRANOL XP 220	COMPOUND MP 220	
	A16	VG 150			COMPOUND MP 150	
	A17	VG 100				
Polyglycols (PG oil)	A21	VG 1000				
	A22	VG 680				
	A23	VG 460				
	A24	VG 320				
	A25	VG 220				
	A26	VG 150				
	A27	VG 100				
Poly-α-olefins (PAO oil)	A31	VG 1000				
	A32	VG 680			Corvus MP 680	
	A33	VG 460			Corvus MP 460	
	A34	VG 320			Corvus MP 320	
	A35	VG 220			Corvus MP 220	
	A36	VG 150			Corvus MP 150	
	A37	VG 100				
Biologically degradable oils (BIO oil)	A41	VG 1000				
	A42	VG 680				
	A43	VG 460				
	A44	VG 320				
	A45	VG 220				
	A46	VG 150				
	A47	VG 100				
Physio-logically safe oils (PHY oil)	A51	VG 1000				
	A52	VG 680				
	A53	VG 460				
	A54	VG 320				
	A55	VG 220				
	A56	VG 150				
	A57	VG 100				

8) TUNGEAR is approved for Brazil under the name of GEAROIL in VG 220, 320, 460 and 680. Distributor: TRIBOTECHNICA Lubrificantes Sinteticos São Paulo.
TUNGEAR is approved for India under the name of Mo_x-Active Gear oil in VG 220, 320, 460. Distributor: OKS Speciality Lubricants Bombay.

1.2 Lubricating greases for gear units and rolling bearings

For special gear unit applications, grease lubrication of the gears and/or 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.

Gear greases are suitable for the lubrication of gears and bearings on closed gear units (e.g. small gear units) and open drives with low peripheral speeds (e.g. for girth gears, racks).

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 oils must not be allowed to mix with bearing greases.

Table D			Lubricating greases for FLENDER gear units and rolling bearings			
Lubricant	Code no.	**Consistency** NLGI class DIN 51818	ARAL	bp	Castrol classic	Castrol performance
Gear greases (MIN-GF) Mineral oil base	G13	3				Optipit
	G14	2				Optipit
	G15	1				
	G16	0				
	G17	00	Aralub FDP 00	Energrease LS^-EP 00	CLS Grease	Tribol 5000 Optitemp OG 0
	G18	000				Longtime PD 00 MA Mehrzweckfett 00
Rolling bearing greases (MIN-WF) Mineral oil base Lithium saponification	H12	4				
	H13	3	Aralub HL3	Energrease LS 3	Spheerol AP 3	
	H14	2	Aralub HL2	Energrease LS 2	Spheerol AP 2 Spheerol EPL 2	Tribol 4020 / 220-2 Longtime PD 2
	H15	1	Aralub HLP1	Energrease LS 1	Spheerol EPL 1	Tribol 3785 [1] Longtime PD 1

1) Mixture of mineral oil and PAO

Table D			Lubricating greases for FLENDER gear units and rolling bearings			
Lubricant	Code no.	**Consistency** NLGI class DIN 51818	Chevron	FAG	FUCHS	FUCHS LUBRITECH
Gear greases (MIN-GF) Mineral oil base	G13	3	Glissando FG 30 EP			
	G14	2				
	G15	1				
	G16	0				
	G17	00	Marfak 00			
	G18	000				
Rolling bearing greases (MIN-WF) Mineral oil base Lithium saponification	H12	4				
	H13	3			Renolit FWA 220 Renolit H 443-HD 88	
	H14	2	Multifak 2 Multifak 20	Arcanol L 186 V [2]	Renolit H 443-HD 88 Renolit FWA 160	LAGERMEISTER EP 2
	H15	1				

2) Li, Ca saponification

Table D	Code no.	Consistency NLGI class DIN 51818	Lubricating greases for FLENDER gear units and rolling bearings			
Lubricant			KLÜBER LUBRICATION	Mobil	Shell	SRS
Gear greases (MIN-GF) Mineral oil base	G13	3				
	G14	2				
	G15	1				
	G16	0				Wiolub GFW
	G17	00	MICROLUBE GB 00	Mobilux EP 004	Alvania GL 00	
	G18	000				
Rolling bearing greases (MIN-WF) Mineral oil base Lithium saponification	H12	4				
	H13	3		Mobilux EP 3	Alvania RL 3 / Alvania EP / LF 3	
	H14	2	CENTOPLEX GLP 402	Mobilux EP 2	Alvania RL 2 / Alvania EP / LF 2	Wiolub LFK 2
	H15	1				

Table D	Code no.	Consistency NLGI class DIN 51818	Lubricating greases for FLENDER gear units and rolling bearings			
Lubricant			TOTAL			
Gear greases (MIN-GF) Mineral oil base	G13	3				
	G14	2				
	G15	1				
	G16	0	Multis EP 0			
	G17	00	Multis EP 00			
	G18	000				
Rolling bearing greases (MIN-WF) Mineral oil base Lithium saponification	H12	4				
	H13	3	Multis 3 / Multis EP 3			
	H14	2	Multis 2 / Multis EP 2			
	H15	1	Multis 1 / Multis EP 1			