

Operating Instructions

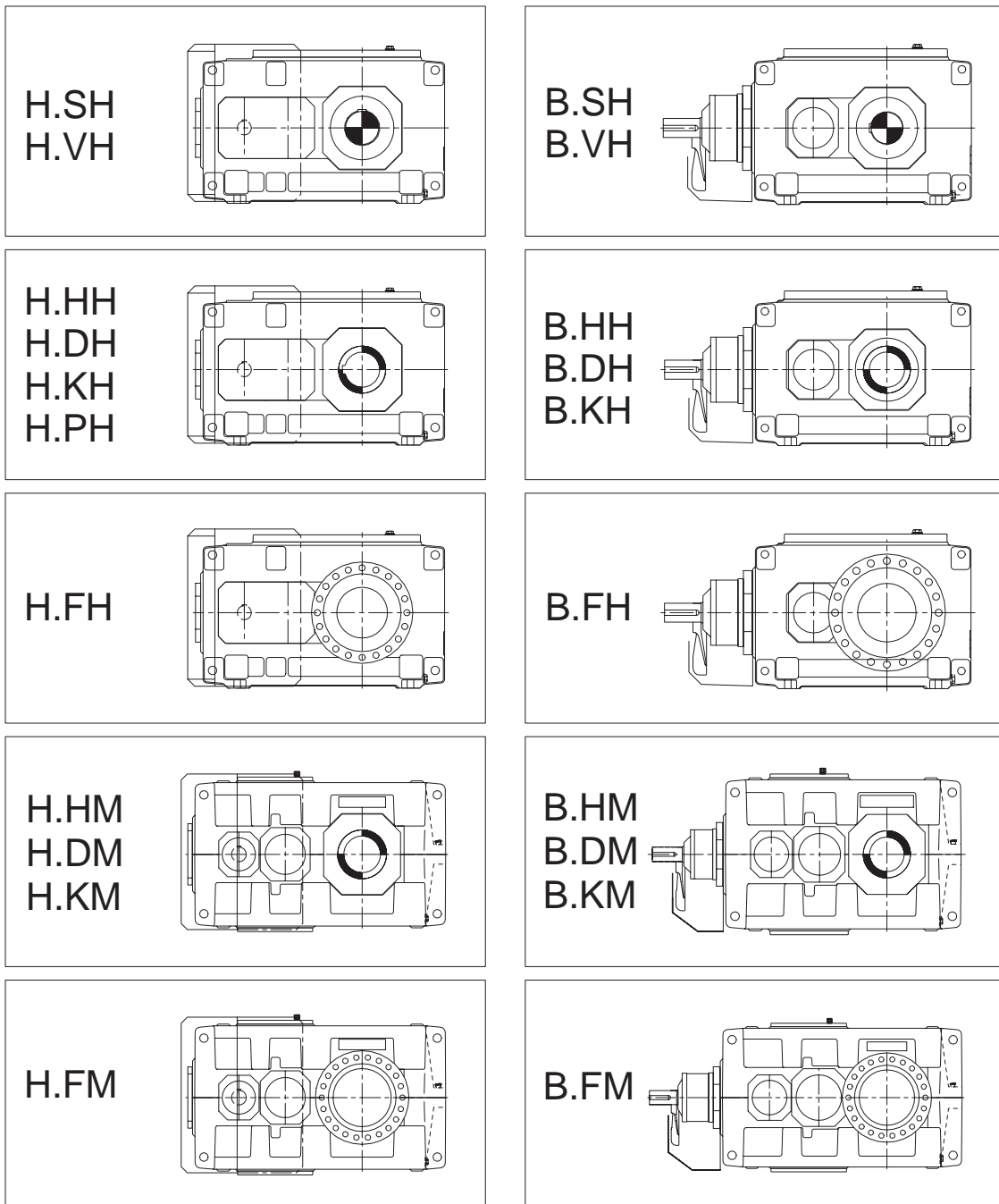
BA 5010 EN 06.03

Gear Unit Types

H.SH, H.VH, H.HH, H.DH, H.KH, H.FH, H.HM, H.DM, H.KM, H.FM, H.PH

B.SH, B.VH, B.HH, B.DH, B.KH, B.FH, B.HM, B.DM, B.KM, B.FM

Sizes 3 to 26



FLENDER

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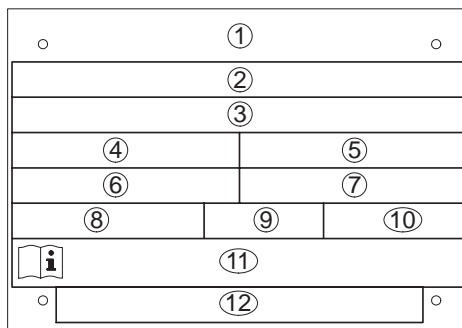
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1. Technical data

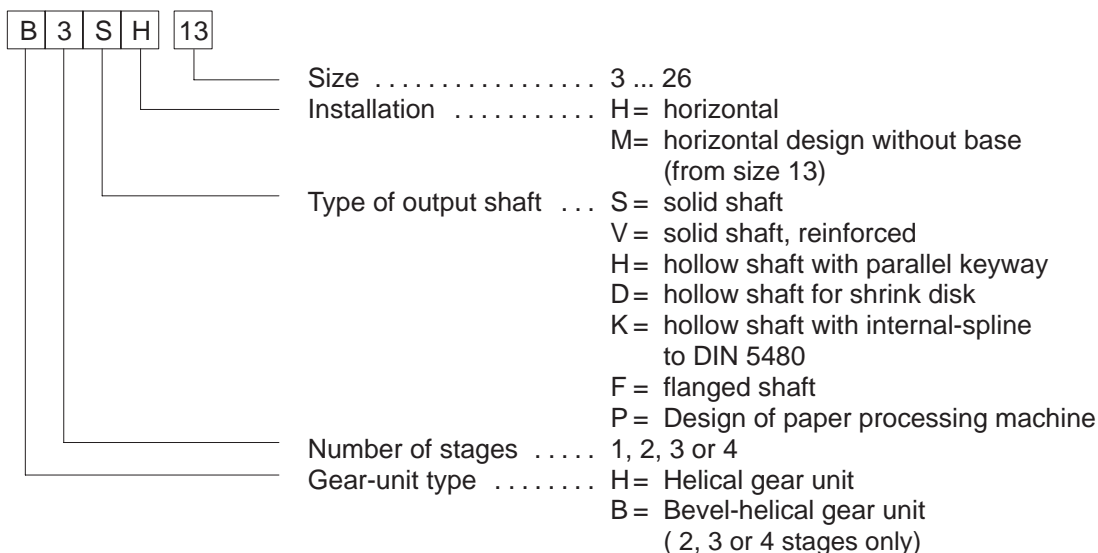
1.1 General technical data

The most important technical data are shown on the rating plate. These data and the contractual agreements between FLENDER and the customer for the gear unit determine the limits of its correct use.



- | | |
|---|---|
| ① Company logo and production location | ⑦ Speed n_2 |
| ② Special information | ⑧ Type of oil |
| ③ Order no. - item - serial no. | ⑨ Viscosity of oil in VG class |
| ④ Type / Size *) | ⑩ Quantity of oil in litres for main gear housing |
| ⑤ Power rating P_2 in kW or T_2 in Nm | ⑪ Operating instructions number(s) |
| ⑥ Speed n_1 | ⑫ Special information |

e.g. *)



Data on weights and measuring-surface sound-pressure levels of the various gear types are given in items 1.1.1 and 1.1.2.

For further technical data, refer to the drawings in the gear-unit documentation.

1.1.1 Weights

Type	Approx. weight (kg) for size											
	3	4	5	6	7	8	9	10	11	12	13	14
H1SH	128	–	302	–	547	–	862	–	1515	–	2395	–
H2.H	115	190	300	355	505	590	830	960	1335	1615	2000	2570
H2.M	–	–	–	–	–	–	–	–	–	–	1880	2430
H3.H	–	–	320	365	540	625	875	1020	1400	1675	2295	2625
H3.M	–	–	–	–	–	–	–	–	–	–	2155	2490
H4.H	–	–	–	–	550	645	875	1010	1460	1725	2390	2730
H4.M	–	–	–	–	–	–	–	–	–	–	2270	2600
B2.H	140	235	360	410	615	700	1000	1155	1640	1910	2450	2825
B2.M	–	–	–	–	–	–	–	–	–	–	2350	2725
B3.H	130	210	325	380	550	635	890	1020	1455	1730	2380	2750
B3.M	–	–	–	–	–	–	–	–	–	–	2260	2615
B4.H	–	–	335	385	555	655	890	1025	1485	1750	2395	2735
B4.M	–	–	–	–	–	–	–	–	–	–	2280	2605

Type	Approx. weight (kg) for size											
	15	16	17	18	19	20	21	22	23	24	25	26
H1SH	3200	–	4250	–	5800	–	–	–	–	–	–	–
H2.H	3430	3655	4650	5125	6600	7500	8900	9600	11600	13000	15500	17200
H2.M	3240	3465	4420	4870	6300	7200	8400	9200	11000	12300	14700	16200
H3.H	3475	3875	4560	5030	6700	8100	9100	9800	11500	13400	16100	17600
H3.M	3260	3625	4250	4740	6200	7600	8500	9300	10600	12500	15200	16500
H4.H	3635	3965	4680	5185	6800	8200	9200	9900	11600	13500	16100	17600
H4.M	3440	3740	4445	4915	6300	7700	8600	9400	10700	12600	15200	16500
B2.H	3990	4345	5620	6150	–	–	–	–	–	–	–	–
B2.M	3795	4160	5320	5860	–	–	–	–	–	–	–	–
B3.H	3730	3955	4990	5495	7000	8100	9200	9900	11500	13400	16000	17500
B3.M	3540	3765	4760	5240	6500	7600	8600	9400	10600	12500	15100	16400
B4.H	3630	3985	4695	5200	6800	8200	9200	9900	11600	13500	16100	17600
B4.M	3435	3765	4460	4930	6300	7700	8600	9400	10700	12600	15200	16500

Table 1.1: Weights (approx. values only)

Note: All weights are for gear unit without oil filling or add-ons. For the exact weights, refer to the drawings in the gear-unit documentation.

1.1.2 Measuring-surface sound-pressure level

The measuring-surface sound-pressure level for the gear unit at a distance of 1 metre can be found in tables 1.1.2.1 to 1.1.2.4.

The measurement is carried out to DIN 45635 Parts 1 and 23, using the sound-intensity method.

The workplace of the operating personnel is defined as the area on the measuring-surface at a distance of 1 metre in the vicinity of which persons may be present.

The sound-pressure level applies to the warmed-up gear unit at input speed n_1 and output power P_2 stated on the rating plate. If several figures are given, the highest speed and power values apply.

The measuring surface sound-pressure level does not include add-on lubricating units.

If repeat measurements on site do not produce conclusive results with regard to measuring technology, the measurement obtained on the FLENDER test bench will apply.

The sound-pressure levels stated in the table were obtained by statistical calculation by our Quality Control Dept. The gear unit can be statistically expected to comply with these sound-pressure levels.

1.1.2.1 Measuring-surface sound-pressure level for bevel-helical gear units (B...) with fan

Measuring-surface sound-pressure level L_{pA} in dB(A) for bevel-helical gear units with fan																											
Type	i_N	n_1 1/min	Gear-unit size																								
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
B2	5	1500	73	76	79	81	83	84	85	87	88	89	91	92	94	-	-	-	-	-	-	-	-	-	-	-	
		1000	67	71	73	74	77	78	79	80	82	83	84	85	87	89	90	-	-	-	-	-	-	-	-	-	-
	8	750	61	64	66	67	70	71	72	73	75	76	77	78	81	82	83	85	-	-	-	-	-	-	-	-	-
		1500	70	73	75	76	78	81	82	83	84	85	86	87	88	90	-	-	-	-	-	-	-	-	-	-	-
	14	1000	63	67	68	70	73	74	75	77	79	80	81	82	83	84	86	87	-	-	-	-	-	-	-	-	-
		750	1)	61	62	64	66	67	68	70	72	73	74	75	77	78	79	80	-	-	-	-	-	-	-	-	-
	16	1500	67	71	74	76	78	79	80	81	83	84	87	88	89	90	-	-	-	-	-	-	-	-	-	-	-
		1000	60	64	67	68	70	72	73	74	78	79	80	81	82	83	84	84	-	-	-	-	-	-	-	-	-
22.4	750	1)	1)	61	63	65	67	68	69	71	72	73	73	74	74	75	76	-	-	-	-	-	-	-	-	-	
B3	12.5	1500	69	72	75	77	79	80	81	82	83	85	88	89	90	91	93	93	93	93	95	95	-	-	-	-	
		1000	62	65	68	69	71	72	73	74	77	78	80	82	83	83	84	85	86	86	88	88	89	90	91	-	
	31.5	750	1)	1)	63	64	66	68	69	70	71	73	74	75	76	77	78	78	79	79	81	81	82	84	85	85	
		1500	67	69	72	73	74	75	77	79	82	84	86	87	88	89	90	91	92	92	93	93	-	-	-	-	
	56	1000	1)	63	65	66	67	69	71	72	73	75	77	78	79	80	81	82	83	84	85	86	86	87	88	89	
		750	1)	1)	1)	1)	62	64	65	67	69	70	71	72	73	74	75	76	77	78	79	79	80	81	82	82	
	63	1500	66	68	70	71	73	74	76	78	81	83	85	86	87	88	89	90	91	91	92	92	-	-	-	-	
		1000	1)	61	63	64	66	68	69	71	73	75	77	78	79	80	81	81	82	82	83	84	84	85	86	86	
	90	750	1)	1)	1)	1)	61	63	64	66	67	68	70	71	72	73	74	75	75	76	77	77	78	79	79	80	

1) $L_{pA} < 60$ dB(A)

1.1.2.2 Measuring-surface sound-pressure level for bevel-helical gear units (B...) without fan

Measuring-surface sound-pressure level L_{pA} in dB(A) for bevel-helical gear units without fan																										
Type	i_N	n_1 1/min	Gear-unit size																							
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
B2	5	1500	72	75	78	80	82	83	84	86	87	88	89	90	93	-	-	-	-	-	-	-	-	-	-	-
	.	1000	66	70	72	73	76	77	78	79	81	82	83	84	86	88	89	-	-	-	-	-	-	-	-	-
	8	750	1)	63	65	66	69	71	72	73	74	75	77	78	80	82	83	84	-	-	-	-	-	-	-	-
	9	1500	67	71	74	75	77	79	80	81	83	84	85	86	87	89	-	-	-	-	-	-	-	-	-	-
	.	1000	61	65	67	69	72	73	74	76	77	78	80	81	82	83	85	86	-	-	-	-	-	-	-	-
	14	750	1)	1)	60	63	65	66	67	69	71	72	73	74	76	77	78	79	-	-	-	-	-	-	-	-
	16	1500	63	66	69	71	72	74	75	77	78	80	81	82	85	85	-	-	-	-	-	-	-	-	-	-
	.	1000	1)	61	63	65	67	68	69	71	72	74	75	77	79	80	81	81	-	-	-	-	-	-	-	-
22.4	750	1)	1)	1)	1)	60	62	63	64	66	67	68	70	72	73	74	75	-	-	-	-	-	-	-	-	
B3	12.5	1500	65	68	71	74	75	76	77	79	81	83	84	85	86	87	87	88	89	90	91	92	-	-	-	-
	.	1000	1)	63	66	68	69	70	72	73	75	77	78	80	80	81	82	82	84	85	86	86	88	89	90	-
	31.5	750	1)	1)	1)	61	62	64	65	66	68	71	71	73	73	74	75	75	77	78	79	79	81	82	83	84
	35.5	1500	60	65	67	70	71	71	72	74	77	79	80	81	82	83	83	84	86	86	88	88	-	-	-	-
	.	1000	1)	1)	62	65	65	66	66	69	71	73	75	76	76	77	77	78	80	81	82	83	84	85	86	87
	56	750	1)	1)	1)	1)	1)	1)	1)	62	65	67	68	69	70	70	71	72	74	74	75	76	78	80	80	80
	63	1500	1)	61	64	70	67	68	68	70	73	75	76	78	78	79	79	80	82	83	84	84	-	-	-	-
	.	1000	1)	1)	1)	63	62	62	62	65	68	70	71	72	73	73	74	75	76	77	78	79	81	81	83	83
90	750	1)	1)	1)	1)	1)	1)	1)	61	63	64	65	66	67	67	68	70	70	72	72	74	75	76	76	76	
B4	80	1500	-	-	64	65	67	68	70	72	75	76	77	79	80	81	82	83	84	85	86	86	87	88	87	89
	.	1000	-	-	1)	1)	61	63	64	67	69	70	72	73	74	75	76	77	78	79	80	80	81	82	82	83
	125	750	-	-	1)	1)	1)	1)	1)	62	64	65	66	68	68	69	71	71	72	73	74	74	75	75	76	
	140	1500	-	-	60	61	63	65	66	68	71	72	73	75	76	77	78	79	80	81	82	82	83	84	85	86
	.	1000	-	-	1)	1)	1)	1)	61	63	65	67	68	69	71	71	72	74	75	76	77	78	78	79	80	
	224	750	-	-	1)	1)	1)	1)	1)	1)	1)	1)	61	62	64	65	66	67	68	69	69	70	71	72	73	73
	250	1500	-	-	1)	1)	1)	62	63	65	67	69	70	71	73	73	75	76	77	77	78	79	80	80	81	82
	.	1000	-	-	1)	1)	1)	1)	1)	62	63	64	66	67	68	69	70	71	72	73	73	74	75	76	77	77
400	750	-	-	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	61	62	63	64	65	66	66	67	68	69	70

1) $L_{pA} < 60$ dB(A)

1.1.2.3 Measuring-surface sound-pressure level for helical gear units (H...) with fan

Measuring-surface sound-pressure level L_{pA} in dB(A) for helical gear units with fan																										
Type	i_N	n_1 1/min	Gear-unit size																							
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
H1	1.25	1500	76	-	81	-	84	-	87	-	91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1000	71	-	76	-	79	-	81	-	83	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	750	67	-	72	-	75	-	78	-	80	-	82	-	85	-	-	-	-	-	-	-	-	-	-	-
		1500	73	-	79	-	82	-	84	-	89	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.24	1000	68	-	74	-	77	-	79	-	82	-	84	-	87	-	-	-	-	-	-	-	-	-	-	-
		3.55	750	64	-	70	-	72	-	75	-	78	-	80	-	83	-	84	-	-	-	-	-	-	-	-
	4	1500	70	-	77	-	81	-	83	-	86	-	89	-	93	-	-	-	-	-	-	-	-	-	-	-
		1000	65	-	71	-	75	-	77	-	80	-	82	-	84	-	85	-	87	-	-	-	-	-	-	-
	5.6	750	61	-	68	-	71	-	72	-	75	-	77	-	79	-	81	-	83	-	-	-	-	-	-	-
H2		6.3	1500	-	75	76	77	80	81	82	84	85	86	88	90	92	94	96	96	-	-	-	-	-	-	-
	1000		-	69	71	72	74	75	77	79	80	81	83	84	85	86	87	88	88	89	90	-	-	-	-	
	10	750	-	66	68	69	70	72	73	75	76	77	79	80	81	82	83	83	84	84	85	85	86	-	-	
11.2	1500	-	73	75	77	79	80	81	82	85	88	90	91	92	93	95	95	-	-	-	-	-	-	-	-	
		1000	-	68	69	70	72	73	75	77	79	80	82	83	84	85	85	86	86	87	87	87	88	88	-	
	16	750	-	64	66	67	69	70	71	73	74	76	78	79	79	80	81	81	82	82	83	83	83	84	84	
18	1500	-	71	73	75	77	78	80	82	84	86	87	90	91	92	93	94	94	95	95	95	-	-	-	-	
		1000	-	65	67	68	71	72	73	75	77	78	80	81	82	83	83	84	85	85	86	86	86	87	87	
	28	750	-	62	64	65	67	68	69	71	73	74	75	77	78	79	79	80	80	81	81	81	82	82	83	
H3	22.4	1500	-	-	71	72	75	75	77	77	80	80	81	81	84	84	84	85	-	-	-	-	-	-	-	
		1000	-	-	65	66	69	70	71	72	74	75	75	75	78	78	78	79	-	-	-	-	-	-	-	
	35.5	750	-	-	62	62	66	67	67	68	70	70	71	72	74	74	75	76	-	-	-	-	-	-	-	
		40	1500	-	-	70	71	73	74	76	76	79	79	80	80	83	82	83	83	-	-	-	-	-	-	-
	1000		-	-	64	65	67	68	69	70	73	73	73	74	77	77	77	77	-	-	-	-	-	-	-	
	63	750	-	-	62	62	63	64	65	66	69	69	69	70	72	73	73	73	-	-	-	-	-	-	-	
		71	1500	-	-	70	70	72	72	75	75	78	78	78	82	82	82	82	82	-	-	-	-	-	-	-
	1000		-	-	64	64	65	66	68	69	71	72	72	72	75	75	75	76	-	-	-	-	-	-	-	
	112	750	-	-	61	61	62	62	64	65	67	67	68	68	71	71	71	72	-	-	-	-	-	-	-	

1) $L_{pA} < 60$ dB(A)

1.1.2.4 Measuring-surface sound-pressure level for helical gear units (H...) without fan

Measuring-surface sound-pressure level L_{pA} in dB(A) for helical gear units without fan																										
Type	i_N	n_1 1/min	Gear-unit size																							
			3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
H1	1.25	1500	73	-	77	-	79	-	81	-	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		1000	69	-	72	-	75	-	76	-	78	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	750	65	-	69	-	71	-	73	-	75	-	77	-	79	-	-	-	-	-	-	-	-	-	-	-
		1500	70	-	75	-	77	-	79	-	81	-	83	-	-	-	-	-	-	-	-	-	-	-	-	-
	2.24	1000	66	-	70	-	72	-	74	-	76	-	78	-	80	-	-	-	-	-	-	-	-	-	-	-
		750	62	-	67	-	68	-	71	-	73	-	75	-	77	-	79	-	-	-	-	-	-	-	-	-
	3.55	1500	67	-	72	-	74	-	76	-	78	-	79	-	82	-	-	-	-	-	-	-	-	-	-	-
		1000	1)	-	67	-	70	-	71	-	73	-	75	-	77	-	79	-	81	-	-	-	-	-	-	-
	5.6	750	1)	-	63	-	66	-	67	-	70	-	71	-	74	-	76	-	78	-	-	-	-	-	-	-
6.3		1500	-	71	74	75	76	77	79	79	80	81	81	82	84	85	85	86	-	-	-	-	-	-	-	
	1000	-	66	69	70	71	72	74	74	75	76	76	77	80	80	80	81	83	83	84	-	-	-	-		
	750	-	63	66	67	67	69	70	71	72	73	73	74	76	77	77	78	80	80	81	81	81	-	-		
H2	11.2	1500	-	69	72	73	74	75	77	77	78	79	79	80	82	83	83	84	-	-	-	-	-	-	-	
		1000	-	64	67	68	69	70	72	72	73	74	74	75	77	78	78	79	81	81	82	82	83	83	-	
	16	750	-	61	64	65	66	67	69	69	70	71	71	72	74	75	75	76	77	78	79	79	79	80	81	
		1500	-	66	69	70	71	72	74	74	75	76	77	78	80	80	81	82	83	84	84	85	-	-	-	
	18	1000	-	61	64	65	66	68	69	69	70	71	72	73	75	75	76	77	78	79	79	80	80	81	81	
		750	-	1)	61	62	63	64	66	66	67	68	69	70	72	72	73	73	75	75	76	76	77	77	78	
H3	22.4	1500	-	-	68	69	73	74	74	75	77	77	78	79	81	81	82	83	83	84	85	86	86	87	-	
		1000	-	-	63	65	68	69	69	71	72	73	73	74	76	77	77	78	79	79	81	81	81	82	83	
	35.5	750	-	-	60	61	65	66	65	67	69	69	70	71	73	73	74	75	75	76	77	78	78	79	80	
		1500	-	-	65	67	70	71	71	73	74	75	76	76	78	79	79	80	81	81	83	83	84	84	-	
	35.5	1000	-	-	1)	62	65	66	66	68	69	70	71	72	73	74	75	75	76	77	78	78	79	79	80	
		750	-	-	1)	1)	62	63	63	65	66	67	67	68	70	71	71	72	73	73	75	75	76	76	77	
	63	1500	-	-	62	64	67	68	68	70	71	72	73	74	76	76	77	78	78	79	80	81	81	82	82	
		1000	-	-	1)	1)	62	63	63	65	66	67	68	69	71	71	72	73	73	74	75	76	76	77	78	
	112	750	-	-	1)	1)	1)	1)	1)	62	63	64	65	66	68	68	69	70	70	71	72	72	73	73	74	
100		1500	-	-	-	-	66	67	68	69	70	71	72	73	75	75	76	76	77	78	78	78	79	80	81	
	1000	-	-	-	-	62	63	63	64	65	66	67	68	70	70	71	72	72	73	73	74	74	76	76		
140	750	-	-	-	-	1)	1)	1)	61	62	63	64	64	66	67	68	68	69	69	70	70	71	72	73		
	160	1500	-	-	-	-	64	65	66	66	68	68	69	70	72	73	73	74	74	75	75	76	76	78	79	
1000		-	-	-	-	1)	60	61	62	63	64	64	65	67	68	68	69	70	70	71	71	72	73	74		
250	750	-	-	-	-	1)	1)	1)	1)	60	61	61	62	64	64	65	66	66	67	67	68	68	70	71		
	280	1500	-	-	-	-	61	62	63	64	65	66	67	67	69	70	70	71	72	72	73	73	74	75	76	
1000		-	-	-	-	1)	1)	1)	1)	60	61	62	63	64	65	66	66	67	68	68	68	69	70	71		
450	750	-	-	-	-	1)	1)	1)	1)	1)	1)	1)	1)	61	62	62	63	64	64	65	65	67	68	68		

1) $L_{pA} < 60$ dB(A)

2. General notes

2.1 Introduction

These Operating Instructions (BA) are an integral part of the gear unit supplied and must be kept in its vicinity for reference at all times.

Caution!

All persons involved in the installation, operation, maintenance and repair of the gear unit must have read and understood these Operating Instructions and must comply with them. We accept no responsibility for damage or disruption caused by disregard of these Instructions.

The "FLENDER gear unit" described in these Operating Instructions (BA) has been developed for stationary use in general engineering applications. Possible areas of use for gear units of this type are (e.g.) sewage treatment, excavators, chemical industry, iron and steel industry, conveyor systems, crane systems, foodstuffs industry, paper machinery, cableways, cement industry, etc.

The gear unit is designed only for the application described in section 1, "Technical data".

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

In the interest of technical progress we reserve the right to make changes to the individual assemblies and accessories which we regard as necessary to preserve their essential characteristics and improve their efficiency and safety.

2.2 Copyright

The copyright to these Operating Instructions is held by **FLENDER AG**.

Technical enquiries should be addressed to the following works

for gear sizes **3 ... 16**

A. FRIEDR. FLENDER AG
Getriebewerk Penig
Thierbacher Straße 24
D-09322 Penig

Tel.: 037381/60
Fax: 037381/80286

Internet: www.flender.com

for gear sizes **17 ... 26**

A. FRIEDR. FLENDER AG
D-46393 Bocholt

Tel.: 02871/92-0
Fax: 02871/92-2596

or to one of our customer-service addresses. A list of our customer-service addresses is given in section 11, "Spare parts, customer-service addresses".

3. Safety notes

3.1 Proper use

- The gear unit has been manufactured in accordance with the state of the art and is delivered in a condition for safe and reliable use. Any changes on the part of the user are not permitted. This applies equally to safety features designed to prevent accidental contact.
- The gear unit must be used and operated strictly in accordance with the conditions laid down in the contract governing performance and supply agreed by FLENDER and the customer.

3.2 Obligations of the user

- The operator must ensure that all persons involved in installation, operation, maintenance and repair have read and understood these Operating Instructions and comply with them at all times in order to:

- avoid injury or damage,
- ensure the safety and reliability of the unit,

and

- avoid disruptions and environmental damage through incorrect use.
- During transport, assembly, installation, dismantling, operation and maintenance of the unit, the relevant safety and environmental regulations must be complied with at all times.
- The gear unit should be operated, maintained or repaired by authorised, trained and qualified personnel.
- The gear unit must not be cleaned using high-pressure cleaning equipment.
- All work must be carried out with great care and with due regard to safety.
- All work on the gear unit must be carried out only when it is not in operation.
The drive unit must be secured against being switched on accidentally (e.g. by locking the key switch or removing the fuses from the power supply). A notice should be attached to the start switch stating clearly that work is in progress.
- No welding work should be done on the gear unit.
The gear unit must not be used as an earthing point for welding operations. Toothed parts and bearings may be irreparably damaged by welding.
- If any changes are noticed during operation (e.g. overheating or unusual noises), the drive assembly must be switched off immediately.
- Rotating drive components such as couplings, gearwheels, belt drives etc. must be protected against accidental contact.
- If the gear unit is intended for installation in plant or machinery, the manufacturer of such plant or machinery must ensure that the contents of these Instructions are incorporated in his own instructions.
- Notices attached to the gear unit, e.g. rating plate, direction arrows etc. must always be observed. They must be kept free from dirt and paint at all times. Missing plates must be replaced.
- Screws which have been damaged during assembly or disassembly work must be replaced with new ones of the same strength class and type.
- Spare parts should always be obtained from FLENDER (please refer to section 11, "Spare parts, customer-service addresses").

3.3 Environmental protection

- When changing oil, the used oil must be collected in suitable containers. Any spillage of oil must be removed immediately.
- Preservative agent should be stored separately from used oil.
- Used oil, preservative agent, oil-binding agents and oil-soaked cloths must be disposed of in accordance with environmental legislation.

3.4 Special dangers

- Depending on operating conditions, the surface of the gear unit may heat up considerably.
Danger of burns!
- When changing oil, take care to prevent scalding by hot oil.
- Small foreign matter such as sand, dust, etc. can get into the cover plates of the rotating parts and be thrown back by these. Eye protection must therefore be worn while the gear unit is operating.

Caution!

The gear unit is not suitable for operation in locations liable to explosion. When operating in locations liable to explosion special additional safety procedures must be observed.

3.5 Warnings and symbols used in these Instructions



This symbol indicates safety measures which must be observed to avoid **personal injury**.

Caution!

This symbol indicates safety measures which must be observed to avoid **damage to the gear unit**.

Note:

This symbol indicates general **operating instructions** which are of particular importance.

4. Handling and storage

Observe the "Safety instructions" in section 3.

4.1 Scope of supply

The products supplied are listed in the despatch papers. Check immediately on receipt to ensure that all the products listed have actually been delivered. Parts damaged during transport or missing parts must be reported in writing immediately to FLENDER AG.

Caution!

If damage has occurred, the gear unit must not be put into operation.

4.2 Handling

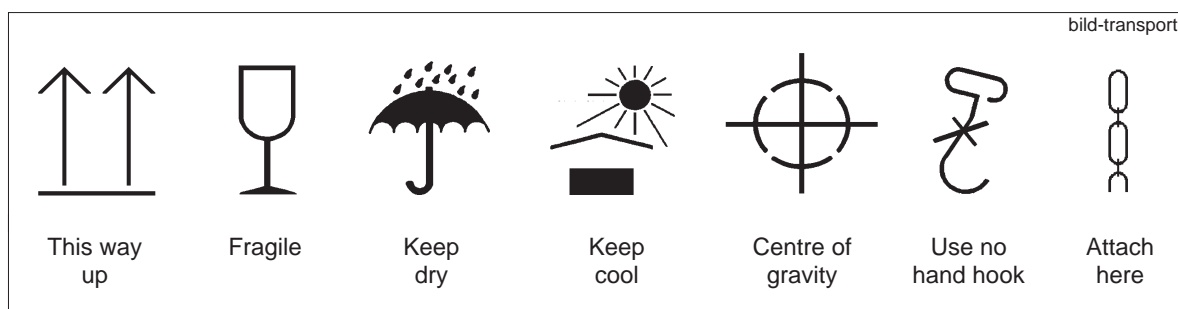


When handling FLENDER products, use only lifting and handling equipment of sufficient load-bearing capacity!
Observe the notes regarding load distribution on the packaging.

The gear unit is delivered in the fully assembled condition. Additional items (e.g. oil cooler, pipes and fittings) can be delivered separately packaged.

Different forms of packaging may be used, depending on the size of the unit and method of transport. Unless otherwise agreed, the packaging complies with the **HPE Packaging Guidelines**.

The symbols marked on the packaging must be observed at all times. These have the following meanings:



FLENDER

Caution!

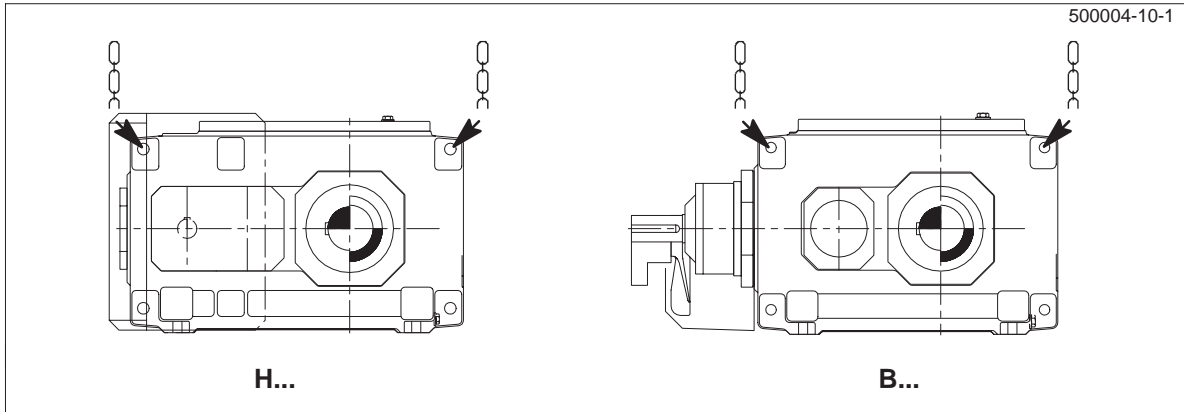
Transport of the gear unit must be carried out so as to avoid personal damage and damage to the gear unit.
If, for example, the free shaft ends are knocked, this may damage the gear unit.

Note:

The gear units must be transported with suitable equipment only.
During transport the gear unit should be left without oil filling and on the transport packaging.

Caution!

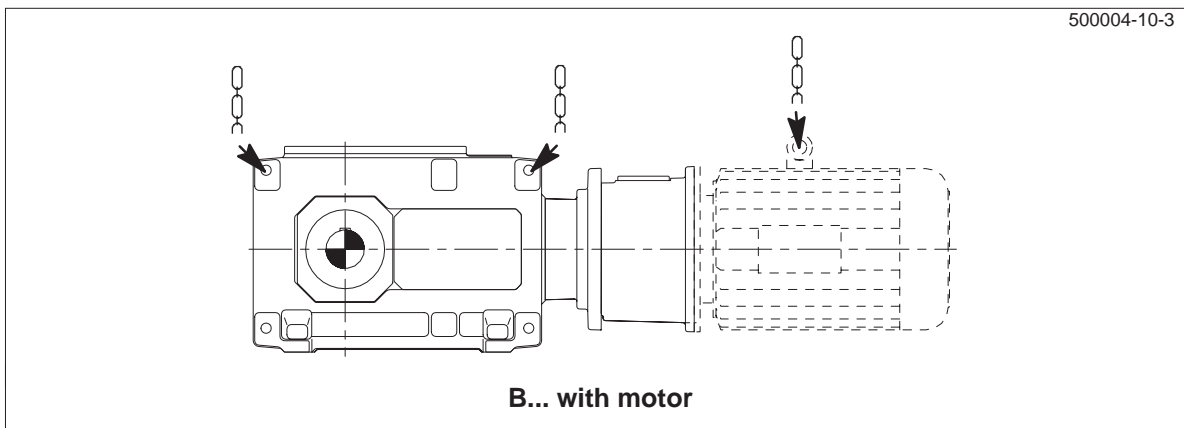
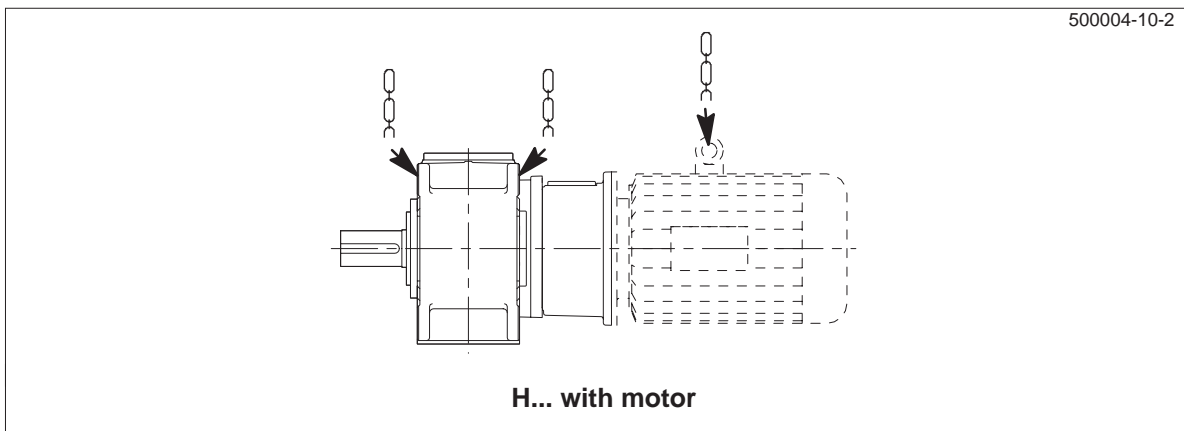
Use only the 4 eyes provided to attach lifting equipment to the unit.
Do not use the front threads at the shaft ends to attach eye bolts for transport.
Slings equipment must be adequate for the weight of the gear unit.

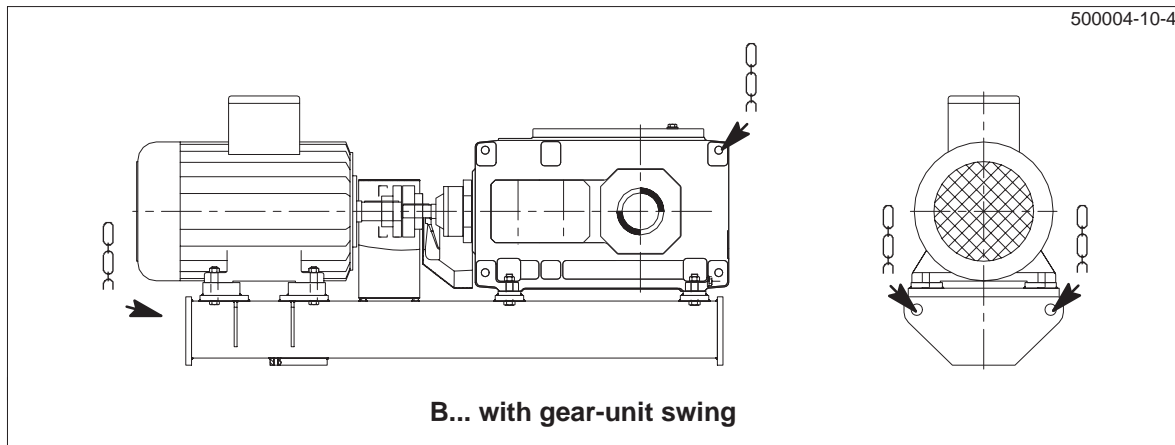


For drive units where additional components (such as motor, attached coupling etc.) are mounted on the gear unit an additional attachment point may be required because of the shift in the centre of gravity.

Caution!

Units which are slung by eyebolts must not be tilted.





For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

4.3 Storing the gear units

The gear unit must be stored in the position of use in a sheltered place; it must be placed on a vibration-free, dry wooden base and covered over.

When storing the gear unit and any single components supplied with it, the preservative agent should be left on them. It must not be damaged, otherwise there is a risk of corrosion.



Do not stack gear units on top of one another.

Caution!

If the gear unit is being stored out of doors, it must be particularly carefully covered, and care taken that neither moisture nor foreign material can collect on the unit (consult FLENDER).

Note: Unless otherwise agreed by contract, the gear units must not be exposed to harmful environmental factors such as chemical products, high air pollution, air humidity, and ambient temperatures outside the range 0 to + 20 °C.

Provision for special environmental conditions during transport (e.g. transport by ship) and storage (climate, termites, etc.) must be contractually agreed.

4.4 Standard preservation

The gear unit is provided with an internal preservative agent; the free shaft ends are painted for protection.

The properties of the outer paint coat are as follows: Resistant to acids, weak alkalis, solvents, atmospheric action, temperatures up to 120 °C (temporarily up to 140 °C) and to tropical conditions.

Note: Ensure that the paint is not damaged!
Mechanical damage (scratches), chemical damage (acids, alkalis) and thermal damage (sparks, welding beads, heat) cause corrosion which may cause failure of the external protective coating.

Unless otherwise contractually agreed, the internal preservation is guaranteed for 6 months, and the preservation of the free shaft ends for 24 months, provided that storage is in dry, frostfree sheds. The period of validity of the guarantee starts on the date of delivery of the gear unit.

For longer periods of storage (> 6 months) we advise regular checking and, if necessary, renewal of the internal and external preservation (see section 7, "Start-up").

The output shaft must be rotated at least one turn to change the position of the rolling element in the bearings. The input shaft must not come to a standstill in the same position as before rotation.

This procedure must be repeated and documented every 6 months until start-up.

5. Technical description

Observe the "Safety instructions" in section 3.

5.1 General description

The helical gear unit is supplied as a one-, two-, three- or four-stage helical gear unit. The bevel-helical gear unit is supplied as a two-, three- or four-stage bevel-helical gear unit. It is designed for installation in the horizontal position. If necessary, it can also be designed for installation in a different position.

It can be operated in both directions of rotation. The only exceptions are gear types with backstop or overrunning clutch. If rotation reversal is required for these types of unit, FLENDER should be consulted.

A number of shaft configurations (types and rotation directions) are possible. These are shown in the following table as solid shafts:

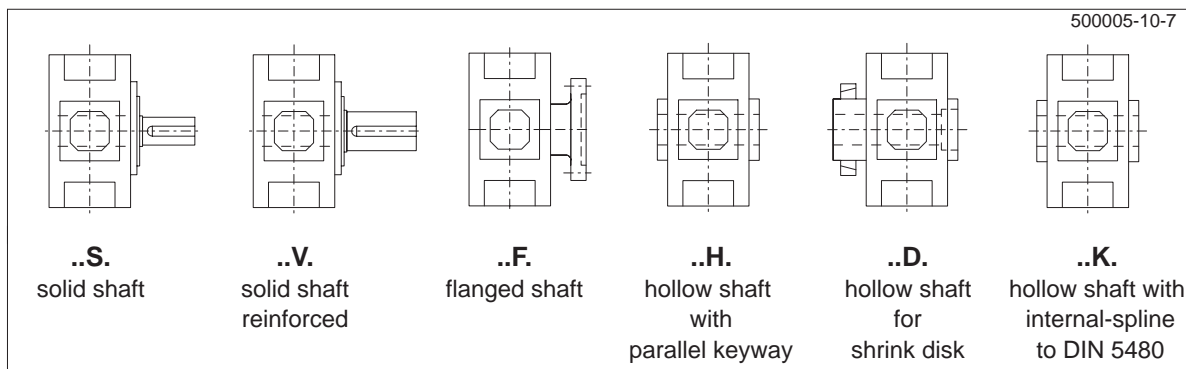
Type	Configuration								
	A	B	C	D	E	F	G	H	I
H1SH									
H2SH H2HM H2HH H2DM H2DH H2KM H2KH H2FM H2FH H2PH H2VH									
H3SH H3HM H3HH H3DM H3DH H3KM H3KH H3FM H3FH H3VH									
H4SH H4HM H4HH H4DM H4DH H4KM H4KH H4FM H4FH H4VH									
B2SH B2HM B2HH B2DM B2DH B2KM B2KH B2FM B2FH B2VH									
B3SH B3HM B3HH B3DM B3DH B3KM B3KH B3FM B3FH B3VH									
B4SH B4HM B4HH B4DM B4DH B4KM B4KH B4FM B4FH B4VH									

The gear units are characterised by a low noise level. This is achieved by helical and bevel-helical gears with a high contact ratio and special sound-damping housings.

The good temperature characteristics of the gear unit are achieved by its high degree of efficiency, large housing surface and performance-related cooling system.

Note: Unless otherwise agreed by contract, the gear units must not be exposed to harmful environmental factors such as chemical products, high air pollution, air humidity, and ambient temperatures outside the range 0 to + 20 °C.

5.2 Output designs



5.3 Housing





The housings are of cast iron. If required, they may also be of steel.

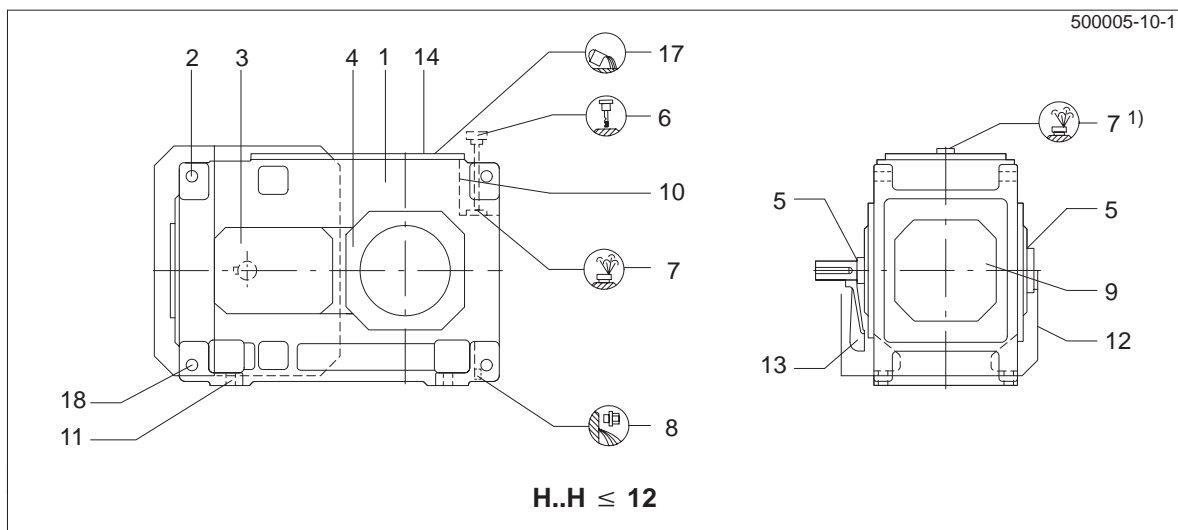
Housings up to size 12 are made in one part. The exception are types H1SH and H2PH, which have a two-part housing similar to those of sizes 13 - 26 of the other types. The housing is rigid in design and due to its form has excellent noise and temperature characteristics.

The housing is fitted with adequately dimensioned lifting eyes, inspection or assembly covers.

The oil level is checked by oil dipstick or by oil sight glass. An oil filler plug for filling with oil, an oil drain plug for oil change and an air filter for aerating and ventilating the gear unit are provided.

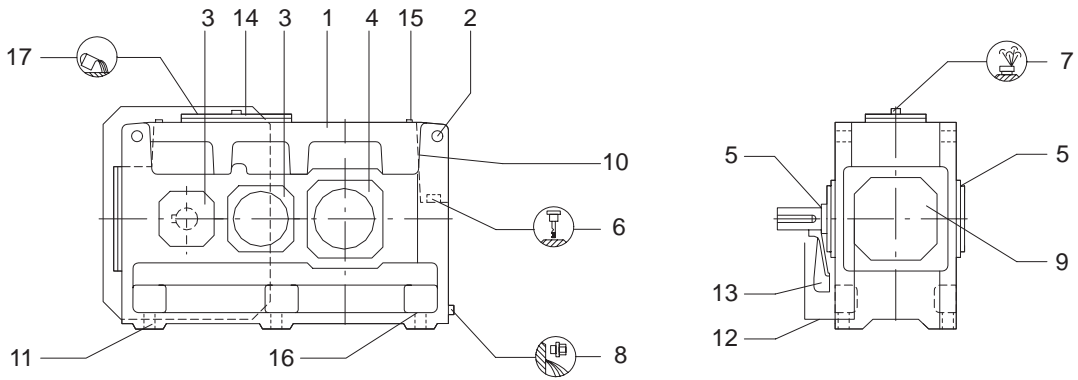
Colour codes for ventilating, oil inlet, oil level and oil drainage:

Breather:	yellow	
Oil inlet:	yellow	
Oil level:	red	
Lubrication points:	red	
Oil drain:	white	



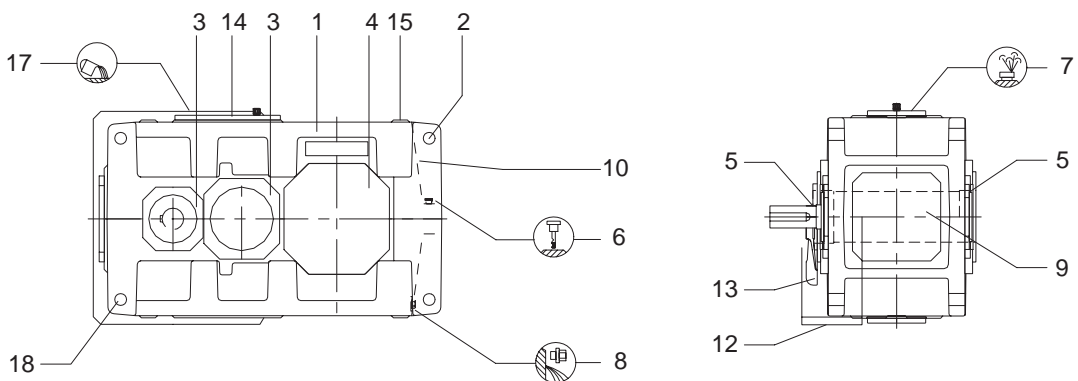
1) for H1SH only

500005-10-2



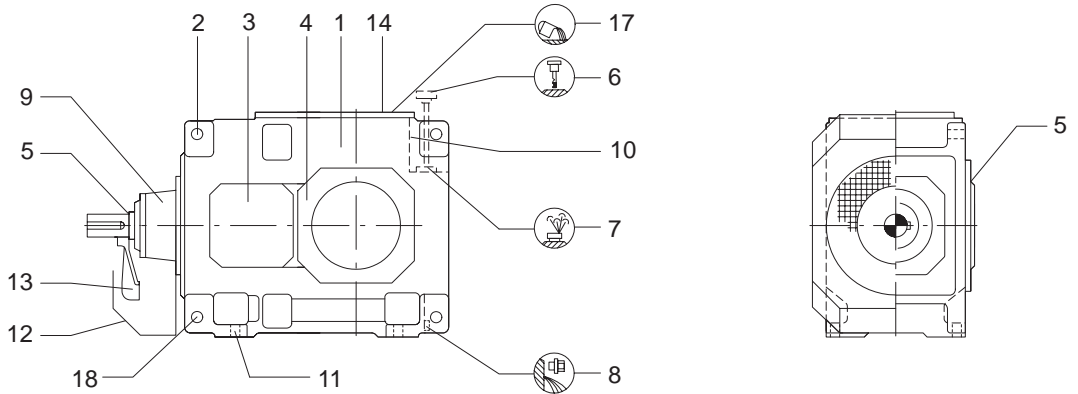
H..H \geq 13

500005-10-3

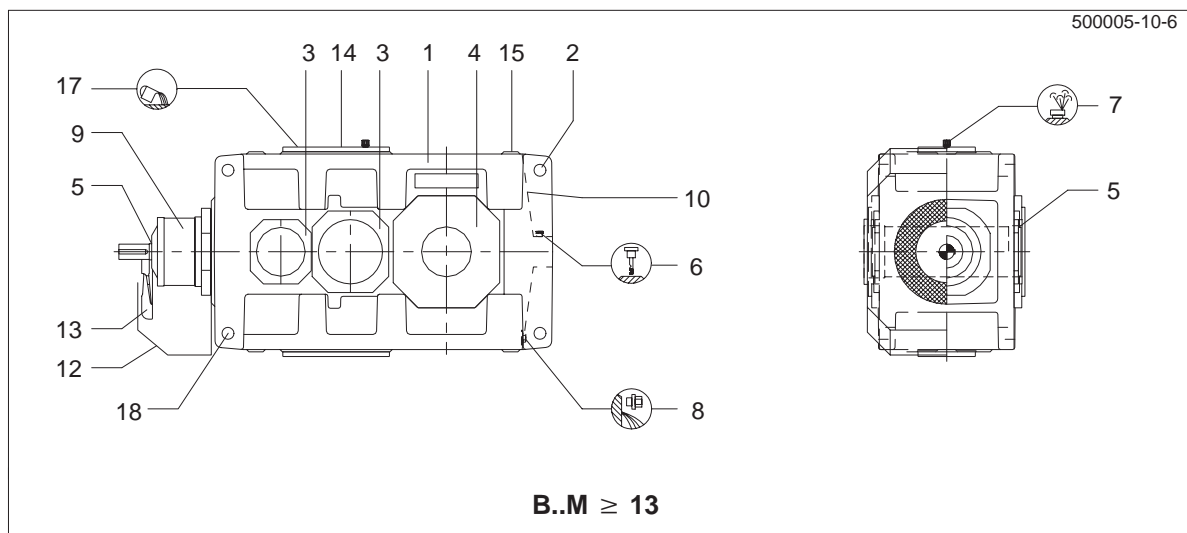
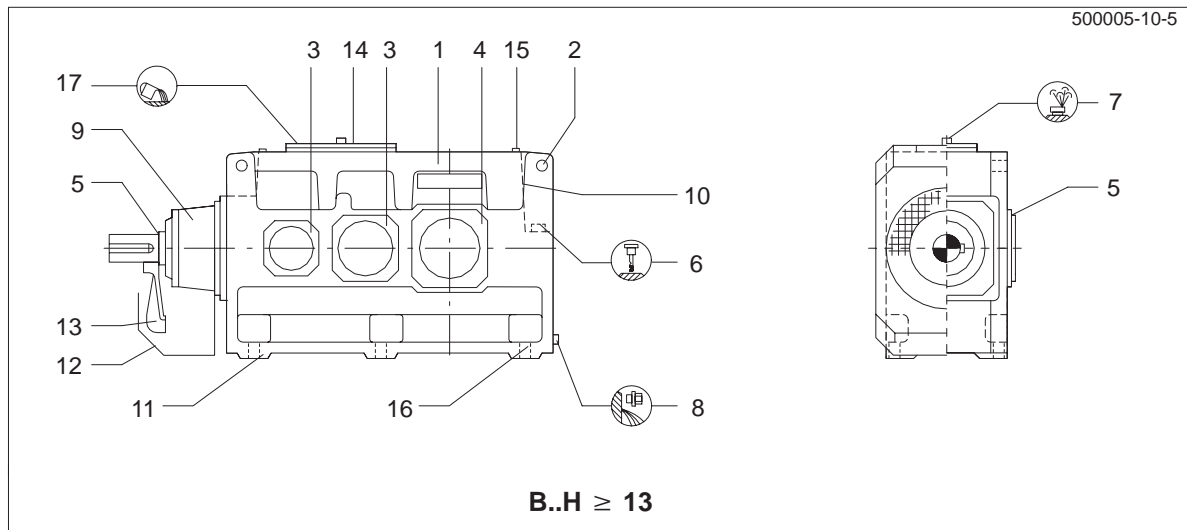


H..M \geq 13

500005-10-4



B..H \leq 12



- | | | | |
|---|--------------------------|----|------------------------------|
| 1 | Housing | 10 | Rating plate |
| 2 | Lifting eyes | 11 | Gear-unit fastening |
| 3 | Cover | 12 | Fan cowl |
| 4 | Cover | 13 | Fan |
| 5 | Shaft seals | 14 | Inspection or assembly cover |
| 6 | Oil dipstick | 15 | Alignment surfaces |
| 7 | Housing ventilation | 16 | Alignment thread |
| 8 | Oil drain plug | 17 | Oil inlet |
| 9 | Cover or bearing journal | 18 | Fastening for torque arm |

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

5.4 Toothed components

The toothed components of the gear unit are case-hardened. The helical gear teeth are ground; depending on their size and transmission ratio, bevel-helical gear teeth are lapped, ground or HPG-gear-cut. The high quality of the teeth leads to a significant noise reduction and ensures safe and reliable running.

The gear wheels are joined to the shafts by interference fits and parallel keys. These types of joints transmit with adequate reliability the torques generated.

5.5 Lubrication

5.5.1 Dip lubrication

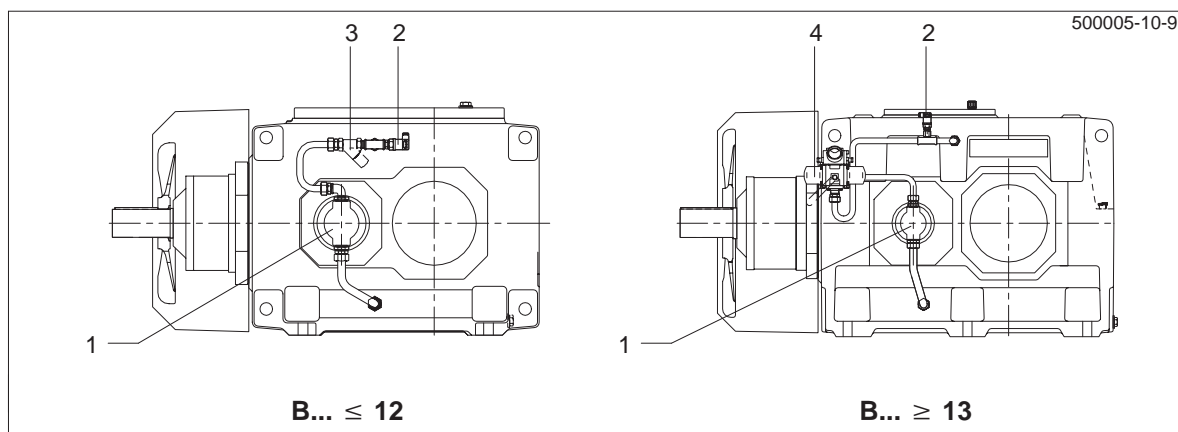
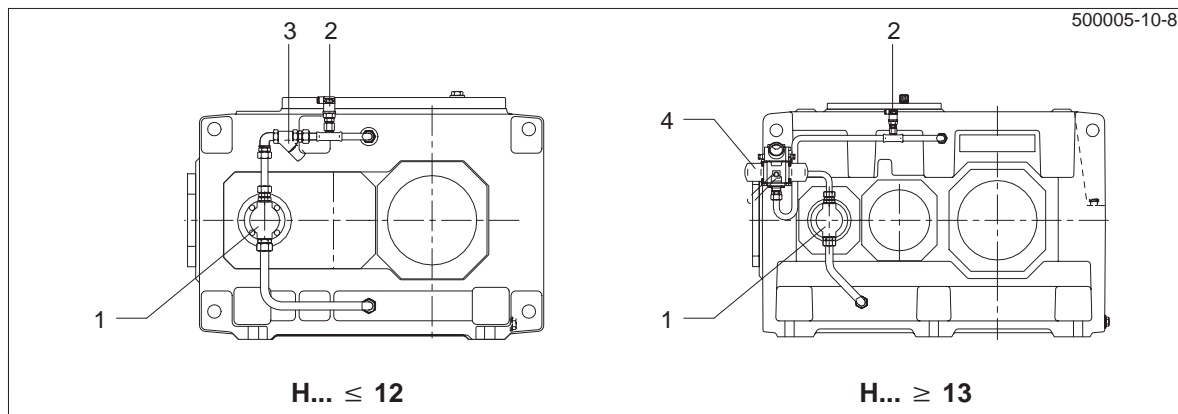
Unless otherwise stated in the order documentation, the teeth and bearings are adequately splash-lubricated with oil by the gearwheels. This means that the gear units require very little maintenance.

5.5.2 Pressure lubrication through add-on oil supply system

In non-horizontal positions, with high bearing speeds or peripheral velocities on the teeth, the splash lubrication system may be replaced or supported by a pressure lubrication system.

The oil supply system is permanently attached to the gear unit and consists of a flange pump, a coarse filter, a pressure-monitoring device and pipework. For gear units of sizes 13 to 26, the coarse filter is replaced by a double change-over filter.

The direction of flow from the flange pumps is independent of the direction of rotation.



- | | |
|--------------------|-----------------------------|
| 1 Flange pump | 3 Coarse filter |
| 2 Pressure monitor | 4 Double change-over filter |

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

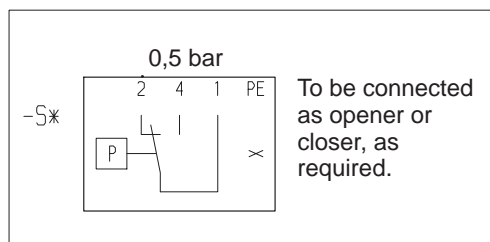
Caution!

In the case of gear units with add-on oil supply system, before starting the unit up the pressure monitor must always be connected ready for operation.

Depending on the order specification and application, the flange pump may be replaced by a motor pump.

The operation and maintenance of the pump, pressure monitor, coarse filter or double change-over filter are described in instructions included in the annex.

For technical data, refer to the order-specific equipment list.



5.6 Shaft bearings

All shafts are mounted in rolling bearings.

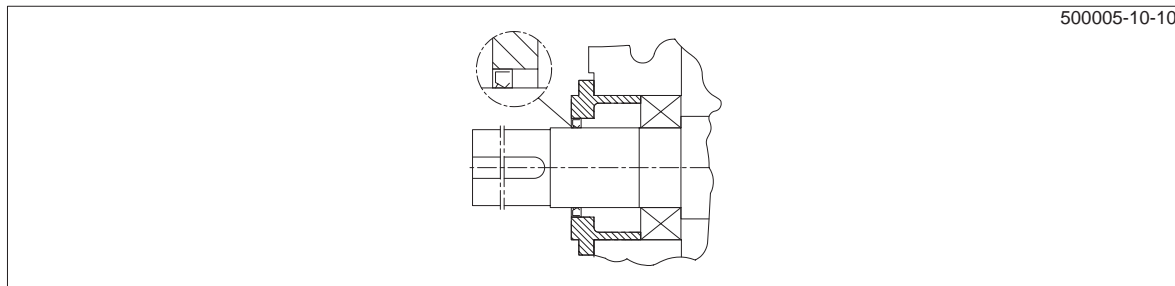
5.7 Shaft seals

Depending on requirements, radial shaft sealing rings, labyrinth seals or Taconite seals are mounted at the shaft exits to prevent oil from leaking from the housing and dirt from entering it.

5.7.1 Radial shaft sealing rings

Radial shaft sealing rings are the standard type of seal. They are fitted preferably with an additional dust lip to protect the actual sealing lip from external contamination.

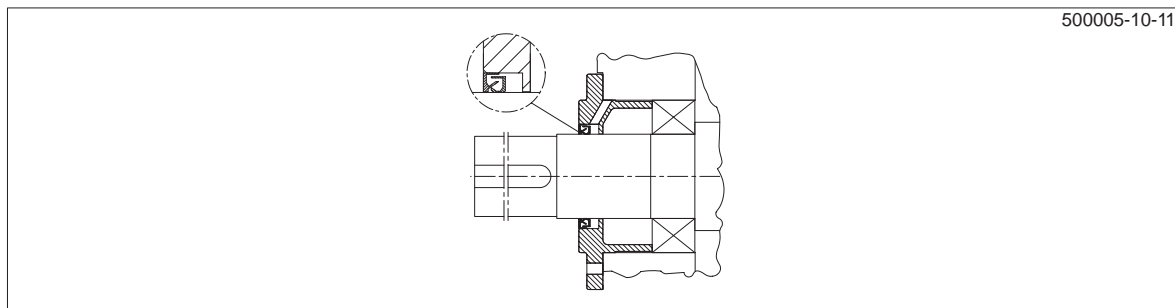
Caution! Use in an area with much dust is not possible.



5.7.2 Labyrinth seals

Labyrinth seals are non-contacting and avoid wear to the shaft. They therefore require no maintenance and ensure favourable temperature characteristics. They can be used only with certain transmission ratios and minimum speeds.

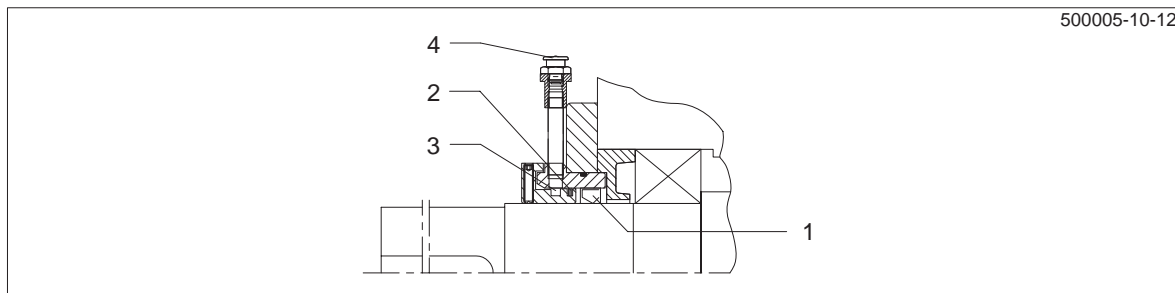
Check in the spare parts drawing and the spare parts list whether the gear unit is provided with labyrinth seals.



Caution! For reliable operation, this type of seal requires horizontal positioning in a splash-free and relatively dust-free environment. Overfilling of the gear unit can cause leakage, as can oil with high foam content.

5.7.3 Taconite seals

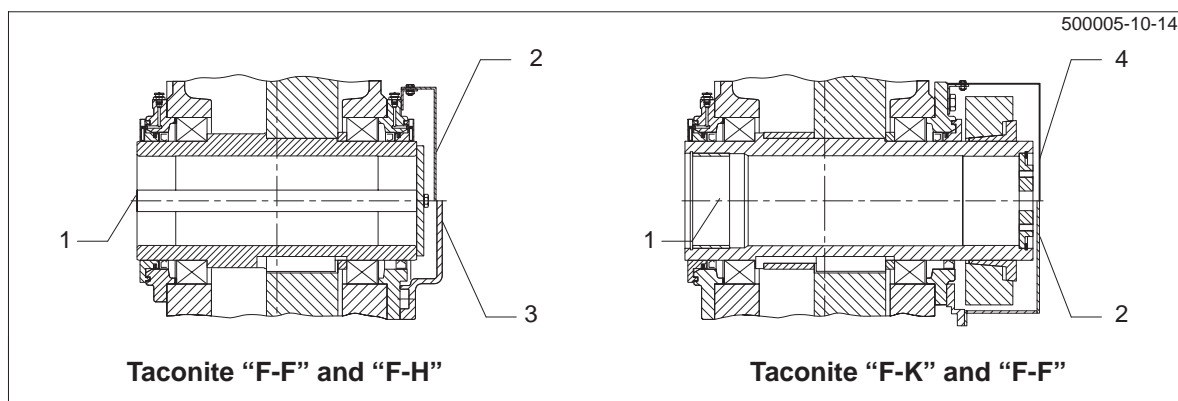
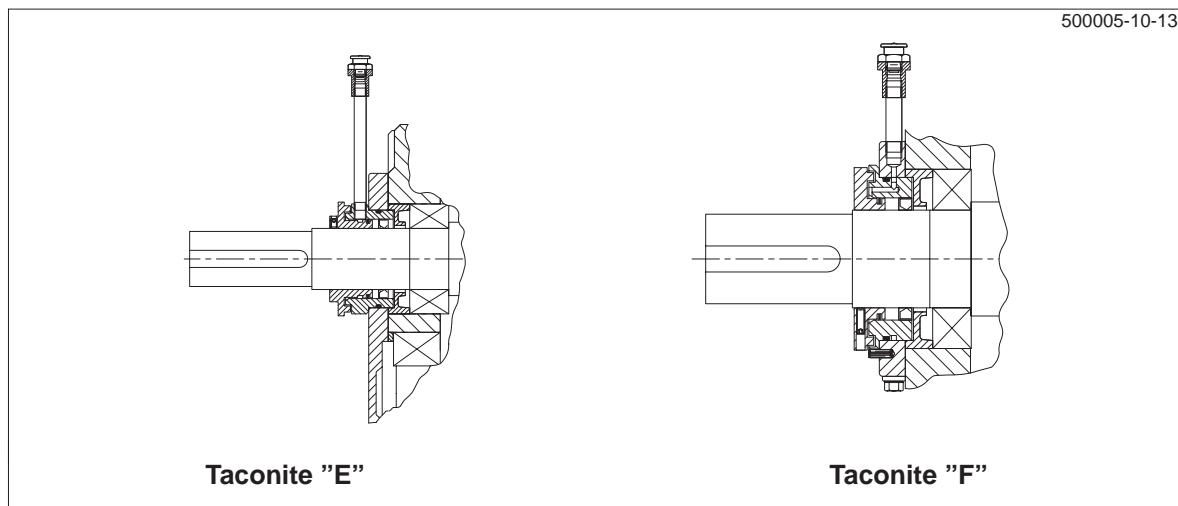
Taconite seals were specially developed for use in a dusty environment. The penetration of dust is prevented by a combination of seal elements (radial shaft sealing ring, lamellar seal and grease-charged labyrinth seal).



1 Radial shaft sealing ring
2 Lamellar seal

3 Grease-charged labyrinth seal (re-chargeable)
4 Flat grease nipple AM10x1 to DIN 3404

Taconite seals are divided into the following types:



- 1 Output
- 2 Taconite "F-F"

- 3 Taconite "F-H"
- 4 Taconite "F-K"

Taconite type variant	Application	Remarks
"E"	All input shafts with or without fan	Re-chargeable labyrinth
"F"	Output shaft Type S (solid shaft) Type V (solid shaft, reinforced) Type F (flanged shaft)	
"F-F"	Output shaft Type H (hollow shaft with parallel keyway) Type K (hollow shaft with internal spline to DIN 5480) Type D (hollow shaft for shrink disk)	Labyrinth re-chargeable on both sides, incl. cowl to prevent contact on gear side facing away from output
"F-H"	Output shaft Type H (hollow shaft with parallel keyway) Type K (hollow shaft with internal-spline to DIN 5480)	Re-chargeable labyrinth on output side; dustproof cowl on opposite side
"F-K"	Output shaft Type D (hollow shaft for shrink disk)	

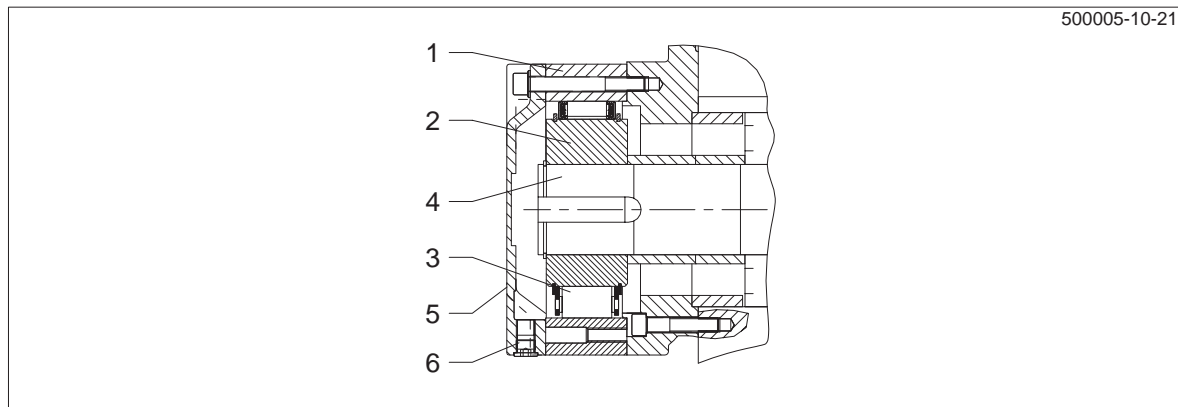
For re-charging the labyrinth seals with grease, the specified frequencies must be observed (see section 10, "Maintenance and repair").

5.8 Backstop

For certain requirements, the gear unit can be fitted with a mechanical backstop. This permits only the specified direction of rotation during the operation of the unit. The direction of rotation is marked by a corresponding arrow on the input and output side of the gear unit.

The backstop is mounted oiltight on an adapter flange on the gear unit and integrated in its oil-circulation system.

The backstop is fitted with centrifugally operated sprags. When the gear unit is running in the specified direction, the inner ring and the cage with the sprags also rotates while the outer ring remains stationary. At a certain rotation speed, the sprags lift off and the backstop then operates without any wear.



- | | | | |
|---|---------------------|---|---------------------------------|
| 1 | Backstop outer ring | 4 | Shaft (adapter flange) |
| 2 | Backstop inner ring | 5 | Cover |
| 3 | Cage with sprags | 6 | Residual-oil drain for backstop |

Note: The stop direction can be changed by turning the cage around. If a change in stop direction is required, FLENDER should be consulted beforehand.

Caution!

To avoid damaging the backstop or the gear unit, the motor must not be run in the stop direction of the gear unit.

Observe the notice fixed to the gear unit.

The minimum lifting speeds must not be exceeded during operation.

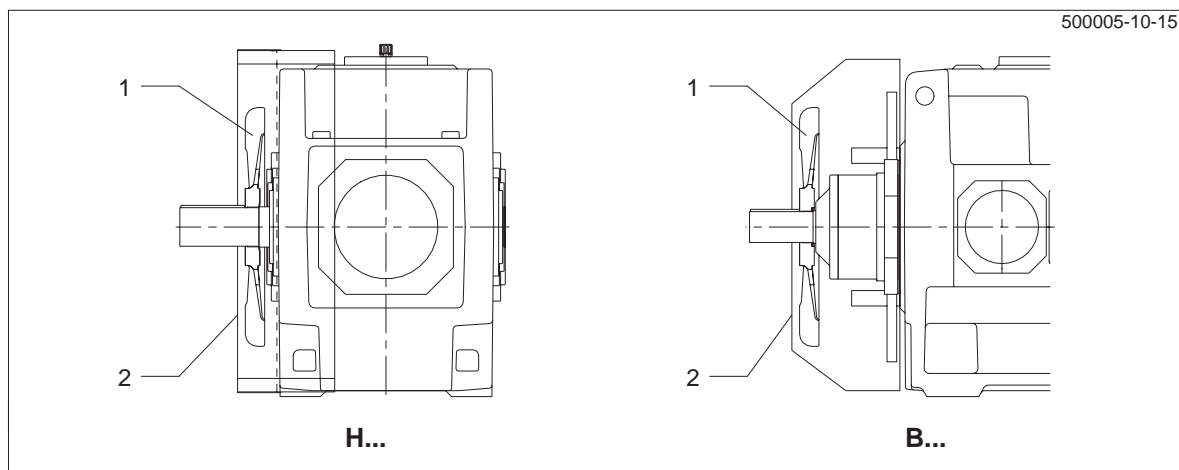
Before connecting the motor, determine the direction of rotation of the three-phase current supply using a phase-sequence indicator, and connect the motor in accordance with the pre-determined direction of rotation.

5.9 Cooling

Depending on requirement, the gear unit is fitted with a fan, a cooling coil, a water or air oil-cooling system or a separate oil supply system. In the case of a separate oil supply system, the specific instructions for this oil supply system must be observed.

5.9.1 Fan

The fan is mounted on a high-speed shaft of the gear unit and is protected from accidental contact by a cowl. The fan sucks air through the grid on the cover and blows it along the air ducts on the side of the gear housing. It thereby dissipates a certain amount of heat from the housing.



1 Fan

2 Fan cowl

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

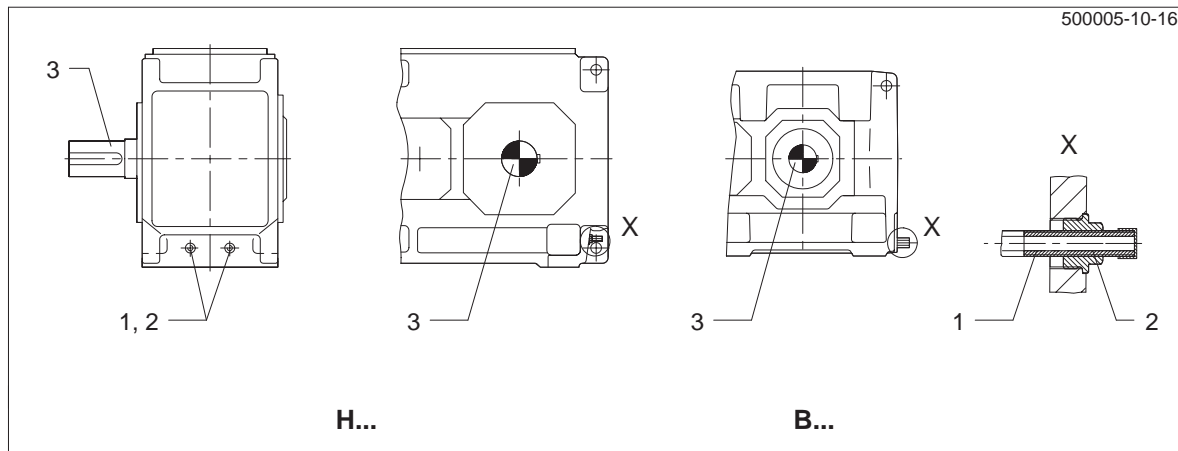
Caution!

For gear units fitted with a fan, sufficient space must be allowed for air intake when mounting the safety guards for the coupling or other components. The correct distance is given in the dimensioned drawing in the gear-unit documentation.
It must be ensured that the fan cover is correctly fastened. The fan cover must be protected against damage from outside. The fan must not come into contact with the fan cover.

The cooling effect is considerably reduced if the fan or the gear housing are dirty (see section 10, "Maintenance and repair").

5.9.2 Cooling coil

The cooling coil is located in the oil sump of the gear unit and is supplied with cooling water via a connection to be provided by the user. Either fresh water, sea water or brackish water can be used for cooling purposes. When water is flowing through the coil, a certain amount of heat is transferred from the oil to the water and thereby removed from the system.



- 1 Cooling-water connection 2 Reducing screw 3 Output shaft

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

Caution!

The water can flow through the gear unit in either direction. The pressure of the cooling water must not exceed 8 bars.

If the gear unit is being withdrawn from service for a longer period or if there is a danger of freezing, the cooling water must be drained off. Remove any remaining water with compressed air.

The ends of the cooling coil must never be twisted because this could destroy the cooling coil.

The reducing bolt must not be tightened or demounted because this may result in damage to the cooling coil.

To avoid excess pressure, the cooling-water inlet must be fitted with a flow-control device, e.g. a pressure reducer or suitable stop valve.

Type	Cooling-water quantity required (l/min)																	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 to 26
H1SH	4	-	4	-	4	-	8	-	8	-	8	-	8	-	8	-	1)	-
H2.H	-	4	4	4	4	4	8	8	8	8	8	8	8	8	8	8	1)	1)
H2.M	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8	1)	1)
H3.H	-	-	4	4	4	4	4	4	8	8	8	8	8	8	8	8	1)	1)
H3.M	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8	1)	1)
B2.H	-	4	8	4	8	4	8	8	8	8	8	8	8	8	8	8	-	-
B3.H	-	4	4	4	4	4	8	8	8	8	8	8	8	8	8	8	1)	1)
B2.M	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8	-	-
B3.M	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8	1)	1)

Note: Refer to the order-specific dimensioned drawing for connecting dimensions.

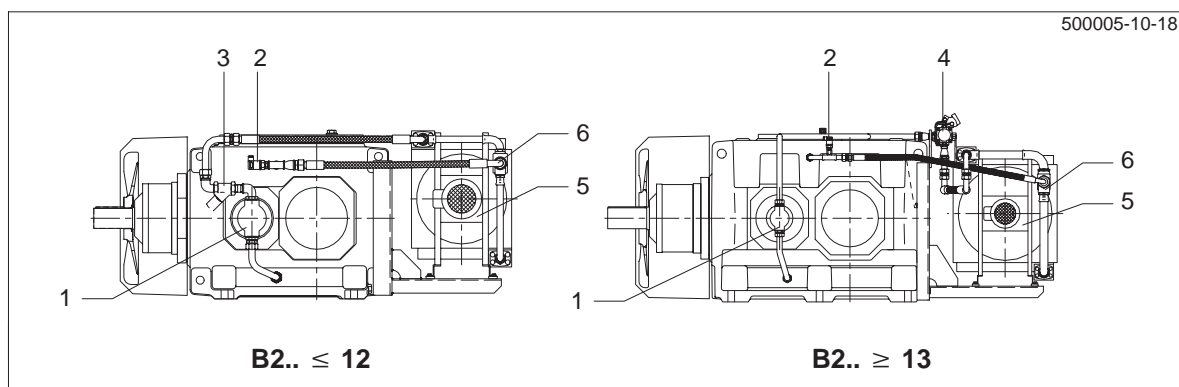
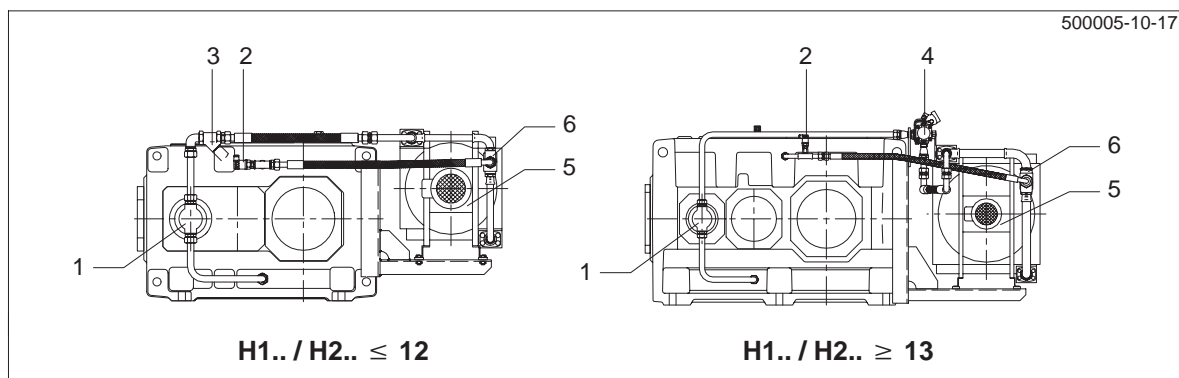
1) on request

5.9.3 Add-on air oil-cooling units

For types H1.., H2.. and B2.., a cooling unit with air oil-cooler may be applied if required in the order. This unit is permanently mounted on the gear unit and consists of a flange pump, a coarse filter, a pressure monitor, a temperature-control valve, the actual air oil-cooler and the necessary pipework. For gear units of sizes 13 to 26, the coarse filter is replaced by a double change-over filter.

The air oil-cooler is designed to cool the gear oil by means of air from the surrounding atmosphere. Depending on the volume flow, the oil passes through the cooler in one or more streams and through the current of air blown in by the fan. For cold starts, a bypass pipe with a temperature-control valve is provided for.

The flow direction of the flange pump used is independent of the direction of rotation, if nothing is specified in the documentation to the contrary.



- | | |
|---|-----------------------------|
| 1 Flange pump | 4 Double change-over filter |
| 2 Pressure monitor (circuit diagram see item 5.5.2) | 5 Air oil-cooler |
| 3 Coarse filter | 6 Temperature-control valve |

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

Caution!

When installing gear units with add-on air oil-cooling units, it must be ensured that the air circulation is not obstructed.

The required minimum distance from adjacent components, walls, etc. is indicated in the drawings in the unit documentation.

Add-on pressure monitors must be connected as shown in item 5.5.2.

Depending on the order specification and application, the flange pump may have been replaced by a motor pump.

For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific equipment list.

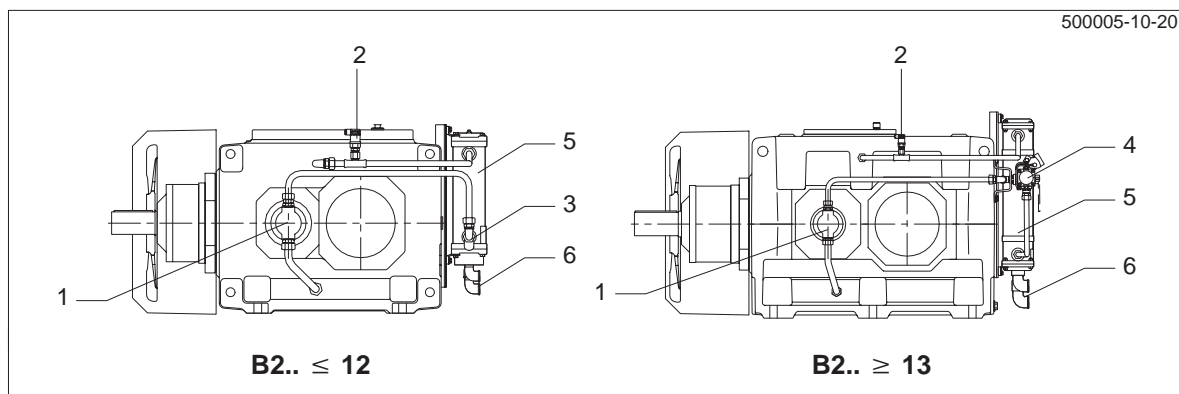
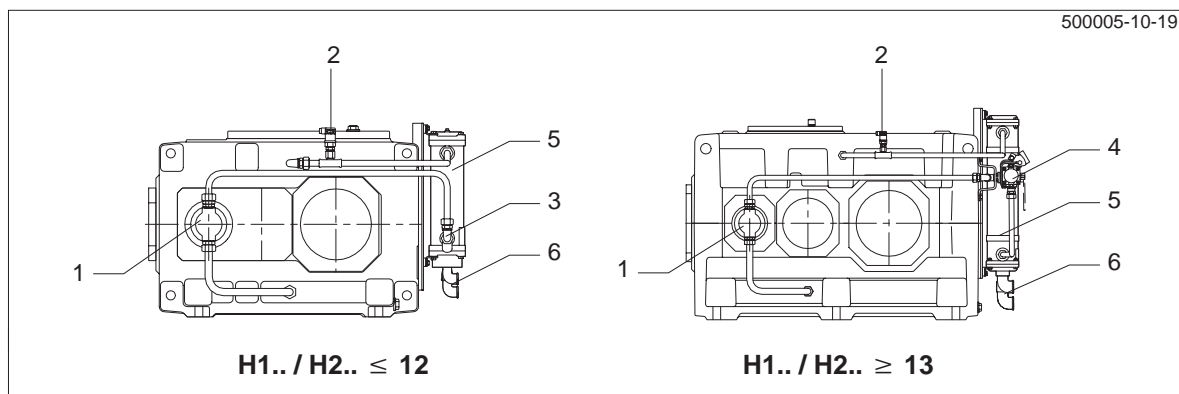
The cooling effect is considerably reduced if the cooler or the gear housing are dirty (see section 10, "Maintenance and repair").

5.9.4 Add-on water oil-cooling units

For types H1.., H2.. and B2.., a cooling unit with water oil-cooler may be applied if required in the order. This oil-cooling unit is permanently mounted on the gear unit and consists of a flange pump, a coarse filter, a pressure monitor, the actual water oil-cooler and the necessary pipework. For gear units of sizes 13 to 26, the coarse filter is replaced by a double change-over filter.

The flow direction of the flange pump used is independent of the direction of rotation, if nothing is specified in the documentation to the contrary.

The required water connection must be provided by the user.



- | | |
|--|--|
| <p>1 Flange pump</p> <p>2 Pressure monitor (circuit diagram see item 5.5.2)</p> <p>3 Coarse filter</p> | <p>4 Double change-over filter</p> <p>5 Water oil-cooler</p> <p>6 Water inlet and outlet</p> |
|--|--|

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

Caution!

To ensure optimum cooling performance, the specified direction of flow in the water oil-cooler must be observed. The cooling-water inlet and outlet must not be reversed.

The pressure of the cooling water must not exceed 8 bars.

If the gear unit is being withdrawn from service for a longer period or if there is a danger of freezing, the cooling water must be drained off. Remove any remaining water with compressed air.

Add-on pressure monitors must be connected as shown in item 5.5.2.

Depending on the order specification and application, the flange pump may have been replaced by a motor pump.

For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

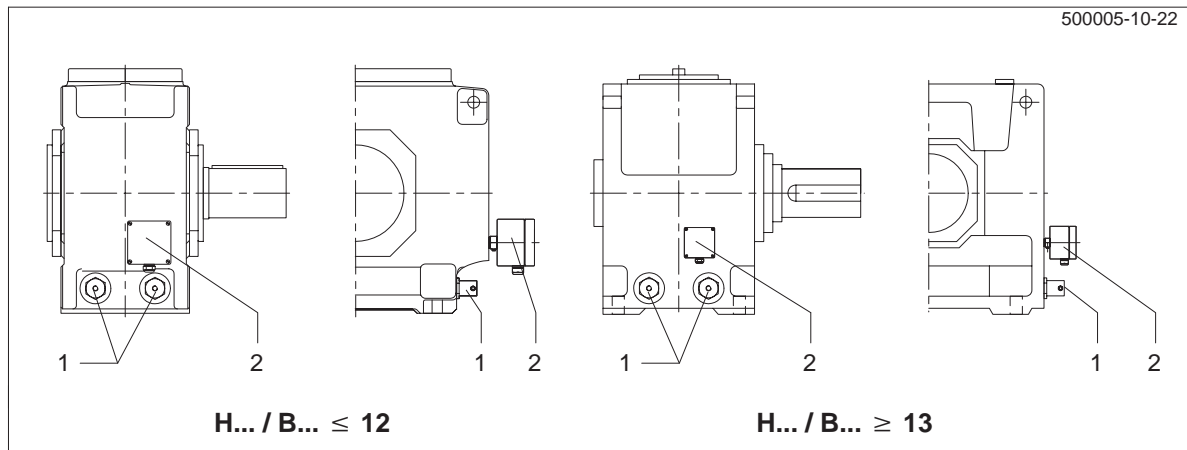
For technical data, refer to the order-specific equipment list.

5.10 Heating element

At low temperatures it may be necessary to heat the gear oil before switching on the drive unit or even during operation. In such cases one or two such heating element may be provided if required. These convert the electrical energy into heat which is conducted to the surrounding oil. The heating elements are located in protective tubes inside the housing, thus making it possible to replace them without draining off the oil.

Complete immersion of the heating elements in the oil bath must be guaranteed.

The heating elements are controlled by a temperature monitor which emits a signal when maximum and minimum temperatures are reached; the signal requires amplification.



1 Heating element

2 Temperature monitor

For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings of the gear-unit documentation.

Caution!

Never switch the heating element on unless complete immersion of the heating elements in the oil bath is ensured. Fire hazard!

If heating elements are installed afterwards the max. heating capacity of 0.8 W/cm^2 on the outer surface of the heating elements must not be exceeded.

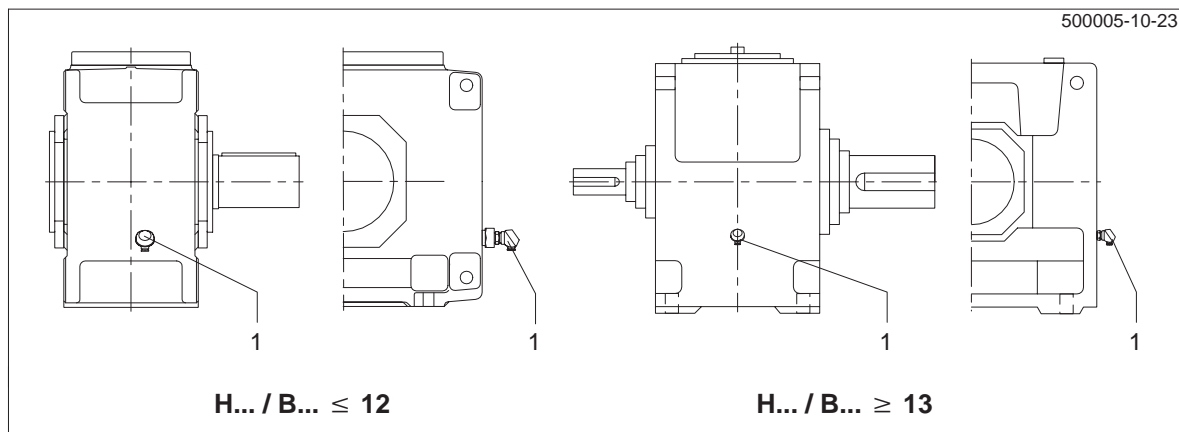
For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific equipment list.

5.11 Oil-temperature measurement

Depending on the order specification, the gear unit may be fitted with a PT100 resistance thermometer for monitoring the oil temperature in the sump. In order to measure the temperatures or temperature differences, the PT100 resistance thermometer should be connected to a suitable instrument provided by the customer. The thermometer has a connection head (protection type IP54) for the wiring. A two-conductor circuit is fitted by the manufacturer. However, the customer may fit his own three- or four-conductor circuit if required.

Note: A certain level of oil is necessary for reliable temperature measurement. For this reason, the resistance thermometer is not suitable for use with labyrinth seals.



1 PT100 resistance thermometer

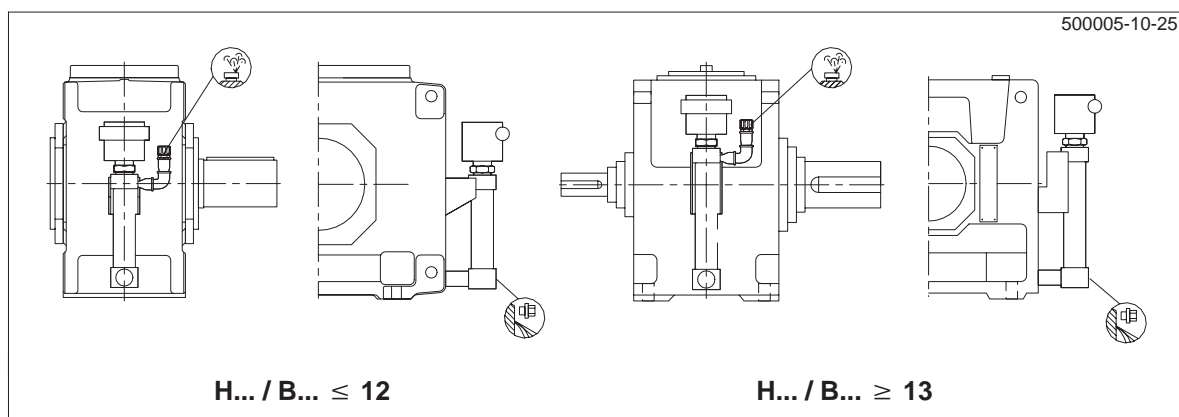
For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings of the gear-unit documentation.

For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific equipment list.

5.12 Oil-level monitoring system

Depending on the order specification, the gear unit may be fitted with an oil-level monitor in the form of a level limit switch. This monitoring is designed as a standstill monitoring (gear unit stop) and checks the level of the oil before the unit is started up. When the signal "oil level too low" is given, it should be wired in such a way that the drive motor cannot start and an alarm is given. During operation, any signal should be bridged.



For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings of the gear-unit documentation.

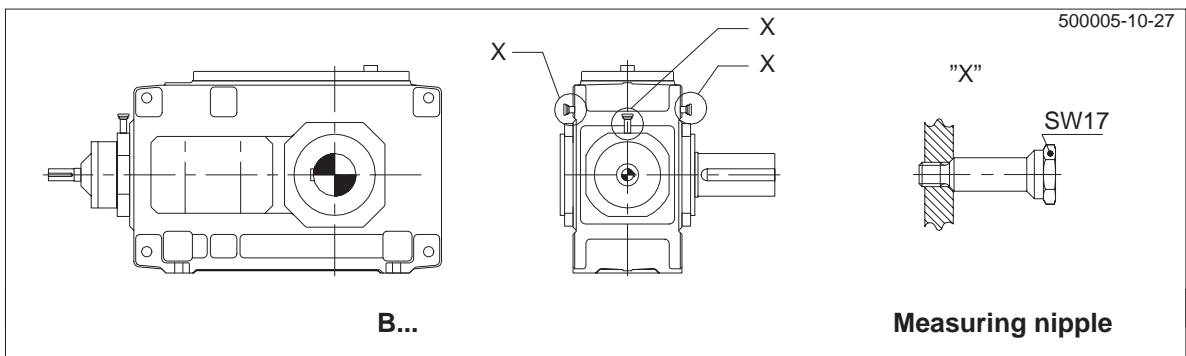
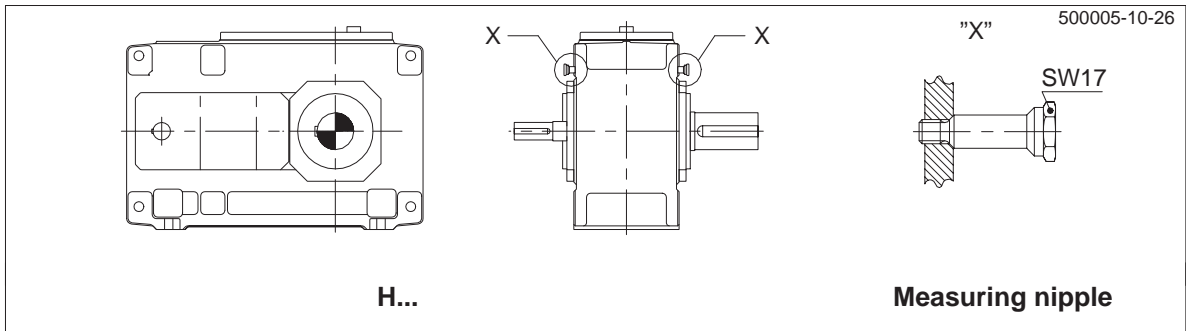
For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific equipment list.

If an oil-level monitoring device is in use, it is very important that the gear unit is in a horizontal position.

5.13 Bearing monitoring system

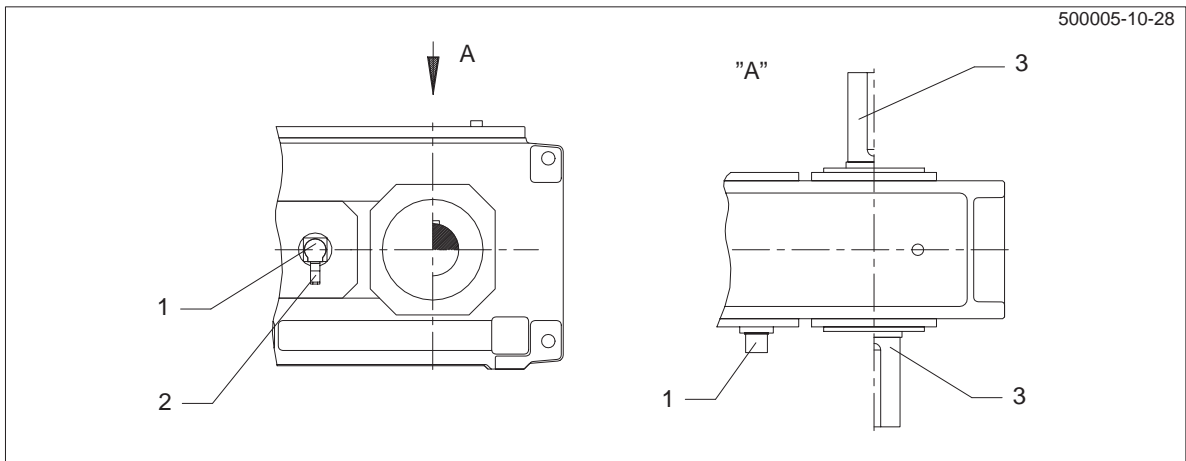
Depending on the order, the gear unit may be prepared for bearing monitoring by fitting measuring nipples. These nipples are intended for attachment of the shock-pulse sensors with rapid-action coupling and are located in the vicinity of the bearings to be monitored.



For a detailed illustration of the gear unit and the position of the add-on parts, please refer to the drawings of the gear-unit documentation.

5.14 Speed transmitter

Depending on order specification, an incremental speed transmitter may be mounted on the second last shaft. Wiring and evaluation instrument should be provided by the customer.



- 1 Incremental transmitter 2 12-pole brass plug 3 Output

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

For operation and maintenance, always observe the operating instructions indicated in the order-specific appendix.

For technical data, refer to the order-specific equipment list.

6. Assembly

Observe the "Safety instructions" in section 3.

6.1 General information on installation

Assembly and installation work must be done with great care by trained and qualified personnel. The manufacturer cannot be held liable for damage caused by incorrect assembly and installation.

During the planning phase sufficient space must be allowed around the gear unit for later care and maintenance work.

Adequate lifting equipment must be available before beginning the installation and assembly work.

If the gear unit is fitted with a fan, there should be sufficient space for air intake.

Caution!

When installing outdoors, direct sunlight should be avoided. Protective features such as covers, roofing, etc. must be provided as required. Do avoid a heat concentration. The operator should ensure that no foreign bodies affect the proper function of the gear unit (e.g. falling objects or heaping over).

Caution!

No welding work must be done at all on the drive. The drives must not be used as an earthing point for welding operations. Toothed parts and bearings may be irreparably damaged by welding.

Caution!

All the fastening points provided by the design of the unit must be used. Screws which have been damaged during assembly or disassembly work must be replaced with new ones of the same strength class and type.

To ensure proper lubrication, the installation position specified in the order must always be observed.

6.2 Installation of gear unit on housing base

6.2.1 Foundation

The foundation must be horizontal and level; the gear unit must not be excessively stressed when tightening the fastening screws.

It must be designed in such a way that no resonance vibrations are set up and that no vibrations are transmitted from adjacent foundations. Steel structures on which the unit is to be mounted must be rigid. It must be designed according to the mass and torque, taking into account the forces acting on the gear unit.

When fastening the gear unit to concrete foundations by means of stone bolts and/or foundation blocks, suitable recesses should be made in the foundation.

Fastening bolts or nuts must be tightened to the prescribed torque. For the correct torque, refer to item 10.2.10. Bolts of the minimum strength class 8.8 must be used.

Slide rails should be correctly aligned and embedded in the concrete foundation.

Note: For dimensions, space requirement, arrangement of supply connections (e.g. with separate oil-cooling units), refer to the drawings in the gear-unit documentation.

6.2.2 Description of installation work

- Remove the anti-corrosion paint on the shafts with suitable cleaning agent such as benzene.

Caution!

Do not allow the cleaning agent (e.g. benzene) to contact the shaft sealing rings.



**Ensure adequate ventilation. Do not smoke!
Danger of explosion!**

- Mount and secure input and output drive elements (e.g. coupling components) on shafts.
If these are to be heated before mounting, refer to the dimensioned drawings in the coupling documentation for the correct joining temperatures.

Unless otherwise specified, the components may be heated inductively, with a burner or in a furnace.



Take precautions to avoid burns from hot components!

Caution!

Protect shaft sealing rings from damage and heating to over + 100 °C (use heat-protective screens to protect against radiant heat.)

The components must be pushed smartly onto the shaft up to the position specified in the order-specific dimensioned drawing.

Caution!

Fit the coupling with the aid of suitable fitting equipment. Never use force or knock the couplings into position, as this may damage the gearwheels, rolling bearings, locking rings, etc.

When fitting the components, care must be taken that the shaft sealing rings and shaft running surface are not damaged.



When installing the drives, make absolutely certain that the individual components are accurately aligned in relation to each other. Inadmissibly large errors in the alignment of the shaft ends to be connected due to angular and axial misalignments result in premature wear and material damage.

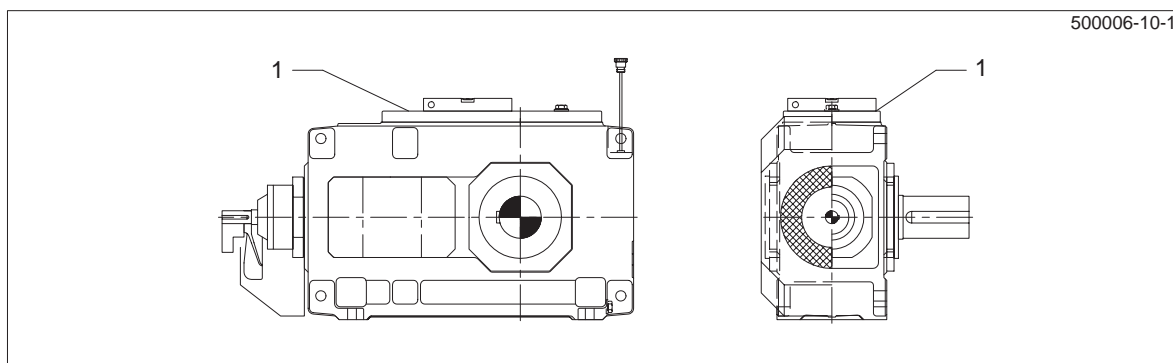
Insufficiently rigid base frames or sub-structures can also during operation cause a radial or axial misalignment, which cannot be measured when the unit is at a standstill.

Note:

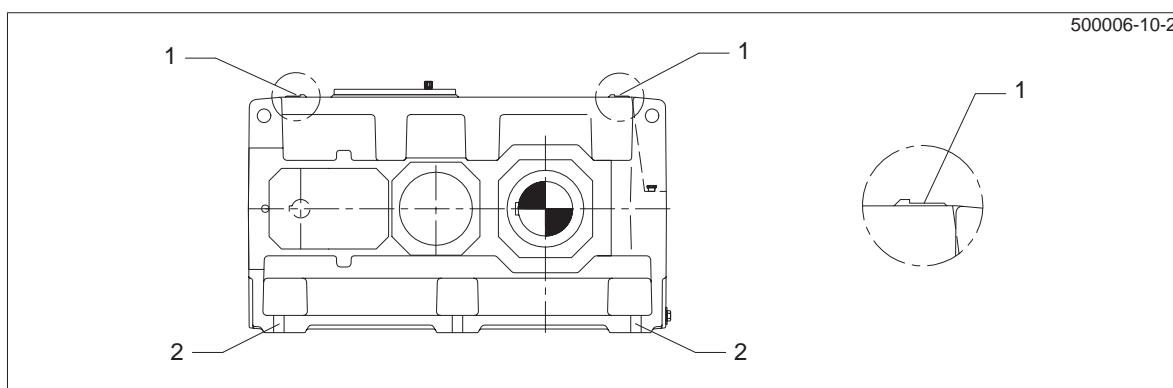
Gear units whose weight requires the use of lifting gear must be attached as shown in section 4, "Transport, handling and storage". When add-on parts are mounted on the gear unit, appropriate additional attachment points must be provided in accordance with the order-specific dimensioned drawing.

6.2.2.1 Aligning surfaces, aligning thread

Initial alignment of the gear units (sizes 3 to 12) in a horizontal direction is done by the surfaces of the inspection or assembly cover.



Gear units of sizes 13 to 26 have special alignment surfaces on the top of the housing. To facilitate alignment of gear units of these sizes, alignment threads are provided on the housing base.



1 Alignment surfaces

2 Alignment thread

6.2.2.2 Mounting on a foundation frame

- Clean the undersurface of the gear-unit base.
- Using suitable lifting gear, place the gear unit on the foundation frame.
- Tighten the foundation bolts to the specified torque (see item 10.2.10). If necessary, use stops to prevent displacement.

Caution!

The gear unit must not be excessively stressed when tensioning the fastening bolts.

The final fine alignment with the assemblies on the in- and output side must be carried out accurately by the shaft axes, using:

- rulers
- spirit level
- dial gauge
- feeler gauge, etc.

Only then should the gear unit be fastened and the alignment checked once again.

Note:

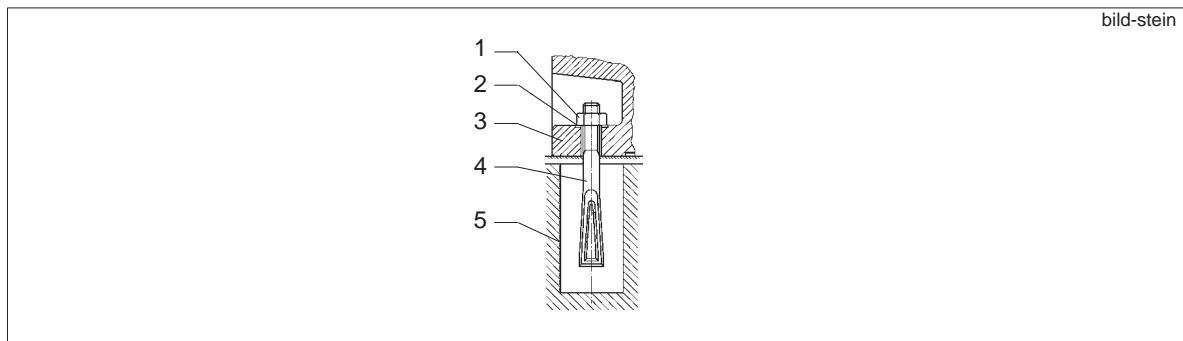
The accuracy of shaft axis alignment is an important factor in determining the life span of shafts, bearings and couplings. If possible, the deviation should be zero. For amongst others the special requirements for the couplings, refer to the specific operating instructions.



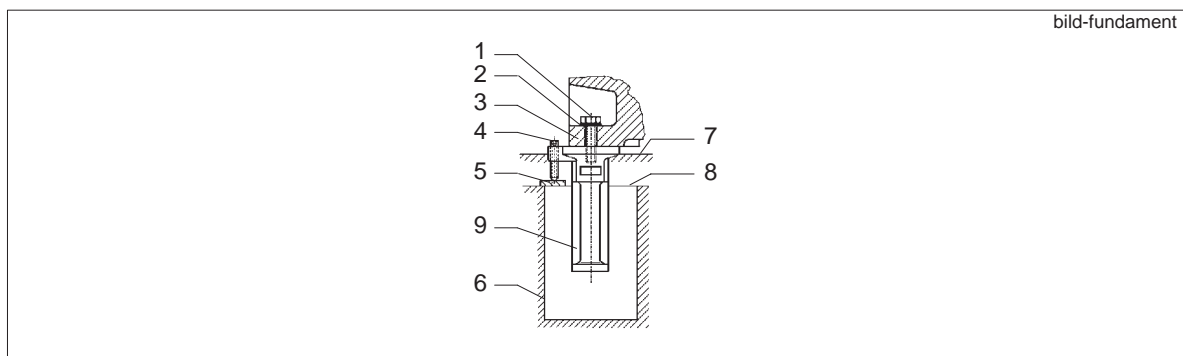
Non-observance can cause shaft rupture, resulting in serious injury or danger of life.

6.2.2.3 Mounting on a concrete foundation by means of stone bolts or foundation blocks

- Clean the undersurface of the gear-unit base.
- Hook the stone bolts with washers and hexagon nuts and/or foundation blocks with washers and fastening bolts into the foundation fastening points on the housing and tighten the hexagon nuts and/or fastening bolts to the specified torque (see item 10.2.10) (see figure below).



- | | | | |
|---|----------------|---|------------|
| 1 | Hexagon nut | 4 | Stone bolt |
| 2 | Washer | 5 | Foundation |
| 3 | Gear-unit base | | |



- | | | | |
|---|------------------|---|----------------------------|
| 1 | Fastening bolt | 6 | Foundation |
| 2 | Washer | 7 | Final foundation height |
| 3 | Gear-unit base | 8 | Prepared foundation height |
| 4 | Set screw | 9 | Foundation block |
| 5 | Flat steel plate | | |

- Using suitable lifting gear, place the gear unit on the concrete foundation.
- Align gear unit horizontally by in- and output shafts:
 - if using stone bolts, with shims
 - if using foundation blocks, with the aid of the set screws
- If applying considerable force, use stops to prevent the unit from displacement.
- Pour concrete into the recesses of the stone bolts or foundation blocks.

Note: Before pouring the concrete foundation, fill up the openings in the foundation blocks with polystyrene.
 When the concrete has set, tighten the hexagon nuts of the stone bolts or fastening bolts to the **specified torque** (see Item 10.2.10).
 With types **H1** and **H2**, remove the air-conducting cowls before tightening the foundation bolts and then bolt them back into position.

Caution!

The gear unit must not be excessively stressed when tensioning the hexagon nuts or fastening bolts.

FLENDER

The final fine alignment with the assemblies on the in- and output side must be carried out accurately by the shaft axes, using:

- rulers
- spirit level
- dial gauge
- feeler gauge, etc.

Only then should the gear unit be fastened and the alignment checked once again.

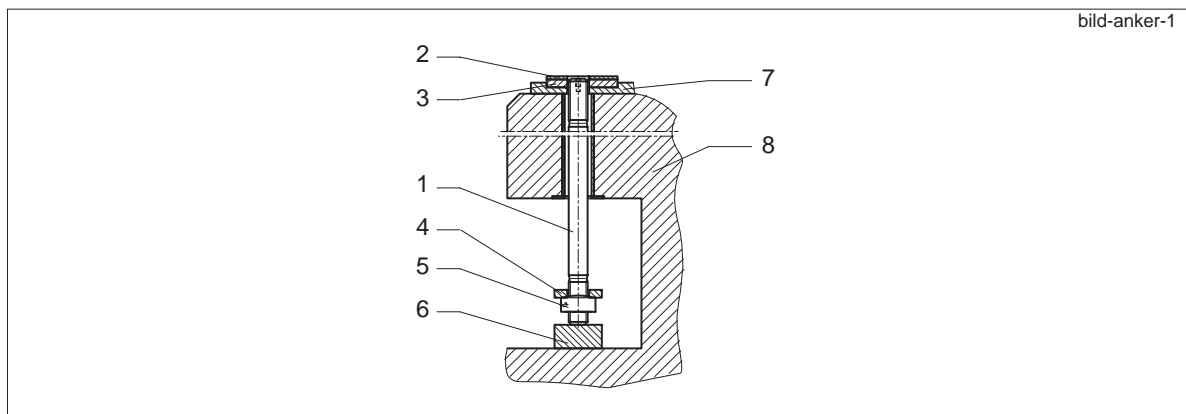
Note: The accuracy of shaft axis alignment is an important factor in determining the life span of shafts, bearings and couplings. If possible, the deviation should be zero. For amongst others the special requirements for the couplings, refer to the specific operating instructions.



Non-observance can cause shaft rupture, resulting in serious injury.

6.2.2.4 Mounting on a concrete foundation by means of anchor bolts

- Clean the undersurface of the gear-unit base.
- Place support on base plate.
- Insert anchor bolts.
- Place pressure plates in position and open hexagon nuts.
- Place wood under anchor bolts in such a way that the top edge is set back about 10 mm.



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

- Place gear unit on foundation

Caution!

The carrying ropes must be attached only by the specified lifting eyes (see Section 4, "Handling and Storage").

FLENDER

- Pull anchor bolts up, fit washer and hexagon nut in place by giving it a few turns

A front-side thread is provided in the anchor bolts for this purpose.

- Align gear unit with supports

The values punched into the screeds must always be observed. Alignment tolerances in relation to the units on the input and output sides are to be in accordance with the permissible angular and longitudinal displacements of the couplings (see Coupling Drawings).

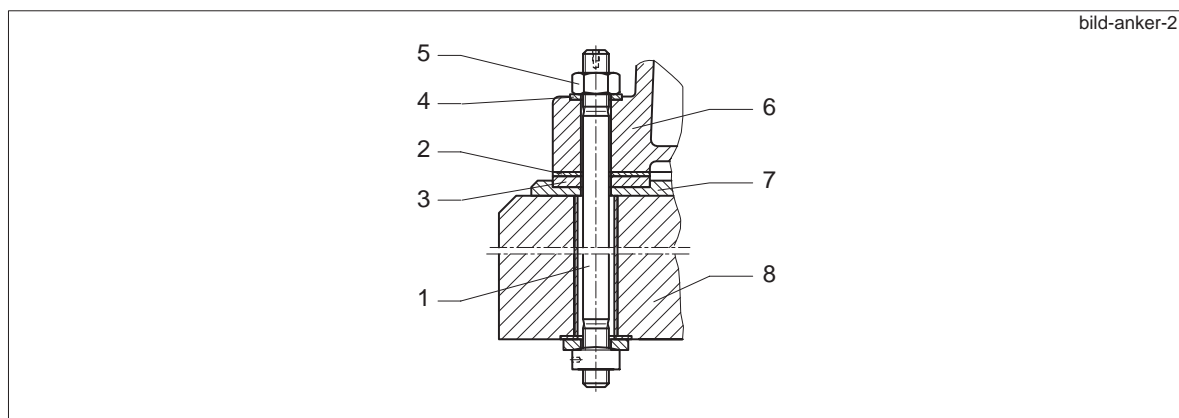
Record alignment dimensions.

Prior to tensioning the anchor bolts, the fine-grained concrete filling must have set for at least 28 days.

- Put anchor bolts under tension by tightening the hexagon nut with your fingers. Place hydraulic tensioning device in position.

Tension bolts alternately to a tensioning force in accordance with Table 10.2.

The tensioning pressures and the initial tensioning forces should be recorded (see also item 7.2.4).



- 1 Anchor bolt
- 2 Support
- 3 Base plate
- 4 Washer

- 5 Hexagon nut
- 6 Housing base
- 7 Fine-grained concrete
- 8 Raw foundation

6.3 Couplings

Generally speaking, flexible couplings or hydraulic couplings combined with flexible couplings should be provided for the input drive.

Note: In the case of gear units with fan, the hydraulic unit of the hydraulic coupling should be located on the motor shaft to ensure that sufficient space is available for intake of cooling air (see item 5.9.1).

In the case of gear unit types with solid output shaft, flexible couplings are, likewise, ordinarily used for the output shaft.

If rigid couplings or other input or output elements which generate additional radial and/or axial forces (e.g. gear wheels, belt pulleys, disk flywheels, hydraulic couplings) are to be used, these must be agreed by contract.



Couplings with peripheral velocities on the outer diameter of up to 30 m/s must be statically balanced. Couplings with peripheral velocities over 30 m/s must be dynamically balanced.

For maintenance and operation of the couplings, refer to the specific operating instructions for the coupling.



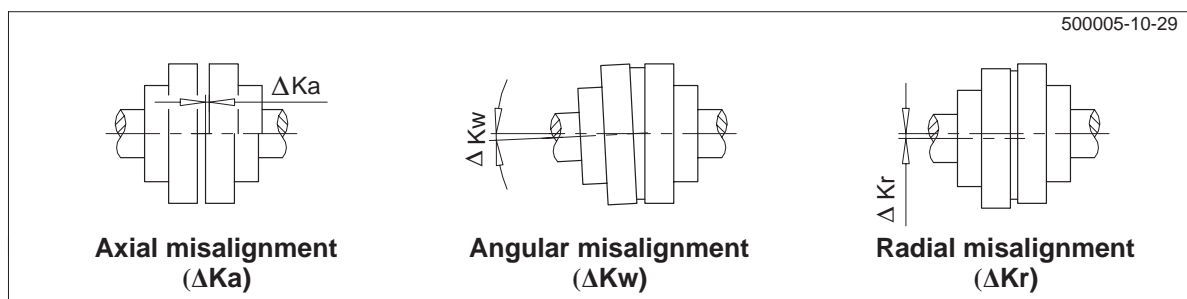
When installing the drives, make absolutely certain that the individual components are accurately aligned in relation to each other. Inadmissibly large errors in the alignment of the shaft ends to be connected due to angular and axial misalignments result in premature wear and material damage. Insufficiently rigid base frames or sub-structures can also during operation cause a radial or axial misalignment, which cannot be measured when the unit is at a standstill.

Note: For permissible alignment errors in the case of couplings supplied by FLENDER, please refer to the operating manuals for the couplings. If you use couplings by other manufacturers, ask which alignment errors are permissible, stating the radial loads occurring.

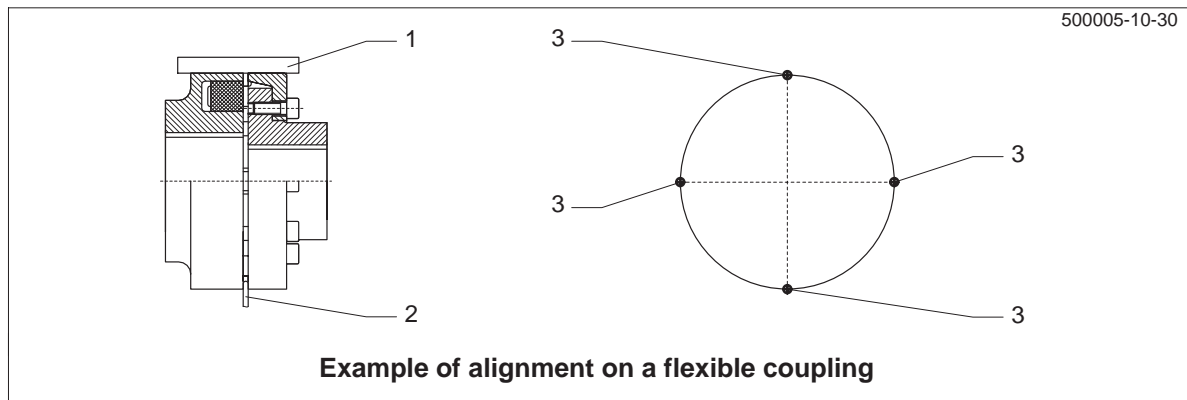
Note: The smaller the radial and angular misalignment between coupling parts on the shaft ends to be connected, the longer the service life and the higher the reliability of the equipment and the quieter the operation.

Misalignments of the coupling parts in relation to each other can be caused by inaccurate alignment during assembly, but also by actual operation of the equipment (expansion due to heat, shaft deflection, insufficiently rigid machine frames, etc.).

Possible misalignments



Alignment has to be done in two axial planes arranged perpendicular to each other. This can be done by means of a ruler (radial misalignment) and feeler gauge (angular misalignment), as shown in the illustration. The aligning accuracy can be increased by using a dial gauge or a laser alignment system.



1 Ruler

2 Feeler gauge

3 Measuring points

Caution!

The maximum permissible misalignments must under no circumstances be exceeded during operation.

For the exact values, please see operating instructions for the coupling.

Angular and radial misalignments may occur at the same time. The sum of both misalignments must not exceed the maximum permissible value of the angular or radial misalignment.

If using couplings by other manufacturers, always consult FLENDER.

Note:

For alignment of the drive components (vertical direction), it is recommended to use packing or foil plates underneath the mounting feet. The use of claws with set screws on the foundation for lateral adjustment of the drive components is also advantageous.

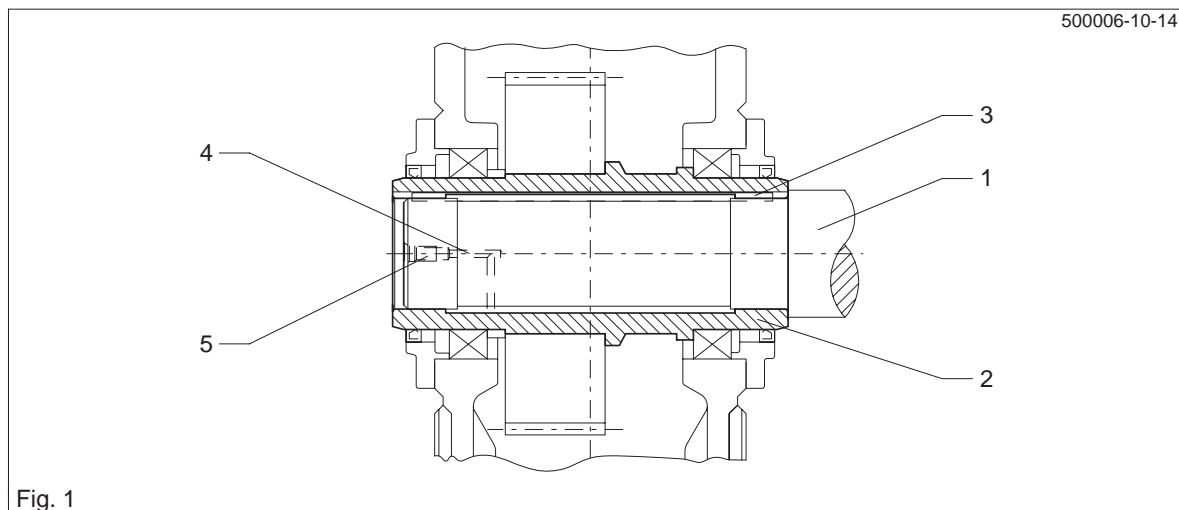
In the case of gear units with hollow output shafts or flange output shafts, the coupling on the output side is not required. Gear units with hollow output shafts must be mounted on the shafts of the customer's machinery. Gear units with flanged output shafts must be mounted on the customer's shaft via a counterflange.

6.4 Assembly of a shaft-mounting gear unit with hollow shaft and parallel keyway

The shaft end of the driven machine must be provided with a parallel key to DIN 6885 Part 1 Form A (material C60+N or higher strength) and should have a centring means to DIN 332 Form DS (with thread) in its end face (for connecting dimensions of the driven machine shaft, see dimensioned drawing in the gear unit documentation).

6.4.1 Preparatory work

To assist demounting (see also item 6.4.3), we recommend providing a connection for pressure oil on the end of the driven machine shaft. For this a hole must be drilled through to the hollow shaft bore (refer to fig. 1).



- | | | | |
|---|---------------|---|------------------------------------|
| 1 | Machine shaft | 4 | Bore for rust-releasing agent feed |
| 2 | Hollow shaft | 5 | Pressure oil connection |
| 3 | Parallel key | | |

6.4.2 Assembly

- Remove the preservative agent from the hollow shaft and the machine shaft with a suitable cleaning agent (such as benzine).

Caution!

Do not allow the cleaning agent (e.g. benzine) to contact the shaft sealing rings.



**Ensure adequate ventilation. Do not smoke!
Danger of explosion.**

- Check the hollow and machine shafts to ensure that seats and edges are not damaged. If necessary, rework the parts with a suitable tool and clean them again.

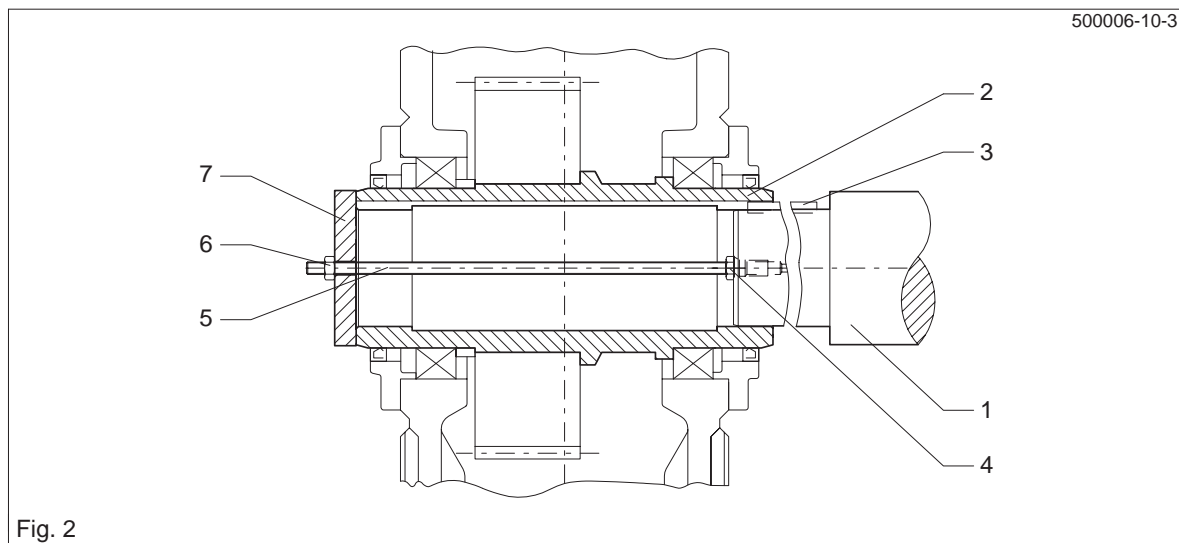
Note: Coat with a suitable lubricant (e.g. Calypsol grease type H 443 HD88) to prevent frictional corrosion of the contact surfaces.

6.4.2.1 Fitting

- Fit the gear unit by means of nut and threaded spindle. The counterforce is provided by the hollow shaft.

Caution!

The hollow shaft must be exactly aligned with the machine shaft to avoid canting.



- | | | | | | |
|---|---------------|---|------------------|---|-----------|
| 1 | Machine shaft | 4 | Nut | 7 | End plate |
| 2 | Hollow shaft | 5 | Threaded spindle | | |
| 3 | Parallel key | 6 | Nut | | |

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as a hydraulic lifting equipment (type Lucas) may be used.

Caution!

The hollow shaft may be pulled against a machine shaft collar only on gear arrangements with a torque arm or if supported with gear unit swing bases, because with a different arrangement the bearings would be excessively stressed.

6.4.2.2 Axial fastening

Depending on type, secure the hollow shaft axially on the machine shaft (e.g. with locking ring, end plate, set screw etc.).

6.4.3 Dismantling

- Remove the axial securing device from the hollow shaft.
- If frictional corrosion has occurred on the seating surfaces, inject rust-releasing or other agent (e.g. with a pump) into the bore cavity to reach the seats in order to facilitate forcing off. The rust releaser can be injected through a bore in the machine shaft (see fig. 1).
- Depending on the facilities available on site, the gear unit can be forced off the machine shaft using forcing screws in an end plate (see fig. 4), a central threaded spindle or preferably a Lucas hydraulic lifting unit.
- When the rust-releasing agent has taken effect, pull the gear unit off with the device as shown in figs. 3 or 4.

Note: The end plate and the auxiliary plate for forcing off the gear unit are not included in our delivery.
Each of the two end faces of the hollow shaft is provided with 2 tapped holes (for dimensions, see fig. 5) to receive bolts for fastening the end plate to the hollow shaft.

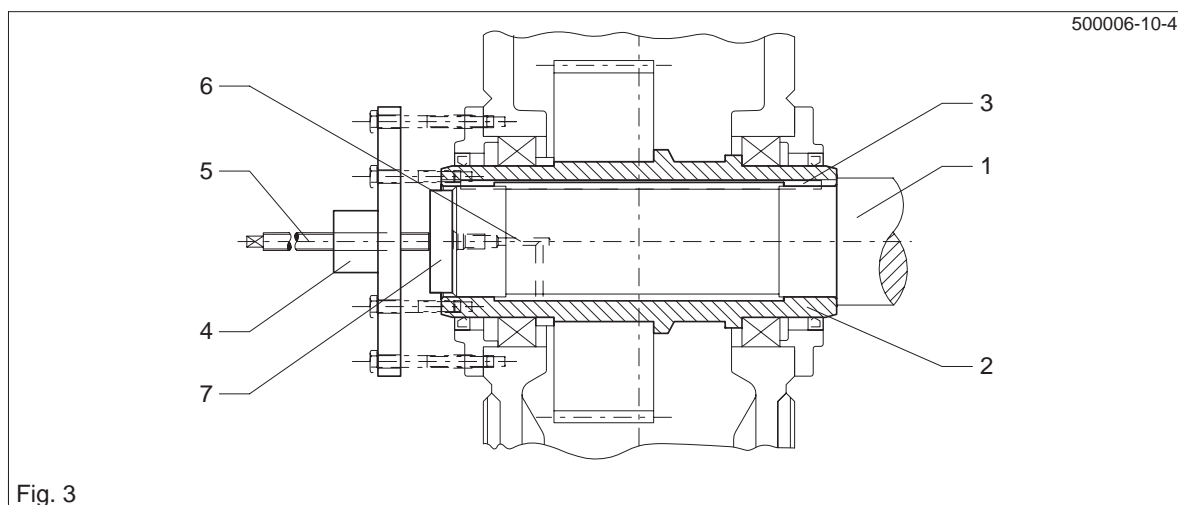


Fig. 3

- | | |
|--------------------------|--------------------------------------|
| 1 Machine shaft | 5 Threaded spindle |
| 2 Hollow shaft | 6 Bore for rust-releasing agent feed |
| 3 Parallel key | 7 Plate for forcing out |
| 4 Hydraulic lifting unit | |

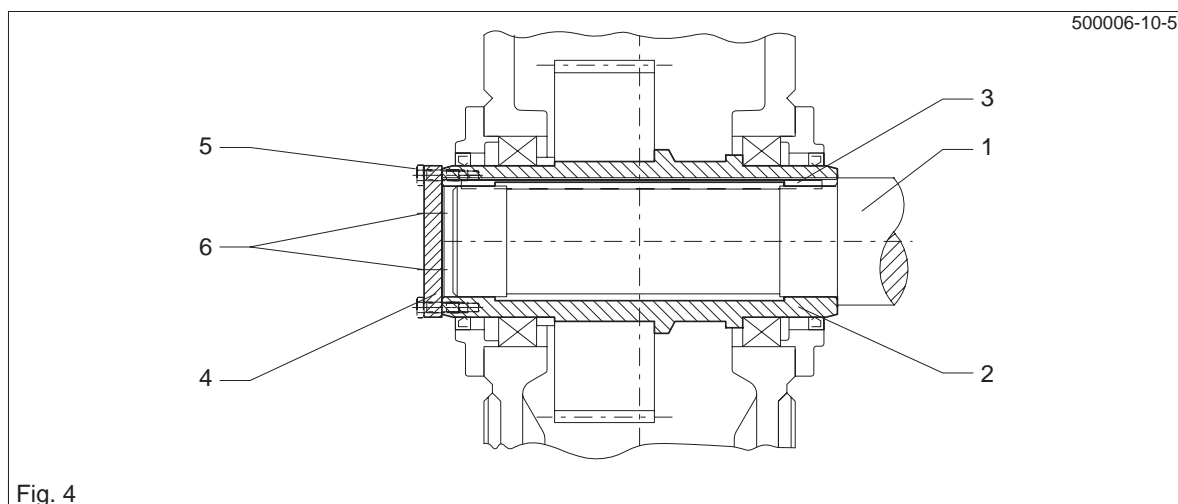


Fig. 4

- | | |
|-----------------|-----------------------------|
| 1 Machine shaft | 4 End plate for forcing out |
| 2 Hollow shaft | 5 Screws |
| 3 Parallel key | 6 Forcing screws |

Caution!

Avoid canting when pulling the unit off.

Note: The plate for forcing out is not included in our delivery.

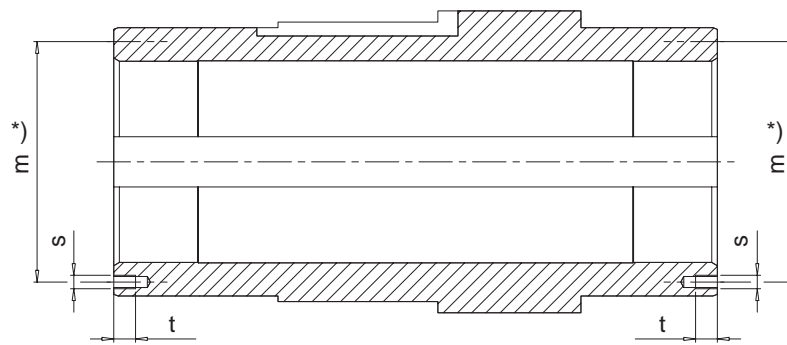


Fig. 5

*) 2 threads offset 180°

Gear-unit size	m mm	s	t mm	Gear-unit size	m mm	s	t mm
4	95	M 8	14.5	12	215	M 12	19.5
5	115	M 8	14.5	13	230	M 12	19.5
6	125	M 8	14.5	14	250	M 12	19.5
7	140	M 10	17	15	270	M 16	24
8	150	M 10	17	16	280	M 16	24
9	160	M 10	17	17	300	M 16	24
10	180	M 12	19.5	18	320	M 16	24
11	195	M 12	19.5	19 ... 26	on request		

Table 6.1: Threaded holes on the end faces of the gear unit hollow shafts

Caution!

If the counterforce is provided not only by the hollow shaft, but also by the housing, as shown in fig. 3, the forces used must not exceed the values given in the following table.

Gear-unit size	Max. forcing pressure N	Gear-unit size	Max. forcing pressure N
4	22600	12	113600
5	33000	13	140000
6	37500	14	160000
7	50000	15	193000
8	56000	16	215000
9	65000	17	240000
10	82000	18	266000
11	97200	19 ... 26	on request

Table 6.2: Maximum forcing pressures

Caution!

If the above values are exceeded, the housing, the hollow-shaft bearings or other gear components may be irreparably damaged. Before replacing the gear unit on the machine shaft, always check the bearings for any signs of damage.

Note:

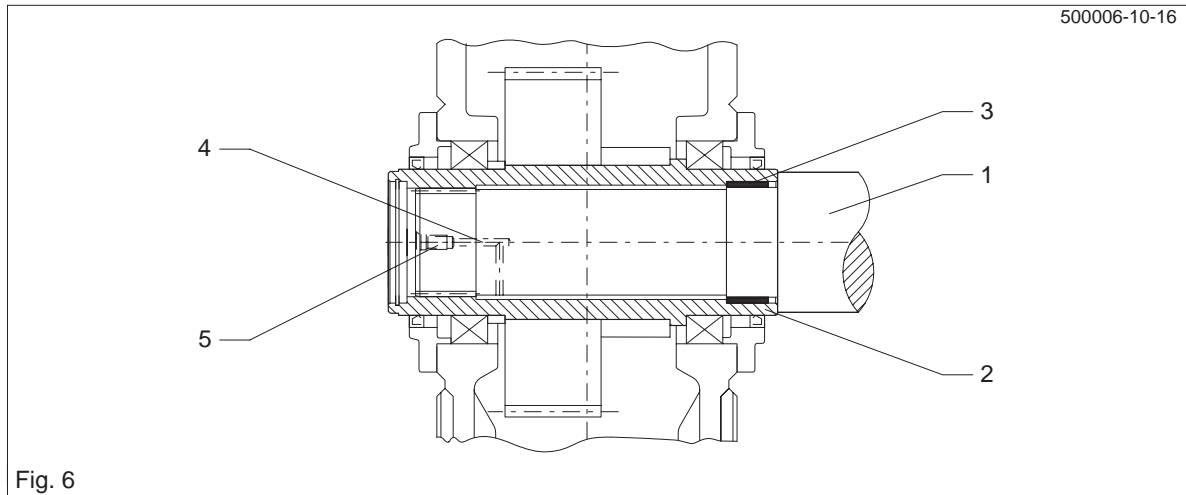
When using forcing screws or threaded spindles, the head of the thread pressing against the driven machine should be rounded and well greased to reduce the risk of seizing at this point.

6.5 Shaft-mounting gear unit with hollow shaft and internal spline to DIN 5480

The shaft end of the driven machine must be designed with involute splines to DIN 5480 and should have a centring means to DIN 332 Form DS (with thread) in its end face (for connecting dimensions of the driven machine shaft, see dimensioned drawing in the gear unit documentation).

6.5.1 Preparatory work

To facilitate demounting (see also item 6.4.3.), we recommend providing a connection for pressure oil on the end of the driven machine shaft. Doing this a hole must be drilled through to the hollow shaft bore (refer to fig. 6).



- 1 Machine shaft
- 2 Hollow shaft
- 3 DU bush

- 4 Bore for rust-releasing agent feed
- 5 Pressure oil connection

6.5.2 Assembly

- Remove the preservative agent from the hollow shaft and the machine shaft with a suitable cleaning agent (such as benzine).

Caution!

Do not allow the cleaning agent (e.g. benzine) to contact the shaft sealing rings.



**Ensure adequate ventilation. Do not smoke!
Danger of explosion.**

- Check the hollow and machine shafts to ensure that seats, teeth or edges are not damaged. If necessary, rework the parts with a suitable tool and clean them again.

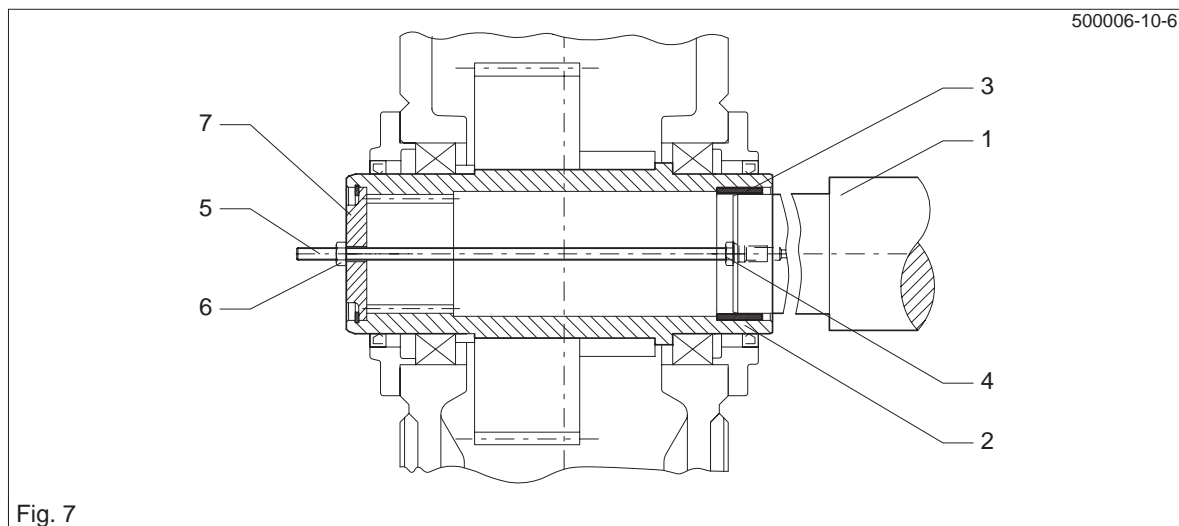
Note: Coat with a suitable lubricant (e.g. Calypsol grease type H 443 HD88) to prevent frictional corrosion of the contact surfaces.

6.5.2.1 Fitting

- Fitting with integrated DU bush
- Fit the gear unit by means of nut and threaded spindle. The counterforce is provided by the hollow shaft.

Caution!

The hollow shaft must be exactly aligned with the machine shaft to avoid canting. When fitting, ensure that the position of the teeth between the machine shaft and hollow shaft is correct. The correct position can be determined by turning the input shaft or by swivelling the gear unit lightly around the hollow shaft.



- | | | | | | |
|---|---------------|---|------------------|---|-----------|
| 1 | Machine shaft | 4 | Nut | 7 | End plate |
| 2 | Hollow shaft | 5 | Threaded spindle | | |
| 3 | DU bush | 6 | Nut | | |

- Fitting with loose DU bush

The loose DU bush is pushed onto the machine shaft, fixed rigidly in position with a locating tie and then pulled into the hollow shaft along with the machine shaft (see fig. 7).

Caution!

The hollow shaft must be exactly aligned with the machine shaft to avoid canting. When fitting, ensure that the position of the teeth between the machine shaft and hollow shaft is correct. The correct position can be determined by turning the input shaft or by swivelling the gear unit lightly around the hollow shaft.

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as a hydraulic lifting equipment (type Lucas) may be used.

Caution!

The hollow shaft may be pulled against a machine shaft collar only on gear arrangements with a torque arm or if supported with gear unit swing bases, because with a different arrangement the bearings may be excessively stressed.

6.5.2.2 Axial fastening

Depending on type, secure the hollow shaft axially on the machine shaft (e.g. with locking ring, end plate, set screw etc.).

6.5.3 Dismantling

- Remove the axial securing device from the hollow shaft.
- If frictional corrosion has occurred on the seating surfaces, inject rust-releasing or other agent (e.g. with a pump) into the bore cavity to reach the seats in order to facilitate forcing off. The rust releaser can be injected through a bore in the machine shaft (see fig. 6).
- The end plate and the locking ring must first be removed.
- Depending on the facilities available on site, the gear unit can be forced off the machine shaft using forcing screws in an end plate (see fig. 9), a central threaded spindle or preferably a Lucas hydraulic lifting unit.
- When the rust-releasing agent has taken effect, pull the gear unit off with the device as shown in figs. 8 or 9.

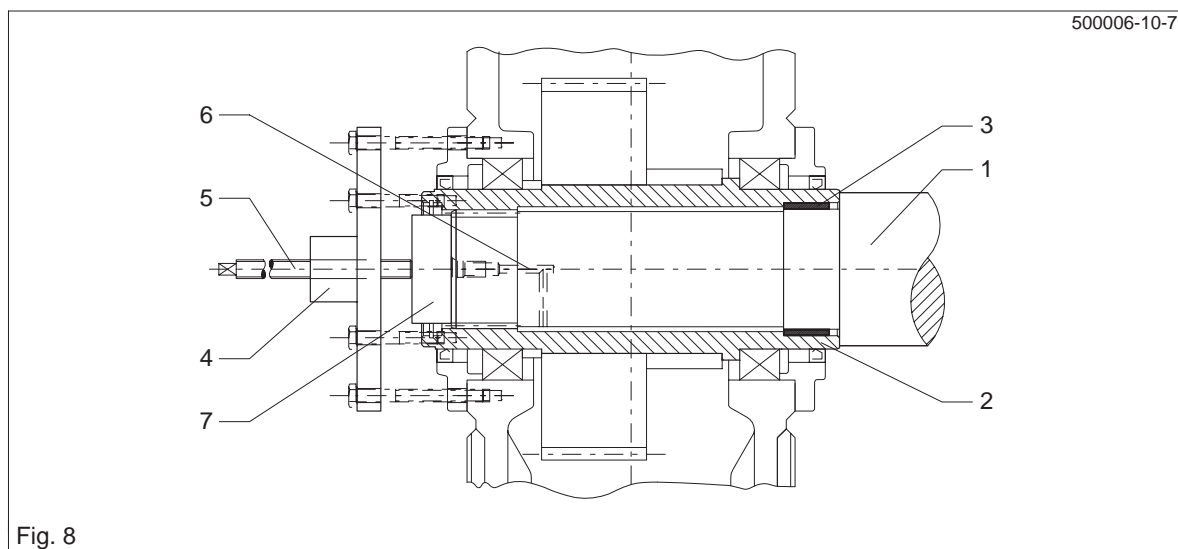


Fig. 8

- | | |
|--------------------------|--------------------------------------|
| 1 Machine shaft | 5 Threaded spindle |
| 2 Hollow shaft | 6 Bore for rust-releasing agent feed |
| 3 DU bush | 7 Plate for forcing out |
| 4 Hydraulic lifting unit | |

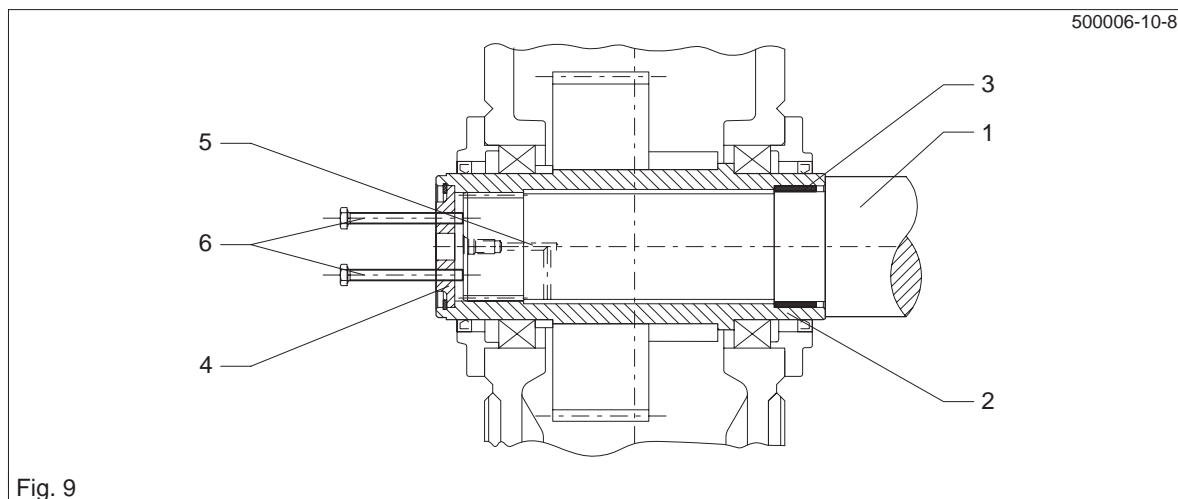


Fig. 9

- | | |
|-----------------|--------------------------------------|
| 1 Machine shaft | 4 End plate |
| 2 Hollow shaft | 5 Bore for rust-releasing agent feed |
| 3 DU bush | 6 Forcing screws |

Caution!

Avoid canting when pulling the unit off.

Note: The plate for forcing out is not included in our delivery.

FLENDER

Caution!

If the counterforce is provided not only by the hollow shaft, but also by the housing, as shown in fig. 8, the forces used must not exceed the values given in the following table.

Gear-unit size	Max. forcing pressure N	Gear-unit size	Max. forcing pressure N
4	22600	12	113600
5	33000	13	140000
6	37500	14	160000
7	50000	15	193000
8	56000	16	215000
9	65000	17	240000
10	82000	18	266000
11	97200	19 ... 26	on request

Table 6.3: Maximum forcing pressures

Caution!

If the above values are exceeded, the housing, the hollow-shaft bearings or other gear components may be irreparably damaged. Before replacing the gear unit on the machine shaft, always check the bearings for any signs of damage.

Note:

When using forcing screws or threaded spindles, the head of the thread pressing against the driven machine should be rounded and well greased to reduce the risk of seizing at this point.

6.6 Shaft-mounting gear unit with hollow shaft and shrink disk

The end of the driven machine shaft (material C60+N or higher strength) should have a centring means to DIN 332 Form DS (with thread) in its end face (for connecting dimensions of the driven machine shaft, see dimensioned drawing in the gear unit documentation).

6.6.1 Assembly

- Remove the preservative agent from the hollow shaft and the machine shaft with a suitable cleaning agent (such as benzine).

Caution!

Do not allow the cleaning agent (e.g. benzine) to contact the shaft sealing rings.



**Ensure adequate ventilation. Do not smoke!
Danger of explosion.**

- Check the hollow and machine shafts to ensure that seats and edges are not damaged. If necessary, rework the parts with a suitable tool and clean them again.

Caution!

**The bore of the hollow shaft and the machine shaft must be absolutely free of grease in the area of the shrink disk seat.
This is essential for safe and reliable torque transmission.
Do not use contaminated solvents or dirty cloths for removing grease.**

6.6.1.1 Fitting

- Fitting with integrated DU bush
- Fit the gear unit by means of nut and threaded spindle. The counterforce is provided by the hollow shaft.

Caution!

The hollow shaft must be exactly aligned with the machine shaft to avoid canting.

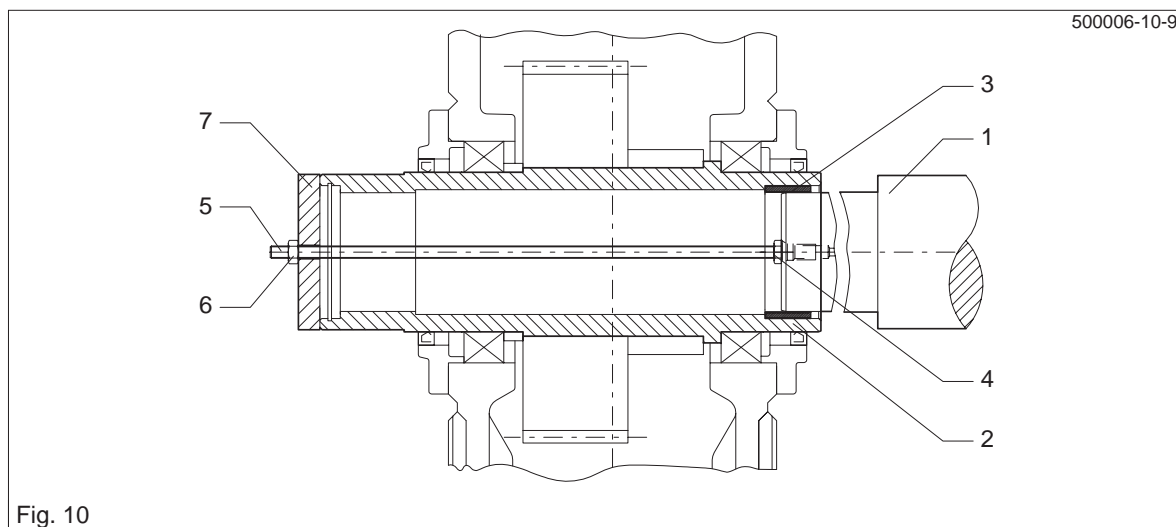


Fig. 10

1	Machine shaft	4	Nut	7	End plate
2	Hollow shaft	5	Threaded spindle		
3	DU bush	6	Nut		

- Fitting with loose DU bush

The loose DU bush is pushed onto the machine shaft, fixed rigidly in position with a locating tie and then pulled into the hollow shaft along with the machine shaft (see fig. 10).

Caution!

The hollow shaft must be exactly aligned with the machine shaft to avoid canting.

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as a hydraulic lifting equipment (type Lucas) may be used.

Caution!

The hollow shaft may be pulled against a machine shaft collar only on gear arrangements with a torque arm or if supported with gear unit swing bases, because with a different arrangement the bearings may be excessively stressed.

6.6.1.2 Axial fastening

If the shrink disk is fitted according to instructions (see item 6.6.2.1), the gear unit is fixed securely in the axial direction. Additional fastening is not required.

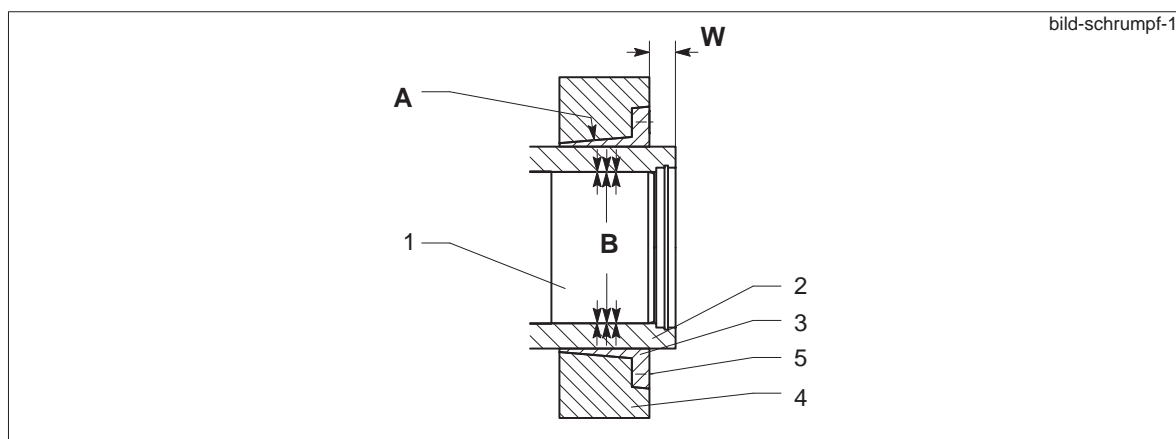
6.6.2 Shrink disk, type HSD

6.6.2.1 Assembly of shrink disk

The shrink disk is delivered ready for installation.

Caution! It must not be dismantled before tensioning for the first time.

Caution! The bore of the hollow shaft and the machine shaft must be absolutely free of grease in the area of the shrink disk seat. This is essential for safe and reliable torque transmission. Do not use contaminated solvents or dirty cloths for removing grease.



A Greased	B Absolutely grease-free	W Installation height
1 Machine shaft	3 Inner ring	5 Tensioning bolt
2 Hollow shaft	4 Outer ring	

- Mounting the shaft or fitting the hub onto the shaft

For the exact installation height (W) of the shrink disk, refer to the dimensioned drawing (see section 1, "Technical data")

Note: The outer surface of the hollow shaft may be greased in the area of the shrink disk seat.

Caution! Do not tighten the tensioning bolts until the machine shaft is installed.

The tensioning bolts must be tightened one after the other, in rotation and in several passes to the tightening torque shown on the shrink disk.

Tighten all the tensioning bolts until the lateral surfaces of the inner and outer rings are aligned.

Note: This allows the tension condition to be checked visually. For safety the tensioning bolts must then be tightened in 2 further passes.

Caution!

To avoid overloading the individual bolts, the maximum tensioning torque (see table 6.4) must never be exceeded. The alignment of the front surfaces has priority. If alignment cannot be achieved by tightening, consult FLENDER.

Tensioning-bolt thread	Max. tensioning torque per bolt (with $\mu = 0.1$)	
	Strength class 10.9 Nm	Strength class 12.9 Nm
M 6	12	14.5
M 8	29	35
M 10	58	70
M 12	100	121
M 14	160	193
M 16	240	295
M 20	470	570
M 24	820	980
M 27	1210	1450
M 30	1640	1970
M 33	2210	2650
M 36	2850	3420

Table 6.4: Maximum torques for tensioning bolts



For safety reasons, a protective cover should be mounted above the shrink disk.

6.6.2.2 Demounting and remounting the shrink disk

Disassemble the protective cover.

The loosening process is similar to that of tightening.

To enable the stored energy of the outer ring during disassembly to be lowered slowly via the bolts to be loosened, the bolts must be loosened evenly and in sequence. Initially only by a quarter turn.

Caution!

Under no circumstances must the bolts be unscrewed one after the other.

If after loosening all the bolts approx. one turn the outer ring does not come free of the inner ring of its own accord, the outer ring can be detensioned with the forcing threads by screwing some of the adjacent fastening bolts into the them. The now loosening outer ring is braced against the remaining bolts. This operation must be carried out until the outer ring releases of its own accord.

Remove shaft or slip hub off the shaft. Rust deposits which may have formed on the shaft must be removed from the hub before performing this operation.

Pull the shrink disk off the hollow shaft.

6.6.2.3 Cleaning and greasing the shrink disk

Dismantled shrink disks do not have to be dismantled and re-greased before being re-installed.

The shrink disk should only be dismantled and cleaned if it is dirty.

Observe the "Safety instructions" in section 3.

Caution!

Following cleaning, only the inner sliding surfaces of the shrink disk should be re-greased.

Use a solid lubricant with a high MoS₂-based molybdenum disulphide content and with a coefficient of friction of $\mu = 0.04$ according to the following table.

Lubricant	Form	Manufacturer
Molykote 321 R (lubricating paint)	Spray	DOW Corning
Molykote Spray (powder spray)	Spray	DOW Corning
Molykote G Rapid	Spray or Paste	DOW Corning
Aemasol MO 19 P	Spray or Paste	A. C. Matthes
Unimoly P 5	Powder	Klüber Lubrication

Table 6.5: Lubricants for shrink disk after cleaning

6.6.3 Dismantling

- If frictional corrosion has occurred on the seating surfaces, inject rust-releasing or other agent (e.g. with a pump) into the bore cavity to reach the seats. The rust releaser can be injected through a bore in the machine shaft (see fig. 11).
- Depending on the facilities available on site, the gear unit can be forced off the machine shaft using forcing screws in an end plate (see fig. 12), a central threaded spindle or preferably a Lucas hydraulic lifting unit.
- When the rust-releasing agent has taken effect, pull the gear unit off with the device as shown in figs. 11 or 12.

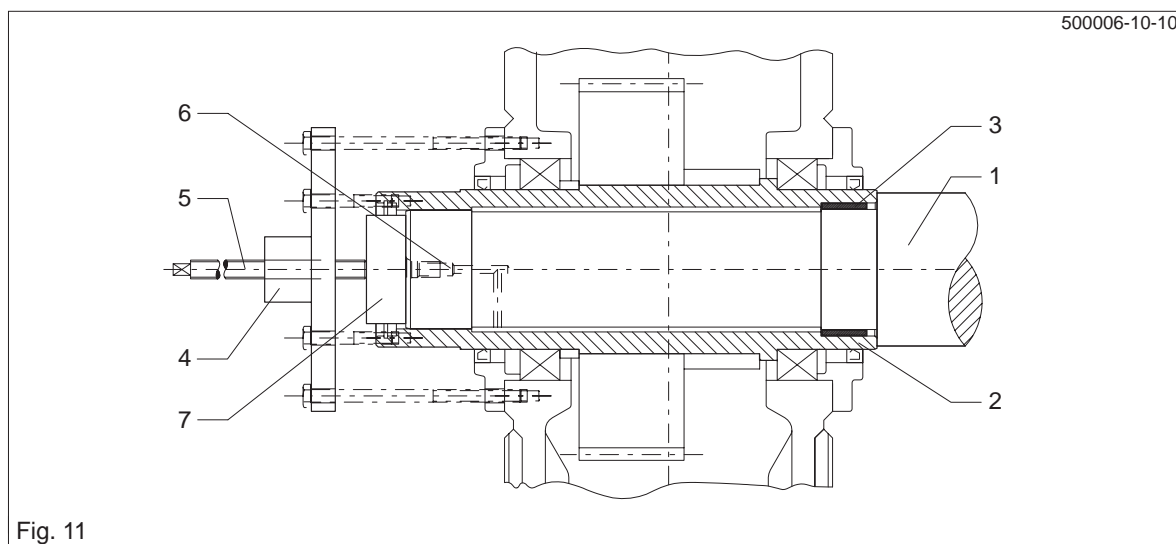


Fig. 11

- | | |
|--------------------------|--------------------------------------|
| 1 Machine shaft | 5 Threaded spindle |
| 2 Hollow shaft | 6 Bore for rust-releasing agent feed |
| 3 DU bush | 7 Plate for forcing out |
| 4 Hydraulic lifting unit | |

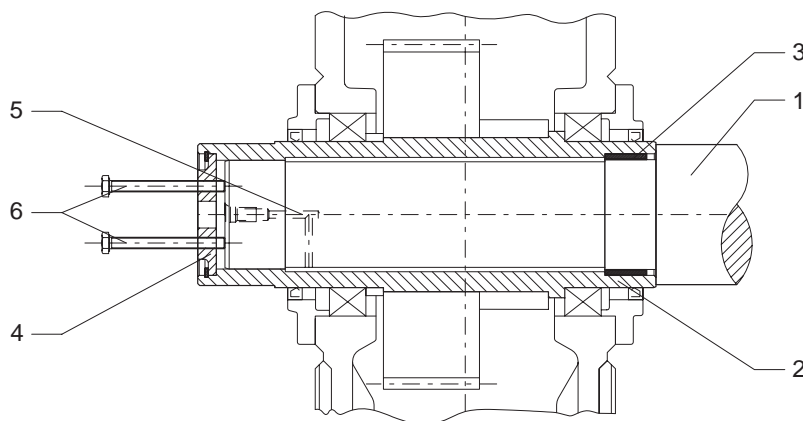


Fig. 12

- | | | | |
|---|---------------|---|------------------------------------|
| 1 | Machine shaft | 4 | End plate |
| 2 | Hollow shaft | 5 | Bore for rust-releasing agent feed |
| 3 | DU bush | 6 | Forcing screws |

Caution!

Avoid canting when pulling the unit off.

Note:

The forcing-out plate is not included in our delivery.

Caution!

If the counterforce is provided not only by the hollow shaft, but also by the housing, as shown in fig. 11, the forces used must not exceed the values given in the following table.

Gear-unit size	Max. forcing pressure N	Gear-unit size	Max. forcing pressure N
4	22600	12	113600
5	33000	13	140000
6	37500	14	160000
7	50000	15	193000
8	56000	16	215000
9	65000	17	240000
10	82000	18	266000
11	97200	19 ... 26	on request

Table 6.6: Maximum forcing pressures

Caution!

If the above values are exceeded, the housing, the hollow-shaft bearings or other gear components may be irreparably damaged. Before replacing the gear unit on the machine shaft, always check the bearings for any signs of damage.

Note:

When using forcing screws or threaded spindles, the head of the thread pressing against the driven machine should be rounded and well greased to reduce the risk of seizing at this point.

6.7 Shaft-mounting gear unit with flanged shaft

Caution!

The front area of the flanged shaft must be absolutely free of grease. This is essential for safe and reliable torque transmission. Do not use contaminated solvents or dirty cloths for removing grease.

Caution!

Before tightening the tensioning bolts it must be ensured that the flange centring means are inserted one inside the other. Then tighten diametrically opposed tensioning bolts to full torque.

- Tightening torques of flange bolts for gear units:

Gear-unit size	Strength class		Tightening torque
	Bolt DIN 931	Nut DIN 934	
5 ... 6	10.9	10	610 Nm
7 ... 10	10.9	10	1050 Nm
11 ... 16	10.9	10	2100 Nm
17 ... 20	10.9	10	3560 Nm
21 ... 26	10.9	10	5720 Nm

Table 6.7: Tightening torques for flange connections

6.8 Shaft mounting gear unit with block flange

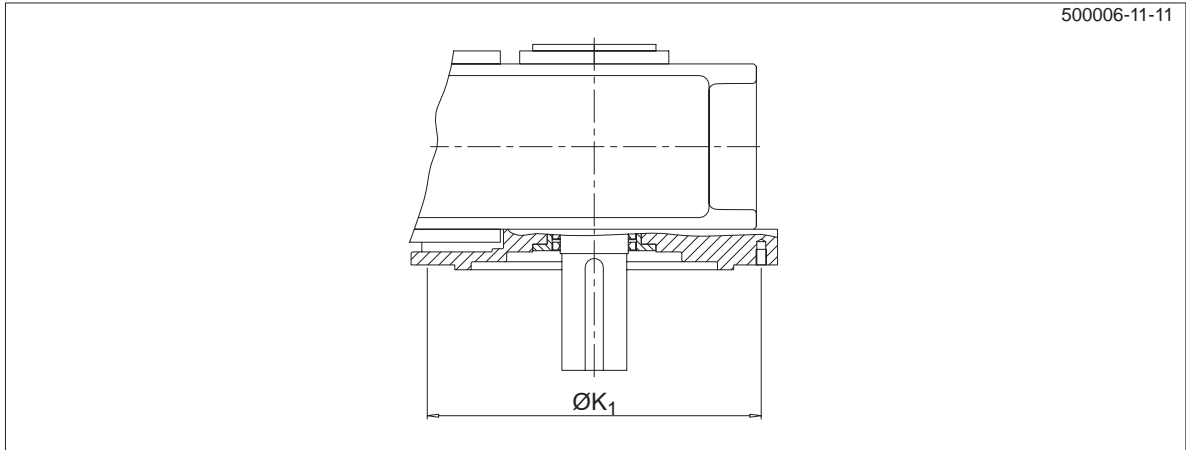
Caution!

The front area of the block flange must be absolutely free of grease. This is essential for safe and reliable torque transmission. Do not use contaminated solvents or dirty cloths for removing grease.

Caution!

Tighten diametrically opposed tensioning bolts to full torque.

The joint bolts must be tightened to the prescribed torque. For the correct torque, refer to item 10.2.10. Bolts of the minimum strength class 8.8 must be used. The transmittable tensioning torque is limited by the bolted joint on bolt circle K_1 .



Type	Configuration 1)	
	B	C
H2..		
H3..		
H4..		
B2..		
B3..		
B4..		

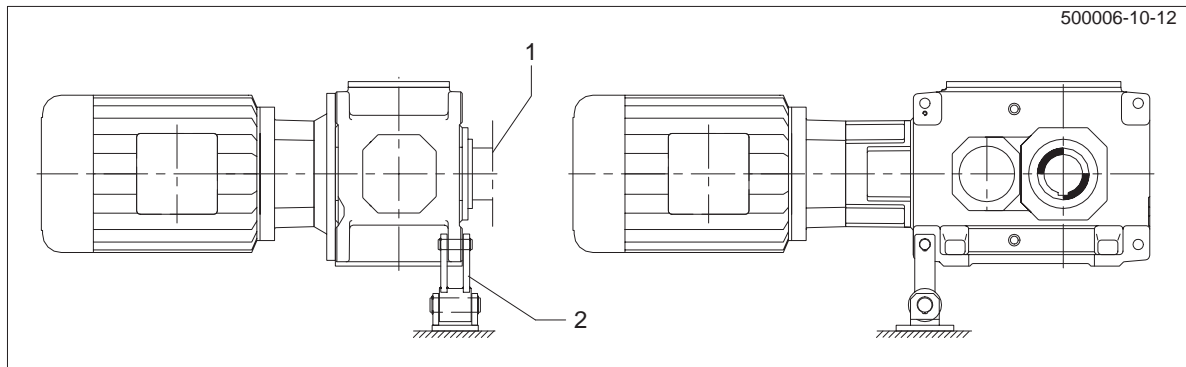
1) Configuration with hollow output shaft on request

6.9 Mounting the torque arm for gear housing

6.9.1 Attaching the torque arm

Caution! The torque arm must be mounted stress-free on the machine side

On helical gear units with a motor bell housing the torque arm is located opposite the motor bell housing.



1 Machine side

2 flexible support block

Gear-unit size	Max. standard-motor size					
	Gear type			Gear type		
	H2	H3	H4	B2	B3	B4
4	200	–	–	200	200	–
5 ... 6	225	225	–	225	225	160
7 ... 8	280	280	180	280	280	200
9 ... 10	280	280	225	280	280	225
11 ... 12	315M	315M	250	315M	315M	280
13 ... 14	–	355	315M	355	355	315M
15 ... 16	–	355	315	–	355	355M
17 ... 18	–	355	355M	–	355	355
19 ... 26	on request					

Table 6.8: Motor types and torque arms

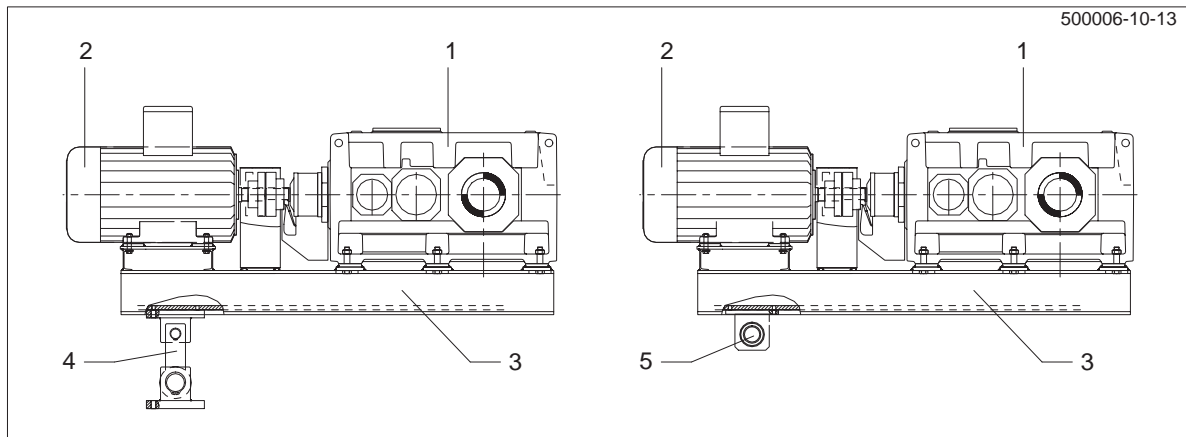
Note: Larger motors should be used only with FLENDER's approval.

- Foundation type for fastening torque arm, see item 6.2.1 "Foundation".
- If the customer fits a torque arm, connection to the foundation must be by means of a flexible element.

6.10 Mounting supports for gear-unit swing bases

6.10.1 Attaching the support

Caution! The support for the swing base must be mounted free of stress.



- 1 Gear unit
- 2 Motor
- 3 Gear-unit swing base

- 4 Torque arm
- 5 flexible support block

Gear-unit size	Max. standard-motor size		
	Gear type		
	B2	B3	B4
4		200	–
5 ... 6		225M	160
7 ... 8		280M	200
9 ... 10	on request	315	225M
11 ... 12		355	280S
13 ... 14		400M	315M
15 ... 16		400M	315
17 ... 18		400M	355L
19 ... 26	on request		

Table 6.9: Motor and gear-unit swing base

Note: Larger motors should be used only with FLENDER's approval.

- Foundation type for fastening torque arm, see item 6.2.1 "Foundation".
- If the customer fits a torque arm, connection to the foundation must be by means of a flexible element.

- 6.11 Gear unit with cooling coil
- Before connecting the cooling coil remove the plugs from the connection bush of the cooling coil and flush the coil well to remove any dirt.
 - Install the cooling-water in- and outflow pipes (for exact position of connections, see dimensioned drawing).
- Note:** Observe also item 5.9.2.
- 6.12 Gear unit with add-on components
- For the technical data to the add-on components, as stated in item 6.13 to 6.18, refer to the order-specific equipment list.
 - The electrical equipment for regulation and control must be wired in accordance with the equipment suppliers' instructions.
 - For operation and maintenance the operating instructions provided specifically for the order and the specifications in item 5.9.2 to 5.14 must be observed.
- 6.13 Gear unit with air oil-cooler
- Connect the indicator for double change-over filter (for gear sizes ≥ 13 only) and pressure monitor electrically
 - Connect the fan motor electrically
- 6.14 Gear unit with water oil-cooler
- Before connecting the water oil-cooler remove the plugs from the water connection and flush the water oil-cooler well to remove any dirt.
 - Install the cooling-water in- and outflow pipes. For the flow direction of the cooling water and the location of the connections please refer to the dimensioned drawing.
 - Connect pressure monitor electrically
- 6.15 Gear units with heating element
- Connect temperature monitor electrically
 - Connect heating elements electrically
- 6.16 Gear units with oil-temperature measurement
- Connect resistance thermometer with evaluating instrument (to be provided by customer) electrically
- 6.17 Gear units with oil-level monitoring
- Connect oil-level monitor electrically
- 6.18 Gear units with speed transmitter
- Connect speed transmitter electrically
- 6.19 Final work
- After installation of the gear unit check all screw connections for tight fit.
 - In addition, after tightening the fixings a check must be made to see that the alignment has not changed.
 - Check by means of the order specific equipment list as well as the associated drawings whether all units which may have been removed for transport have been refitted.
 - Rotating parts must be checked for correct seating. Contact with rotating parts is not permitted.

7. Start-up

Observe the "Safety instructions" in section 3.

7.1 Procedure before start-up

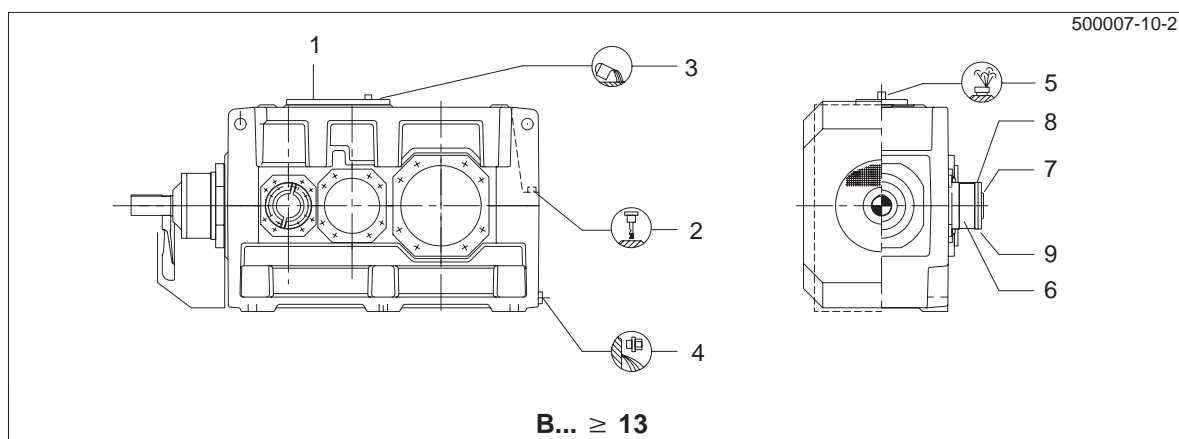
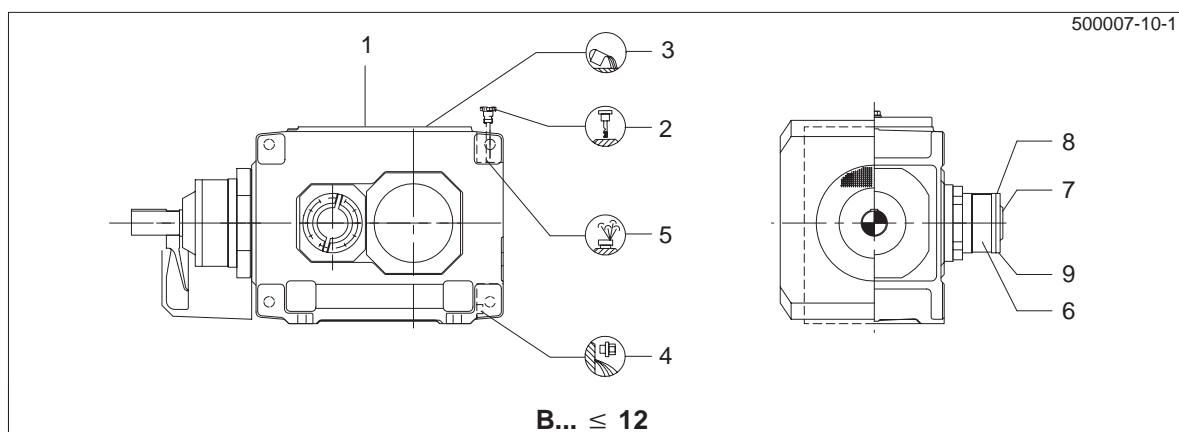
7.1.1 Removal of preservative agent

- Unscrew the oil drain plug or open the draining valve, allow the preservative agent or run-in oil to drain into a suitable container and dispose of it in accordance with regulations. Any residual-oil drain plugs should also be opened (e.g. in the case of gear units with add-on backstop). The location of the oil draining point is marked by an appropriate symbol in the dimensioned drawing in the unit documentation.



Remove any oil spillage immediately with an oil-binding agent.

- Replace the oil drain plug.



- | | | | |
|---|------------------------------|---|---|
| 1 | Inspection or assembly cover | 6 | Backstop |
| 2 | Oil dipstick | 7 | Cover for backstop |
| 3 | Oil inlet | 8 | Screw plug for oil inlet backstop |
| 4 | Oil drain plug | 9 | Screw plug for residual-oil drainage backstop |
| 5 | Venting or screw plug | | |

For a detailed view of the gear unit, refer to the drawings in the gear-unit documentation.

Caution!

Before start-up, replace the yellow plastic plug with a breather screw with cap (see also notice on gear unit).

7.1.2 Charging with lubricant

- Release the fastening bolts on the inspection or assembly cover and remove the cover (including seal) from the housing or use the marked oil filler plug. Do not discard the seal.
- In the case of gear units with add-on backstop, release the screw plug on the backstop cover and pour in approx. 0.5 l fresh oil of the total oil quantity via a filter (max. filter mesh 25 μm)
- Replace the screw plug

Caution!

**Using a filter (max. mesh 25 μm), fill the gear unit with fresh oil up to the MAX mark on the oil dipstick or oil sight glass.
Remember to fill the oil pockets above the bearings and (with bevel-gear units) at the input shaft on the inside.**

Caution!

The sealing surfaces must not be contaminated nor damaged.

Note:

For the correct type of oil (of various brands) to be used, refer to the BA 7300 EN operating instructions supplied separately.
Information on the type, quantity and viscosity of the oil is given on the rating plate on the gear unit.

The quantity of oil indicated on the rating plate is an approximation only. The marks on the dipstick or oil sight glass are decisive for the amount of oil to be filled in.

Note:

In the case of gear units fitted with forced lubrication or an oil-cooling system, the oil circuit must also be charged with oil. To do this, briefly start up the gear unit with add-on pump as described in section 8.

- Check the oil level in the gear unit housing with the oil dipstick or by means of the oil sight glass.

Note:

The oil level must be at the upper mark on the oil dipstick or oil sight glass.



Remove any oil spillage immediately with an oil-binding agent.

- Place the inspection or assembly cover (including seal) on the housing and replace and tighten the fastening bolts (see item 10.2.10).

7.1.2.1 Oil quantities

Type	Oil quantity (approx.) in litres for size											
	3	4	5	6	7	8	9	10	11	12	13	14
H1SH	7	–	22	–	42	–	68	–	120	–	175	–
H2.H	–	10	15	16	27	30	42	45	71	76	135	140
H2.M	–	–	–	–	–	–	–	–	–	–	110	115
H3.H	–	–	15	17	28	30	45	46	85	90	160	165
H3.M	–	–	–	–	–	–	–	–	–	–	125	130
H4.H	–	–	–	–	25	27	48	50	80	87	130	140
H4.M	–	–	–	–	–	–	–	–	–	–	120	125
B2.H	–	10	16	19	31	34	48	50	80	95	140	155
B2.M	–	–	–	–	–	–	–	–	–	–	120	130
B3.H	–	9	14	15	25	28	40	42	66	72	130	140
B3.M	–	–	–	–	–	–	–	–	–	–	110	115
B4.H	–	–	16	18	30	33	48	50	80	90	145	150
B4.M	–	–	–	–	–	–	–	–	–	–	120	125

Type	Oil quantity (approx.) in litres for size											
	15	16	17	18	19	20	21	22	23	24	25	26
H1SH	190	–	270	–	390	–	–	–	–	–	–	–
H2.H	210	215	290	300	320	340	320	340	430	450	600	640
H2.M	160	165	230	240	300	320	350	370	470	500	660	700
H3.H	235	245	305	315	420	450	470	490	620	650	880	935
H3.M	190	195	240	250	390	415	515	540	690	725	970	1030
H4.H	230	235	290	305	360	380	395	420	520	550	735	780
H4.M	170	175	225	230	310	330	430	450	500	600	800	850
B2.H	220	230	320	335	–	–	–	–	–	–	–	–
B2.M	180	190	260	275	–	–	–	–	–	–	–	–
B3.H	210	220	290	300	380	440	370	430	520	600	720	840
B3.M	160	165	230	235	360	420	420	490	560	650	790	920
B4.H	230	235	295	305	480	550	540	620	710	810	1000	1100
B4.M	170	175	230	235	440	510	590	680	790	910	1110	1200

Table 7.1: Approximate figures for required oil quantities in horizontal gear units with **radial shaft seals and Taconite seals**

Type	Oil quantity (approx.) in litres for size																
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
H1SH	5.5	–	19	–	36	–	60	–	106	–	155	–	156	–	225	–	230

Table 7.2: Approximate figures for required oil quantities in horizontal gear units with **labyrinth seals**

7.2 Start-up

7.2.1 Oil level

The oil level must be monitored by means of the oil level monitoring equipment provided. The gear unit must be shut down or FLENDER consulted.

When the oil is cool, the level should be at the upper mark on the oil dipstick or oil sight glass. When the oil is warm it may slightly exceed this mark. It must in no case be allowed to fall below the mark. If necessary, top up to the correct level.

7.2.2 Gear unit with cooling coil or external oil cooling or oil supply system

For technical data, refer to the order-specific equipment list.

After starting up the external oil cooling or oil supply system for the first time the oil level must be once more checked in accordance with item 7.2.1.

Fully open the stop valves in the coolant in- and outflow pipes.

7.2.3 Gear units with backstop

Before start-up, check whether the backstop can be turned manually in the free-wheeling direction without exerting undue force. Observe the direction-of-rotation arrows on the housing.

Caution!

To avoid damaging the backstop or the gear unit, the motor should not be run in the stop direction of the gear unit.

Observe the notice fixed to the gear unit.

The minimum lifting speeds must not be exceeded during operation.

Before connecting the motor, determine the direction of rotation of the three-phase current supply using a phase-sequence indicator, and connect the motor in accordance with the pre-determined direction of rotation.

Note: The unit can be started up once the amount of oil indicated on the notice has been poured in through the oil filler plug screw of the backstop. Always use oil of the same type and viscosity as for the gear unit.

7.2.4 Checking procedure

The following visual checks must be conducted and recorded when starting up:

- Oil level
- Oiltightness of the oil cooling or oil supply lines
- Opening condition of the shut-off valves
- Effectiveness of the shaft seals
- Freedom of the rotating parts from contact

The tension pressures and pretensioning forces in accordance with item 6.2.2.4 must also be recorded in this document.

Note: The document must be kept with the operating instructions.

7.3 Removal from service

- To take the gear unit out of service, first switch off the drive unit.



Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch!

- In the case of gear units fitted with cooling coil or water oil-coolers, close the stop valve on the water inflow and outflow pipes. To prevent freezing, drain the water from the cooling coil or the water oil-cooler.
- During longer periods of disuse, start the unit up briefly at intervals of approx. 3 weeks. If the gear unit is to remain out of service for longer than six months, it must be treated with preservative agent (see item 7.3.1).

7.3.1 Interior preservation during longer disuse

Depending on the type of lubrication or shaft sealing, the following types of internal preservative agent can be used.

7.3.1.1 Interior preservation with gear oil

Gear units with dip lubrication systems and contacting shaft seals can be filled with the correct type of oil up to a point just below the breather screw.

7.3.1.2 Interior preservation with preservative agent

Before longer periods of storage gear units with forced lubrication systems, oil circulation cooling or non-contacting shaft seals should be filled with preservative agent and run without load.

Duration of protection	Preservative agent	Special measures
up to 6 months	Castrol Alpha SP 220 S	none
up to 24 months		Close gear unit, replace breather screw or air filter with a yellow plug screw (replace the original parts before start-up)
For storage periods longer than 24 months, renew the preservative agent. For storage periods over 36 months, FLENDER should be consulted before.		

Table 7.3: Preservation procedure when using mineral oil or PAO-based synthetic oil

Duration of protection	Preservative agent	Special measures
up to 6 months	Special anti-corrosion oil TRIBOL 1390 1)	none
up to 36 months		Close gear unit, replace breather screw or air filter with a yellow plug screw (replace the original parts before start-up)
For storage periods over 36 months, FLENDER should be consulted before.		

Table 7.4: Preservation procedure when using PG-based synthetic oil

1) resistant to tropical conditions and sea water. Max. ambient temperature 50 °C

7.3.1.3 Interior preservation procedure

- Switch the gear unit off and drain the oil as described in section 10, "Maintenance and repair".
- Pour in the preservative agent specified in Table 7.3 or 7.4 through the venting hole or the opening in the inspection or assembly cover until it reaches the top mark on the oil dipstick or oil sight glass.
- Close the venting hole or the opening in the inspection or assembly cover.
- Start the gear unit and allow it to idle for a short time.
- Unscrew the oil drain plug and allow the preservative agent to drain into a suitable container and dispose of it according to regulations.



There is a risk of scalding from the hot preservative agent draining from the gear unit. Wear protective gloves to avoid scalding.

- Replace the oil drain plug.

Caution!

**Before re-starting the gear unit replace the screw plug with the breather screw or air filter.
See also item 7.1.1.**

7.3.2 Exterior preservation

Duration of protection	Preservative agent	Layer thickness	Remarks
up to 24 months	Tectyl 846 K19	approx. 50 µm	Long-term wax-based preservative agent, resistant to sea water and tropical conditions (soluble with CH compounds)

Table 7.5: External preservation of shaft ends and other bright machined surfaces

7.3.2.1 Exterior preservation procedure

- Clean the surfaces
- For separation between the sealing lip of the shaft sealing ring and the preservative agent, the shaft should be brushed with grease in way of the sealing lip
- Apply preservative agent

8. Operation

Observe the "Safety instructions" in section 3, the instructions in section 9, "Faults, causes and remedy", and in section 10, "Maintenance and repair"!

- During operation the unit must be monitored for:
 - Oil temperature (The gear unit is designed for a temperature of 90 °C with mineral oil in continuous operation. For higher temperatures, synthetic oils must be used. The maximum short-term operating temperature is 100 °C; see also section 10.)
 - Changes in gear noise
 - Possible oil leakage on the housing and shaft seals
 - Bearing vibrations with present measuring sequence
 - Correct oil level (see section 7, "Start-up")

Caution!

If any irregularities are noticed during operation or if the pressure monitor in the oil-cooling system (if installed) triggers the alarm, switch the drive unit off at once. Determine the cause of the fault, using the table in section 9. This table contains a list of possible faults, their causes and suggested remedies. If the cause cannot be found, a fitter from one of our customer service centres should be called in (see section 11).

9. Faults, causes and remedy

Observe the "Safety instructions" in section 3 and the instructions in section 10, "Maintenance and repair"!

9.1 General information on faults and malfunctions

Note: Faults and malfunctions occurring during the guarantee period and requiring repair work on the gear unit must be carried out only by FLENDER Customer Service. In the case of faults and malfunctions occurring after the guarantee period and whose cause cannot be precisely identified, we advise our customers to contact our customer service.

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Caution!

FLENDER will not be bound by the terms of the guarantee or otherwise be responsible in cases of improper use of the gear unit, modifications carried out without FLENDER's agreement or use of spare parts not supplied by FLENDER.



To remedy faults and malfunctions, the gear unit must always be taken out of service.

Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.

9.2 Possible faults

Malfunctions	Causes	Remedy
Loud noises in area of gear-unit fastening	Fastening has worked loose	Tighten bolts / nuts to prescribed torque. Replace damaged bolts / nuts.
Changes in gear noise	Damage to gear teeth	Contact Customer Service. – Check all toothed components and replace any damaged parts.
	Excessive bearing play	Contact Customer Service. – Adjust bearing play.
	Bearing defective	Contact Customer Service. – Replace defective bearings.
Operating temperature too high	Oil level in gear-unit housing too high	Check oil level and, if necessary, adjust
	Oil too old	Contact Customer Service. – Check date of last oil change.
	Oil badly contaminated	Contact Customer Service. – Change oil.
	On gear units with oil-cooling system: Coolant flow too low or too high	Fully set valves in inflow and outflow pipes. Check for free flow through water oil-cooler.
	Coolant temperature too high	Check temperature and, if necessary, adjust
	Oil flow through water oil-cooler too low due to: badly clogged oil filter	Clean oil filter.
	Oil pump defective	Contact Customer Service. – Check that oil pump is functioning correctly – Repair or replace oil pump
	On gear units with fan: Suction opening in fan cowl and/or housing badly contaminated	Clean fan cowl and gear-unit housing
Gear unit with cooling coil: Deposits in cooling coil	Contact Customer Service. – Clean or replace cooling coil	

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Malfunctions	Causes	Remedy
Increased temperature at bearing points	Oil level in gear-unit housing too low or too high	Check oil level at room temperature and, if necessary, top up oil
	Oil too old	Contact Customer Service. – Check date of last oil change.
	Mechanical oil pump defective	Contact Customer Service. – Check that oil pump is functioning correctly Repair or replace oil pump
	Bearing defective	Contact Customer Service. – Consult values obtained during vibration measurement by the operator. – Check and, if necessary, replace bearings.
Increased vibration amplitudes at the bearing points	Bearing defective	Contact Customer Service. – Check and, if necessary, replace bearings.
	Gears defective	Contact Customer Service. – Check gears and, if necessary, replace.
Temperature at backstop too high Locking function fails	Damage to backstop	Contact Customer Service. – Check backstop and replace, if necessary.
Oil leakage from gear unit	Inadequate sealing of housing covers or joints	Check and, if necessary, replace seals. Seal joints.
	Radial shaft sealing rings defective	Contact Customer Service. – Replace radial shaft sealing rings
Water in oil	Oil foams in sump	Check state of oil by the test-tube method for water contamination. Have oil analysed by laboratory.
	Defective oil cooler or cooling coil	Contact Customer Service. – Look for and repair any leaks. – Replace oil cooler or cooling coil.
	Gear unit exposed to cold air from machine-room ventilator: water condensing	Protect gear unit with suitable heat insulation. Close air outlet or alter its direction by structural measures.
Pressure monitor triggers alarm (gear units with pressurised lubrication, water oil-cooler, air oil-cooler)	Oil pressure < 0.5 bar	Check oil level at room temperature and, if necessary, top up oil. Check oil filter, clean if necessary. Contact Customer Service. – Check that oil pump is functioning correctly – Repair or replace oil pump
Indicator on double change-over filter triggers alarm	Double change-over filter clogged	Change filter over as instructed, remove clogged filter element and clean
Fault in oil supply system		Consult operating instructions for oil supply system

Table 9.1: Faults, causes and remedies

10. Maintenance and repair

Observe the "Safety instructions" in section 3 and the instructions in section 9, "Faults, causes and remedy".

10.1 General notes on maintenance

Maintenance and repair work must be done with care by trained and qualified personnel only.

The following applies to all work in item 10.2:



Switch gear unit and add-on components off.

**Secure the drive unit to prevent it from being started up unintentionally.
Attach a warning notice to the start switch.**

Caution!

The periods indicated in table 10.1 depend on the conditions under which the gear unit is operated. Only average periods can therefore be stated here. These refer to:

a daily operating time of	24 hours
a duty factor of	100 %
an input-drive speed of	1500 1/min
a maximum oil temperature of	90 °C (mineral oil only)
	100 °C (synthetic oil only)

For operation and maintenance, always observe the instructions given in the order-specific appendix. For technical data, refer to the order-specific equipment list.

Measures	Periods	Remarks
Check oil temperature.	daily	
Check for unusual gear-unit noise.	daily	
Check gear unit for leaks.	monthly	
Check oil level.	each time before starting up the gear unit	
Test oil for water content.	after approx. 400 operating hours once per year at least	see Item 10.2.1
First oil change	400 operating hours following start-up	see Item 10.2.2
subsequent oil changes	every 2 years or after max. 10 000 operating hours ¹⁾	see Item 10.2.2
Clean the oil filter.	every 3 months	
Clean the breather screw.	every 3 months	see Item 10.2.3
Refill Taconite seals with grease.	every 3 000 operating hours or every 6 months at least	see Item 10.2.4
Clean fan, fan cowl and gear-unit housing.	depending on requirements or simultaneously with due oil change	see Item 10.2.5
Check cooling coil for deposits.	approx. every 2 years simultaneously with due oil change	see Item 10.2.6
Check condition of air oil-cooler.	simultaneously with oil change	see Item 10.2.7
Check condition of water oil-cooler.	simultaneously with oil change	see Item 10.2.8

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Measures	Periods	Remarks
Check tightness of fastening bolts.	after first oil change, thereafter after every second oil change	see Item 10.2.10
Carry out complete inspection of gear unit.	approx. every 2 years simultaneously with due oil change	see Item 10.3.1

Table 10.1: Maintenance and repair work

1) When using synthetic oils, the periods can be doubled.

10.2 Description of maintenance and repair work

10.2.1 Test water-content of oil

For detailed information on testing the oil for water-content apply to the lubricant manufacturer.

10.2.2 Changing the oil

- The instructions in item 7.1 must be observed!
- Close the stop valves in the coolant in- and outflow pipes (gear units with cooling coil or water oil-cooling systems)
- Drain the oil while it is still warm, i.e. immediately after shutting down the machinery.

Caution!

When changing the oil, always re-fill the gear unit with the same type of oil. Never mix different types of oil or oils made by different manufacturers. Never mix synthetic oils with mineral-based oils or with other synthetic oils. When changing from mineral-based oil to synthetic oil or from one type of synthetic oil to another, flush the gear unit well with the new type of oil beforehand.

When changing the oil, the housing must be flushed with oil to remove sludge, metal particles and oil residue. Use the same type of oil as is used for normal operation. High-viscosity oils must be heated beforehand. Ensure that all residues have been removed before filling with fresh oil.

- Place a suitable container under the oil drain plug of the gear-unit housing
- Unscrew the breather screw on the top of the housing
- Unscrew the oil drain plug and allow the oil to drain into the container



There is a danger of scalding from the hot oil emerging from the housing. Wear protective gloves to avoid scalding. Remove any oil spillage immediately with an oil-binding agent.

- Clean the permanent magnet of the oil drain plug thoroughly
- Replace the oil drain plug

Note: Check the condition of the sealing ring (the sealing ring is vulcanised onto the oil drain plug). If necessary, use a new oil drain plug.

- Clean oil filter in oil-cooling system
- Fill with lubricant according to item 7.1.2

10.2.3 Cleaning the breather screw

If a layer of dust has built up, the breather screw must be cleaned, whether or not the minimum period of 3 months has expired. To do this, the breather screw must be unscrewed, cleaned with benzine or similar agent and dried. It can also be cleaned by blowing out with compressed air.

Caution!

Foreign bodies must be prevented from entering the gear unit.

10.2.4 Refilling Taconite seals with grease

- Inject approx. 30 g lithium-based bearing grease into each of the lubrication points of the Taconite seal. The lubrication points are fitted with flat grease nipples type AM10x1 to DIN 3404.



Remove and dispose of any old grease escaping.

10.2.5 Cleaning the fan and gear unit

- The instructions in item 5.9.1 must be observed!
- Remove the fan cowl
- Using a stiff brush, remove any dirt adhering to the fan wheel, cowl and safety grid.
- Remove any corrosion.
- Screw safety grid back onto the fan cowl

Caution!

The gear unit must not be cleaned with high-pressure cleaning equipment.

Caution!

It must be ensured that the fan cowl is correctly fastened. The fan must not come into contact with the fan cover.

10.2.6 Checking cooling coil

- Disconnect the water in- and outflow pipes from the cooling coil
- Check the inside walls of the cooling coil for deposits

Caution!

If the cooling coil is dirty, heat is no longer withdrawn effectively from the gear unit. Any dirt adhering to the inside of the coil should be removed by chemical cleaning or the coil should be replaced with a new one.

- If thick deposits have formed on the inside of the cooling coil, the cooling water (or the deposits themselves) should be chemically analysed. These analyses are carried out by companies which specialise in chemical cleaning. They also supply the special cleaning agents required.

Note:

Before using these cleaning agents, ensure that they will not damage the coil materials (contact FLENDER). Observe the manufacturer's instructions at all times.



Avoid burns when working with corrosive cleaning agents. Always observe the manufacturers' instructions for safety and use.

- Seriously contaminated cooling coils must be replaced. Consult our Customer Service.
- Re-connect the water in- and outflow pipes.

10.2.7 Checking air oil-cooler

- The instructions in items 5.9.3, 7.1.2 and 10.1 must be observed!
- Remove dirt from the cooler block
- Check the condition of screw connections and, if necessary, replace.

10.2.8 Checking water oil-cooler

- The instructions in items 5.9.4, 7.1.2 and 10.1 must be observed!
- Close the stop valves in the coolant in- and outflow pipes
- Inspect cooler for leaks in the piping.
- Check the condition of screw connections and, if necessary, replace.

10.2.9 Topping up oil

- The instructions in item 7.1.2 must be observed!
- Always top up with the same type of oil as already used in the gear unit (see also item 10.2.2).

10.2.10 Checking tightness of fastening bolts

- The instructions in item 10.1 must be observed!
- Close the stop valves in the coolant in- and outflow pipes (gear units with cooling coil or water oil-cooling system)
- Check tightness of all fastening bolts with a torque wrench

Thread size	Tightening torque	Initial tensioning force
M 42	4070 Nm	526000 N
M 48	6140 Nm	693000 N
M 56	9840 Nm	959000 N
M 64	14300 Nm	1268000 N
M 72 x 6	20800 Nm	1600000 N
M 80 x 6	28900 Nm	1950000 N
M 90 x 6	41650 Nm	2550000 N
M 100 x 6	57800 Nm	3200000 N

Table 10.2: Tightening torques and initial tensioning forces of the foundation bolts

All other bolts on the gear unit should be checked for tightening torques according to the following table:

Thread size	Tightening torque (with $\mu = 0.14$)	
	Strength class 8.8	Strength class 10.9
M 10	49 Nm	69 Nm
M 12	86 Nm	120 Nm
M 16	210 Nm	295 Nm
M 20	410 Nm	580 Nm
M 24	710 Nm	1000 Nm
M 30	1450 Nm	2000 Nm
M 36	2530 Nm	3560 Nm
M 42	4070 Nm	5720 Nm
M 48	6140 Nm	8640 Nm
M 56	9840 Nm	13850 Nm
M 64	14300 Nm	21000 Nm

Table 10.3: Tightening torques

Note: Damaged bolts must be replaced with new bolts of the same type and strength class.

10.3 Final work

Note: Observe also item 6.19

10.3.1 General inspection of gear unit

The general inspection of the gear unit must be carried out by the FLENDER Customer Service, as our engineers have the experience and training necessary to identify any components requiring replacement.

10.4 Lubricants

The oil selected for use in the gear unit must be of the viscosity (VG class) indicated on the nameplate. The viscosity class applies for the contractually agreed operating conditions.

FLENDER must be consulted for any change in operating conditions.

Note: For the correct type of oil (of various brands) to be used, refer to the BA 7300 EN operating instructions supplied separately.

We are familiar with the composition of these lubricants and, as far as we are currently aware, they possess the properties with regard to load-bearing capacity, corrosion resistance, resistance to grey staining and compatibility with seals and internal paint coats which are necessary for the type of gear unit concerned.

We therefore advise our customers to select one of the lubricants listed in the BA 7300 EN instructions, taking into account the VG class specified on the rating plate.

Note: To avoid misunderstandings, we should like to point out that this recommendation is in no way intended as a guarantee of the quality of the lubricant supplied. Each lubricant manufacturer is responsible for the quality of his own product.

If for an important reason of your own you do not wish to follow our recommendation, you assume responsibility for the technical suitability of the lubricant used.

11. Spare parts, customer-service addresses

11.1 Stocking spare parts

By stocking the most important spare and wearing parts on site you can ensure that the gear unit is ready for use at any time.

To order spare parts, refer to the spare-parts list.

For further information refer to the spare-parts drawing stated in the list.

We guarantee only the original spare parts supplied by us.

Caution!

Please note that spare parts and accessories not supplied by us have not been tested or approved by us. The installation and/or use of such products may therefore impair essential characteristics of the gear unit, thereby posing an active or passive risk to safety. FLENDER will assume no liability or guarantee for damage caused by spare parts and accessories not supplied by FLENDER.

Please note that certain components often have special production and supply specifications and that we supply you with spare parts which comply fully with the current state of technical development as well as current legislation.

When ordering spare parts, always state the following:

Order no. / Item	Type / Size	Part no.	Quantity
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11.2 Spare-part and customer service addresses

When ordering spare parts or the services of our specialist engineers, apply first to FLENDER AG.

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A. FRIEDR. FLENDER AG - Kupplungswerk Mussum

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12. Declaration by the manufacturer

Declaration by the manufacturer

in accordance with EC Engineering Guideline 98/37/EC, Appendix II B

We hereby declare that the

Gear Unit Types

H.SH, H.VH, H.HH, H.DH, H.KH, H.FH, H.HM, H.DM, H.KM, H.FM, H.PH
B.SH, B.VH, B.HH, B.DH, B.KH, B.FH, B.HM, B.DM, B.KM, B.FM
Sizes 3 to 26

described in these Operating Instructions are intended for incorporation in a machine, and that it is prohibited to put them into service before verifying that the machine into which they are incorporated complies with the EC Guidelines (original edition 98/37/EC including any subsequent amendments thereto).

This Manufacturer's Declaration takes into account all the unified standards (inasmuch as they apply to our products) published by the European Commission in the Official Journal of the European Community.



Penig, 2003-06-20

Signature (Director ZGE Engineering) Sizes 3 to 16



Bocholt, 2003-06-20

Signature (Director IDE Engineering) Sizes 17 to 26