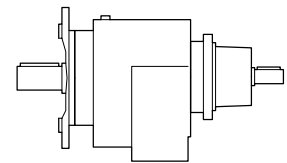
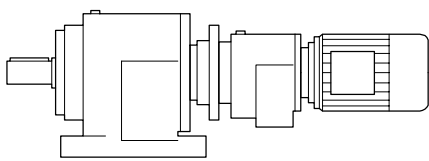
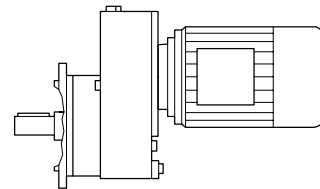
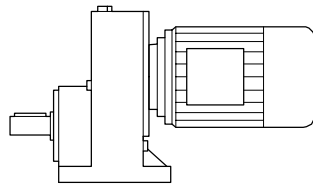


Operating Instructions

BA G298 EN 12.01

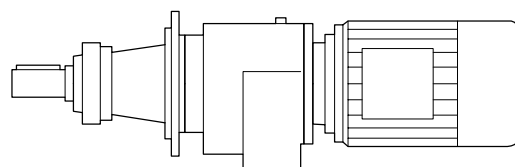
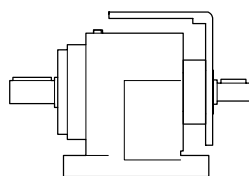
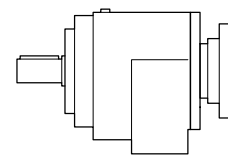
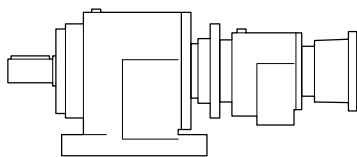
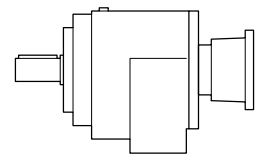
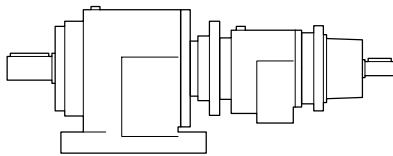


MOTOX[®]-N

Helical gear units

and

gear motors



FLENDER
TÜBINGEN

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1. General notes

1.1 General

These Operating Instructions constitute part of the gear unit shipment and should be kept in the immediate vicinity of the gear unit at all times.

Only a precise knowledge of the Operating Instructions will ensure trouble-free operation of the drive by avoiding operating errors and incorrect usage. It is therefore in the interest of the operator that the Operating Instructions are read, understood and observed in all respects by the persons responsible for handling, installation and operation.

Note: We accept no liability for any damage or malfunction resulting from non-observance of the Operating Instructions.

The drives described here are manufactured in accordance with the latest technology at the time of these Operating Instructions going into print.

In the interest of further development, we reserve the right to introduce modifications to the individual subassemblies and accessories which, while retaining the essential features, can be regarded as desirable to increase their efficiency and safety.

The copyright of these Operating Instructions remains the property of **FLENDER TÜBINGEN GMBH**.

These Operating Instructions may not be duplicated in part or whole, utilized for the purpose of publicity or communicated to third parties without our express consent.

Alterations or additions of these Operating Instructions may be done exceptionally by us only; otherwise complete liability will be cancelled.

Note: For couplings, motors, brake motors and additional features of motors (external fan, back stop, encoder system, etc.) please observe further Operating Instructions supplied with shipment (e.g.: BA 3400, BA M295, BA B295, N-R 430, etc.). For special designs of drives and their optional features the particular contractual agreements and technical documentation, e.g. special dimension sheet, etc. are effective in addition to these Operating Instructions.

Please contact our works listed below in respect of all technical queries

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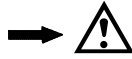
or one of our service branches which are listed in section 11. "Spare parts stock, service addresses".

1.2 Proper usage

The **MOTOX[®]-N drives** dealt with in these Operating Instructions have been developed for stationary usage in general engineering. If not otherwise agreed the drives are suitable **for use in machines and plants in industrial areas**.

The drives are only designed for the field of application as specified in section 3. "Technical data". The drives may not be operated outside the given performance limits. Operating conditions which differ from those stated will require new contractual agreements.

2. Safety notes



2.1 Notes and symbols in the Operating Instructions

Instructions in the Operating Instructions which concern operating safety are emphasized as follows:



This symbol draws attention to safety measures to prevent **personal injury**.

Attention!

This symbol draws attention to the safety measures which must be observed to prevent **damage to the gear unit**.

Note:

This note draws attention to general **operating notes** which should be especially observed.

2.2 Safety notes

- The gear unit is constructed in accordance with the latest technology and is reliable in the condition as shipped. Unauthorized modifications which impair its reliability are not permissible. This also applies to guards which are fitted as protection against accidental contact.
- The gear unit may only be used and operated within the scope of the conditions specified in the contract of performance and supply.
- The operator should ensure that the persons entrusted with installation, operation, care and maintenance have read and understood the Operating Instructions and observe them in all respects in order to:
 - prevent hazard to the life and limb of the user and third parties
 - ensure the reliability of the gear unit
 - prevent failure and environmental pollution due to incorrect handling.
- The drive unit may only be operated, serviced and repaired by authorized, trained and properly instructed personnel. Definition for trained personnel see e.g. IEC 364.
- All work should be carried out carefully with the safety aspect in mind.
- Notes affixed to drive units, such as rating plate, direction of rotation arrows, etc., must be observed. They must be kept free from paint and dirt. Missing plates must be replaced.
- All work on the gear unit may only be carried out when it is stationary. The drive unit must be secured to prevent accidental startup (e.g. by locking the key switch or by removing the fuses in the power supply). A notice should be displayed at the switch-on point stating that work is in progress on the gear unit.
- The relevant regulations concerning industrial safety and pollution control should be observed during handling, installation, operation, care and maintenance.
- Rotating parts, such as couplings, gear wheels or belt drives must be protected by means of suitable guards to prevent accidental contact.
- The drive unit should be shut off at once if changes in the gear unit are detected during operation, such as increased operating temperature or a change in gear unit noises.
- During installation of the gear unit in devices or systems, the manufacturer of the device or system is obliged to incorporate the requirements, notes and descriptions contained in these Operating Instructions in his own Operating Instructions.
- On the occasion of oil changes, the old oil should be collected in a suitable receptacle. Any pools of oil which have occurred should be removed at once with an oil binding agent. Very dirty and oil-soaked cleaning rags should be kept in suitable containers. The oil, the oil binding agent and the cleaning rags should be disposed of in accordance with the relevant pollution control requirements.

3. Technical data

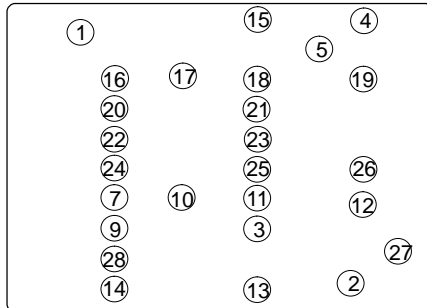
3.1 General technical data

The rating plate of the gear units or gear motors contains the most essential technical data. These data and the contractual agreements for the drives define the limits of its proper use.

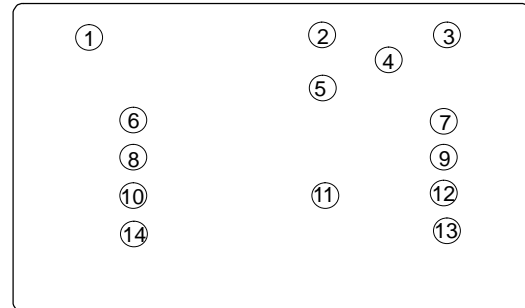
On gear motors normally one rating plate, attached to the motor, is used for the complete drive.

In some cases separate rating plates are used on the gear unit and the motor.

Examples: Rating plate of gear motor



Rating plate of gear unit



- | | |
|--|--|
| <ul style="list-style-type: none"> ① Company logo ② Date of manufacture (coded, e.g. U01) ③ Weight m [kg] (only if > 30kg) ④ Order No. / consecutive No. ⑤ Type - Size ⑥ Power rating T_2 [Nm] ⑦ Type of construction ⑧ Total ratio i ⑨ Speed n_2 [min^{-1}] ($\text{min}^{-1}=1/60\text{s}$) ⑩ Oil grade, e.g.:
CLP-oil DIN 51517/3 (mineral oil)
or PGLP-oil (synthetic oil) ⑪ Oil viscosity: ISO VG-class to
DIN 51519 / ISO 3448 ⑫ Oil quantity [l] ($1\text{l}=1\text{dm}^3 \approx 1\text{kg}$) ⑬ Free field for additional data
e.g. commission number (customer's request) ⑭ max. ambient temperature $T_{U_{\max}}$ [$^{\circ}\text{C}$] | <ul style="list-style-type: none"> ⑮ Phase number and type of current of the motor
(e.g.: 3~ Mot. or 1~ Mot.) ⑯ Connecting symbol to DIN 40900 T6/IEC617-6 ⑰ Rated voltage U [V] ⑱ Rated current I [A] ⑲ Rated frequency f [Hz] ⑳ Rated speed n [min^{-1}] ($\text{min}^{-1}=1/60\text{s}$) ㉑ Rated power P [kW] ㉒ Duty type (if \neq S1) ㉓ Power factor $\cos \varphi$ ㉔ Type of protection to IEC 60034-5 or IEC 529 ㉕ Thermal class Th. Cl. ㉖ standards used as a basis
e.g.: IEC 60034, EN 60034 or VDE 0530 ㉗ EC symbol (CE) or other marking
(CSA, NRTL/C, UL, etc.) if applicable ㉘ Brake data |
|--|--|

Symbols (IEC 617-2): = brake

= coupling, clutch

Data on the weight and sound pressure of the various drives will be found under 3.4 and 3.5.

Further technical data will be found in the drawings and the gear unit documentation.

3.2 Mounting positions

- The drives may only be operated in the mounting position specified on the rating plate. This will ensure the correct quantity of lubricant.
- The designations of the mounting position correspond to IEC 60034-7 (Code I).

Marking:



Oil level



Housing ventilation



Oil drain plug



Dipstick

V Size 38 gear units are standard-fitted with a screw plug at point "V".

* on opposite side

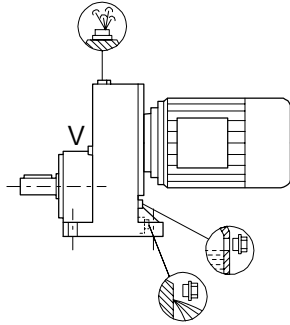
② 2-stage gear units

③ 3-stage gear units

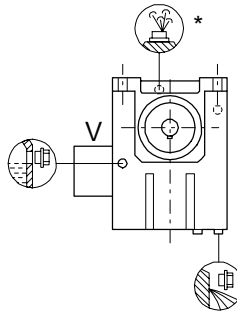
3.2.1 Single-stage gear units and gear motors

- E 38 - E 148

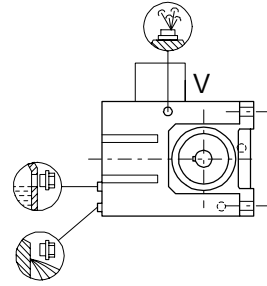
E **B3 (IM B3)**



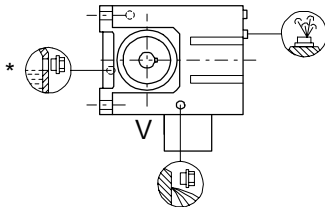
E **B8 (IM B8)**



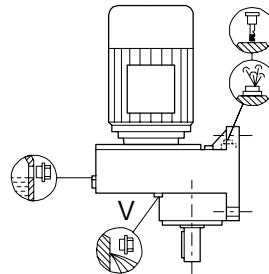
E **B7 (IM B7)**



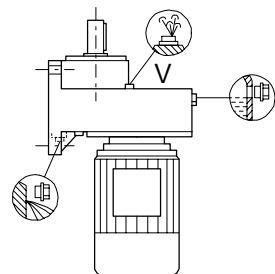
E **B6 (IM B6)**



E **V5 (IM V5)**

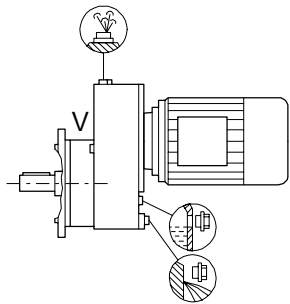


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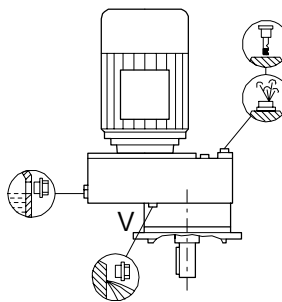


- E. 38 - E. 148

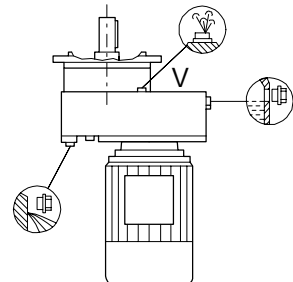
EF,EK **B5 (IM B5)**
EZ **B14 (IM B14)**



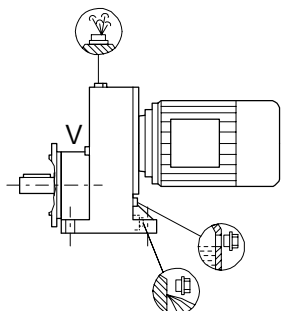
EF,EK **V1 (IM V1)**
EZ **V18 (IM V18)**



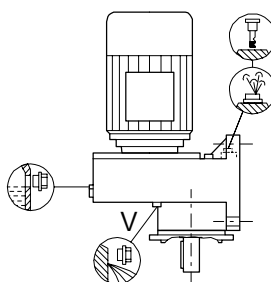
EF,EK **V3 (IM V3)**
EZ **V19 (IM V19)**



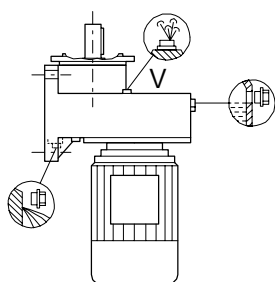
EB **B3/B5 (IM B35)**



EB **V1/V5 (IM V15)**



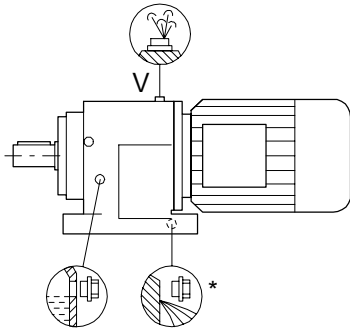
EB **V3/V6 (IM V36)**



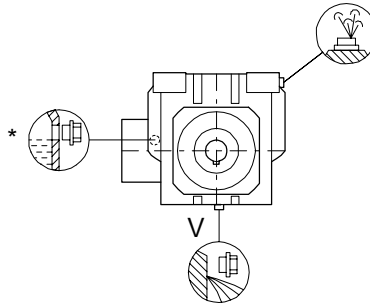
3.2.2 Two- and three-stage gear units and gear motors

- D/Z 38 - D/Z 88

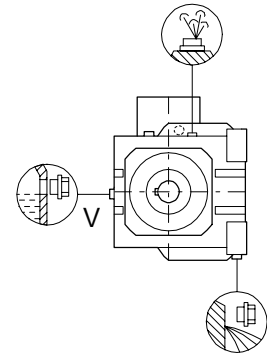
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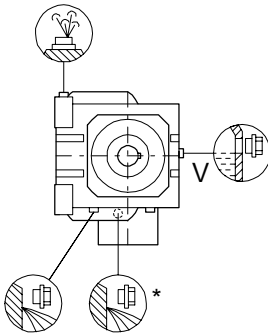
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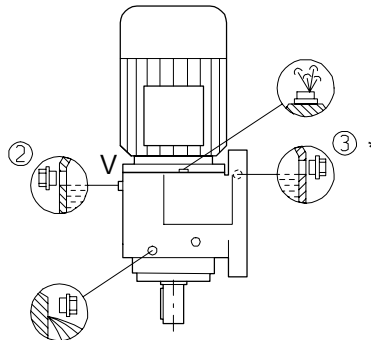
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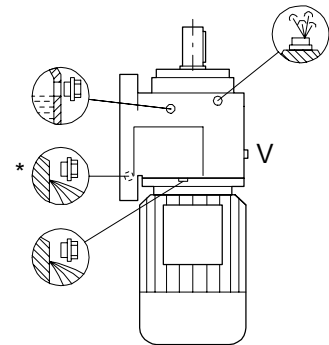
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D/Z **V5 (IM V5)**

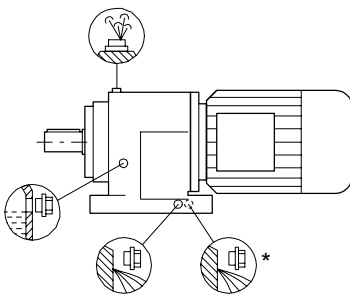


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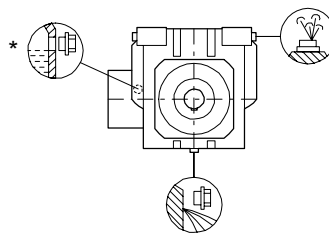


- D/Z 108 - D/Z 168

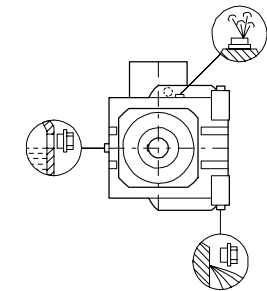
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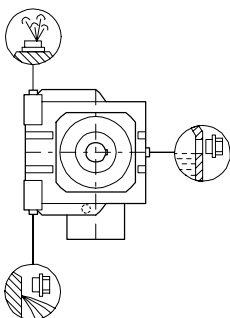
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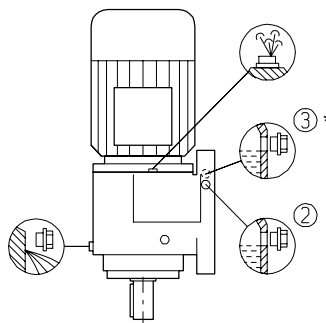
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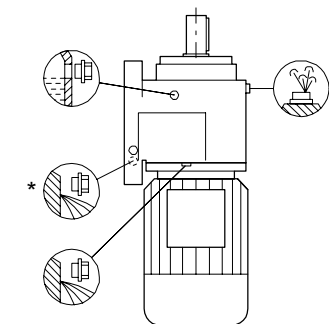
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D/Z **V5 (IM V5)**

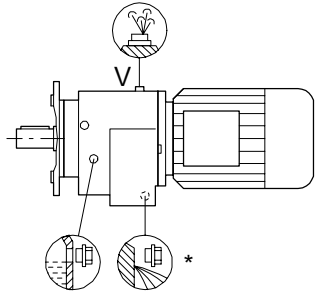


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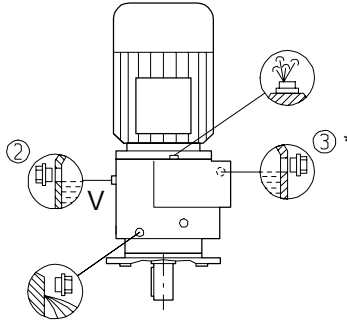


• D./Z. 38 - D./Z. 88

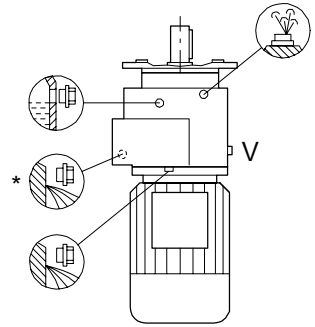
ZK, DF/ZF **B5 (IM B5)**
DZ/ZZ **B14 (IM B14)**



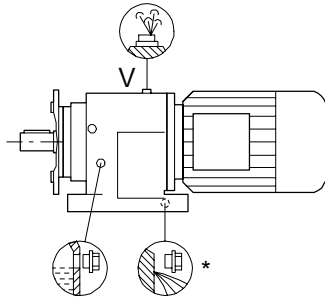
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DZ/ZZ **V18 (IM V18)**



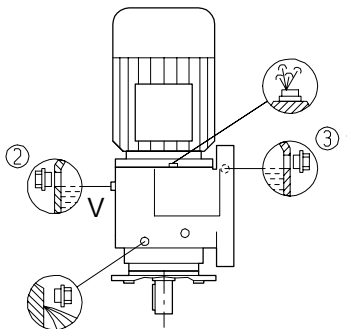
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DZ/ZZ **V19 (IM V19)**



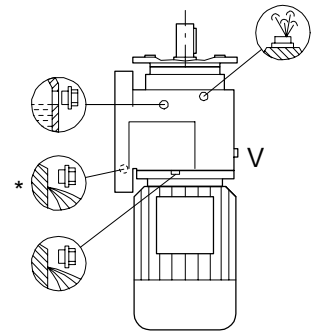
DB/ZB **B3/B5 (IM B35)**



DB/ZB **V1/V5 (IM V15)**

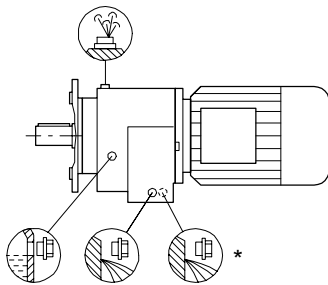


DB/ZB **V3/V6 (IM V36)**

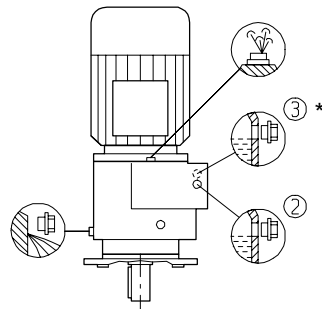


• D./Z. 108 - D./Z. 168

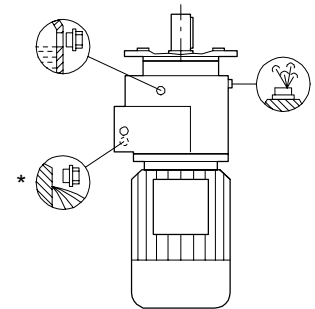
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DZ/ZZ **B14 (IM B14)**



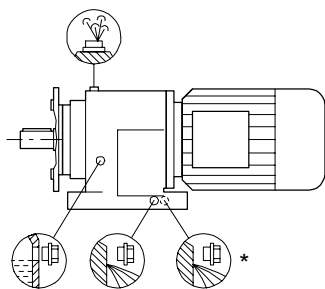
ZK, DF/ZF **V1 (IM V1)**
DZ/ZZ **V18 (IM V18)**



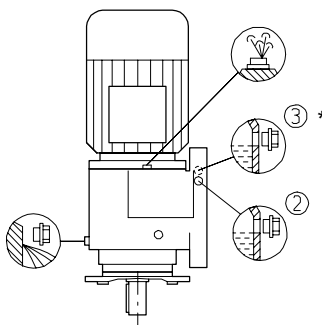
ZK, DF/ZF **V3 (IM V3)**
DZ/ZZ **V19 (IM V19)**



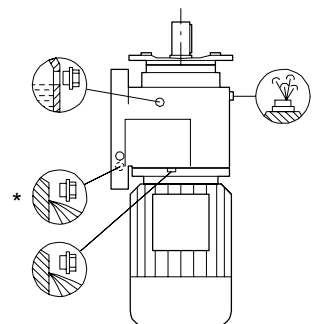
DB/ZB **B3/B5 (IM B35)**



DB/ZB **V1/V5 (IM V15)**

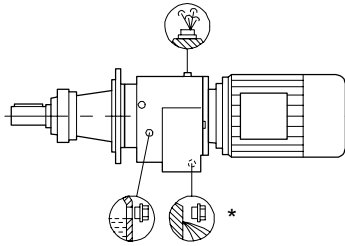


DB/ZB **V3/V6 (IM V36)**

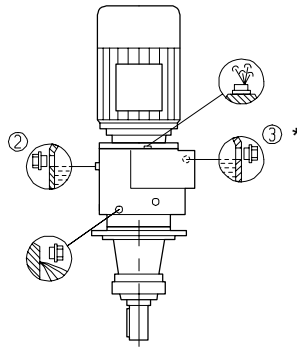


• DR/ZR 68 - DR/ZR 88

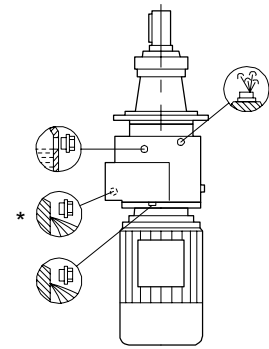
DR/ZR B5 (IM B5)



DR/ZR V1 (IM V1)

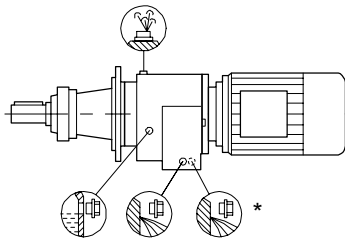


DR/ZR V3 (IM V3)

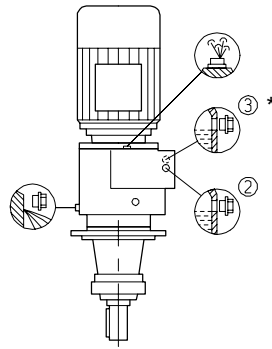


• DR/ZR 108 - DR/ZR 168

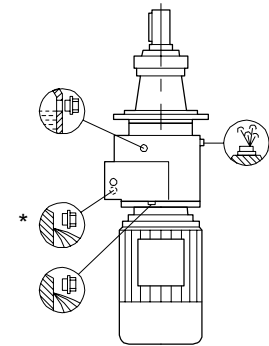
DR/ZR B5 (IM B5)



DR/ZR V1 (IM V1)



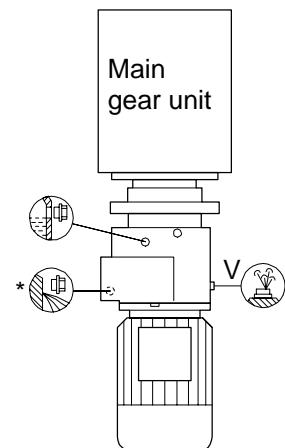
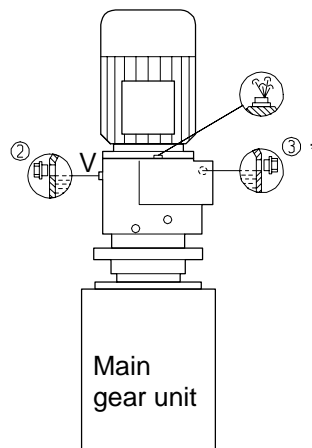
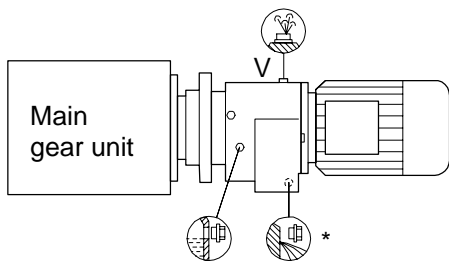
DR/ZR V3 (IM V3)



3.2.3 Tandem gear unit - compound helical gear unit

horizontal operating position

vertical operating position



The type Z.28 is fitted as standard with three screw plugs.

Attention!

In horizontal operating position, the housing recess of the 2. gear unit in general points downwards.

3.3 Oil quantities

The exact oil quantities are specified on the rating plates of the drives.

Attention! The gear units should always be filled up to the oil level (see section 7. "Startup").

Note: The quantities in litres listed in the following are reference values. Because of the different transmission ratios per gear unit type carefully calculated mean values, which e.g. serve for purposes of stocking, lubricant provision, etc., are specified.

3.3.1 Single-, two- or three-stage gear units and gear motors

Type	Mounting position								
	B3 B3/B5	B5 B14	B6	B7	B8	V1 V18	V3 V19	V5 V1/V5	V6 V3/V6
E. 38	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.5	0.6
E. 48	0.3	0.3	0.6	0.5	0.7	0.7	1.1	0.7	1.1
E. 68	0.5	0.5	1.0	1.1	1.5	1.7	1.9	1.8	1.9
E. 88	0.8	0.7	1.6	1.6	2.5	2.2	3.8	2.3	3.8
E. 108	1.3	1.0	2.7	2.8	4.6	3.7	6.6	3.8	6.6
E. 128	2.3	2.3	5.3	5.2	7.2	6.4	10.9	6.4	10.9
E. 148	4.0	2.8	7.0	7.0	10.3	9.3	14.5	9.5	14.8
Z. 18	0.2	0.2	0.4	0.4	0.4	0.6	0.6	0.6	0.6
Z. 28	0.3	0.3	0.6	0.6	0.5	0.9	1.0	0.9	1.0
Z. 38	0.5	0.5	0.6	0.6	0.6	0.7	1.2	0.7	1.1
Z. 48	1.1	1.0	1.6	1.3	1.5	1.8	2.4	1.9	2.4
Z. 68	1.8	1.7	2.7	2.3	2.5	3.0	4.1	3.2	4.1
Z. 88	4.1	3.7	6.1	5.3	5.7	6.8	8.8	7.5	8.8
Z. 108	6.7	5.3	10.5	9.3	8.6	13.8	14.0	13.2	13.6
Z. 128	9.0	6.4	16.0	14.1	13.2	17.4	20.7	19.9	20.9
Z. 148	12.2	9.9	20.8	18.3	26.9	23.9	27.7	25.7	27.4
Z. 168	18.8	15.3	34.8	30.1	32.1	43.8	31.1	45.7	41.7
D. 38	0.5	0.5	0.6	0.6	0.6	0.9	1.1	0.9	1.1
D. 48	1.1	1.0	1.5	1.4	1.5	2.3	2.4	2.4	2.4
D. 68	1.7	1.6	2.6	2.4	2.6	3.9	4.0	4.0	4.0
D. 88	4.0	3.6	5.9	5.4	5.9	8.7	8.9	9.3	8.9
D. 108	6.5	5.1	10.3	9.5	9.0	15.3	14.2	15.6	13.7
D. 128	8.7	6.1	15.8	14.8	14.1	22.2	21.3	24.4	21.5
D. 148	11.7	9.4	20.4	19.1	23.4	30.6	28.2	32.2	27.9
D. 168	18.1	14.6	34.1	31.2	33.8	53.0	43.7	54.4	42.2

3.3.2 Tandem gear unit - compound helical gear unit

Attention!

In horizontal operating position, the housing recess of the 2. gear unit in general points downwards.

Type	Mounting position								
	B3 B3/B5	B5 B14	B6	B7	B8	V1 V18	V3 V19	V5 V1/V5	V6 V3/V6
Z.38 - Z28	0.5+0.3 0.8	0.5+0.3 0.8	0.6+0.3 0.9	0.6+0.3 0.9	0.6+0.3 0.9	0.7+0.8 1.5	1.2+0.8 2.0	0.7+0.8 1.5	1.1+0.8 1.9
Z.48 - Z28	1.1+0.3 1.4	1.0+0.3 1.3	1.6+0.3 1.9	1.3+0.3 1.6	1.5+0.3 1.8	1.8+0.8 2.6	2.4+0.8 3.2	1.9+0.8 2.7	2.4+0.8 3.2
Z.68 - Z28	1.8+0.3 2.1	1.8+0.3 2.1	2.7+0.3 3.0	2.3+0.3 2.6	2.5+0.3 2.8	3.0+0.8 3.8	4.1+0.8 4.9	3.2+0.8 4.0	4.1+0.8 4.9
Z.68 - Z38	1.8+0.5 2.3	1.8+0.5 2.3	2.7+0.5 3.2	2.3+0.5 2.8	2.5+0.5 3.0	3.0+0.7 3.7	4.1+1.2 5.3	3.2+0.7 3.9	4.1+1.2 5.3
D.38 - Z28	0.5+0.3 0.8	0.5+0.3 0.8	0.6+0.3 0.9	0.6+0.3 0.9	0.6+0.3 0.9	0.9+0.8 1.7	1.1+0.8 1.9	0.9+0.8 1.7	1.1+0.8 1.9
D.48 - Z28	1.1+0.3 1.4	1.0+0.3 1.3	1.5+0.3 1.8	1.4+0.3 1.7	1.5+0.3 1.8	2.3+0.8 3.1	2.4+0.8 3.2	2.4+0.8 3.2	2.4+0.8 3.2
D.68 - Z28	1.7+0.3 2.0	1.6+0.3 1.9	2.6+0.3 2.9	2.4+0.3 2.7	2.6+0.3 2.9	3.9+0.8 4.7	4.0+0.8 4.8	4.0+0.8 4.8	4.0+0.8 4.8
D.68 - Z38	1.7+0.5 2.2	1.6+0.5 2.1	2.6+0.5 3.1	2.4+0.5 2.9	2.6+0.5 3.1	3.9+0.7 4.6	4.0+1.2 5.2	4.0+0.7 4.7	4.0+1.2 5.2
D.68 - D38	1.7+0.5 2.2	1.6+0.5 2.1	2.6+0.5 3.1	2.4+0.5 2.9	2.6+0.5 3.1	3.9+0.9 4.8	4.0+1.1 5.1	4.0+0.9 4.9	4.0+1.1 5.1
D.88 - Z28	4.0+0.3 4.3	3.6+0.3 3.9	5.9+0.3 6.2	5.4+0.3 5.7	5.9+0.3 6.2	8.7+0.8 9.5	8.9+0.8 9.7	9.3+0.8 10.1	8.9+0.8 9.7
D.88 - Z38	4.0+0.5 4.5	3.6+0.5 4.1	5.9+0.5 6.4	5.4+0.5 5.9	5.9+0.5 6.4	8.7+0.7 9.4	8.9+1.2 10.1	9.3+0.7 10.0	8.9+1.2 10.1
D.88 - D38	4.0+0.5 4.5	3.6+0.5 4.1	5.9+0.5 6.4	5.4+0.5 5.9	5.9+0.5 6.4	8.7+0.9 9.6	8.9+1.1 10.0	9.3+0.9 10.2	8.9+1.1 10.0
D.108 - Z28	6.5+0.3 6.8	5.1+0.3 5.4	10.3+0.3 10.6	9.5+0.3 9.8	9.0+0.3 9.3	15.3+0.8 16.1	14.2+0.8 15.0	15.6+0.8 16.4	13.7+0.8 14.5
D.108 - Z38	6.5+0.5 7.0	5.1+0.5 5.6	10.3+0.5 10.8	9.5+0.5 10.0	9.0+0.5 9.5	15.3+0.7 16.0	14.2+1.2 15.4	15.6+0.7 16.3	13.7+1.2 14.9
D.108 - D38	6.5+0.5 7.0	5.1+0.5 5.6	10.3+0.5 10.8	9.5+0.5 10.0	9.0+0.5 9.5	15.2+0.9 16.1	14.2+1.1 15.2	15.6+0.9 16.5	13.7+1.1 14.8
D.128 - Z28	8.7+0.3 9.0	6.1+0.3 6.4	15.8+0.3 16.1	14.8+0.3 15.1	14.1+0.3 14.4	22.2+0.8 23.0	21.3+0.8 22.1	24.4+0.8 25.2	21.5+0.8 22.3
D.128 - Z38	8.7+0.5 9.2	6.1+0.5 6.6	15.8+0.5 16.3	14.8+0.5 15.3	14.1+0.5 14.6	22.2+0.7 22.9	21.3+1.2 22.5	24.4+0.7 25.1	21.5+1.2 22.7
D.128 - Z48	8.7+1.0 9.7	6.1+1.0 7.1	15.8+1.0 16.8	14.8+1.0 15.8	14.1+1.0 15.1	22.2+1.8 24.0	21.3+2.4 23.7	24.4+1.8 26.2	21.5+2.4 23.9
D.128 - D38	8.7+0.5 9.2	6.1+0.5 6.6	15.8+0.5 16.3	14.8+0.5 15.3	14.1+0.5 14.6	22.2+0.9 23.1	21.3+1.1 22.4	24.4+0.9 25.3	21.5+1.1 22.6
D.148 - Z38	11.7+0.5 12.2	9.4+0.5 9.9	20.4+0.5 20.9	19.1+0.5 19.6	23.4+0.5 23.9	30.6+0.7 31.3	28.2+1.2 29.4	32.2+0.7 32.9	27.9+1.2 29.1
D.148 - Z48	11.7+1.0 12.7	9.4+1.0 10.4	20.4+1.0 21.4	19.1+1.0 20.1	23.4+1.0 24.4	30.6+1.8 32.4	28.2+2.4 30.6	32.2+1.8 34.0	27.9+2.4 30.3
D.148 - D38	11.7+0.5 12.2	9.4+0.5 9.9	20.4+0.5 20.9	19.1+0.5 19.6	23.4+0.5 23.9	30.6+0.9 31.5	28.2+1.1 29.3	32.2+0.9 33.1	27.9+1.1 29.0
D.168 - Z48	18.1+1.0 19.1	14.6+1.0 15.6	34.1+1.0 35.1	31.2+1.0 32.2	33.8+1.0 34.8	53.0+1.8 54.8	43.7+2.4 46.1	54.4+1.8 56.2	42.2+2.4 44.6
D.168 - Z68	18.1+1.7 19.8	14.6+1.7 16.3	34.1+1.7 35.8	31.2+1.7 32.9	33.8+1.7 35.5	53.0+3.0 56.0	43.7+4.1 47.8	54.4+3.0 57.4	42.2+4.1 46.3
D.168 - D48	18.1+1.0 19.1	14.6+1.0 15.6	34.1+1.0 35.1	31.2+1.0 32.2	33.8+1.0 34.8	53.0+2.3 55.3	43.7+2.4 46.1	54.4+2.3 56.7	42.2+2.4 44.6

3.4 Weights

The weight of the drive is shown on the rating plate of the gear unit or the gear motor, if higher than 30 kg; it can always be found in the shipment documents.

When there are several rating plates on one drive, the value on the main gear unit is decisive.

The weight specification refers only to the condition of the product on delivery.

3.5 Sound power level

The A-qualified sound power levels L_{WA} of a selection of gear units in figure 3.5 were determined according to DIN EN 21680 measured with testing apparatus to DIN IEC 651.

The sound is dependent upon speed, power rating and ratio.

The **MOTOX®-N-Gear Motors** are shown predominantly in the dark-coloured section. Gear units with very small ratios, high power rating and high input speed may lie in the hatched range.

If no proper measuring system can be established when measuring again at the place of use, the measurement on the **FLENDER TÜBINGEN GMBH** test rigs are valid.

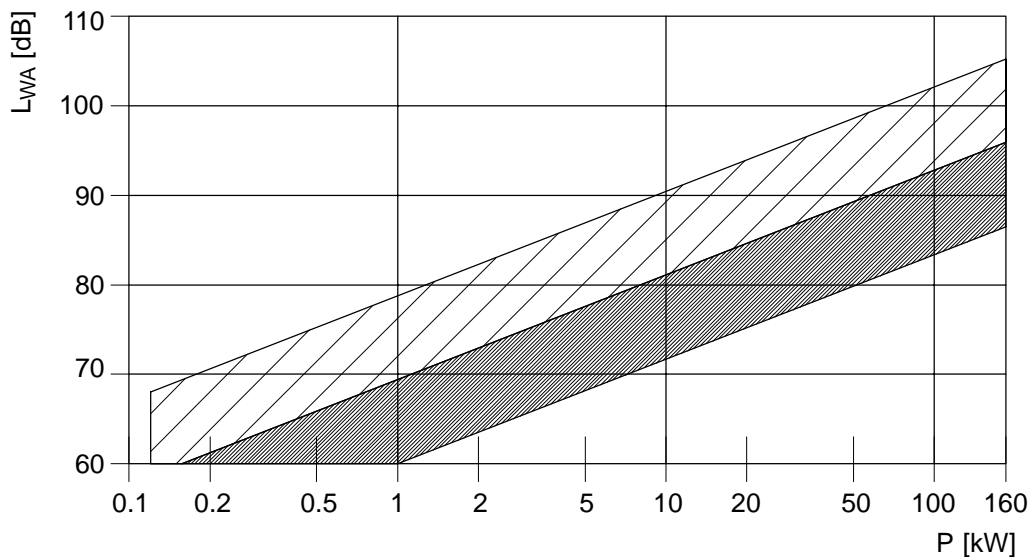


Figure 3.5: Sound power level

L_{WA} [dB] Sound power level
 P [kW] Mechanical power rating

• External noises

Noises which are not generated by the gear unit but are emitted by the gear unit are not taken into consideration.

Noises which are emitted by input and output machines as well as by the foundation are not taken into consideration either, even if they were transmitted to that point by the gear unit.



General guidelines concerning the influence of noise on people should be taken into consideration.

4. Incoming goods, handling and storage

4.1 Incoming goods

The contents of the shipment are listed in the shipping documents. The shipment should be checked for completeness and shipping damage immediately on receipt. If necessary, a loss advice should be written out in the presence of the forwarder, otherwise repairing the damage without costs will not be possible.



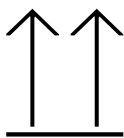
Damaged drives must not be put into operation.

4.2 Handling

The drive is shipped in assembled state. Ancillary equipment (such as for example pipes and valves) are shipped packed separately.

The packing of the gear unit will differ, dependent on the method of shipment and size. The packing, unless otherwise agreed contractually, complies with **HPE Packing Guidelines**.

The symbols shown on the packing should be noted. Their significance is as follows:



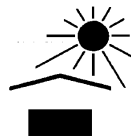
This side up



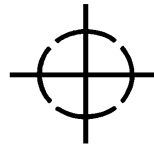
Fragile Goods



Keep dry



Protect from heat



Centre of gravity



Use no hooks



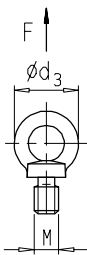
Sling here

Attention!

When handling and loading and unloading of the drive, exercise special care to avoid damage due to the use of force.



The drive system must be attached to the transport fixture with the maximum permissible suspension weight. As a rule this is on the main gear unit. Check the eye-bolt provided for firm seating and, if necessary, tighten it. The eye-bolt on the motor may be used only as auxiliary suspension, e.g. for horizontal mounting position of the motor, to transport the un- or demounted motor.



The permissible attaching weight is to be observed:

d_3 [mm]	36	45	54	63	72	90	108
M	M 8	M 10	M 12	M 16	M 20	M 24	M 30
m [kg]	140	230	340	700	1200	1800	3600

Highest load exercised by the drive to be attached in kg with tension \uparrow in the direction F of the screw axis.

Attention!

To ensure maximum load-bearing capacity in direction F of the lifting eye or eye bolt axis additional suitable transport means (cables or the like) must be used for transport and/or installation.



When attaching with several chains and ropes, two ropes must already be sufficient to support the complete load. Lifting devices such as ropes and similar should be secured against slipping.

Attention!

The threads in the shaft ends must not be used for attaching eye bolts for handling.

Attention!

Transport fixtures, if present, should be removed and stored or be made noneffective according to additional notes. For further transport reuse or make effective again.

4.3 Storage

The drives should be stored in dry rooms with minimum temperature fluctuations in their positions of use on a horizontal wooden support and covered.

Attention!

The storage area must be free of vibrations (shocks) as otherwise the anti-friction bearings may be damaged.



It is not permissible to stack drives on top of one another.

The gear units are provided with internal preservation, the free shaft ends and the flange surfaces are provided with a protective coating.

Note: Unless agreed to the contrary by contract, a warranty period of 6 months is given for the standard preservation. The warranty period starts to run on the date of delivery of the gear unit.

In the case of prolonged interim storage (> 6 months) check preservation and renew it, if necessary (see section 7. "Startup").

The contractually agreed external coating (Type, structure, colour) was carefully applied by spray painting. See 5.11 for the resistances of the coating.

Note: Do not damage the coating!
Mechanical (scratches), chemical (acids, alkaline solutions) or thermal (sparks, welding beam, heat) damage leads to corrosion and to the failure of the external protection.

Attention!

If stored in the open, the drive should be covered with special care and it should be ensured that neither moisture nor foreign matter are allowed to collect on the gear unit.

5. Technical description

5.1 General description

The gear units are supplied as single-, two- or three-stage helical gear units.
The gear units are suitable for the different mounting positions taking into consideration the oil level.

5.2 Housings

The gear unit grey cast iron housings are stable, vibration dampening and are designed for continuous operation.

The housings are manufactured by completely new machining processes on the most up-to-date machines, so ensuring a high centre distance accuracy and so preventing local overload of the tooth flanks. The high accuracy likewise ensures favourable bearing load and good noise characteristics.

5.3 Toothed components

The toothed gear unit components are hardened. Due to the high quality of the gearing as well as the flank- and profile-corrected involute gearing, the noise level of the gear unit is minimized and the flank capacity is optimized.

5.4 Lubrication

The components of the tooth system are adequately supplied with lubricant by splash lubrication. This ensures that the gear units are especially maintenance-free.

Attention!

See section 10. "Maintenance and repair" for trouble-free operation.

5.5 Bearings

All shafts are mounted in anti-friction bearings. Lubrication of the anti-friction bearings is effected by splash lubrication assisted by the gear wheels. Bearings which are not supplied with lubricant hereby are enclosed and grease lubricated (lifetime lubrication).

5.6 Shaft seals

Radial shaft seals at the shaft outlet to the speed reducing gear unit prevent, lubricant from the entering in the variable speed gear unit. In case of higher ambient temperatures (>40°C ... 100°C according to order agreement), shaft seal rings from temperature resistant material are used.

5.7 Cooling

The gear units do not require any additional cooling. The generously dimensioned housing surface is sufficient for dissipating the heat loss in case of free convection.

Attention!

The surface of the gear unit or the gear motor should be kept free of dirt (see section 10. "Maintenance and repair").

5.8 Couplings

As a rule, flexible couplings should be provided for the input drive and output drive sides of the gear unit.

If rigid couplings or other input drive and output drive elements are used which give rise to additional radial and/or axial forces (for example gear wheels, belt pulleys, etc.), this must be agreed on by contract.

Attention!

Couplings with peripheral speeds at the outside diameter up to 30 m/s must be statically balanced. Couplings with peripheral speeds above 30 m/s require dynamic balancing.

The special Operating Instructions should be noted for operation of the couplings.

5.9 Backstop

The gearboxes can be provided with a mechanical backstop for certain requirements. During operation, this permits rotation in the specified direction only. This direction is marked by a corresponding direction of rotation arrow.

The backstop incorporates centrifugally operated grippers. When the gear unit is rotating in the specified direction, the inner ring and the cage with the grippers rotate, the outer ring remaining stationary. From a certain speed of rotation, the grippers lift off and the back stop now operates without wear.

The backstops are lubricated ready for duty, they don't need to be serviced.

Attention!

To prevent damage to or destruction of the backstop, it is essential to ensure that the motor is not run against the locked backstop. Please observe the notes on the gear.

5.10 Name plates

The gear unit or gear motor name plates are normally of coated aluminium foil. They are covered in a special adhesive covering foil to ensure permanent resistance to UV radiation and media of all kinds (oils, greases, salt water, cleaning materials, etc.).

The adhesives and materials are selected to ensure firm adhesion and permanent legibility even at the limits of the operational temperature range (-40°C ... $+155^{\circ}\text{C}$).

The edges of the name plates are coated with the appropriate paint (see 5.11).

In special cases, i.e. with special specifications, rivetted or bolted metal plates are used.

5.11 Coats of paint

5.11.1 General

All coats of paint are applied carefully by spray painting in the most modern painting plants.

Note: As a precaution against misunderstandings, we would like to point out that the recommendation does not imply any release in the sense of a warranty for the quality of the paint provided by your supplier. Each paint manufacturer must warrant the quality of his product himself.

5.11.2 Paint finish

Paint system	Plastic	2K-PUR	2K-Epoxid
Standard colour	RAL 7011	RAL 7031	RAL 7035
Typical area of use	Standard 1-layer coat of lacquer for the internal area, in the open with roof, i.e. suitable protection against sun and continuous atmospheric influence	Standard 2-layer coat of lacquer especially for installation in the open or in case of increased demands on corrosion protection	High-quality coat of lacquer for the external area or in case of attacks by diluted acid and alkaline solution ($\leq 5\%$)
Overpaintability	With plastic lacquer or synthetic resin lacquer	After preceding grinding with: 2K-PUR lacquer 2K-Epoxy lacquer	After preceding grinding with: 2K-PUR lacquer 2K-Epoxy lacquer 2K-AC lacquer
Chem. phys. resistance	Good resistance to cleaning agents, oil and benzine, resistant to short-time attack by diluted acid and alkaline solution ($\leq 3\%$), not resistant to solvent	Excellent resistance to: oil, grease, benzine, water, sea water and cleaning agent; good resistance to atmospheric influences and diluted acid and alkaline solution ($\leq 3\%$); good mechanical resistance to abrasion	Excellent resistance to weak acid and alkaline solution ($\leq 5\%$), oil, grease, benzine, cooling emulsion, salt, solvent; tough and scratch-resistant coating film
Temperature resistance	$-40^{\circ}\text{C} \dots +100^{\circ}\text{C}$ up to 140°C for a short time	$-40^{\circ}\text{C} \dots +150^{\circ}\text{C}$	$-40^{\circ}\text{C} \dots +150^{\circ}\text{C}$
Remark	Standard coat of lacquer with excellent adhesive characteristics	Standard coat of lacquer for cooling tower and agitator drive or if sea water resistance below deck or similar is required	2K-Epoxy lacquer "chalks" in case of installation in the open (does not effect the quality), high gloss with good mechanical resistance

Table 5.11.2: Paint finish

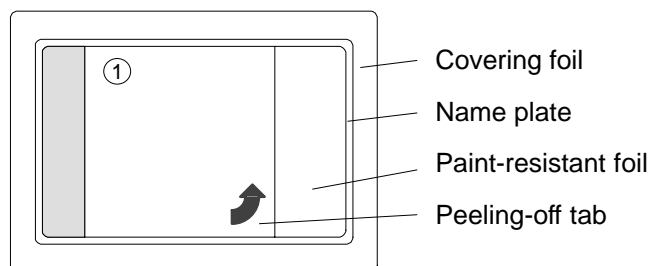
5.11.3 Primed finish

Paint system	Primed	Unpainted
Standard colour	RAL 7032	-
Typical area of use	For overpainting*): adhesive agent for all common paint systems, temporary corrosion protection	For overpainting*): (adhesive agent) temporary corrosion protection
Overpaintability	Excellent with: plastic lacquer, synthetic resin lacquer, 2K-PUR lacquer, 2K-Epoxy lacquer, SH lacquer, 2K-AC lacquer	Excellent with: plastic lacquer, synthetic resin lacquer, oil paint, bitumenous paint, 2K-PUR paint 2K-Epoxy paint
Chem. phys. resistance	Good resistance to cleaning agent, to salt spraying and resistant to oil and benzine	-
Temperature resistance	-40°C ... +150°C	(-40°C ... +150°C)
Remark	Adhesive agent with excellent adhesive characteristics and good corrosion protection	Components from grey cast iron dip-primed, components from steel primed or galvanised, components from Al and plastic untreated

Table 5.11.3: Primed finish

*) On drives with a primed or painted finish the name plate and the covering foil are provided with paint-resistant foil (see 5.10). They enable painting over without further preparation, e.g. masking, etc.

After the paint coat has hardened (is at least hard to the touch) peel off the paint-resistant foil:



① Company logo

➔ Lift tab.

➔ Carefully peel off from one corner diagonally in the direction of the arrow (not parallel with plate).

➔ If necessary, blow off or wipe off paint splashes with a clean rag.

6. Installation

6.1 General information on installation

During installation, the safety notes in section 2. "Safety notes" should be observed.

Installation should be carried out by specialist personnel with extreme care. Damage caused by improper execution results in the exclusion of our liability.

Right at the planning stage, it should be ensured that there is adequate space around the gear unit for installation and subsequent care and maintenance.

Adequate space for air intake should be left for drives with fan.

Attention!

The drives may overheat if positioned in strong direct sunlight. Provide appropriate protective devices such as cover, roof or similar!

Before commencing installation, adequate hoist equipment must be provided for lifting the drives.

Attention!

No welding work must be carried out on the drive. The drives must not be used as ground points for welding work. Components of the tooth system and bearings may be destroyed by welding.

Note: Use shoulder studs of property class 8.8 or higher for mounting the drives.

Attention!

All mounting possibilities assigned to the respective mounting position should be used.

6.2 Drives with foot mounting

6.2.1 Foundation

The foundation must be flat.

Note: The flatness of the gear unit support must not exceed the following values:
for gear units up to size 88 ≤ 0.1 mm
on gear unit size 108 and upward ≤ 0.2 mm

It should be executed in such a way that no resonance vibrations occur and no vibration can be transmitted from adjacent foundations. Steel structures on which the gear unit is installed must be torsionally rigid. They are to be designed corresponding to weight and torque, taking into account the forces acting on the gear unit.

When mounting the gear unit on a concrete foundation, using foundation blocks, suitable recesses should be provided in the foundation.

When alignment has been completed, slide rails should be grouted to the concrete foundation.

6.2.2 Installation of gear units with foot mounting

When making use of the highest possible output torque or shearing forces besides the foot mountings by studs or bolts of property class 8.8. suitable additional positive connections such as e.g. cylindrical grooved pins, dowel pins, spring type straight pins or fitting pipes should be provided. These measures are also necessary for dynamically loaded screw connections.

In some cases headed screws can't be used, due to lack of space for insertion. If in doubt, please contact us giving the type of gear.

Attention!

Do not use spring rings, serrated lock washers, spring washers or tooth lock washers, plate springs or idler pulleys as substitute for the above mentioned positive connections.

Attention!

The gear unit housings must not be distorted when tightening the fastening screws.

Note: See 10.2.5 for tightening torques T_A .

Note: Gear units which require the use of a hoist due to their weight should be attached according to 4.2.

6.3 Drives with foot-/flange

The fixture of the drive unit for force and torque transmission may only be done by the flange or by means of bottom fixture in accordance with section 6.2 in order to prevent distortion of the gear unit housings.

The second fixing option (foot or flange) is normally provided for add-on elements, e.g. safety enclosures or the like, with a dead weight of up to max. 30 % of the weight of the drive unit.

Attention!

The gear unit housings must not be distorted by the add-on elements. Likewise no forces, torques and vibrations, e.g. through the attachment of smaller auxiliary equipment and the like, must be transmitted to the drives.

6.4 Drives with flange fixture

6.4.1 A-type flange-mounted design

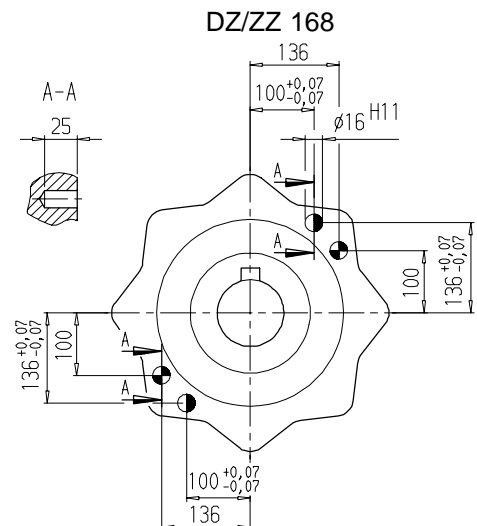
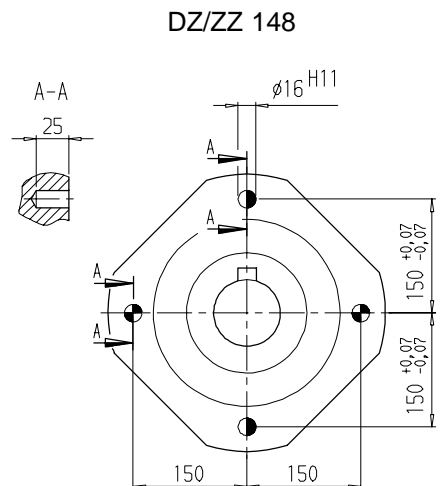
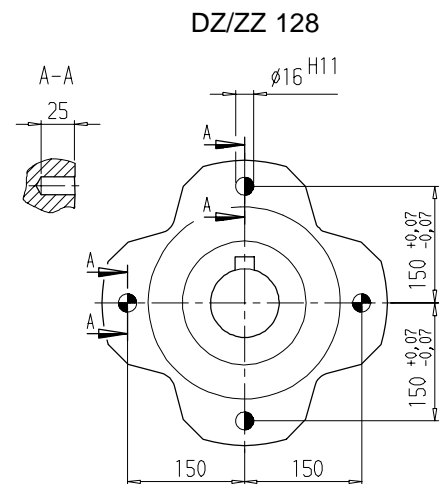
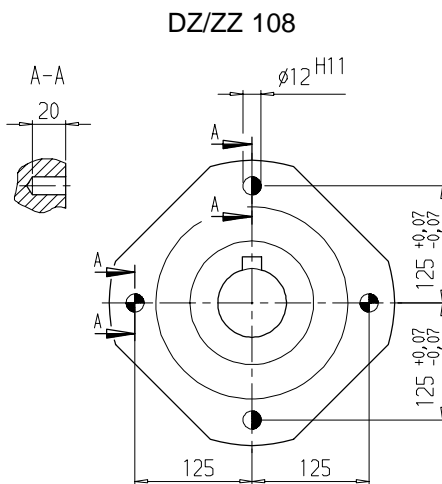
For assembly option DF/ZF 128 we recommend pinning the flange size A350 to the customer's interface.

6.4.2 C-type housing-flange-mounted design

On the C-type flange-mounted housing assembly options 108-168 the customer's interface can be pinned. The output flanges are designed so that the permissible torques and radial forces can be reliably transmitted by the screw connections.

Attention!

If additional security is required, e.g. for reversing operation or with high shock loads, the provided pinhole bores can be used. The gear unit can also be drilled and pinned jointly with the machine. For this the listed dimensions must be adhered to.



- Dowel pins, heavy-type, to DIN 1481: use available pinholes in the housing flange.
- ⊕ Full-length parallel grooved pin with chamfer to DIN EN 28740 / ISO 8740: drill connection piece and housing jointly.

Attention!

Adhere to max. drilling depth (A-A).

6.5 Installation of input drive and output drive elements on gear unit shafts

Elements such as running wheels, chain sprockets and gear wheels, couplings and belt pulleys, etc. should be installed on the gear unit shafts using a fitting device.

Note: Deburr elements to be fitted in the bore and keyway area.
Recommendation: $0.2 \times 45^\circ$

Centre bores according to DIN 332 are provided in the shaft faces which are used in this case.

Description of the assembly work

- Remove corrosion protective coating from the shaft ends and flanges with benzine or solvent, or remove protection skin if existing.



Ensure adequate ventilation. Do not inhale vapours. Do not smoke. Explosion hazard.

Attention!

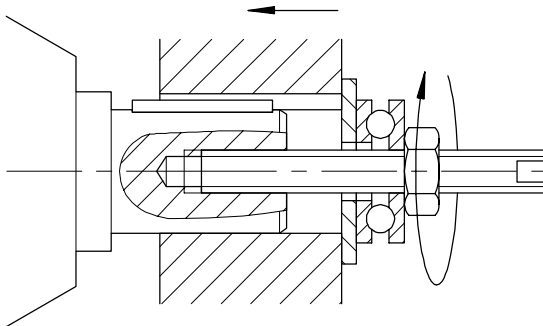
Under any circumstances, ensure that benzine or solvent does not contact the shaft seals.

- Fit input drive and output drive elements on the shaft ends and secure them, if necessary.

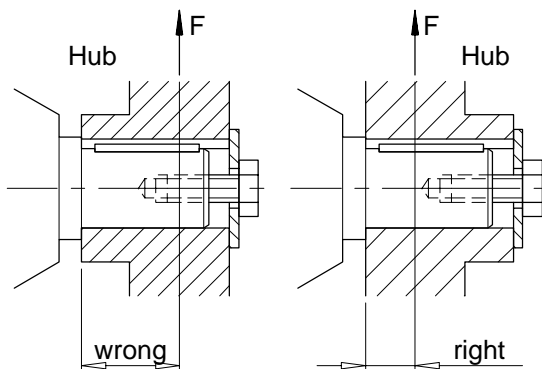
If couplings are used which are to be fitted after heating, the Operating Instructions of the coupling in question should be observed.

Attention!

Under no circumstances must the part to be installed be driven onto the shaft by hammer blows as this may cause damage to bearings, housing, shaft and circlips.



Example of a fitting device for installing couplings or hubs on gear unit or motor shaft ends.
If possible, the thrust bearing on the fitting device can be omitted.



Correct assembly arrangement of running or gear wheel chain sprocket, pulley, or similar, in order to keep the load of the shaft or bearing by shearing forces as low as possible.

6.6 Attachment of standard motors

6.6.1 Attachment to bell housing with torsionally flexible coupling

Description of the assembly work

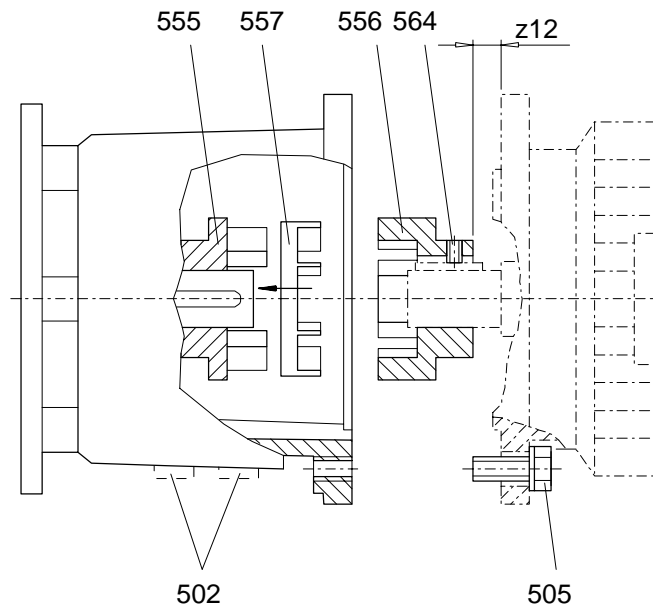
- Fit coupling half pos.556 onto the motor shaft end observing 6.5.
Secure the coupling half against axial shifting with grub screw pos.564.
On motors which are balanced with a half parallel key (marked "H"): Machine away projecting, visible portions of parallel key.

Attention! Adhere to distance dimension z12 as shown on table 6.6.1.

Note: Dimension z12 applies to the standard assignment of the coupling. In case of a special assignment, the dimension should be taken from the corresponding special dimension drawing.

- Insert elastic element pos.557 into coupling half pos.555.
- Flange motor to coupling lantern and fasten it by means of screws pos.505 according to the prescribed tightening torque, see table 10.2.5.

Note: In case of installation of the drive outdoors or with a higher degree of protection (\geq IP 55):
Seal flange, screws pos.505 and plugs pos.502 if present or inserted elements, e.g. proximity switches with sealing compound.



- | | |
|------------------------|---------------------|
| 502 Plug | 556 Coupling half |
| 505 Hexagon head screw | 557 Elastic element |
| 555 Coupling half | 564 Grub screw |

IEC B5	80	90	100	112	132	160	180	200	225	250
z12 [mm]	15	26	30	30	45	66	59	60	90	75

NEMA TC	56C	143TC/ 145TC	182TC/ 184TC	213TC/ 215TC	254TC/ 256TC	284TC/ 286TC	324TC/ 326TC	364TC/ 365TC
z12 [mm]	27.5	28	36.5	45.5	50	61	71	78

Table 6.6.1: Motor size

6.6.2 Attachment to coupling lantern with clamping ring

Description of the assembly work

- Remove mounting plugs pos.502 and pos.503.
- To fasten the clamping ring align input shaft and clamping ring of the gear unit to the mounting bores pos.502 and pos.503 by rotating.
- Moisten grub screw pos.564 by adhesive compound (medium strength, e.g. Loctite 243) see Fig. 6.6.2.
- Flange motor to coupling lantern and fasten it by means of screws pos.505 according to the prescribed torque, see table 10.2.5.

Attention!

Motor shaft must not be braced axially when flanging motor. Motor shaft must be absolutely free of grease in the area around the clamping ring. With brake motors release brake during flanging motor.

Note:

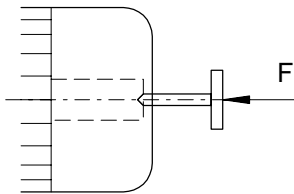
In case of installation of the drive outdoors or with a higher degree of protection (\geq IP 55):
Seal flange, screws pos.505 and assembly plug pos.502 and pos.503 with sealant.

- Screw the grub screw pos.564 onto the key pos.563 until a light resistance is felt, then unscrew half a turn.

Attention!

Grub screw pos.564 must not abut during tightening of hexagon socket screw pos.561.

- To prevent the shafts turning insert socket spanner in threaded pin, pos.564, through bore for pos.503.
- Support motor shaft on ventilation side under light pressure. Tighten hexagon socket screw, pos.561 with torque $T_{A\ SW2}$ (torque $T_{A\ SW2}$ and wrench size SW2 see table 6.6.2).



Mot.	≤ 71	≥ 80
F ca. [N]	10	25

- Tighten grub screw pos.564 with torque $T_{A\ SW1}$ (torque $T_{A\ SW1}$ and wrench size SW1 see table 6.6.2).
- Cover mounting bores with plugs pos.502 and pos.503.

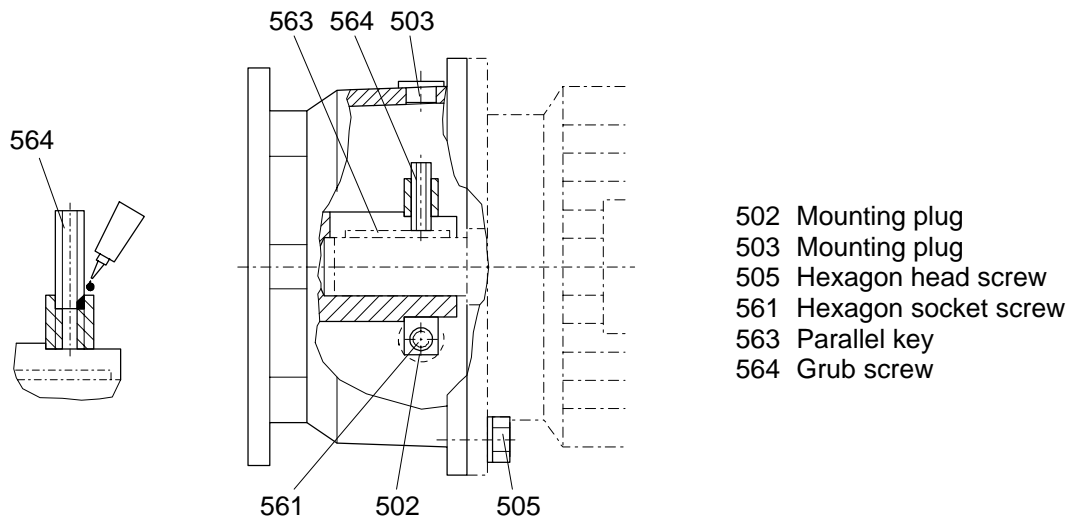


Figure 6.6.2

IEC B5	63	71	80	90	100	112	132	160	180	200	225	250	280
T_{A SW1} [Nm]	1.3	1.3	1.3	2.9	2.9	2.9	5.8	9.9	9.9	9.9	9.9	9.9	48
SW1 [mm]	2	2	2	3	3	3	4	5	5	5	5	5	8
T_{A SW2} [Nm]	10	10	10	25	35	35	70	120	120	295	295	295	580
SW2 [mm]	5	5	5	6	6	6	8	10	10	14	14	14	17

NEMA TC	56C	143TC / 145TC	182TC / 184TC	213TC / 215TC
T_{A SW1} [Nm]	1.3	1.3	2.9	5.8
SW1 [mm]	2	2	3	4
T_{A SW2} [Nm]	10	10	35	70
SW2 [mm]	5	5	6	8

Table 6.6.2: Motor size

6.7 Motor base plate

The motor bracket is designed for the mounting of an IEC-B3 bottom-mounted motor used primarily to power a V-belt drive. The motor must be set up in accordance with the maker's operating instructions.

Attention!

Follow the relevant operating instructions for V-belt drives, e.g. V51. Fit pulley wheels on to the drive shaft, pos.515, in accordance with section 6.5.

Note:

Incorrect belt tension results in belt breakages and damage to the bearing.

For other types of drive, e.g. chain-type drive and the like, follow relevant operating instructions and/or maker's information.



Always fit suitable safety fixtures to cover the belt-, chain- or other open-type drive systems.

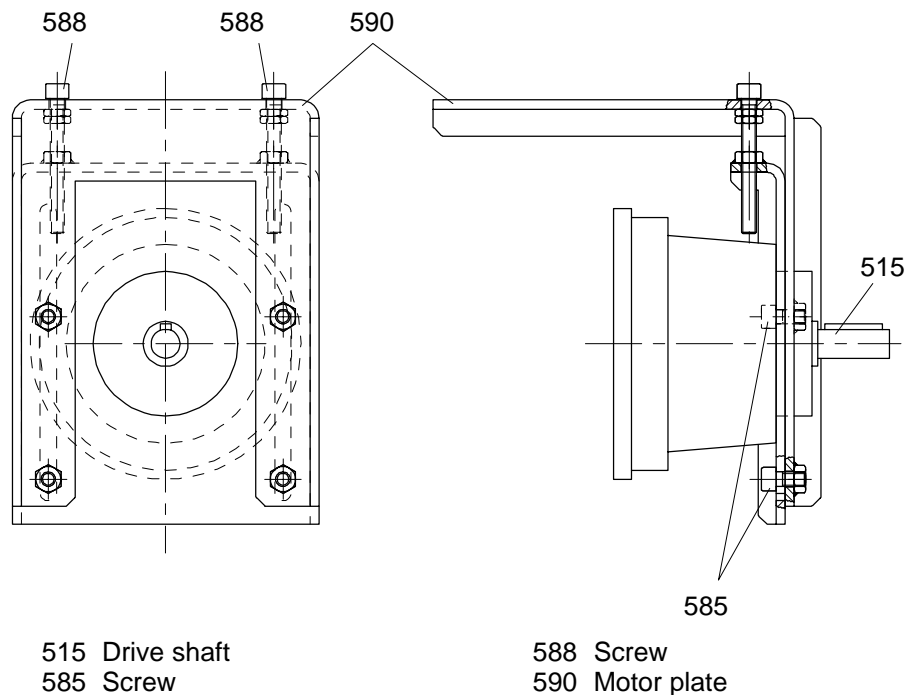
Attention!

After completion of mounting or adjustment work protect columns, pos.581, and any other bright parts against corrosion as set out in section 7.4 or with another suitable, permanent anti-corrosive agent.

6.7.1 IEC Motor frame size up to 112

Description of the assembly work

- Loosen screw (4x) pos.585.
- Set height of motor plate, pos.590, by evenly turning screws, pos.588, and thereby adjust e.g. the belt tension.
- After setting to the correct height tighten screws, pos.585, to torque specified in table 10.2.5.



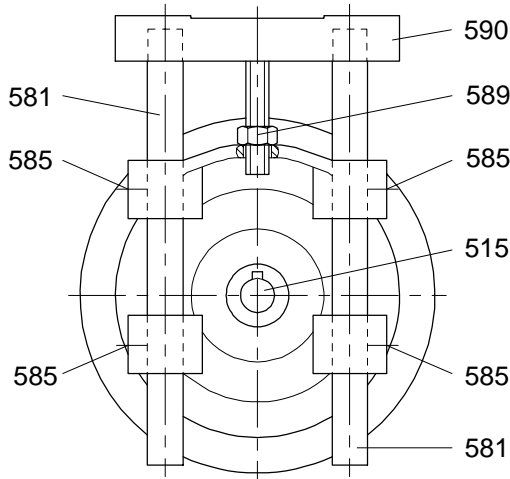
6.7.2 IEC Motor frame size 132 to 200



Do not re-adjust the motor base plate in downward mounting position as it may slip out of the holder.

Description of the assembly work

- Loosen grub screw (4x) pos.585.
- Set height of motor plate, pos.590, by evenly turning the hexagon nut, pos.589.
- Tighten grub screws pos.585 after adjusting the correct height.



- 515 Drive shaft
- 581 Column
- 585 Grub screw
- 589 Hexagon nut
- 590 Motor plate

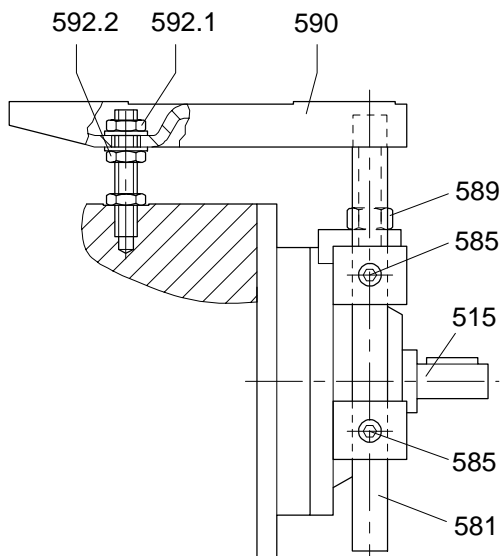
6.7.3 IEC Motor frame size 225

Description of the assembly work

- Loosen grub screw (4x) pos.585.
- Loosen hexagon nuts, pos.592.1 and pos.592.2 of the support.
- Set height of motor plate, pos.590, by evenly turning the hexagon nuts (2x), pos.589, and so adjust e.g. the belt tension.
- Tighten grub screws pos.585 after adjusting the correct height.
- Tighten hexagon nuts, pos.592.1 and pos.592.2.

Attention!

When tightening the hexagon nuts, pos.592.1 and pos.592.2, the motor bracket, pos.590, must not be displaced or distorted.



- 515 Drive shaft
- 581 Column
- 585 Grub screw
- 589 Hexagon nut
- 590 Motor plate
- 592.1 Hexagon nut
- 592.2 Hexagon nut

7. Startup

7.1 Measures before startup

7.1.1 Oil level check

- Before connecting up the drive system to the current supply check the oil level or
- Shut down the gear unit by shutting off the drive unit.

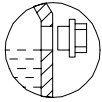


Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

Note:

In case of tandem gear units, each single gear unit should be inspected separately. Check oil level with the oil cooled down. Even after a short run, oil needs a longer 'rest' in order to release possible air bubbles.

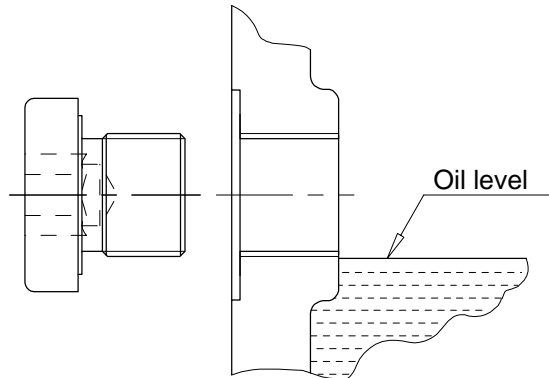
7.1.1.1 Checking the oil level in the gear unit housing



Screw out the plug screw at the point marked with this symbol.

Note:

If the oil level is correct, a small amount of oil may flow out, the oil must at least come up to the lower edge of the bore.

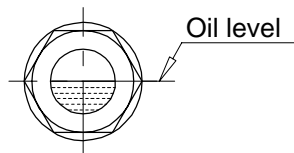


Any oil escaping should be removed immediately with oil binding agent in an environmentally compatible way.

For drives with only one plug screw, checking the oil level is not possible.

7.1.1.2 Oil sight glass (Special feature)

- If an oil inspection glass is provided, the oil level must be visible in the middle of the inspection glass



7.1.1.3 Dipstick (Special feature)

- Check oil level with dipstick:
The oil level must be between the lower and upper mark of the dipstick.

7.1.2 Ventilation of gear unit

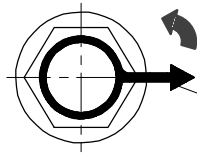
- **MOTOX[®]-N drives** are delivered with the appropriate lubricants ready for operation depending on the specified conditions of use.

Drive with ventilation filter



On gear systems with the required housing ventilation the required ventilation filter is delivered loose with the unit. It must be replaced with the appropriate screw plug before the initial start-up of the gear unit. It must be used at the position indicated by this symbol (see 3.2).

Drive with pressure release valve



Remove handling seal.

- Pull off sealing strap in the direction of arrow.

Sealing strap

7.1.3 Startup in case of long term preservation

7.1.3.1 Long term preservation up to 18 months

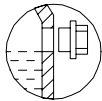
Attention!

Before starting up the gear unit, it should be filled with lubricant (see 7.1.4).

7.1.3.2 Long term preservation up to 36 months

Attention!

The gear unit is completely filled with oil. Before the startup, the oil level should be corrected according to the type of construction.



The oil level should be reduced to the level marked with this symbol (see 7.1.1).



Any oil escaping should be removed immediately with oil binding agent in an environmentally compatible way.

7.1.4 Filling with lubricant

- Screw out venting screw or venting filter or plug screw at the highest point (see 3.2 or point of ventilation).

Attention!

Fill gear unit up with fresh oil using a filling filter (max. filter coarseness 60 µm). The quantity of oil depends on the mounting position!

Note:

Recommendations on the oil to be used should be taken from section 10. "Maintenance and repair". Data, such as oil grade, oil viscosity and oil quantity required will be found on the rating plate (see section 3. "Technical data").

Attention!

Finally, check the oil level (see 7.1.1).



Any oil escaping should be removed immediately with oil binding agent in an environmentally compatible way.

7.1.5 Drive with backstop



Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

Attention!

Check the direction of rotation before putting into service!

E.g. by manually turning the input shaft or the motor. Check the motor direction of rotation according to the phase sequence, swap two supply leads if necessary.

7.2 Shutdown

- Shut down the gear unit by shutting off the drive unit.



Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

Note: If shut down for a considerable period of time, the gear unit should be run briefly at intervals of three weeks. If shut down for a period exceeding six months, the gear unit should be preserved (see 7.3 and 7.4).

7.3 Preservation with gear oil

- Long term preservation up to 36 months.

Completely top up the gear unit with the filled oil grade.



Any oil escaping should be removed immediately with oil binding agent in an environmentally compatible way.

7.4 External preservation procedure

- Clean surfaces.

Attention!

Cleaning the drive with a high-pressure cleaning device is not permissible. Do not use sharp-edged tools.

- Smear shaft seal rings with grease for protection against preservatives.
- Coating: check, in case of damage have it repaired by an expert.
- Apply preservatives, e.g.:

Protection time	Preservative name	Layer thickness	Remarks
up to 12 months	Tectyl 846 K19	approx. 50 µm	Wax base long preservation, sea water resistant, tropic-proof, benzine-soluble

Table 7.4: External preservation of shaft ends and other bright metal surfaces

8. Operation

During operation, the gear units should be checked for

- excessive operating temperature (In continuous operation using mineral oil, the gear unit is suitable for a temperature of 90°C; at higher temperatures, it may be necessary to use synthetic oil. Short-term temperatures of 100°C are permissible, see also section 10. "Maintenance and repair").
- any changes in gear unit noises
- possible oil leakage at the housing and the shaft seals.

Attention!

If irregularities are detected during operation, the drive assembly should be shut off immediately. The cause of the malfunction should be determined with the aid of the Troubleshooting Table (see section 9. "Disturbances, reasons and remedy").

The Troubleshooting Table lists possible malfunctions, their causes and suggestions for their remedy.

If the cause cannot be determined or there is no facility for repair with suitable equipment, we recommend calling in one of our service fitters (see section 11. "Spare parts stock, service addresses").

9. Disturbances, reasons and remedy

Note: Malfunctions occurring during the warranty period which necessitate repair of the gear unit may only be repaired by **FLENDER TÜBINGEN GMBH** service personnel. Even after the warranty period has elapsed, we recommend our customers to consult our Service Division concerning malfunctions whose cause cannot be clearly ascertained.

Malfunctions	Causes	Remedy
Temperature rise at bearing points	Oil level in gear unit housing too low	For oil level check see section 7.1.1; if necessary, adjust oil level.
	Oil is overaged	Check when last oil change was carried out; change oil if necessary, see section 10..
	Bearing(s) defective	Call in FLENDER TÜBINGEN Service. Check bearing(s); replace if necessary.
Excessive operating temperature	Oil level in gear unit housing too high	For oil level check see section 7.1.1; if necessary, adjust oil level.
	Oil is overaged	Check when last oil change was carried out; change oil if necessary, see section 10..
	Oil is very dirty	Change oil, see section 10..
	Fan cowl of the motor and/or drive is very dirty	Clean fan cowl and surface of the drive, see 10.2.4.
	Backstop does not run freely	Call in FLENDER TÜBINGEN Service. Repair backstop, replace if necessary.
Change in gear unit running noises	Damage to tooth systems	Call in FLENDER TÜBINGEN Service. Check toothed components; if necessary replace damaged components.
	Excessive bearing play	Call in FLENDER TÜBINGEN Service. Adjust bearing play.
	Bearing defective	Call in FLENDER TÜBINGEN Service. Replace defective bearings.
	External loading on input and output too high	Correct loading to nominal data. E.g. correct belt tension.
Loud noises in the region of the gear unit mounting	Gear unit mounting has loosened	Tighten bolts/nuts at recommended tightening torque. Replace damaged bolts/nuts.

Malfunctions	Causes	Remedy
Noticeable lubricant leakage	Wrong mounting position/oil level	Correct mounting position according to rating plate. For oil level check see section 7.1.1; if necessary, adjust oil level.
	Inadequate sealing of housing cover or joints	Call in FLENDER TÜBINGEN Service. Seal again.
	Shaft seal defective	Call in FLENDER TÜBINGEN Service. Replace shaft seal.
Drive does not start or starts under great effort	Lubricant viscosity incorrect	Fill in correct lubricant.
	Oil level in the gear unit housing too high	For oil level check see section 7.1.1; if necessary, adjust oil level.
	External loading on output too high	Correct loading to nominal data.
	Brake of motor is not released	Check switching/connection of brake, correct if necessary.
	Drive works against the backstop	Call in FLENDER TÜBINGEN Service. Change the direction of rotation of the motor or the backstop. Check the backstop.
Drop in speed or torque	Belt tension too low (on belt drives)	Correct belt tension. Replace belt if necessary.
Play on input and output too high	Elastic element worn (on couplings)	Replace elastic element; Call in FLENDER TÜBINGEN Service.
	Positive connection worn out by overload	Call in FLENDER TÜBINGEN Service.

Table 9.: Malfunctions, causes and remedy

10. Maintenance and repair

10.1 General information on maintenance

Note: All maintenance and repair work should be carried out with due care and only by thoroughly trained personnel.
The notes in section 2. "Safety notes" should be observed.

Attention!

The periods listed in table 10.1 are largely dependent on the conditions of use of the gear unit. For this reason, it is only possible to give average periods which refer to a

- daily operating time of 24 h
- duty factor of ED 100 %
- input drive speed of 1500 min⁻¹
- max. oil temperature of 90°C (with mineral oils, CLP)
 100°C (with synth. oils, PGLP)

Note: Under different operating conditions, the periods should be adjusted accordingly.

Measures	Causes	Remedy
Observe/check gear unit noise for changes	from time to time, more often during operation if possible	-
Observe/check oil temperature	from time to time, more often during operation if possible	-
Oil level check	monthly	see 7.1.1
Check gear unit for leakage	monthly	-
Initial oil change after startup	after approx. 10000 operating hours, at the latest after 3 years	see 10.2.1
Subsequent oil changes	every 3 years or 10000 operating hours 1)	see 10.2.1
Relubrication of anti-friction bearings	jannually or every 5000 operating hours 2)	see 10.2.2
Clean ventilator filter	every 3 months	see 10.2.3
Clean drive	according to the degree of contamination	see 10.2.4
Check all fixing screws for tightness	at least once a year	see 10.2.5
Carry out complete inspection of gear unit	at least once a year	see 10.2.6

Table 10.1: Maintenance and repairs

1) With synthetic oils (PGLP), the times can be doubled.

2) The specified grease service lives apply with a max. ambient temperature of 40°C. The grease service life must be decreased by a factor of 0,7 for every 10°C rise in temperature (max. 20°C = factor 0,5).

With an ambient temperature of 25°C double the grease service life can be expected.

10.2 Description of maintenance and repairs

10.2.1 Perform oil change or oil flushing

Attention! Different types of oil must not be mixed.

Note: Types of oil:
- mineral oil (CLP oil DIN 51517/3)
- synthetic oil with a specific base (PGLP-Öl)

Specifications like oil type, oil viscosity and required oil quantity are shown on the name plate (see 3.1).

Attention! Oil change and oil flushing:
If using the same type of oil as before, use only that oil.
If using a new oil type, use only the new type.

Thoroughly remove oil sludge, abraded material and used oil residue from the housings by oil flushing.

Note: High-viscosity oils must be warmed beforehand. The oil should be drained off after shutdown, while the gear unit is still warm.

- Shut down the gear unit by shutting off the drive unit.



Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

- Place a suitable collection receptacle under the oil drain plug of the gear unit housing.
- Unscrew ventilator filter on the upper side of the housing.
- Unscrew oil drain plug and drain oil off into the receptacle.



There is a risk of scalding from the hot oil emerging. Wear protective gloves.

- Screw in oil drain plug.

Note: Check condition of seal ring, use new seal ring if necessary.

- Filling with lubricant see 7.1.4.
- Screw in ventilator filter on the upper side of the housing.

10.2.2 Relubricating the anti-friction bearings in drive units

Relubricating the drive units is necessary from motor size 160 on.

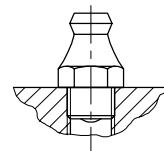
The lubricating period of one year or 4000 operating hours refers to a temperature of 50°C measured on the housing surface near the bearing point.

Note: In case of temperatures exceeding 50°C, the lubricating period should be reduced by half of the original value for each temperature increase of 15 K.

Attention! Do not mix greases of different soap bases when relubricating.

The grease is injected into the bearing point by means of a grease gun via the grease nipples provided for this purpose. See 10.3 for lubricating greases to be used.

Note: Inject 50 g grease per lubricating point, unless other specifications are given in the vicinity of the lubricating point



10.2.3 Clean ventilator filter

The ventilator filter must be cleaned after deposit of a dust layer - at least every 3 months. For this the filter must be unscrewed, flushed out with cleaning benzine or a similar cleaning agent and dried or blown through with compressed air.



Ensure adequate ventilation. Do not inhale vapours. Do not smoke. Explosion hazard.

10.2.4 Clean drive

- Shut down the gear unit by shutting off the drive unit.



Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

Keep drives free of dirt and dust, etc. in order to ensure a sufficient heat dissipation.

Attention!

Cleaning the drive with a high-pressure cleaning device is not permissible. Do not use sharp-edged tools.

10.2.5 Checking all fixing screws for tightness

- Shut down the gear unit by shutting off the drive unit.



Secure drive unit to prevent accidental startup. Affix notice at the switch-on point.

- Check all fixing screws for tightness with a torque wrench

Thread size	Tightening torque T_A [Nm]	Property class min.
M 6	10	8.8
M 8	25	
M 10	50	
M 12	90	
M 16	210	
M 20	450	
M 24	750	
M 30	1500	
M 36	2500	

Table 10.2.5: Tightening torques T_A

Note: Unserviceable screws should be replaced by new ones of the same property class and type.

10.2.6 Inspection of the drive

The drive should be checked annually and with the aid of an inspection plan according to the possible criteria listed in section 9. "Disturbances, reasons and remedies".

In addition, the drive should be checked according to the criteria described in section 2. "Safety notes", e.g. check tight fit of the protective devices.

Any damage of the coating should be repaired by an expert.

10.3 Lubricants

Oil selection should always be determined by the oil viscosity (ISO VG class) specified on the rating plate of the gear unit. The viscosity class is valid for the operating conditions agreed on by contract.

Under different operating conditions, it will be necessary to consult us.

We have put together a list of suitable lubricants for the gear unit in table 10.3.

We are acquainted with the composition of these lubricants and know that, in accordance with the latest technology, they possess values in respect of loadability, corrosion protection, load carrying capacity with micro-pitting, as well as compatibility with seals and internal coating on which the design of the gear unit has been based.

Thus, we recommend that our customers should select a lubricant from this table, taking in account the viscosity class stated on the rating plate.



The lubricants listed have no approval according to USDA -H1/-H2 (United States Department of Agriculture) and are as such not, or only limited approved, for use in the food or pharmaceutical industry.

The lubricants are not, or only limited biologically decomposeable. They are usually according to the Classes 2 or 1 of hazard for water.

If lubricants are necessary according to these classifications, please contact the factory.

If the gearboxes are filled with special lubricants from the factory for the cases given above, this can be seen on the name plate e.g.: CLP-H1 VG220 or CLP E VG220.

Note:

As a precaution against misunderstandings, we would like to point out that the recommendation does not imply any release in the sense of a warranty for the quality of the lubricant provided by your supplier. Each lubricant manufacturer must warrant the quality of his product himself.

If you do not follow our recommendations, you must take the responsibility for the technical suitability of the lubricant.

- In the case of synthetic oils not listed in table 10.3, the corrosiveness of the oil to our internal coating should also be checked. A check of this nature is carried out by us at cost (cost on request).












Lubricant	Designation according to DIN 51502	Examples of lubricants										
												
Mineral Oils 1)	Oil CLP ISOVG220	Degol BG220	Energol GR-XP220	Falcon CLP220	SPAR-TAN EP220	Renolin CLP220	Klüberoil GEM 1 220	Mobil-gear 630	Optigear BM220	OMALA OIL 220	Ersolan 220	TRIBOL 1100 ISO220
	Oil CLP ISOVG100	Degol BG100	Energol GR-XP100	Falcon CLP100	SPAR-TAN EP100	Renolin CLP100	Klüberoil GEM 1 100	Mobil-gear 627	Optigear BM100	OMALA OIL 100	Ersolan 100	TRIBOL 1100 ISO100
Synthetic Oils 2)	OIL PGLP ISOVG460	Degol GS460	Enersyn SG-XP 460	Polydea PGLP460	GLYCO-LUBE 460	Renodiol PGP460	Syntheso D460EP	Glygoyle HE460	Optiflex A460	TIVELA OIL SD		TRIBOL 800/460
	OIL PGLP ISOVG220	Degol GS220	Enersyn SG-XP 220	Polydea PGLP220	GLYCO-LUBE 220	Renodiol PGP220	Syntheso D220EP	Glygoyle 30	Optiflex A220	TIVELA OIL WB		TRIBOL 800/220
Lithium saponified anti-friction bearing greases NLGI 3/2		Aralub HL3, HL2	Energrease LS3, LS2	Glissando 30, 20	BEACON 3	Renolit FWA220, FWA160	CENTRO-PLEX GLP402	Mobilux 3, 2	Longtime PD2	ALVANIA R3, R2	Wiolub LFK2	TRIBOL 4020/220-2

Table 10.3: Lubricant selection

We would be pleased to recommend further suitable lubricants of the makes ADDINOL, CASTROL, FUCHS Lubritech, OMV, STATOIL, TEXACO, TUNAP and VALVOLINE on request through any of our customer service points.

- 1) Mineral base gear oils in accordance with designation CLP as per DIN 51 502.
 These oils comply with the minimum requirements as specified in DIN 51 517 Part 3.
 They are suitable for the following operating temperatures:
 CLP ISO VG 220: -5°C ... +90°C
 CLP ISO VG 100: -15°C ... +80°C
 The maximum temperatures can be exceeded by 10K for a short time.

- 2) Synthetic lubricants (polyglycols) in accordance with designation PGLP as per DIN 51 502.
 These oils are distinguished by their high ageing resistance and favourable effect on the efficiency of the gear unit.
 They are suitable for the following operating temperatures:
 PGLP ISO VG 220: -30°C ... +100°C
 PGLP ISO VG 460: -15°C ... +100°C
 The maximum temperatures can be exceeded by 10K for a short time.

Note: If the operating temperature of the drive exceeds or undershoots the limit values, the oil selected should be checked for suitability by consulting us.

11. Spare parts stock, service addresses

11.1 Stocking spare parts

Maintaining a stock of the most essential replacement and wearing parts on site will ensure that the drive is serviceable at all times.

We assume warranty only for original spare parts supplied by us.

Attention!

We would like to explicitly draw attention to the fact that spare parts and accessories not supplied by us have not been tested and approved by us either. Fitting and/or use of such products can therefore under certain circumstances adversely effect structurally specified properties of the drive and will thus impair active and/or passive safety. No form of reliability or warranty will be assumed by FLENDER TÜBINGEN GMBH for damage caused by the use of non-original spare parts and accessories.

Please note that special production and supply specifications frequently exist for components and we will always offer spare parts in accordance with the latest technology and the latest legal requirements.

When ordering spare parts, the following data should be stated:

- Order No. (see rating plate ④)
- Type designation (see rating plate ⑤)
- Part No. (3-digit pos. No. from the spare parts list, or 6-digit ident. No. or 7-digit part No.)
- Quantity

11.2 Spare parts stock and service addresses

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12. Declaration by the manufacturer

Declaration by the manufacturer

as defined by EC machinery directive 98/37/EEC Annex I I B

We hereby declare that the

Gear units and gear motors of types

E. 38	E. 108	D./Z. 38	D./Z. 108
E. 48	E. 128	D./Z. 48	D./Z. 128
E. 68	E. 148	D./Z. 68	D./Z. 148
E. 88	E. 168	D./Z. 88	D./Z. 168

described in these operating instructions are meant for being installed in a machine and that their putting into operation is prohibited until it has been ascertained that the machine, in which these components will be installed, corresponds to the regulations of the EC directive 98/37/EC.

All the harmonised standards published by the EC-Commission in the official journal of the European Community applicable for our products are either totally or partly observed with this manufacturers declaration

These are especially:

- EN 292-1
- EN 292-2
- EN 294
- EN 349
- EN 60204-1

Tübingen, the 29.02.2000



(Manager of Standards Department)