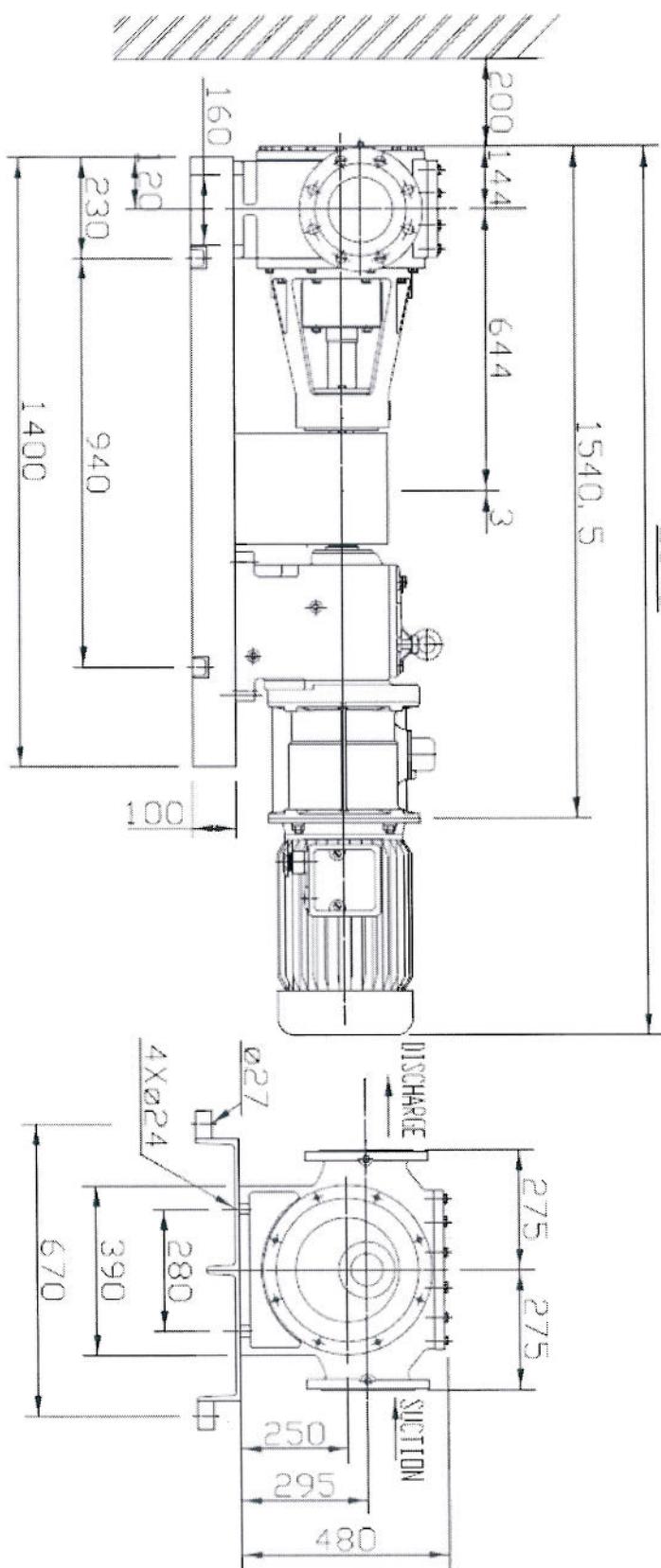


CERTIFIED DRAWING / DIMENSION DA CONFERMARE



FLANGES

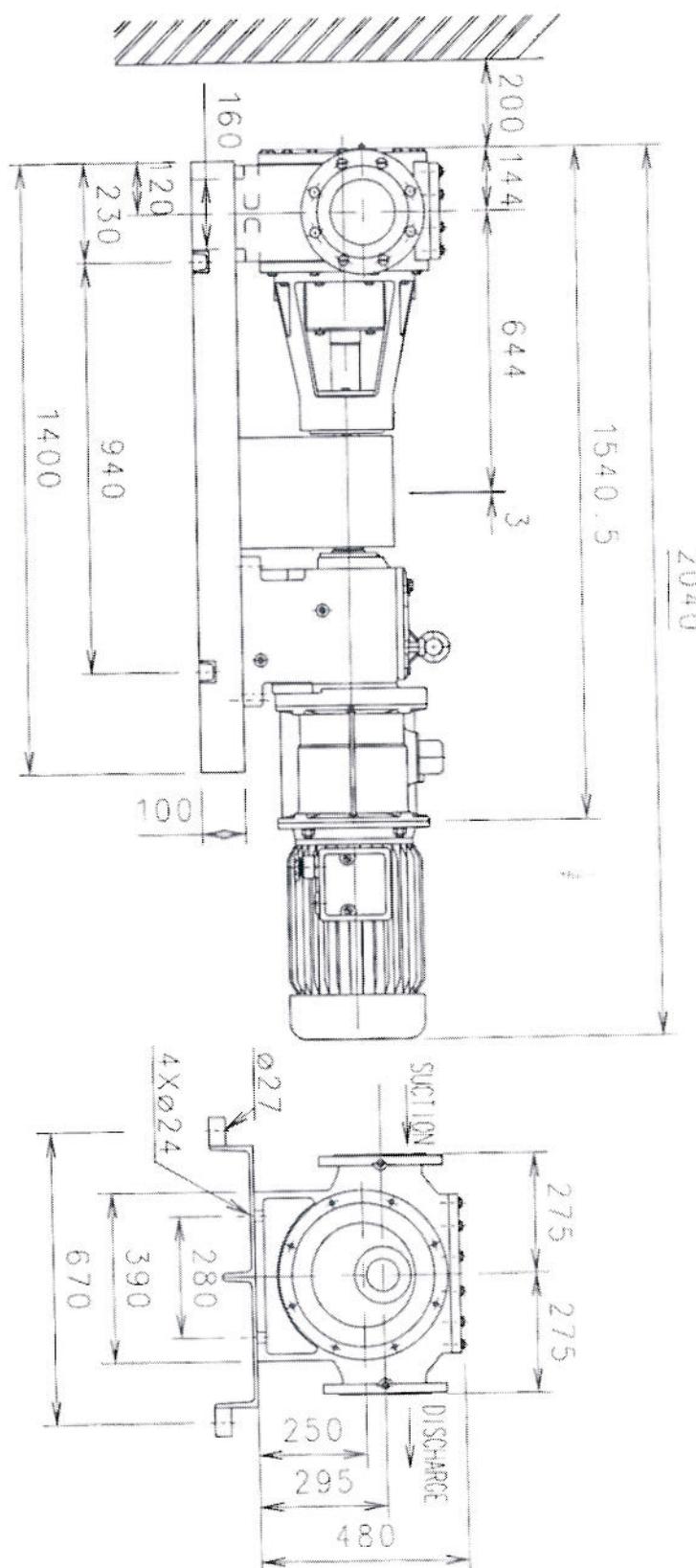
| GEAR/MOTOR | | | | | | DIMENSIONAL | | DRAWING | |
|--------------|--------|--------------|---------|------|-------|-------------|-------|---------|--|
| Order No.: | 120620 | CPL. | BASEPL. | BORE | OUTER | BCD | HOLEs | DD2084 | |
| Job | 2F11 | Sk62 IEC 180 | B-200 | 600K | ø150 | ø285 | ø240 | 8xø24 | |
| Item No.: | 63P2B | | | | | | | | |
| Total weight | 657 Kg | | | | | | | | |

DESMI A/S
P. O. Box 225
Tøndervej 1
DK-5400 Næstved, Denmark
Phone +45 96 32 81 11
Telefax +45 96 17 34 99
Web: <http://www.desmi.com>
E-mail: desmi@desmi.dk

Prepared by SD
Blad 1 af 1 blade
Dato 2012.06.08

Subject to alterations

CERTIFIED DRAWING / DIMENSION DA CONFERMARE

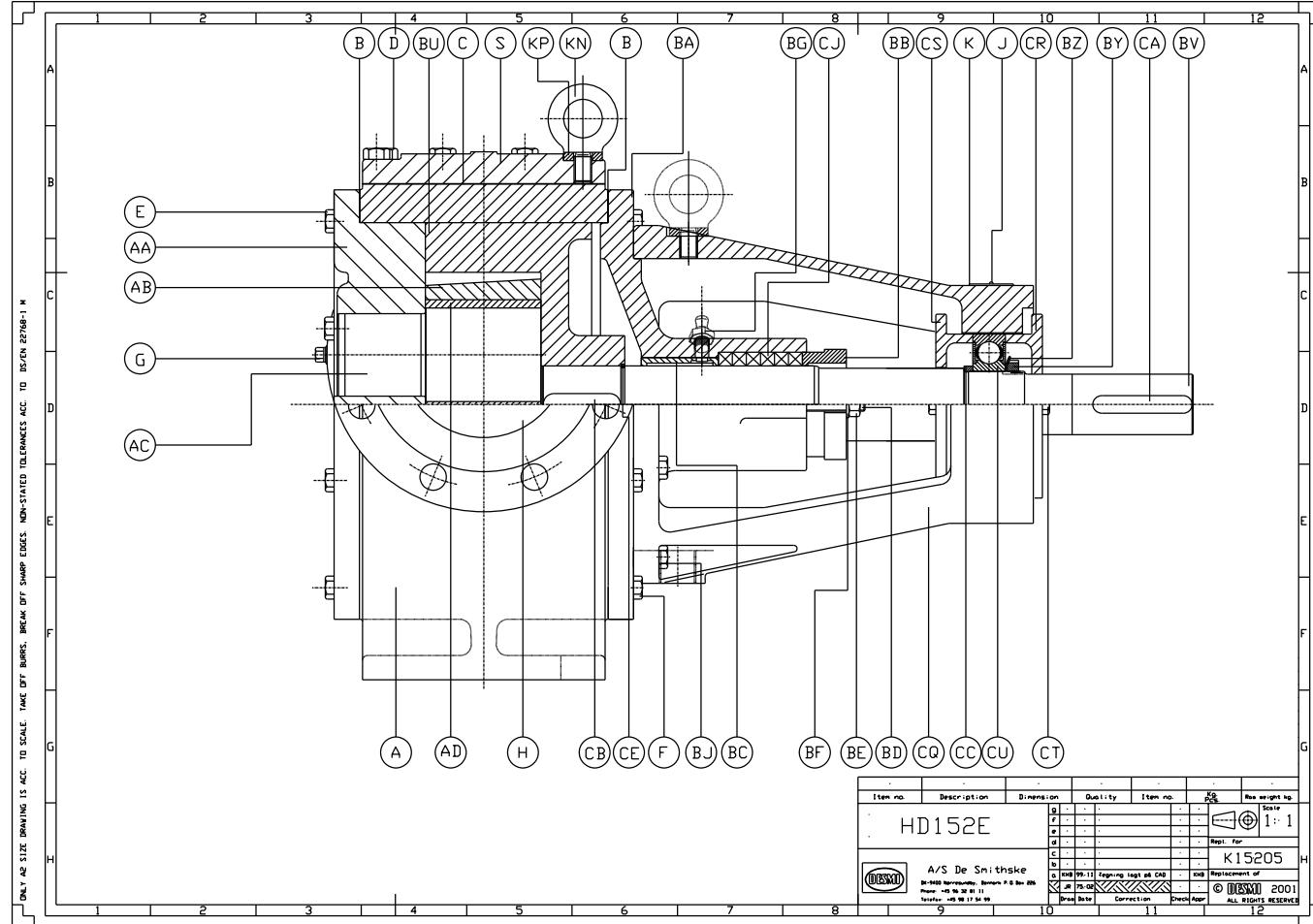


FLANGES

| Order No.: | 120620 | GEAR/MOTOR | CPL. | BASEPL. | BORE | OUTER | BCD | HOLeS |
|--------------|--------|---|---|---------------------|--------|------------------|---------------|------------------|
| Job | 2F11 | SK62 IEC 180 | B-200 | 600K | Ø150 | Ø285 | Ø240 | 8xØ24 |
| Item No.: | 63P2A | DESMI A/S | | | | | | |
| Total weight | 657 KG | P. O. Box 226 Torupminde 1 DK-9450 Hørresundby Denmark | Phone: +45 96 52 61 11 Telefax: +45 98 12 54 99 E-mail: http://www.desmi.com | DIMENSIONAL DRAWING | DD0503 | Blad 1 af 1 blad | Date 05.02.11 | Udstartet af RPK |
| | | | | HD 152 E | | | | |

Subject to alterations

ONLY A2 SIZE DRAWING IS ACC. TO SCALE. TAKE OFF BURRS, BREAK OFF SHARP EDGES. NEEN-STATED TOLERANCES ACC. TO DS/EN 23768-1 N



Sparepart list HD152ET-1U84BS CL150RF**Item no.: 8557,**

| Pos. No. | Quantity | Item no. | Description |
|-----------------|-----------------|-----------------|-------------------------------|
| | 1,00 | 8557 | HD152ET-1U84BS CL150RF |
| ..A. | 1,00 | 1152-001AE225 | |
| ..AA | 1,00 | 1152-002AE342 | AA FRONT COVER "GGG 40" |
| ..AB | 1,00 | 1152-005AE225 | AB IDLER / GG25 T=1 |
| ..AC | 1,00 | 1152-021EA804 | AC IDLER PIN "8" |
| ..AD | 1,00 | 0007-080AC804 | AD IDLER BUSH "T" "8" |
| ..B. | 2,00 | 0030-330DA904 | B GASKET |
| ..BA | 1,00 | 1152-003AA225 | BA REAR COVER |
| ..BB | 1,00 | 0006-070EA215 | BB GLAND |
| ..BC | 1,00 | 0008-070MB803 | M.BUSHING Ø70XØ85X70 |
| ..BD | 2,00 | 3008-130KA080 | STUD BOLT M12X130/STEEL |
| ..BE | 2,00 | 760279 | NUT M12/DIN934-8 |
| ..BF | 2,00 | 3030-000KA030 | WASHER Ø12/DIN125B-ST.50-2 |
| ..BG | 2,00 | 704000 | PLUG 1/4"KRG GG20 |
| ..BJ | 8,00 | 700312 | SCREW M10X35/DIN933-8.8 |
| ..BU | 1,00 | 1152-004AC225 | BU ROTOR T=1 GG25 |
| ..BV | 1,00 | 1152-020AC872 | BV SHAFT |
| ..BY | 1,00 | 701038 | LOCK NUT KM 12 |
| ..BZ | 1,00 | 701049 | LOCK WASHER MB12 |
| ..C. | 1,00 | 0031-365AA904 | C GASKET |
| ..CA | 1,00 | 3400-090KA030 | KEY A 16X10X90 ST60.11 |
| ..CB | 1,00 | 702134 | SUNK KEY A 20X12X70 ST.60.11 |
| ..CC | 1,00 | 0028-060KA035 | DISTANCE RING |
| ..CE | 1,00 | 3459-070EA104 | CE SNAP RING |
| ..CJ | 6,00 | 3360-260LA812 | PACKING 1/2"X260 |
| ..CQ | 1,00 | 0010-165AA220 | CQ BRACKET |
| ..CR | 1,00 | 0012-130RB215 | CS BEARING COVER |
| ..CS | 1,00 | 0012-130RA215 | CR BEARING COVER |
| ..CT | 4,00 | 700312 | SCREW M10X35/DIN933-8.8 |
| ..CU | 1,00 | 1838156 | CU BALL BEARING 6312 2RS1 |
| ..D. | 12,00 | 700319 | SET SCREWM12X40 ST.3.6 DIN558 |
| ..E. | 8,00 | 700319 | SET SCREWM12X40 ST.3.6 DIN558 |
| ..F. | 8,00 | 700319 | SET SCREWM12X40 ST.3.6 DIN558 |
| ..G. | 2,00 | 3110-001CA225 | PIPE PLUG 3/8"NPT / GG25 |
| ..H. | 2,00 | 3191-137AA860 | DUST CAP NO.137 |
| ..HD | 2,00 | 0068-165AA104 | GUARD FOR BEAR. BRAC. |
| ..HE | 8,00 | 703544 | E SCREW M6x25/DIN933-AISI316 |
| ..HF | 8,00 | 704389 | WASHER AM6 AISI316 DIN125A |
| ..HG | 1,00 | 0011-120AA020 | HG PLATE F. PIN |
| ..HH | 8,00 | 3006-012GA116 | U.SCREW M6 |
| ..HR | 1,00 | 0030-120DA906 | GASKET Ø120X1,5 C-4500 |
| ..J. | 2,00 | 709355 | SCREW Ø1,85 X 4,76 A2 |
| ..KN | 1,00 | 709050 | |
| ..KP | 1,00 | 0027-035AA116 | KP DISTANCE RING 35X17X7,5 |
| ..S. | 1,00 | 0040-365AB225 | |
| 0100 | 1,00 | 1152-002AB342 | AA F.COVER 1152-002AB342 |
| 0100 | 1,00 | 1152-005AA225 | AB IDLER |
| 0100 | 1,00 | 1152-004AA225 | BU ROTOR |



DESMI

Certificate of dimensional check.

Desmi Rotan confirm, that all relevant dimensions for the complete pump unit concerning -

Project:

Order Rotan no: 363758 (# Pump HD152ET-1U84BS CL150RF item 63P2A)

Is checked after assembling, and it is according to the delivered dimensional drawing with drawing number:

Order Desmet no. 120620 (2F11) Drawing no. DD0503

Date inspected

Inspected by

.....2012 06 11.....

DESMI PUMPING TECHNOLOGY A/S

DESMI Pumping Technology A/S
Tagholm 7
DK-9400 Norresundby
Denmark

Phone: +45 9632 8111
Fax: +45 9817 5499
E-mail: desmi@desmi.com
Internet: www.desmi.com

CVR No.: 19351211
VAT No.: DK46837150

PUMP TEST SHEET

Pump Type: HD152ET-1U84BS CL150RF I

Motor Type:

Pump No.: 363758101

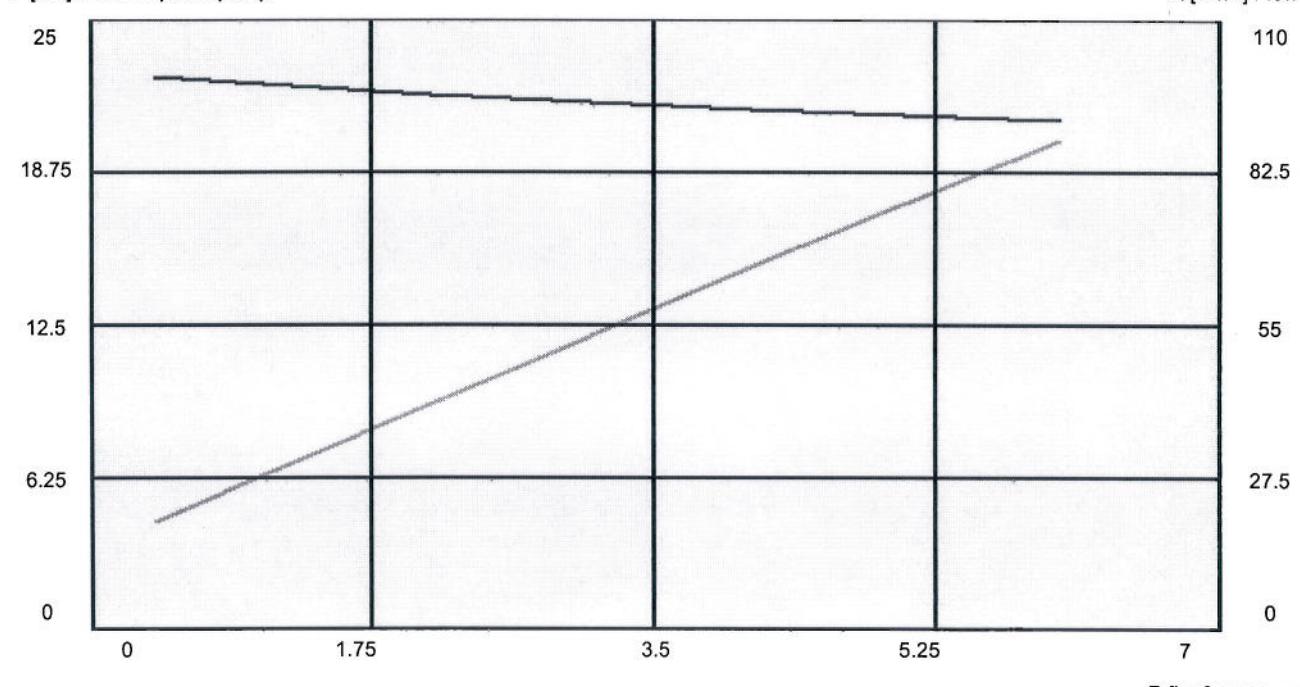
Output (kW):

Part List No.: 8557

Voltage (Volts):

Frequency (Hz):

P [kW] Power input to pump



Speed (RPM): 400 <= n <= 404

Flow measurement : _____

Testrig No.: 3

Effect measurement : _____

Test medium: Olie

Temperature (°C): 25.7

Viscosity (cSt): 53.7

Hydrostatic test

Pump (bar): 15

Heating jacket (bar): 0

Testdate : 2012 6 12

Signed :

PUMP TEST SHEET

Pump Type: HD152ET-1U84BS CL150RF I

Motor Type:

Pump No.: 363758102

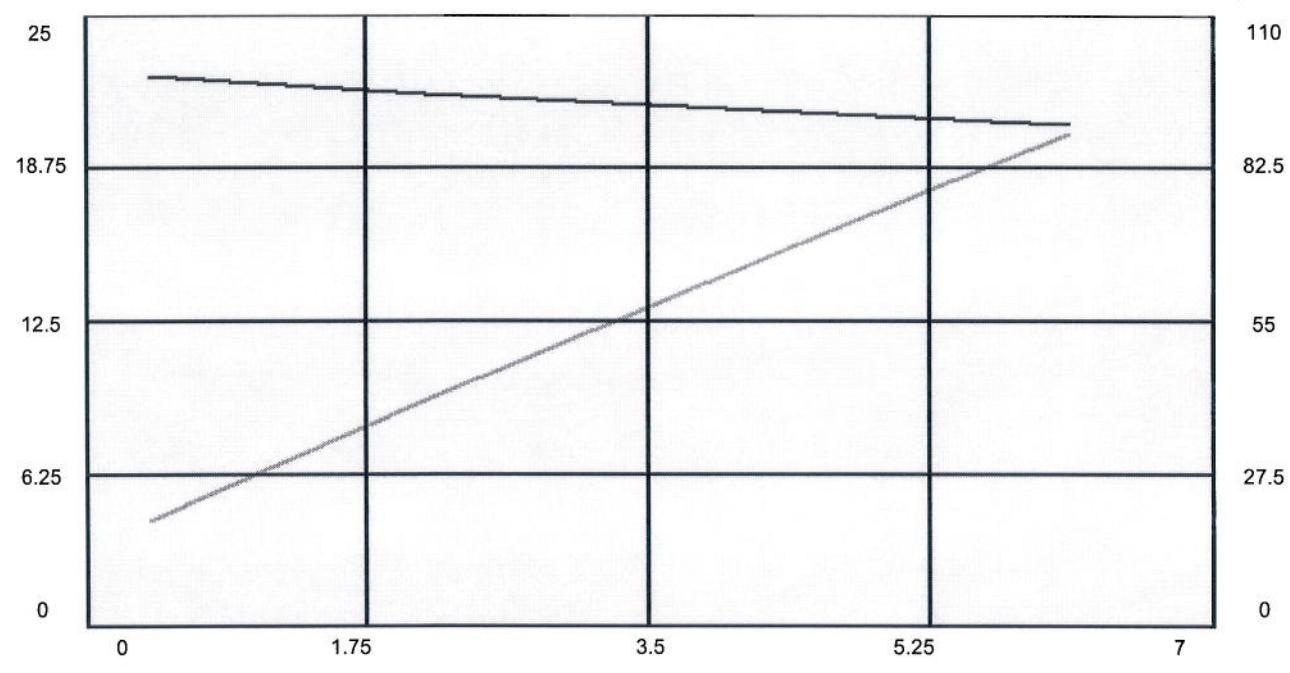
Output (kW):

Part List No.: 8557

Voltage (Volts):

Frequency (Hz):

P [kW] Power input to pump

Q [m³/h] Flow

Speed (RPM): 397 <= n <= 401

P [bar] pressure

Testrig No.: 3

Flow measurement :

Test medium: Olie

Effect measurement :

Temperature (°C): 24.9

Testdate : 2012 6 11

Viscosity (cSt): 55.5

Hydrostatic test

DESMI

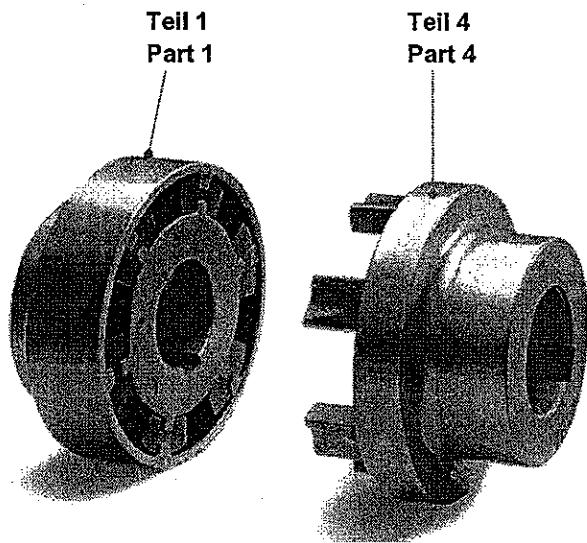
Pump (bar): 15

Signed :

Heating jacket (bar): 0

N-EUPEX - Kupplungen / Couplings

Bauart B / Type B



Bauart A / Type A

Aufteilung Teil 2 + 3:

Baugröße 110 - 200: Teil 2 = 50 % / Teil 3 = 50 %

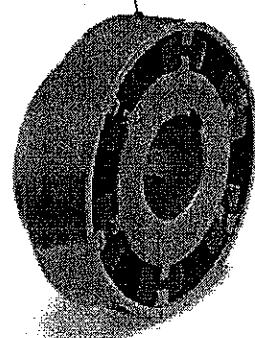
Baugröße 225 - 710: Teil 2 = 60 % / Teil 3 = 40 %

Division part 2 + 3

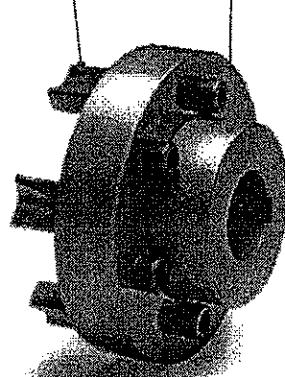
Size 110 - 200: Part 2 = 50 % / Part 3 = 50 %

Size 225 - 710: Part 2 = 60 % / Part 3 = 40 %

Teil 1
Part 1



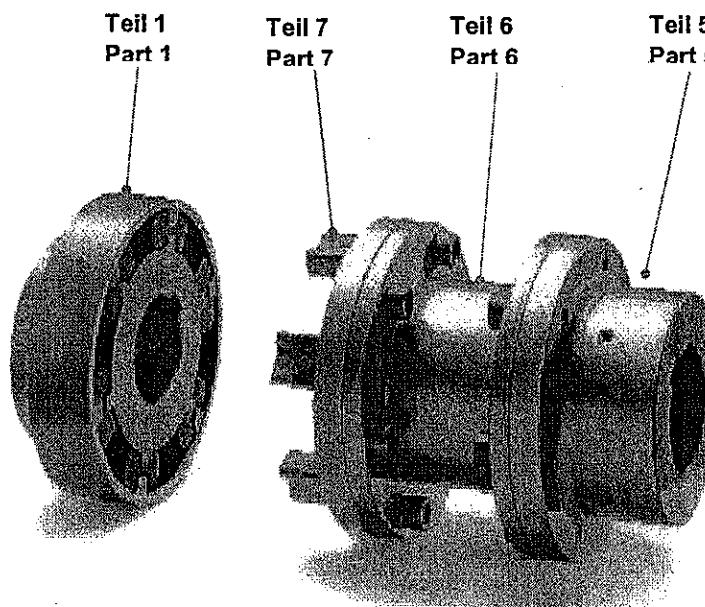
Teil 3
Part 3



Teil 2
Part 2



N-EUPEX - Kupplungen / Couplings Bauart H / Type H



N-EUPEX - Kupplungen / Couplings Bauart B / Type B

Standardbohrungen ab Lager • Standard bores from stock:

→ Sonstige Bohrung = zylindrische Bohrungsgrößen, die nicht in u.a. Tab. aufgeführt sind

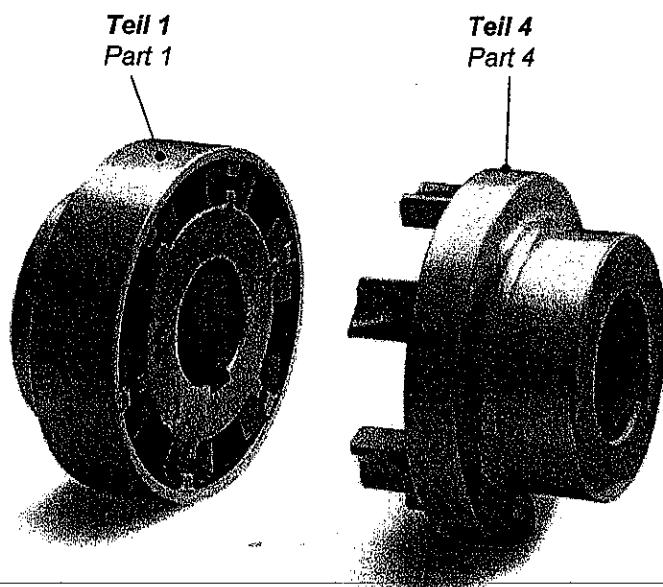
Other bore size = cylindrical bore sizes which are NOT listed below

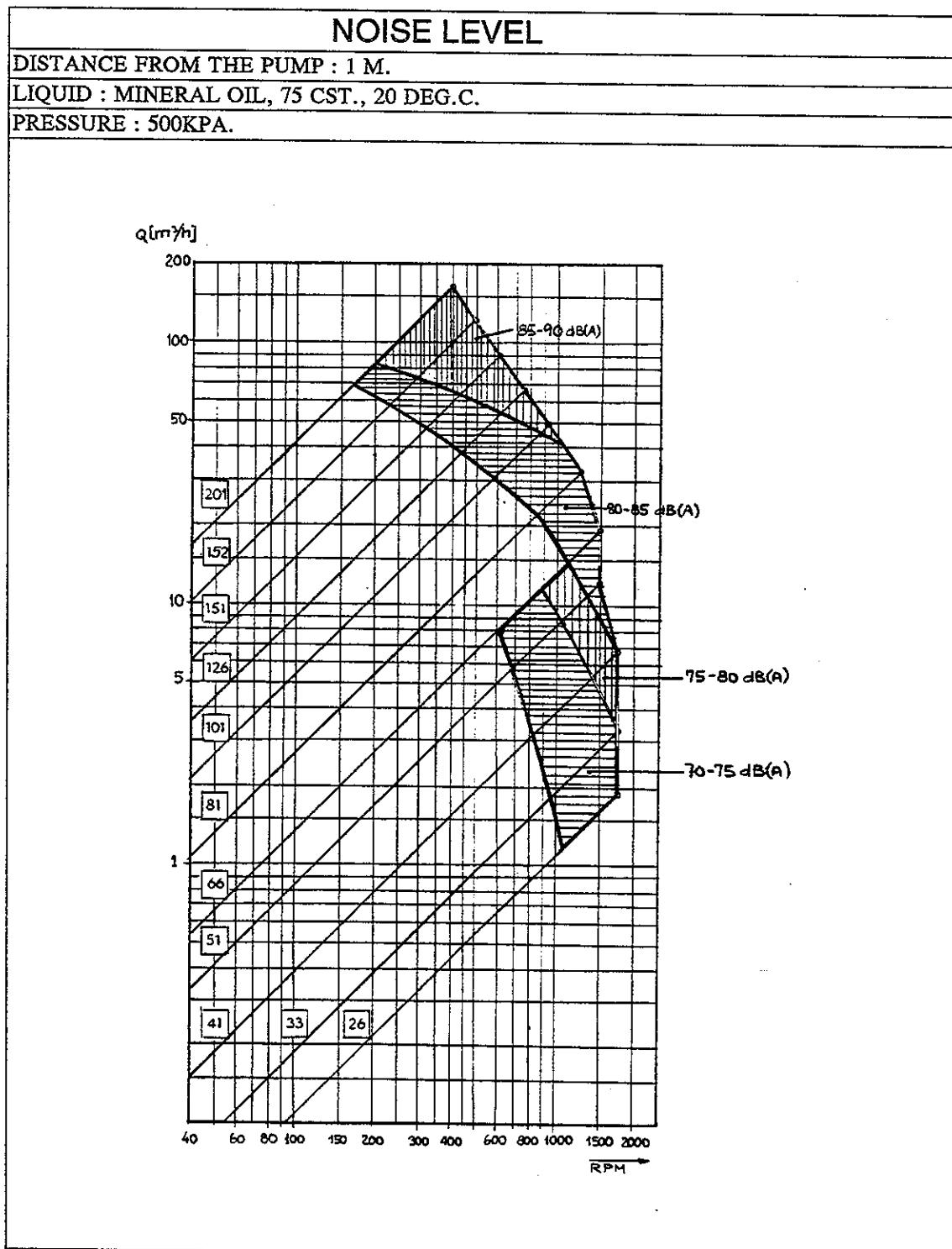
Bohrungstoleranzfeld ISO H7, Nut nach DIN 6885/1 • Nutbreitentoleranzfeld ISO JS9

Bore tolerance range to ISO H7, keyway to DIN 6885/1 • Keyway width tolerances to ISO JS9

→ Einzelteile Wuchtgüte G 6.3 bei $n = 3,000 \text{ min}^{-1}$ (bis Gr. 225) (Halbkeilprinzip)

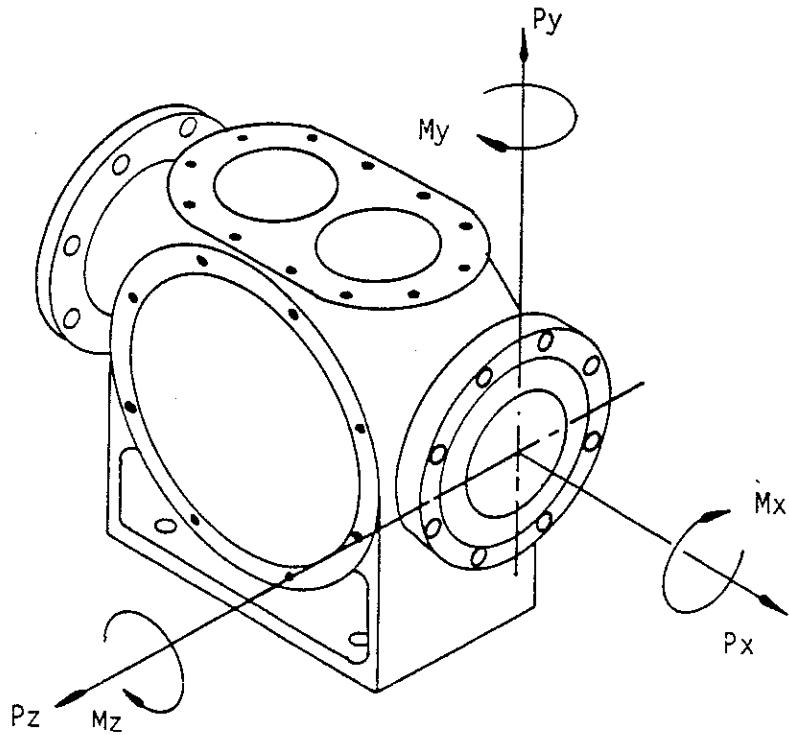
Single parts balancing quality G 6.3 at $n = 3,000 \text{ min}^{-1}$ up to Size 225 (half parallel key)





IMPORTANT:

THIS TABLE MAY ONLY BE USED TO GET AN INDICATION OF THE NOICE LEVEL.
THE REAL FIGURES CAN DIFFER FROM TIME TO TIME, DEPENDING OF THE BRAND
OF MOTOR, THE KIND OF FOUNDATION, AND THE INSTALLATION AREA.

T 1088
910101**ALLOWABLE FORCE AND TORQUE ON FLANGES**

| SIZE | FORCE IN N | | | TORQUE IN Nm | | |
|------|------------|------|------|--------------|------|------|
| | Px | Py | Pz | Mx | My | Mz |
| 26 | 630 | 460 | 350 | 28 | 45 | 50 |
| 33 | 630 | 460 | 350 | 28 | 45 | 50 |
| 41 | 1090 | 980 | 850 | 93 | 120 | 120 |
| 51 | 2180 | 1570 | 1390 | 175 | 260 | 275 |
| 66 | 2180 | 1570 | 1390 | 175 | 260 | 275 |
| 81 | 3400 | 2450 | 2160 | 330 | 500 | 520 |
| 101 | 3580 | 2580 | 2460 | 460 | 650 | 670 |
| 126 | 6450 | 5050 | 4070 | 950 | 1200 | 1500 |
| 151 | 7500 | 5600 | 4500 | 1200 | 1850 | 1950 |
| 152 | 11600 | 8250 | 6650 | 1950 | 3150 | 3450 |
| 201 | 10500 | 8400 | 6650 | 2450 | 3650 | 3850 |

MATERIAL CERTIFICATE

Certificate acc. to DS/EN 10204 2.2

Customer.....: Atlas Com. Industrial S.A.

Madrid, SPAIN

Customer Order No..... : 18448
Desmi Rotan Order No..... : 363758
Pump Type..... : HD152ET
Material Code..... : 1U84BS CL150RF
Serial No..... : 363758-1/2

Pump Materials.....:

| | |
|--------------------|----------------|
| Casing/covers..... | GG25 |
| Shaft..... | Cr-oxid belagt |
| Main bearing..... | Al. Oxid |
| Rotor..... | X8CrNiMo275 |
| Idler pin..... | Wolfram Carbid |
| Idler bearing..... | Wolfram Carbid |
| Idler | X8CrNiMo275 |

Hydrostatic Test Pressure..... :

Pump..... : 24 bar
Heating jacket..... : 0 bar

Classified by..... :

Test No..... :

Date/Signature..... :

Aalborg..... : 12-06-2012

Signature.....: Alfons Almdorff

DESMI Pumping Technology A/S

Tagholm 1

DK-9400 Nørresundby, Denmark

Phone: +45 96 32 81 11, Fax: +45 98 17 54 99

Homepage: www.desmi.com

E-mail: desmi@desmi.com



Quality control plan

QCP CO. 363758 - DESMET BALLESTRA SPA
type of pump and gear - (JOB NO. 2F11)

CERTIFIED BY BVQI
ISO 9001/2000

| Pos. | job. No. | applicable specification | checked by | | location | document/certificate |
|------|---|------------------------------|------------|----------|----------|----------------------|
| | | | ROTAN | Customer | | |
| 1 | review, order, specification | standard ROTAN | H | R | ROTAN | customer order/ROTAN |
| 2 | purchases | internal specification ROTAN | D | | ROTAN | customer order/ROTAN |
| 3 | material certificate > casing > idler > shaft > rotor > idler pin > idler bush > main bearing bush | internal specification ROTAN | D | R | ROTAN | certificate by ROTAN |
| 4 | Production check | internal specification ROTAN | D | | ROTAN | |
| 5 | hydrostatic test | internal specification ROTAN | H | R | ROTAN | certificate by ROTAN |
| 6 | performance test with noise test and dimensional visual check | internal specification ROTAN | H | R | ROTAN | certificate by ROTAN |
| 7 | final inspection > packing > marking | internal specification ROTAN | D | | ROTAN | |

H = critical point

D = IMPLEMENTATION

R = APPROVATION

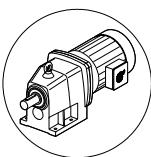
Intelligent Drivesystems, Worldwide Services



B1000

Operating and Assembly Instructions for
Gear Units and Geared Motors

NORD
DRIVESYSTEMS

| | | | |
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1. Notes



1. Notes

1.1 General information

Read the Operating Manual carefully prior to performing any work on or putting the gear unit into operation. Strict compliance with the instructions in this Operating Manual is essential. Getriebbau NORD accepts no liability for damage to persons, materials or assets as a result of the non-observance of this Operating Manual, operating errors or incorrect use. General wearing parts, e.g. radial seals are excluded from the warranty.

If additional components are attached to or installed in the gear unit (e.g. motor, cooling system, pressure sensor etc.) or components (e.g. cooling system) are supplied with the order, the operating instructions for these components must be observed.

If geared motors are used, compliance with the Motor Operating Manual is also necessary.

If you do not understand the contents of this Operating Manual or additional operating instructions, please consult Getriebbau NORD!

1.2 Safety and information symbols

Please always observe the following safety and information symbols!

| | |
|--|-------------------------------|
| | Danger! |
| | Risk of fatalities and injury |
| | Attention! |
| | Machine may be damaged |
| | Note! |
| | Useful information |

1.3 Correct use

These gear units generate a rotational movement and are intended for use in commercial systems. The gear unit must only be used according to the information in the technical documentation from Getriebbau NORD.

| | |
|--|--|
| | Danger! |
| | Use in explosion hazard areas is prohibited. |

Strict compliance with the technical data on the rating plate is essential.

The documentation must be observed.

Appropriate safety measures must be taken for applications where failure of a gear unit or geared motor may result in injury.



1.4 Safety information

All work including transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must be performed **only by qualified specialist personnel**. It is recommended that repairs to NORD Products are carried out by the NORD Service department.

| | |
|---|--|
|  | Danger! |
| | <p>Installation and maintenance work must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.</p> <p>Tighten the drive elements or secure the parallel key before switching on.</p> |

| | |
|---|--|
|  | Danger! |
| | <p>Only transport use the eyebolts attached to the gear unit. No additional loads may be attached. Transportation aids and lifting gear must have an adequate load-bearing capacity.</p> |

If geared motors have an additional eyebolt attached to the motor, this must also be used. Avoid pulling the eyebolts at an angle. The thread of the eyebolt must be fully screwed in.

Observe all safety information, including that provided in the individual sections of this Operating Manual. All national and other regulations on safety and accident prevention must also be observed.

| | |
|---|--|
|  | Danger! |
| | <p>Serious physical and property damage may result from inappropriate installation, non-designated use, incorrect operation, non-compliance with safety information, unauthorised removal of housing components or safety covers and structural modifications to the gear unit.</p> |



1. Notes



1.5 Other documents

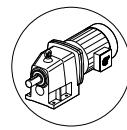
Further information may be obtained from the following documents:

- Gear unit catalogues (G1000, G2000, G1011, G1012, G1034, G1035)
- Operating and maintenance instructions for the electric motor
- if applicable, operating instructions for attached or supplied options

1.6 Disposal

Observe the current local regulations. In particular, lubricants must be collected and disposed of correctly.

| Gear unit components: | Material: |
|--|--------------------------------|
| Toothed wheels, shafts, rolling bearings, parallel keys, locking rings, ... | Steel |
| Gear unit housing, housing components, ... | Grey cast iron |
| Light alloy gear unit housing, light alloy gear unit housing components, ... | Aluminium |
| Worm gears, bushes, ... | Bronze |
| Radial seals, sealing caps, rubber components,... | Elastomers with steel |
| Coupling components | Plastic with steel |
| Flat seals | Asbestos-free sealing material |
| Gear oil | Additive mineral oil |
| Synthetic gear oil (rating plate code: CLP PG) | Polyglycol-based lubricants |
| Cooling spiral, embedding material of the cooling spiral, screw fittings | Copper, epoxy, yellow brass |

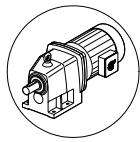


2. Description of gear units

2.1 Type designations and gear unit types

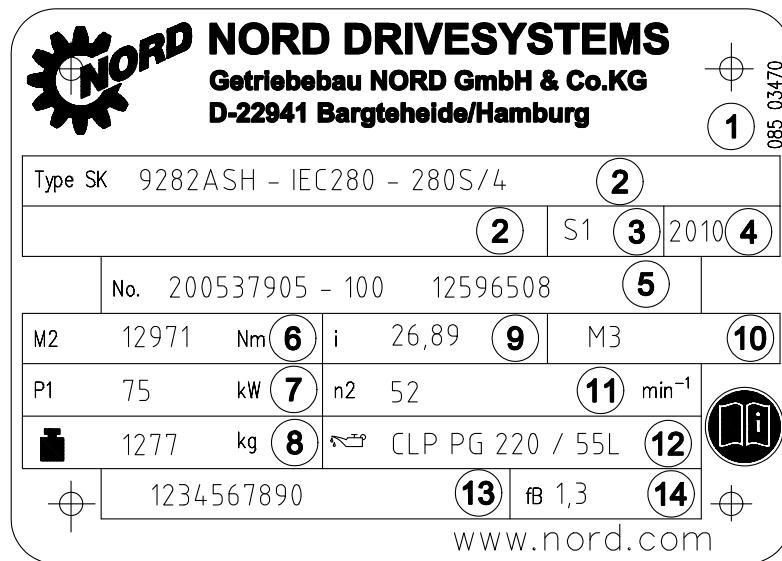
| <u>Helical gear units</u> | <u>Versions / Options</u> |
|---|---|
| SK 11E, SK 21E, SK 31E, SK 41E, SK 51E (single-stage) SK 02, SK 12, SK 22, SK 32, SK 42, SK 52, SK 62N (2-stage) | - Foot mounting with solid shaft |
| SK 03, SK 13, SK 23, SK 33N, SK 43, SK 53 (3-stage) SK 62, SK 72, SK 82, SK 92, SK 102 (2-stage) SK 63, SK 73, SK 83, SK 93, SK 103 (3-stage) | A Hollow shaft version |
| NORDBLOC helical gear units | V Solid shaft version |
| SK 320, SK 172, SK 272, SK 372, SK 472, SK 572, SK 672, SK 772, SK 872, SK 972 (2-stage) | L Solid shaft both sides |
| SK 273, SK 373, SK 473, SK 573, SK 673, SK 773, SK 873, SK 973 (3-stage) | Z Drive flange B14 |
| SK 072.1, SK 172.1, SK 372.1, SK 572.1, SK 672.1, SK 772.1 SK 872.1, SK 972.1 (2-stage) | F Output flange B5 |
| SK 373.1, SK 573.1, SK 673.1, SK 773.1, SK 873.1, SK 973.1 (3-stage) | X Foot mounting |
| Standard helical gear units | XZ Base and output flange B14 |
| SK 0, SK 01, SK 20, SK 25, SK 30, SK 33 (2-stage) SK 010, SK 200, SK 250, SK 300, SK 330 (3-stage) | XF Base and output flange B5 |
| Parallel shaft gear units | AL Reinforced axial drive bearings |
| SK 0182NB, SK 0282NB, SK 1282, SK 2282, SK 3282, SK 4282, SK 5282, SK 6282, SK 7282, SK 8282, SK 9282, SK 10282, SK 11282 (2-stage) | 5 Reinforced output shaft (Standard helical gear unit) |
| SK 1382NB, SK 2382, SK 3382, SK 4382, SK 5382, SK 6382, SK 7382, SK 8382, SK 9382, SK 10382, SK 11382, SK 12382 (3-stage) | V Reinforced drive shaft (Standard helical gear unit) |
| Bevel gear units | D Torque support |
| SK 92072, SK 92172, SK 92372, SK 92672, SK 92772 (2-stage) | K Torque console |
| SK 9012.1, SK 9016.1, SK 9022.1, SK 9032.1, SK 9042.1, SK 9052.1, SK 9062.1, SK 9072.1, SK 9082.1, SK 9086.1, SK 9092.1, SK 9096.1 (3-stage) | S Shrink disc |
| SK 9013.1, SK 9017.1, SK 9023.1, SK 9033.1, SK 9043.1, SK 9053.1 (4-stage) | VS Reinforced shrink disc |
| Contrate worm gear unit | EA Hollow shaft with internal spline |
| SK 02040, SK 02050, SK 12063, SK 12080, SK 32100, SK 42125 (2-stage) | G Rubber buffer |
| SK 13050, SK 13063, SK 13080, SK 33100, SK 43125 (3-stage) | VG Reinforced rubber buffer |
| MINIBLOC worm gear units | R Back stop |
| SK1 S32, SK1 S40, SK 1S50, SK 1S63, SK 1SU... SK 1SM31, SK 1SM40, SK 1SM50, SK 1SM63 (single-stage) SK 2S32NB, SK 2S40NB, SK 2S50NB, SK 2S63NB, SK 2SU..., SK 2SM40, SK 2SM50, SK 2SM63 (2-stage) | B Fixing element |
| UNIVERSAL worm gear units | H Covering cap as contact guard |
| SK 1SI31, SK 1SI40, SK 1SI50, SK 1SI63, SK 1SI75, SK 1SIS31, ..., SK 1SIS75, SK 1SD31, SK 1SD40, SK 1SD50, SK 1SD63, SK 1SIS-D31, ..., SK 1SIS-D63 (single-stage) | H66 Covering cap IP66 |
| SK 2SD40, SK 2SD50, SK 2SD63, SK 1SI.../31, SK 1SI.../H10, SK 2SIS-D40, ..., SK 2SIS-D63 (2-stage) | VL Reinforced bearings |
| | VL2 Agitator design |
| | VL3 Drywell agitator design |
| | IEC Standard motor mounting |
| | NEMA Standard motor mounting |
| | W With free drive shaft |
| | VI Viton radial seals |
| | OA Oil expansion vessel |
| | OT Oil level tank |
| | SO1 Synthetic oil ISO VG 220 |
| | CC Casing cover with cooling spiral |
| | DR Spring Loaded Breather |
| | H10 Modular contrate pre-stage |
| | /31 Worm pre-stage |
| | /40 Worm pre-stage |

Double gear units consist of two single gear units. They are to be treated as per the instructions in this Manual, i.e. as two individual gear units. Type designation of double gear units: e.g. SK 73/22 (consisting of single gears SK 73 and SK 22)



2. Description of Gear Units

2.2 Name plate



Explanation of the Name Plate

- 1 Matrix – Barcode
- 2 NORD gear unit type
- 3 Operating mode
- 4 Year of manufacture
- 5 Serial number
- 6 Rated torque of gear unit output shaft
- 7 Drive power
- 8 Weight according to ordered version
- 9 Overall gear unit ratio
- 10 Installation orientation
- 11 Rated speed of gear unit output shaft
- 12 Lubricant type, viscosity and quantity
- 13 Customer's part number
- 14 Operating factor



3. Assembly instructions, storage, preparation, installation



3. Assembly instructions, storage, preparation, installation

Please observe all of the general safety information in Section 1.4, 1.3 and in the individual sections.

3.1 Storing the gear unit

For short-term storage before commissioning, please observe the following:

- Store in the fitting position (see Section 6.1) and secure gear units against falling
- Lightly grease bare metal housing surfaces and shafts
- Store in dry rooms
- Temperature must not fluctuate beyond the range of -5°C to $+40^{\circ}\text{C}$
- Relative humidity less than 60%
- No direct exposure to sunlight or UV light
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity
- No vibration or oscillation

3.2 Long-term storage

|  | Note! |
|--|--|
| | For storage or standstill periods in excess of 9 months, Getriebbau NORD recommends the long-term storage option. With the long-term storage option and the use of the measures listed below, storage for up to 2 years is possible. As the actual influences on the unit greatly depend on the local conditions, these times should only be regarded as guide values. |

Conditions of the gear unit and storage area for long-term storage prior to commissioning:

- Store in the fitting position (see Section 6.1) and secure gear units against falling
- Transportation damage to the external paint must be repaired. Check that a suitable rust inhibitor is applied to the flange bearing surfaces. If necessary apply a suitable rust inhibitor to the surfaces.
- Gear units with the long-term storage option are completely filled with lubricant or have VCI corrosion protection agents added to the gear oil. (See label on gear unit)
- The sealing band in the vent plug must not be removed during storage. The gear unit must remain sealed tight.
- Store in a dry place.
- In tropical regions, the drive unit must be protected against damage by insects
- Temperature must not fluctuate beyond the range of -5°C to $+40^{\circ}\text{C}$
- Relative humidity less than 60%
- No direct exposure to sunlight or UV light
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity
- No vibration or oscillation

Measures during storage or standstill periods

- If the relative humidity is <50% the gear unit can be stored for up to 3 years.

Measures before commissioning

- If the storage or standstill period exceeds 2 years or the temperature during short-term storage greatly deviates from the standard range, the lubricant in the gear unit must be replaced before commissioning.
- If the gear unit is completely filled, the oil level must be reduced before commissioning.



3. Assembly instructions, storage, preparation, installation



3.3 Transporting the gear unit

| | |
|---|----------------|
| | Danger! |
| To prevent injury, the danger area must be generously cordoned off . Standing under the gear unit during transport is extremely dangerous . | |

| | |
|---|-------------------|
| | Attention! |
| Avoid damage to the gear unit. Impacts to the free ends of the shafts may cause internal damage to the gear unit. Use adequately dimensioned and suitable means of transportation . Lifting tackle must be designed for the weight of the gear unit. The weight of the gear unit can be obtained from the dispatch documents. | |

3.4 Preparing for installation

The drive unit must be inspected and may only be installed if no transportation damage or leaks are visible. In particular the radial seals and the sealing caps must be inspected for damage.

All bare metal surfaces and shafts of the gear unit are protected against corrosion with oil, grease or corrosion protection agents before shipping.

Thoroughly remove all oil, grease or corrosion protection agents and any dirt from the shafts and flange surfaces before assembly.

In applications where an incorrect rotational direction may result in damage or potential risk, the correct rotational direction of the drive shaft is to be established by test running the drive when uncoupled and guaranteeing such for subsequent operation.

Gears with integrated return stops are marked with arrows on the driven/driving sides. The arrows point in the rotation direction of the gear unit. It must be ensured, when connecting the motor and during motor control, that the gear unit can only operate in the rotation direction, e.g. by means of a rotary field test. (For further details, please refer to Catalogue G1000 and WN 0-000 40)

| | |
|--|-------------------|
| | Attention! |
| With gear units with an integrated back stop, switching the drive motor to the blocked rotation direction, i.e. incorrect rotation direction, can lead to gear damage. | |

Ensure that no aggressive or corrosive substances are present in the area surrounding the installation site or are subsequently expected during operation, which attack metal, lubricants or elastomers. In case of doubt, please contact Getriebbau NORD and take the recommended action.

Oil expansion tanks (Option OA) must be fitted in accordance with the attached works standard WN 0-530 04. For gear units with an M10x1 vent plug, works standard WN 0-52135 must be observed.

Oil storage tanks (Option OT) must be fitted in accordance with the attached works standard WN 0-521 30.

If venting of the gear unit is provided, the vent or the pressure vent must be activated before commissioning. To activate, remove the transport securing devices (sealing cord). Position of the vent plug: see Section 6.1.

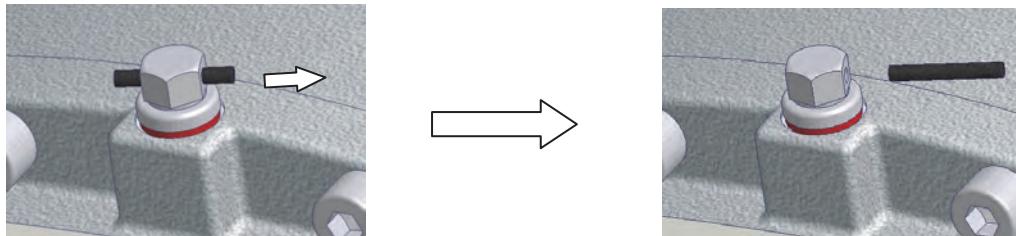


Figure 3-1: Activating the vent plug

Special pressure vents are supplied as loose parts. Before commissioning, the vent plug must be replaced with the pressure vent which is supplied as a loose part. This is achieved by screwing out the vent fitting and replacing it with the pressure vent and seal (refer to Section 6.2 for torque values). Double gear units consist of two single units and are equipped with 2 oil chambers and 2 pressure vents.

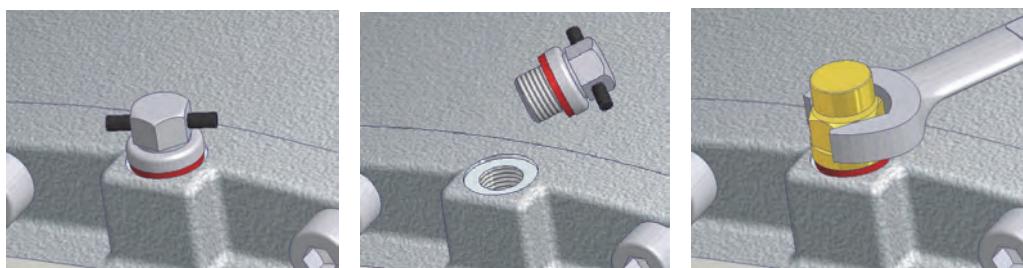


Figure 3-2: Removing vent plug and fitting the pressure vent

3.5 Installing the gear unit

The eyebolts screwed into the gear units must be used during installation. The safety notes in Section 1.4 must be observed.

The base and/or flange to which the gear unit is fitted should be vibration-free, torsionally strong and flat. The smoothness of the mating surface on the base or flange must be according to tolerance class K of DIN ISO 2768-2. All contamination to the bolting surfaces of gear unit and base and/or flange must be thoroughly removed.

The gear unit must be precisely aligned with the drive shaft of the machine in order to prevent additional forces from being imposed on the gear unit due to tension.

Welding of the gear unit is prohibited. The gear unit must not be used as the earth connection for welding work, as this may cause damage to the bearings and gear wheels.



3. Assembly instructions, storage, preparation, installation



The gear unit must be installed in the correct configuration (see Section 6.1) (UNIVERSAL gear unit types SI and SIS are independent of the configuration). Changes to the installation position after delivery require adjustment of the quantity of oil, and often other measures such as e.g. the installation of encapsulated roller bearings. Damage may result if the stated installation position is not observed.

All gear unit feet and/or all flange bolts on each side must be used. Bolts must have a minimum quality of 8.8. The bolts must be tightened to the correct torques (refer to Section 6.2 for torque values). Tension-free bolting must be ensured, particularly for gear units with a foot and flange.

| | |
|--|---|
| | Danger! |
| | To ensure that the gearbox does not get too warm and to avoid injury to persons, observe the following during installation: <ul style="list-style-type: none">• The surfaces of gear units or geared motors may become hot during or shortly after operation. Attention: danger of burns!! Protection against accidental contact may need to be installed.• With geared motors, the cooling air of the motor fan must be able to flow unobstructed onto the gear unit. |

3.6 Fitting hubs on the gear shafts

| | |
|--|---|
| | Attention! |
| | Do not subject the gear unit to harmful axial forces when fitting the hubs. |

Drive and driven elements, e.g. coupling and chain-wheel hubs must be mounted onto the drive and driven shaft of the gear unit using suitable pullers that will not apply damaging axial forces onto the gear unit. In particular, do not hit the hubs with a hammer.

Use the end thread of the shafts for pulling. Fitting can be aided by coating the hub with lubricant or heating it up to approx. 100°C beforehand.

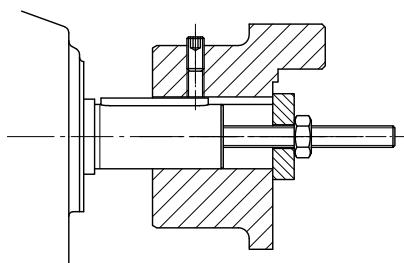


Figure 3-3: Example of a simple pulling device

| | |
|--|---|
| | Danger! |
| | Drive and driven elements, such as belt drives, chain drives and couplings must be fitted with contact protection. |

Driven elements may only subject the drive units to the maximum radial force F_R and axial force F_A as specified in the catalogue. Observe the correct tension, particularly on belts and chains. Additional loads due to unbalanced hubs are not permitted. The radial force must be applied to the gear unit as closely as possible.



3.7 Fitting push-on gear units

| | |
|--|-------------------|
| | Attention! |
| The bearings, gear wheels, shafts and housing may be damaged by incorrect fitting. | |

The push-on gear unit must be fitted onto the shaft using a suitable puller, which will not exert damaging axial forces on the gear unit. In particular, do not hit the gear unit with a hammer.

Assembly and subsequent dismantling is aided by applying an anti-corrosive lubricant to the shaft before fitting.

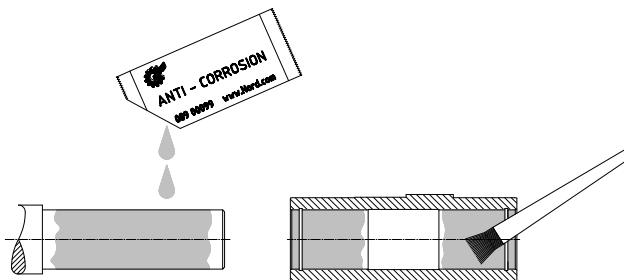


Figure 3-4: Applying lubricant to the shaft and the hub

| | |
|--|--------------|
| | Note! |
| The gear unit can be fitted to shafts with and without a shoulder using the fastening element (Option B). Tighten the bolt of the fastening element to the correct torque. (See Chapter 6.2 for torque values) For gear units with option H66, the factory-fitted closing cap must be removed before assembly. | |

For shaft mounted gear units with option H66 and fastening element (Option B) the pressed-in closing cap must be pushed out before fitting the gear unit. The pressed-in closing cap may be destroyed during dismantling. As standard a second closing cap is supplied as a loose spare part. After fitting the gear unit, fit the new / new condition closing cap as described in Section 3.11.

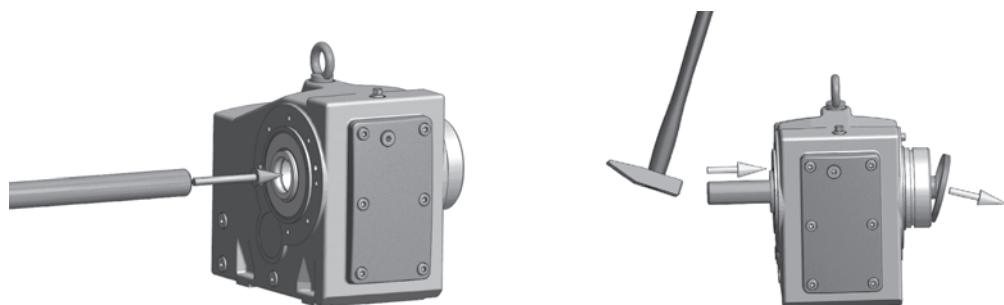


Figure 3-5: Removing the factory-fitted closing cap



3. Assembly instructions, storage, preparation, installation

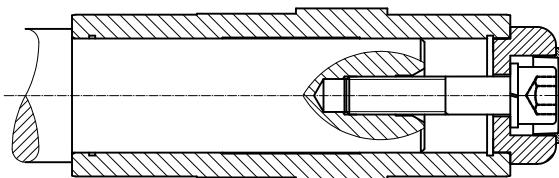


Figure 3-6: Gear unit mounted to shaft with a shoulder using the fastening element

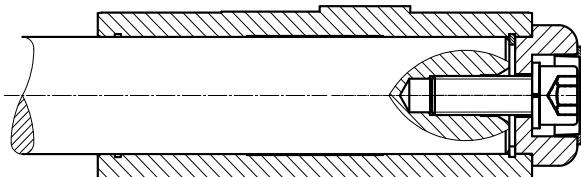


Figure 3-7: Gear unit mounted to shaft without a shoulder using the fastening element

A gear unit can be dismantled from a shaft with shoulder using the following device, for example.

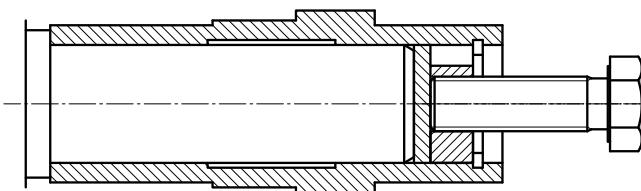


Figure 3-8: Dismantling using dismantling device

When mounting push-on gears with torque supports, the support must not be distorted. Tension-free mounting is aided by the rubber buffer (Option G and/or VG).

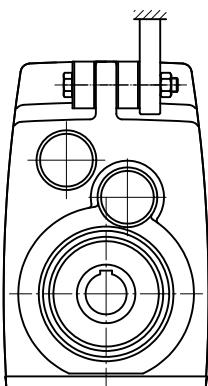


Figure 3-9: Mounting the rubber buffer (Option G and/or VG) on parallel shaft gear units

To fit the rubber buffer, tighten the screw fastening until there is no play between the contact surfaces when there is no load. Then turn the fastening nut (only applies for screw fastenings with adjusting threads) half a turn in order to pre-tension the rubber buffer. Greater pre-tension is not permissible. Secure the screw fastening from coming loose, e.g. with Loctite 242 or a second nut.

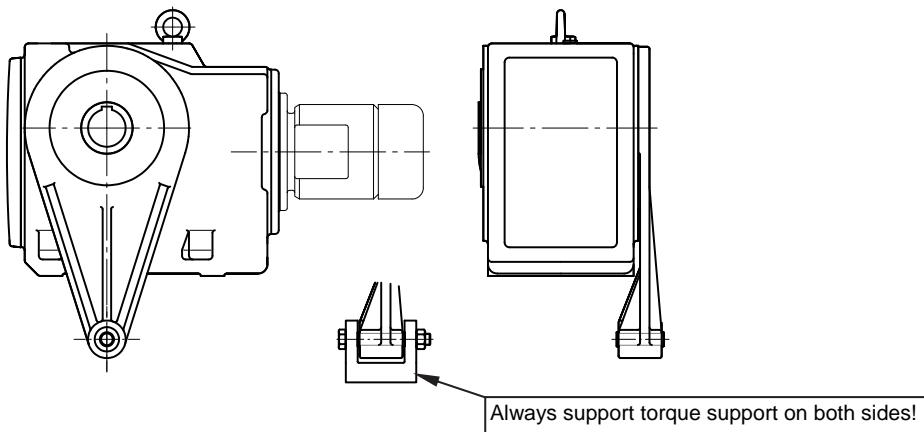


Figure 3-10: Attaching the torque support on bevel gear and worm gear units

Tighten the bolts on the torque support to the correct torque (see Section 6.2 for torque values) and secure to prevent loosening (e.g. Loctite 242, Loxeal 54-03).

3.8 Fitting shrink discs

Shrink disc type, Mat. No.
and torque details for tensioning screws

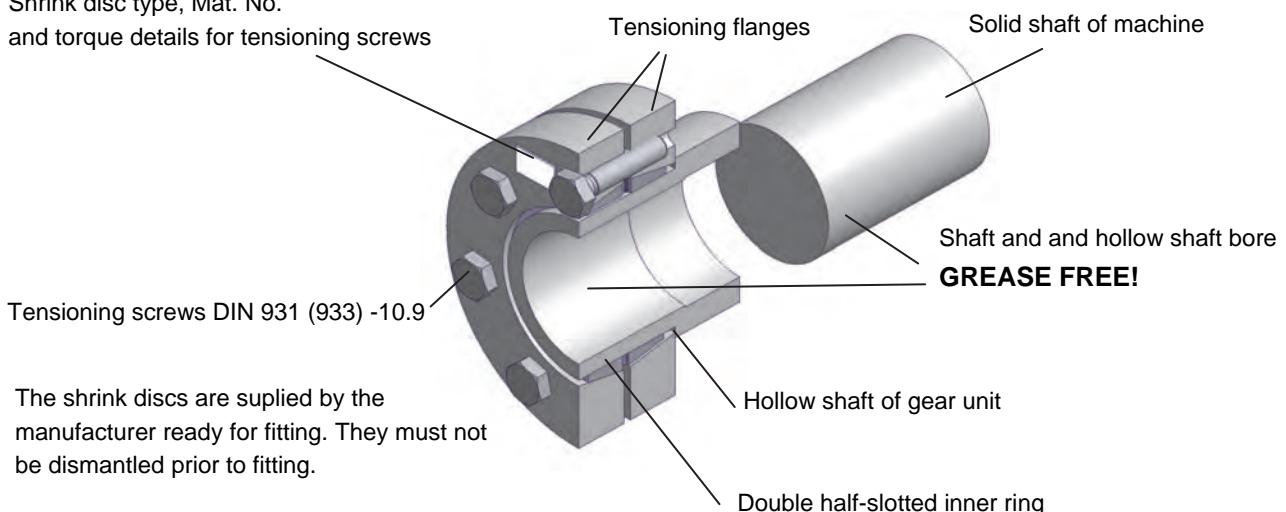


Figure 3-11: Hollow shaft with shrink disc

| | |
|--|---|
| | Attention! |
| | Do not tighten bolts if the solid shaft is not inserted! |

Assembly sequence:

1. Remove any transport securing devices.
2. Loosen but do not remove tightening bolt and tighten gently by hand until there is no play between the flanges and the inner ring.



3. Assembly instructions, storage, preparation, installation



3. Slide the shrink disc onto the hollow shaft until the outer clamping flange is flush with the hollow shaft. The shrink disc is easier to slide on if the bore of the inner ring is lightly greased.
4. Prior to mounting, grease the solid shaft only in the area which will later come into contact with the bronze bush in the hollow shaft of the gear unit. Do not grease the bronze bush, in order to prevent grease penetrating the area around the shrink connection.
5. The hollow shaft of the gear unit must be completely de-greased and **completely free of grease**.
6. In the area of the shrink connection the solid shaft of the machine must be degreased and **completely free of grease**.
7. Insert the solid shaft of the machine into the hollow shaft so as to completely fill the area around the shrink connection.
8. Position the clamping flange by gently tightening the bolts.
9. Tighten the bolts successively in a clockwise direction by several turns – not crosswise – with approx. $\frac{1}{4}$ rotation per turn. Tighten the bolts with a torque wrench to the torque indicated on the shrink disc.
10. When the tensioning bolts have been tightened, there must be an even gap between the clamping flanges. If this is not the case, the gear unit must be dismantled and the shrink disc connection checked for correct fit.

| | |
|---|----------------|
| | Danger! |
| Risk of injury from incorrect mounting and dismantling of the shrink disc. | |

Dismantling sequence:

1. Loosen the bolts successively in a clockwise direction by several turns with approx. $\frac{1}{4}$ rotation per turn. Do not remove the bolts from their thread.
2. Loosen the clamping flanges from the cone of the inner ring.
3. Remove the gear unit from the solid shaft of the machine.

3.9 Fitting the covers

| | |
|--|----------------|
| | Danger! |
| Shrink discs and exposed rotating shaft ends require contact guards in order to prevent injuries. A cover (Option H and Option H66) can be used as a guard. If this does not achieve sufficient protection against contact according to the required protection type, the machinery and plant constructor must ensure this be means of special attached components. | |

All fixing screws must be used and tightened to the correct torque. (See Section 6.2 for torque values) For covers with option H66, press in the new / new condition closing cap by tapping it lightly with a hammer.



Figure 3-12: Fitting the covers, Option SH, Option H, and Option H66

3.10 Fitting a standard motor

The maximum permitted motor weights indicated in the table below must not be exceeded when attaching the motor to an IEC- / NEMA adapter

| Maximum permitted motor weights | | | | | | | | | | | | | | |
|---------------------------------|----|-----|------|------|------|------|------|------|------|------|------|------|------|------|
| IEC motor size | 63 | 71 | 80 | 90 | 100 | 112 | 132 | 160 | 180 | 200 | 225 | 250 | 280 | 315 |
| NEMA Motor size | | 56C | 143T | 145T | 182T | 184T | 210T | 250T | 280T | 324T | 326T | 365T | | |
| Max. motor weight [kg] | 25 | 30 | 40 | 50 | 60 | 80 | 100 | 200 | 250 | 350 | 500 | 700 | 1000 | 1500 |

Assembly procedure to attach a standard motor to the IEC adapter (Option IEC)/NEMA adapter

1. Clean motor shaft and flange surfaces of motor and IEC /NEMA adapter and check for damage. Mounting dimensions and tolerances of the motor must conform to DIN EN 50347/NEMA MG1 Part 4.
2. Push the coupling sleeve onto the motor shaft so that the motor parallel key engages into the groove in the sleeve on tightening.
3. Tighten the coupling sleeve on the motor shaft in accordance with the motor manufacturer's instructions until it touches the collar. With motor sizes 160, 180 and 225, any spacer bushes must be positioned between the coupling sleeve and the collar. With standard helical gear units, dimension B between the coupling sleeve and the collar must be observed (see Figure 3-13). Certain **NEMA adapters** require the adjustment of the coupling in accordance with the specifications indicated on the adhesive plate.
4. Secure the coupling half with the threaded pin. The threaded pin must be coated prior to use with a securing lubricant e.g. Loctite 242, Loxeal 54-03 and tightened to the correct torque. (See Chapter 6.2 for torque values)
5. Sealing of the flange surfaces of the motor and the IEC /NEMA adapter is recommended if the motor is installed outdoors or in a humid environment. **The flange surfaces** of motor and adapter must be completely coated with **surface sealant** Loctite 574 or Loxeal 58-14 prior to mounting so that the flange seals after mounting.
6. Mount the motor to the IEC /NEMA adapter, do not forget to fit the gear rim or the sleeve. (See Figure 3-13)
7. Tighten the IEC /NEMA adapter bolts to the correct torque. (See Chapter 6.2 for torque values)



3. Assembly instructions, storage, preparation, installation

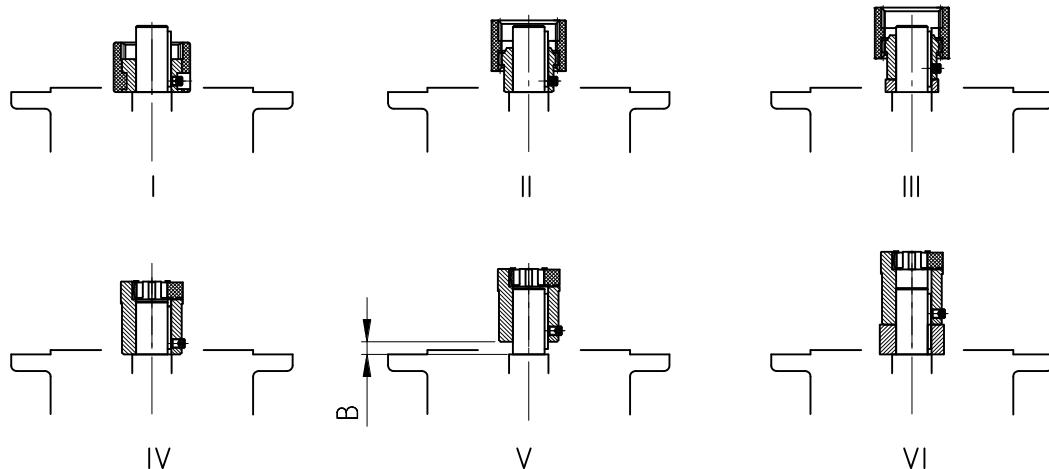


Figure 3-13: Fitting the coupling onto the motor shaft - various types of coupling

- I Gear coupling, one-part
- II Gear coupling, two-part
- III Gear coupling, two-part with spacer bush
- IV Claw coupling, two-part
- V Claw coupling, two-part, observe dimension B:

Standard helical gear unit: SK0, SK01, SK20, SK25, SK30, SK33 (2-stage)
SK010, SK200, SK250, SK300, SK330 (3-stage)

| | IEC size 63 | IEC size 71 |
|--------------------------|-------------|-------------|
| Dimension B (Fig. 3-13V) | B = 4.5mm | B = 11.5 mm |

- VI Claw coupling, two-part with spacer bush

3.11 Retrospective paintwork

| | |
|--|--|
| | Attention! <p>For retrospective painting of the gear unit, the radial seals, rubber elements, pressure venting valves, hoses, type plates, adhesive labels and motor coupling components must not come into contact with paints, lacquers or solvents, as otherwise components may be damaged or made illegible.</p> |
|--|--|



3.12 Fitting the cooling coil to the cooling system

Cutting ring screw threads (see Item 1, Figs. 3-14) are located at the casing cover for the connection of a pipe with an external diameter of 10 mm according to DIN 2353. **Remove the drain plug from the screw neck prior to assembly to avoid any contamination of the cooling system.** The screw necks should be connected with the coolant circuit, which must be provided by the operator. The flow direction of the coolant is irrelevant.

Make sure not to twist the screw necks during or after assembly as the cooling coil may be damaged (see Item 3, Fig. 3-14). You must ensure that no external forces act on the cooling coil.

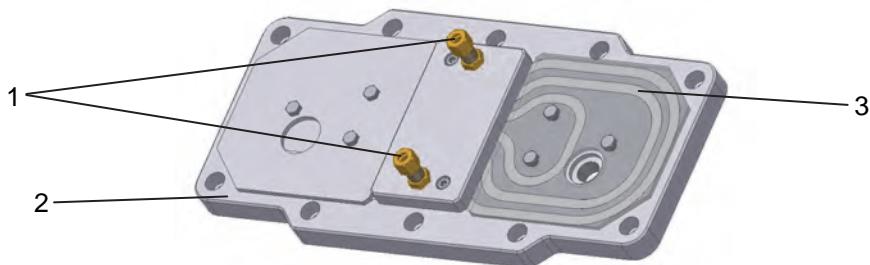


Figure 3-14: Cooling cover

| | |
|---|----------------|
|  | Danger! |
| The pressure released from the cooling circuit before carrying out any work on the gear unit. | |



4. Commissioning

4. Commissioning

4.1 Checking the oil level

The oil level must be checked prior to commissioning. See Section 5.2.

4.2 Activating the automatic lubricant dispenser

Some gear unit types with standard motor (Option IEC/NEMA) have an automatic lubricant dispenser for the rolling bearings. This dispenser must be activated prior to commissioning. The cartridge case cover has a red information sign for the activation of the lubricant dispenser.

Activating the Automatic Lubricant Dispenser:

1. Loosen and remove cylinder bolts M8x16 (1)
2. Lift off cartridge case cover (2)
3. Insert activation screw (3) into the lubricant dispenser (5) until the lug (4) breaks off at the defined fracture point
4. Refit cartridge case cover (2) and fasten using cylinder bolt (1). (See Chapter 6.2 for torque values)
5. Mark activation date on the adhesive plate (6) indicating month/year

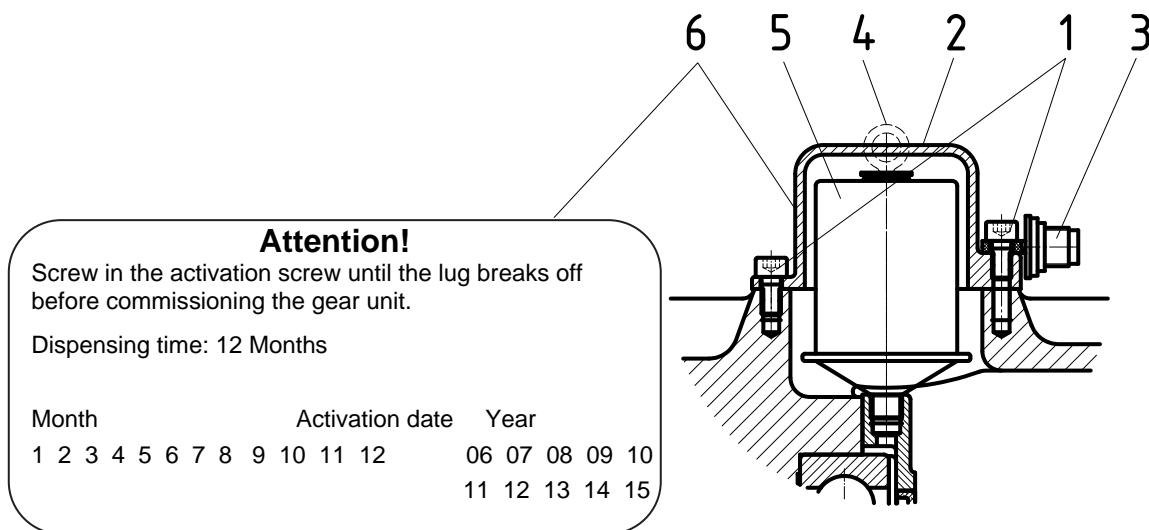


Figure 4-1: Activating the automatic lubricant dispenser with standard motor mounting



4. Commissioning



4.3 Operation with lubricant cooling

Water cooling

| | |
|---|-----------------|
| | Caution! |
| The drive may only be commissioned after the cooling spiral has been connected to the cooling circuit, and the cooling circuit has been put into operation. | |

The coolant must have a similar thermal capacity as water (specific thermal capacity at 20°C $c=4.18 \text{ kJ/kgK}$). Industrial water without any air bubbles or sediments is recommended as a coolant. The water hardness must be between 1° dH and 15° dH, and the pH value must be between pH 7.4 and pH 9.5. No aggressive liquids should be added to the coolant!

The **coolant pressure** must not exceed **8 bar**. The required **quantity of coolant** is **10 litres/minute**, and the **coolant inlet temperature** should not exceed 40°C; we recommend **10°C**.

We also recommend fitting a pressure reducer at the coolant inlet to avoid any damage due to excessive pressure.

If there is a danger of frost the operator should add a suitable anti-freeze solution to the cooling water.

The **temperature of the cooling water** and the **cooling water flow rate** must be **supervised** and **ensured** by the operator.

Air/Oil cooler

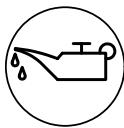
This version and all important data concerning the air/oil cooler can be obtained from Catalogue G1000, or contact the manufacturer of the cooling unit.

4.4 Running-in time for the worm gear unit

| | |
|---|--------------|
| | Note! |
| In order to achieve maximum efficiency of the worm gear unit, the gear unit must be subjected to a running-in period of approx. 25 h – 48 h under maximum load. There may be a reduction in efficiency before the running-in period is complete. | |

4.5 Checklist

| Checklist | | Information – see Section |
|---|-------------|---------------------------|
| Object of the check | Checked on: | Information – see Section |
| Is the vent plug activated or the pressure vent screwed in? | | Sec. 3.4 |
| Does the required configuration conform with the actual installation? | | Sec. 6.1 |
| Are the external gear shaft forces within permitted limits (chain tension)? | | Sec. 3.6 |
| Is the torque support correctly fitted? | | Sec. 3.7 |
| Are contact guards fitted to rotating components? | | Sec. 3.9 |
| Is the automatic lubricant dispenser activated? | | Sec. 4.2 |
| Is the cooling cover connected to the cooling circuit? | | Sec. 3.12/4.3 |



5. Service and Maintenance



5. Service and maintenance

5.1 Service and maintenance intervals

| Service and Maintenance Intervals | Service and Maintenance Work | Information – see Section |
|---|---|---------------------------------|
| At least every six months | <ul style="list-style-type: none">- Visual inspection- Check for running noises- Check oil level- Re-grease (applicable only to free drive shaft / Option W and on agitator bearings / Option VL2 / VL3)- Replace automatic lubricator (for operating times < 8 h/day: a replacement interval for the lubricant dispenser of 1 year is permissible) (only with IEC/NEMA standard motors) | 5.2 5.2 5.2 5.2 5.2 |
| For operating temperatures up to 80°C Every 10000 operating hours at least every 2 years (The interval is double this if the unit is filled with synthetic products) For higher temperatures or extreme operating conditions (high humidity, aggressive environments and large temperature fluctuations) the oil change intervals must be halved. | <ul style="list-style-type: none">- Change the oil- Clean or replace the vent plug. | 5.2 5.2 |
| At least every 10 years | <ul style="list-style-type: none">- General overhaul | 5.2 |

5.2 Service and maintenance work

Servicing and maintenance work must only be performed by qualified specialist personnel.

Installation and maintenance work must only be performed when gear units are at a standstill. The drive must be isolated and secured to prevent accidental start-up.

Visual inspection

The gear unit must be checked for leaks. In addition, the gear unit must be inspected for external damage and cracks in the hoses, hose connections and rubber buffers. Have the gear unit repaired in case of leaks, e.g. dripping gear oil or cooling water, damage or cracks. Please contact the NORD service department.

Note:

SI type universal worm gear drives, IEC/NEMA adapters for NORDBLOC.1 up to size 673.1 and SEP/SEK servo motor adapters are sealed on the drive side by means of a shaft sealing ring which is located directly in the oil space. **This ensures that the shaft sealing ring is especially well supplied with lubricating oil, and has low friction and a long service life.**

The drive shaft bearing has two cover discs, which form a non-contact seal (See Fig. 5-1). These form a long sealing gap between the shoulder of the inner ring. Because of this, the bearing is almost frictionless, friction losses are minimal and there is no temperature increase in the drive shaft bearing.

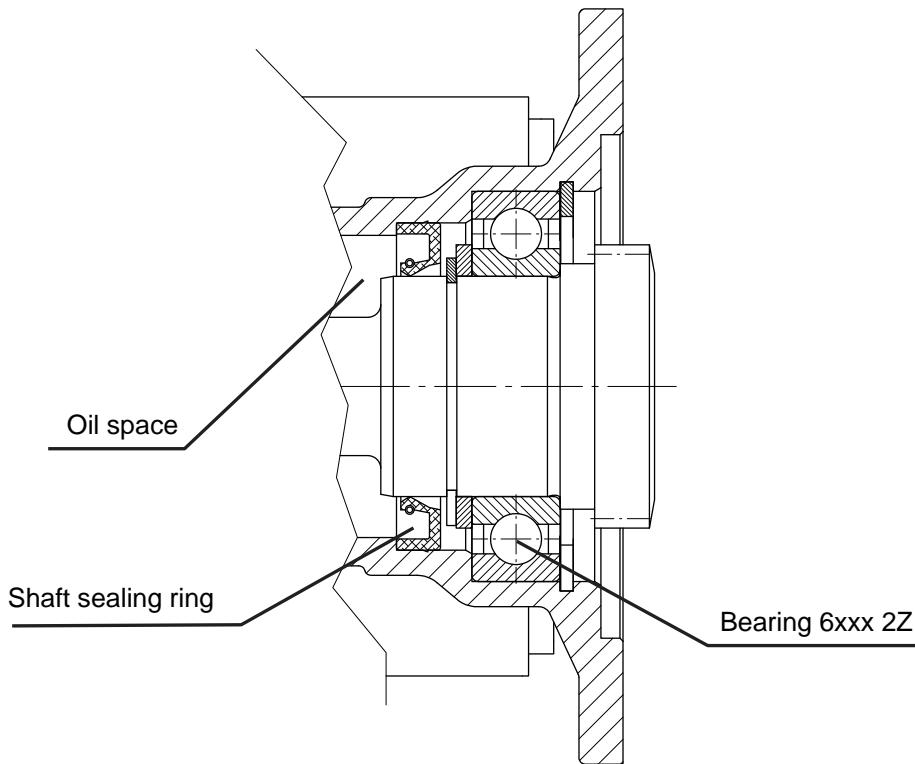


Fig. 5-1: Drive shaft bearing and seal on the coupling side of universal worm gear units

Due to the internal construction of the bearing, there may initially be a very slight apparent leakage on the drive shaft, which is caused by transport or storage. I.e. there may be a slight escape of oil from the bearing grease before commissioning and in the initial phase of operation.

We hereby explicitly point out that any slight escape of oil does not constitute technical faults and does not impair the reliability of the gear unit and the bearing.

Check for running noises

If the gear unit produces unusual running noises and/or vibrations, this could indicate damage to the gear unit. In this case the gear should be shut down and a general overhaul carried out.

Check the oil level

Section 6.1 describes the versions and the corresponding oil level screws. With double gear units, the oil level must be checked on both units. The pressure vent must be at the position marked in Section 6.1.

The oil level does not need to be checked on gear units without oil level screw (see Section 6.1).

Gear unit types that are not supplied full of oil must be filled before the oil level is checked. (see "Changing the oil")

Checking the oil level:

1. The oil level may only be checked when the gear unit is **at a standstill and has cooled down**. The gear unit must be secured to prevent accidental switch-on.
2. The oil level screw corresponding to the version must be screwed out. (See Section 6.1)



5. Service and Maintenance

| | |
|--|--------------|
| | Note! |
| At the first oil level check a small amount of oil may escape, as the oil level may be below the lower edge of the oil level hole. | |

3. **Gear units with oil level screw:** The maximum oil level is the lower edge of the oil level hole. The minimum oil level is 4 mm below the oil level hole. If the oil level is too low, this must be corrected using the correct type of oil. An oil level glass is available instead of the oil level screw
4. **Gear units with an oil level vessel:** The oil level must be checked **in the oil level vessel** with the aid of the dipstick plug (thread G1 1/4). The oil level must be between the upper and lower mark when the dipstick is completely screwed in (see Fig. 5-2). The oil level must be corrected with the correct type of oil if necessary. These gearboxes may only be operated in the configuration stated in Section 6.1.
5. The oil level screw or the cap screw with dipstick and all other loosened screws must be correctly re-tightened.

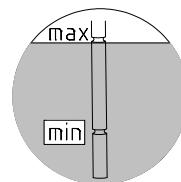


Figure 5-2: Check the oil level with a dipstick

Regreasing

Some gear unit designs (free drive shaft, Option W, agitator designs VL2 and VL3) are equipped with a regreasing device.

For agitator versions VL2 and VL3, the vent screw located opposite to the grease nipple must be unscrewed before regreasing. Grease should be injected until a quantity of 20-25g escapes from the vent hole. After this, the vent plug must be reinserted and tightened.

For Option W and some IEC adapters, the outer roller bearing must be regreased with approx. 20-25g of grease via the grease nipple provided

Recommended grease: Petamo GHY 133N (see Section 6.4: Klüber Lubrication).

Replacing the automatic lubricant dispenser

Screw-off the cartridge case cover (2), (see Fig. 4-1). The lubrication dispenser (5) is screwed out and replaced with a new component (Part No. 283 0100). Then activate (see Chapter 4.2)!

Changing the oil

The figures in Section 6.1 show the oil drain screw, the oil level screw and the pressure vent screw for various designs.

Sequence:

1. Place the drip tray below the oil drain screw or the oil drain cock
2. Completely remove oil level screw, screwed sealing plug with dipstick if an oil level tank is being used and oil drain screw.

| | |
|--------------------------|----------------|
| | Danger! |
| Warning: Hot oil! | |



3. Drain all the oil from the gear unit.
4. If the screw lock coating of the oil drain screw or oil level screw is damaged in the thread, a new oil level screw must be used or the thread cleaned and coated with securing lubricant, e.g. Loctite 242, Loxeal 54-03 prior to inserting. The seal ring must be replaced if damaged.
5. Support the seal ring, insert the oil drain screw into the hole and tighten to the correct torque! (See Section 6.2 for torque values)
6. Using a suitable filling device, refill with oil of the same type through the oil level hole until oil emerges from the oil level hole. (The oil can also be filled through the pressure vent screw or a sealing plug located higher than the oil level). If an oil level vessel is used, fill the oil through the upper inlet (thread G1½) until the oil level is set as described in Section 5.2.
7. Wait at least 15 minutes, or at least 30 minutes if an oil level tank is used, and then check the oil level. Proceed as described in Section 5.2.

| | |
|---|---|
|  | Note! The oil does not need to be changed on gear units without oil level screw (see Section 6.1). These gear units are lubricated for life. Standard helical gear units have no oil level screw. Here, the oil is topped up through the pressure vent bolt using the quantities listed in the table in Section 6.5. |
|---|---|

Cleaning or replacing the vent plug

In case of severe dirt, unscrew the vent plug and clean it thoroughly. If necessary screw in a new vent plug with a new sealing ring.

General overhaul

The gear units must be completely dismantled. The following work must be carried out:

- Clean all gear unit components
- Examine all gear unit components for damage
- All damaged components must be replaced
- All roller bearings must be replaced
- Replace back stops if fitted
- Replace all seals, radial seals and Nilos rings
- Replace plastic and elastomer components of the motor coupling

The general overhaul must be carried out by qualified personnel in a specialist workshop with appropriate equipment in observance of national regulations and laws. We recommend that the general overhaul is carried out by the NORD service department.



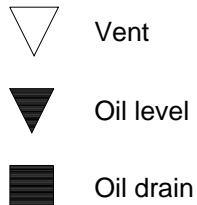
6. Appendix



6. Appendix

6.1 Versions and maintenance

Explanation of symbols for the following version illustrations:



| Note! | |
|--------------|---|
| | SK 320, SK 172, SK 272, SK 372K, SK 273 and SK373 as well as SK 01282 NB, SK 0282 NB, SK 1382 NB and UNIVERSAL / Minibloc gear units are lubricated for life. These gear units do not have an oil filler screw. |

Parallel shaft gear units with oil level vessel

The following applies for SK 9282, SK 9382, SK 10282, SK 10382, SK 11282, SK 11382 parallel gear units and SK 12382 in the M4 configuration with oil level vessels:

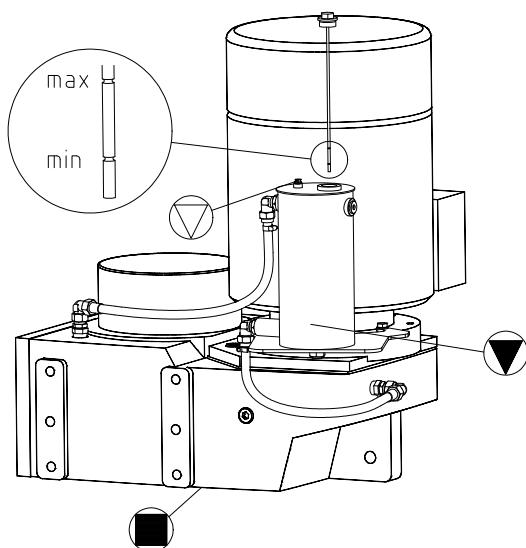
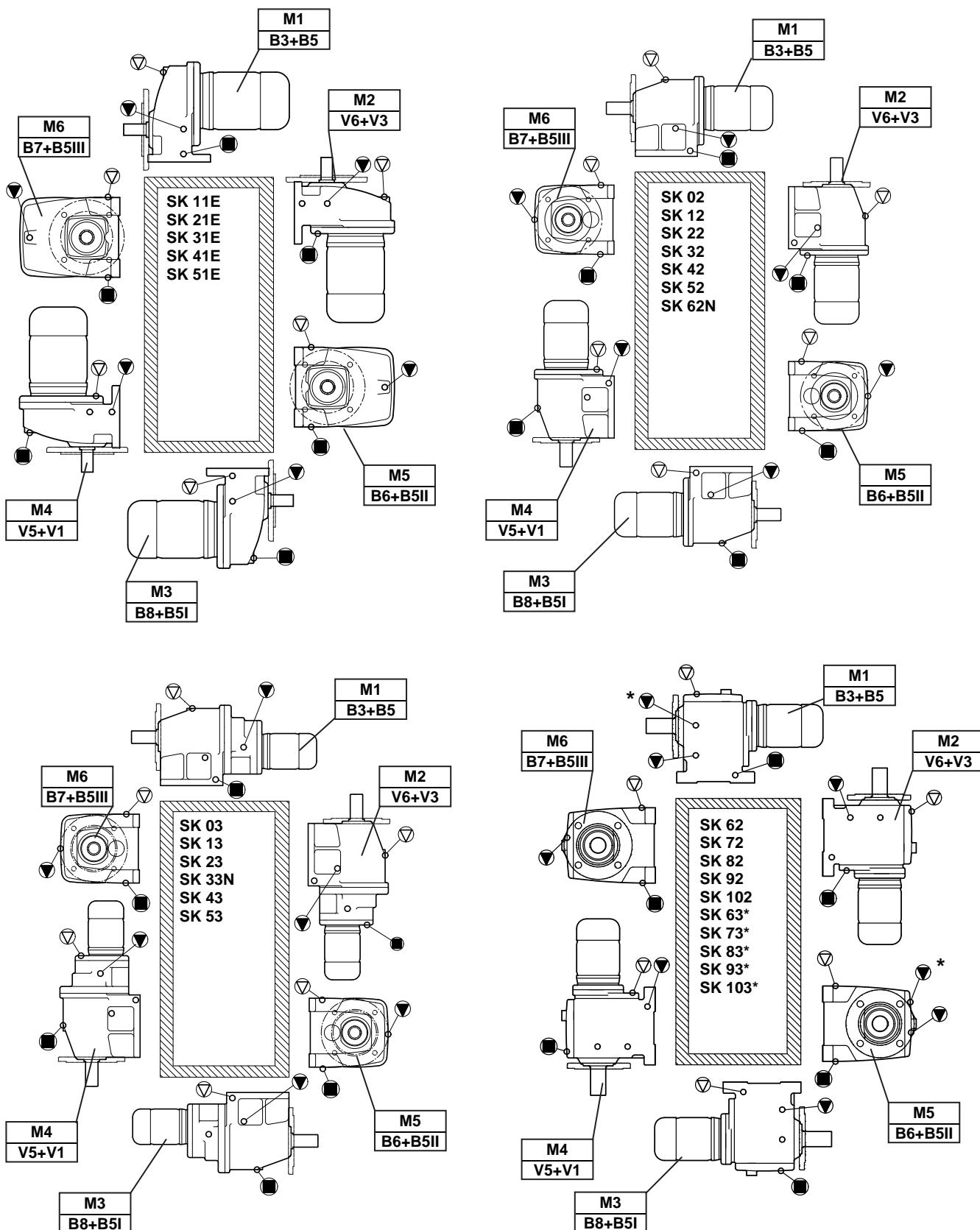
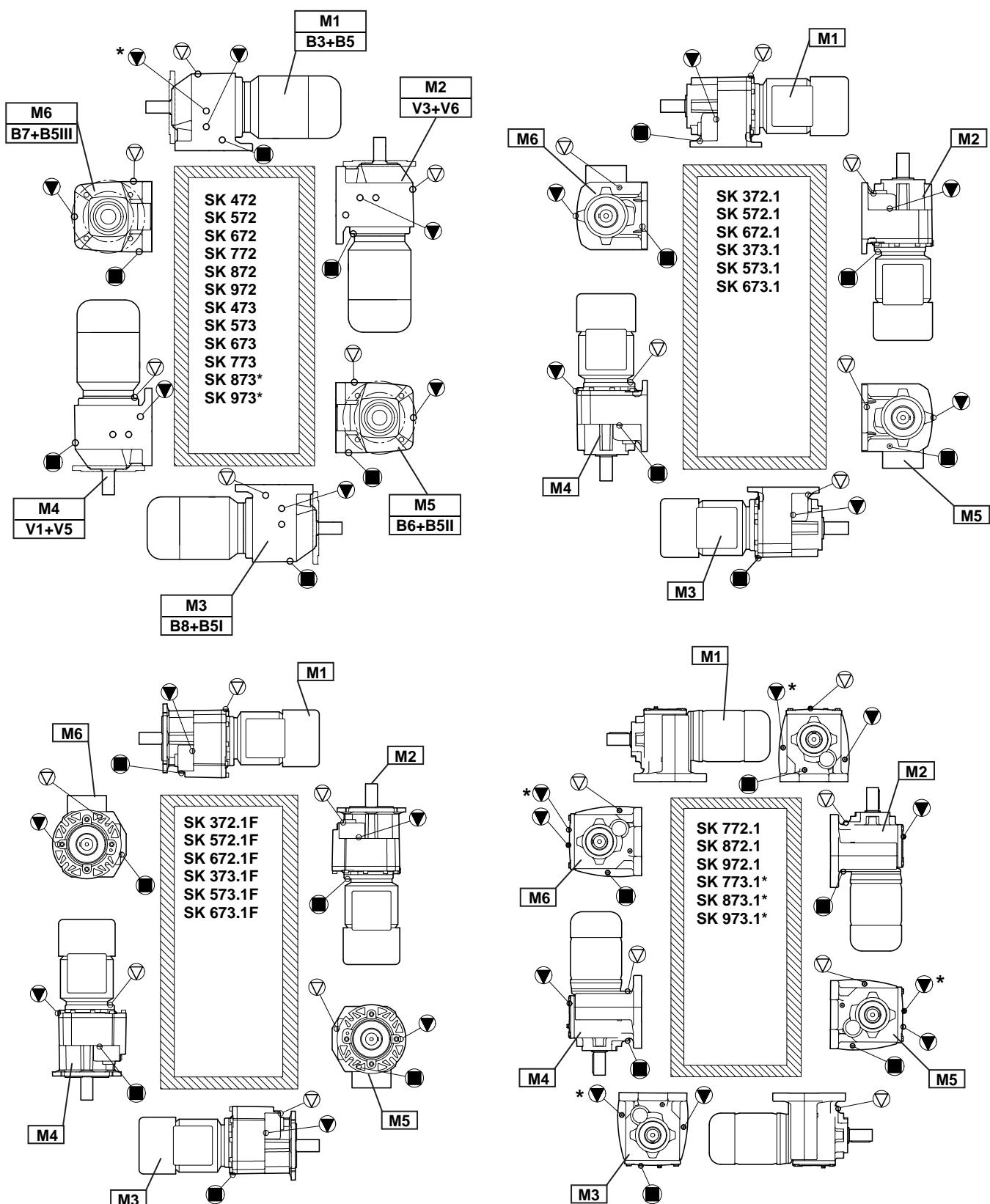
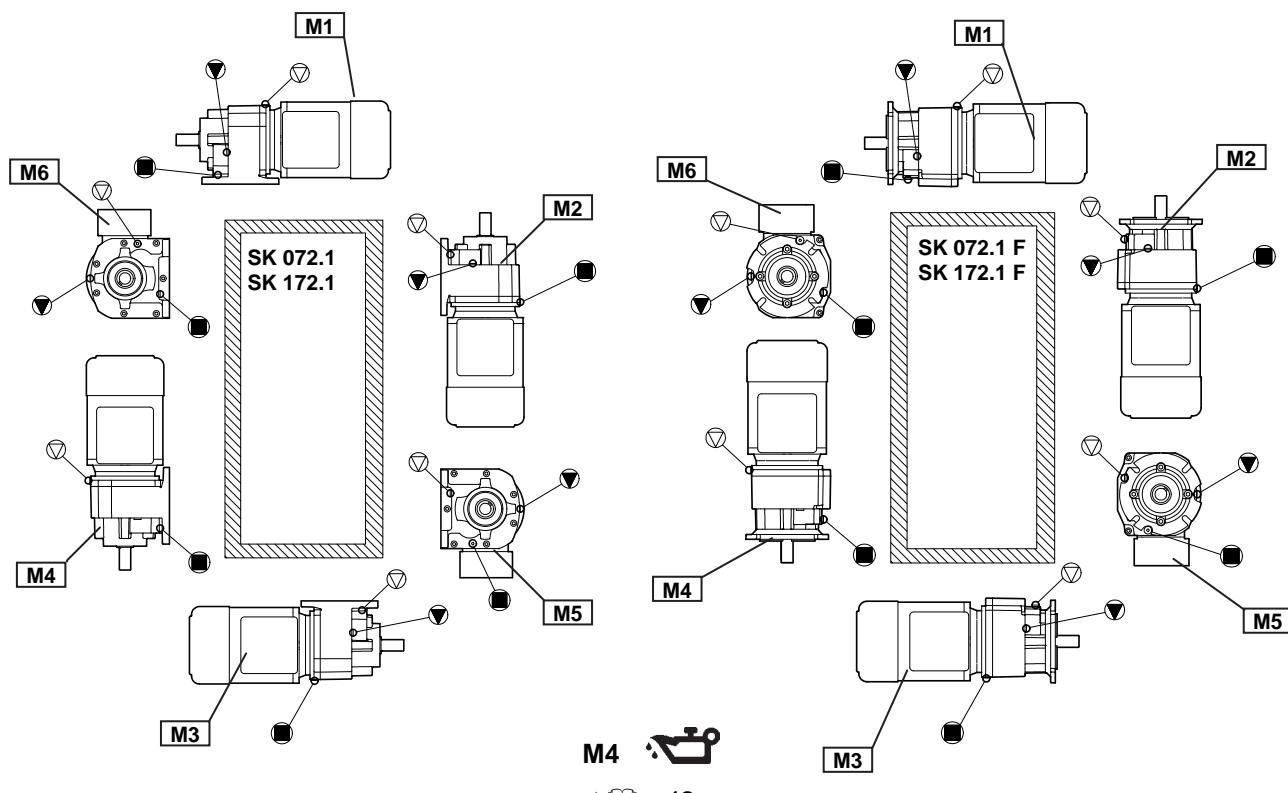
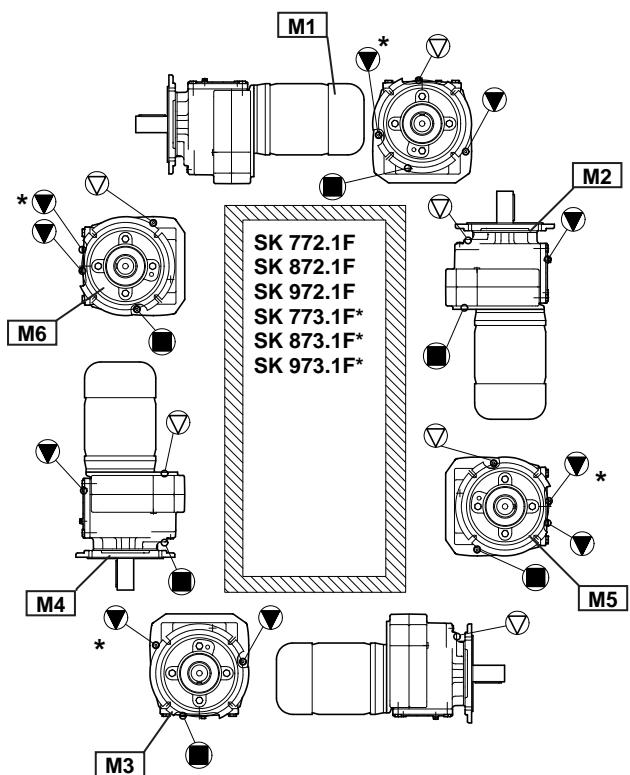


Figure 6-1: Oil level check with oil level tank

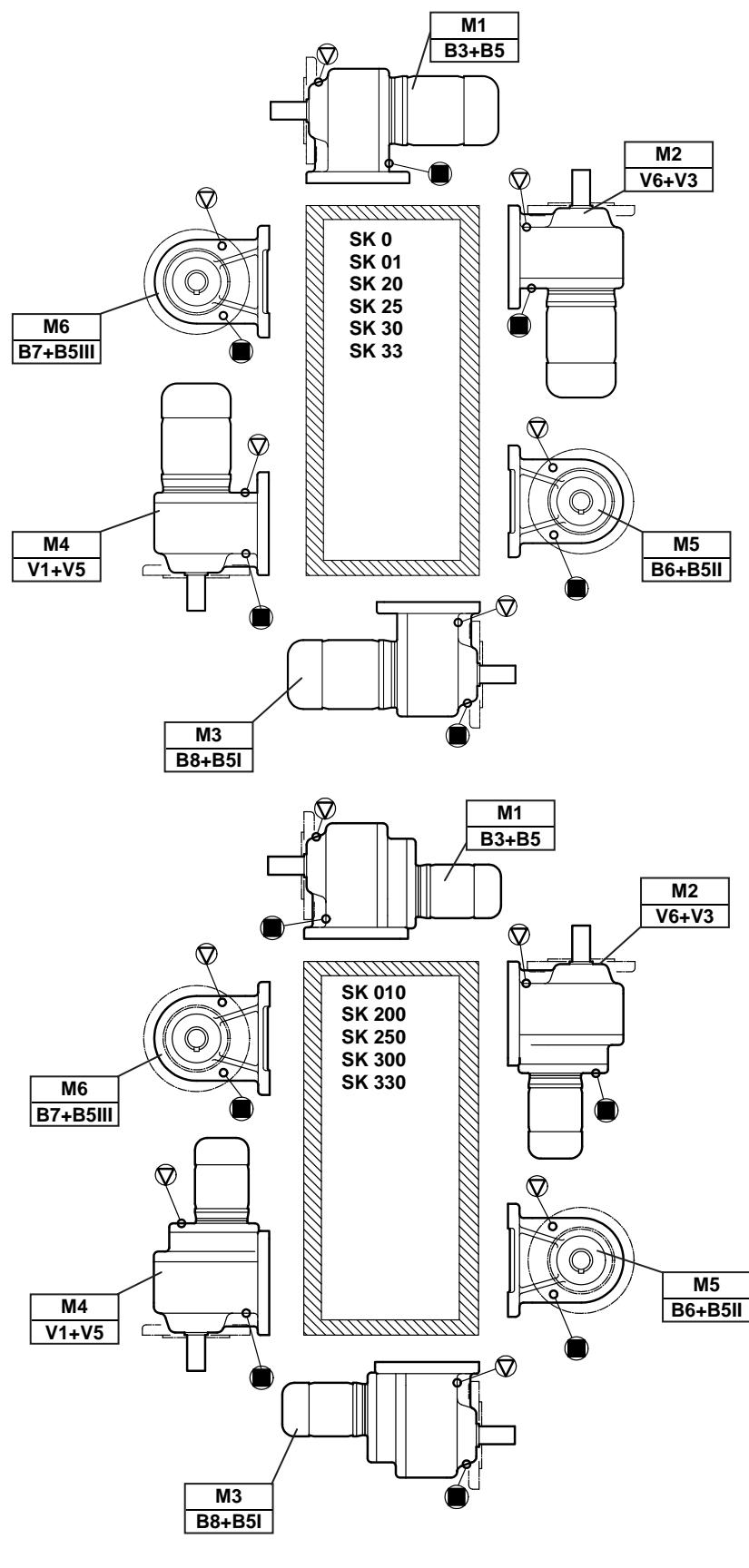




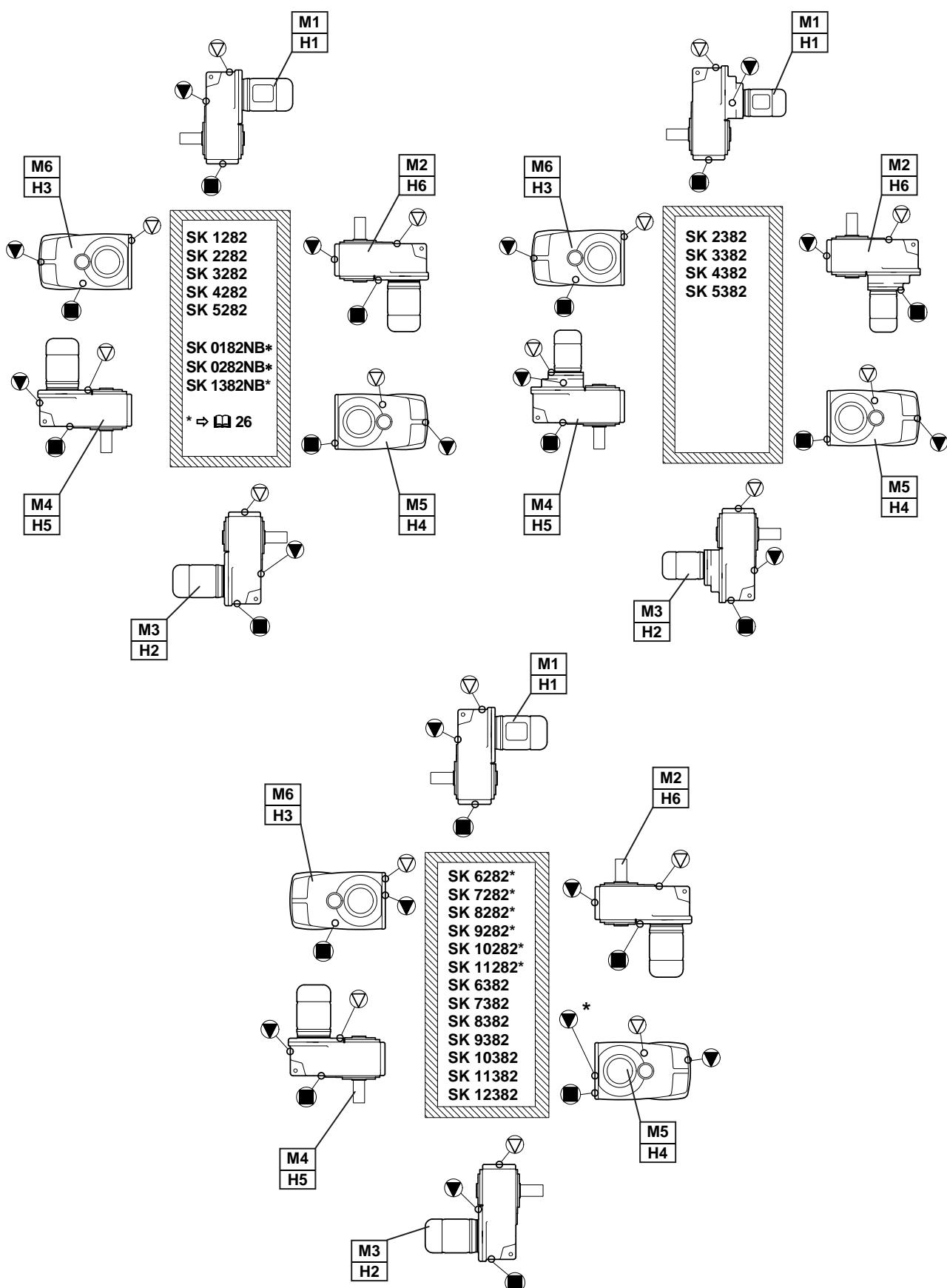


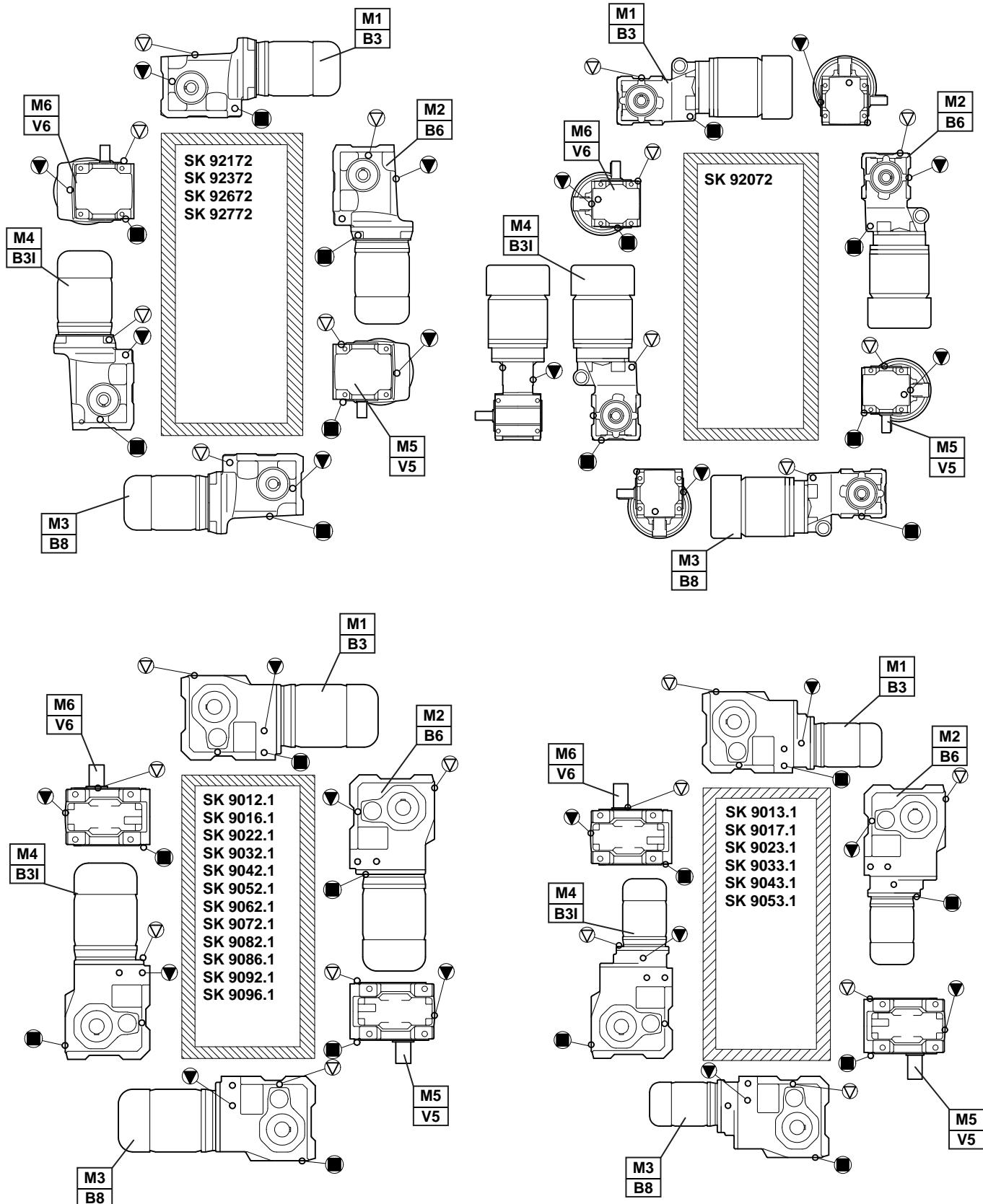
M4 42

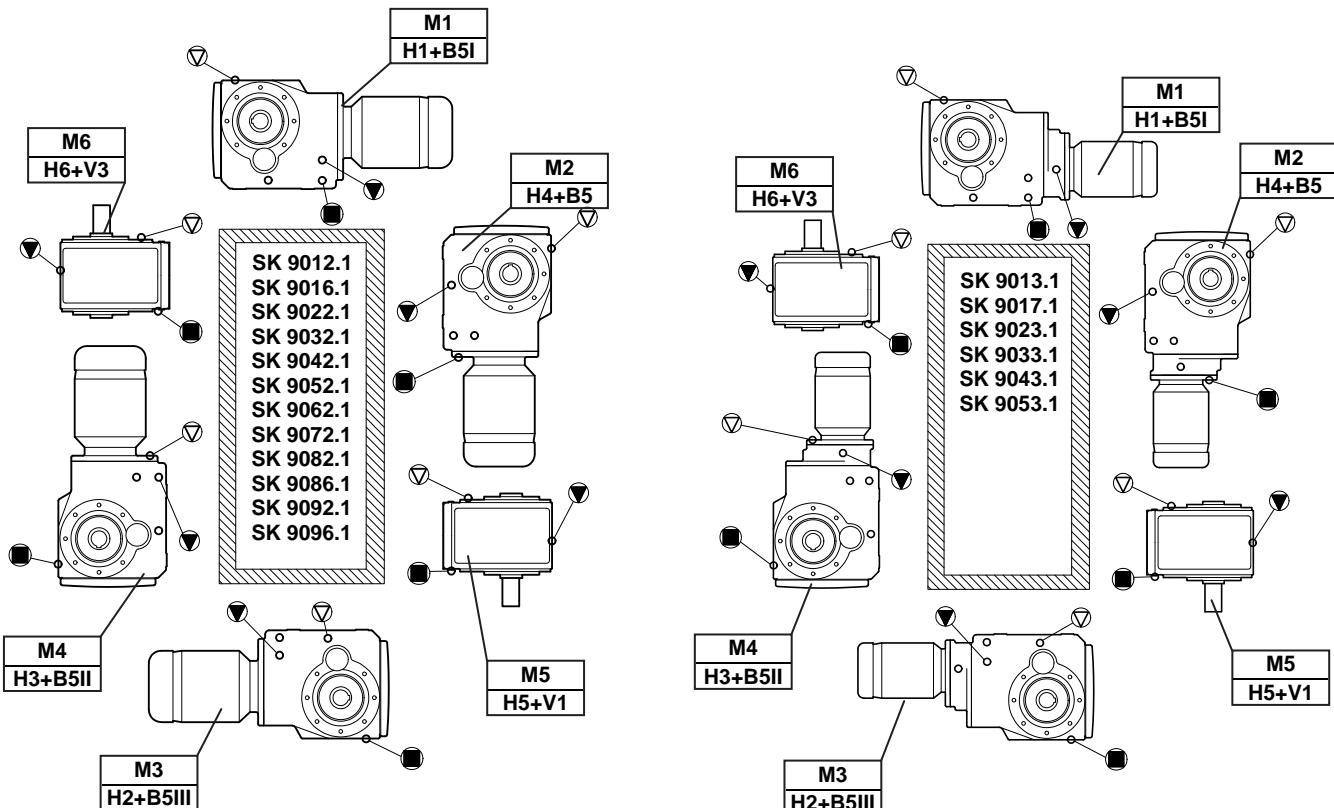
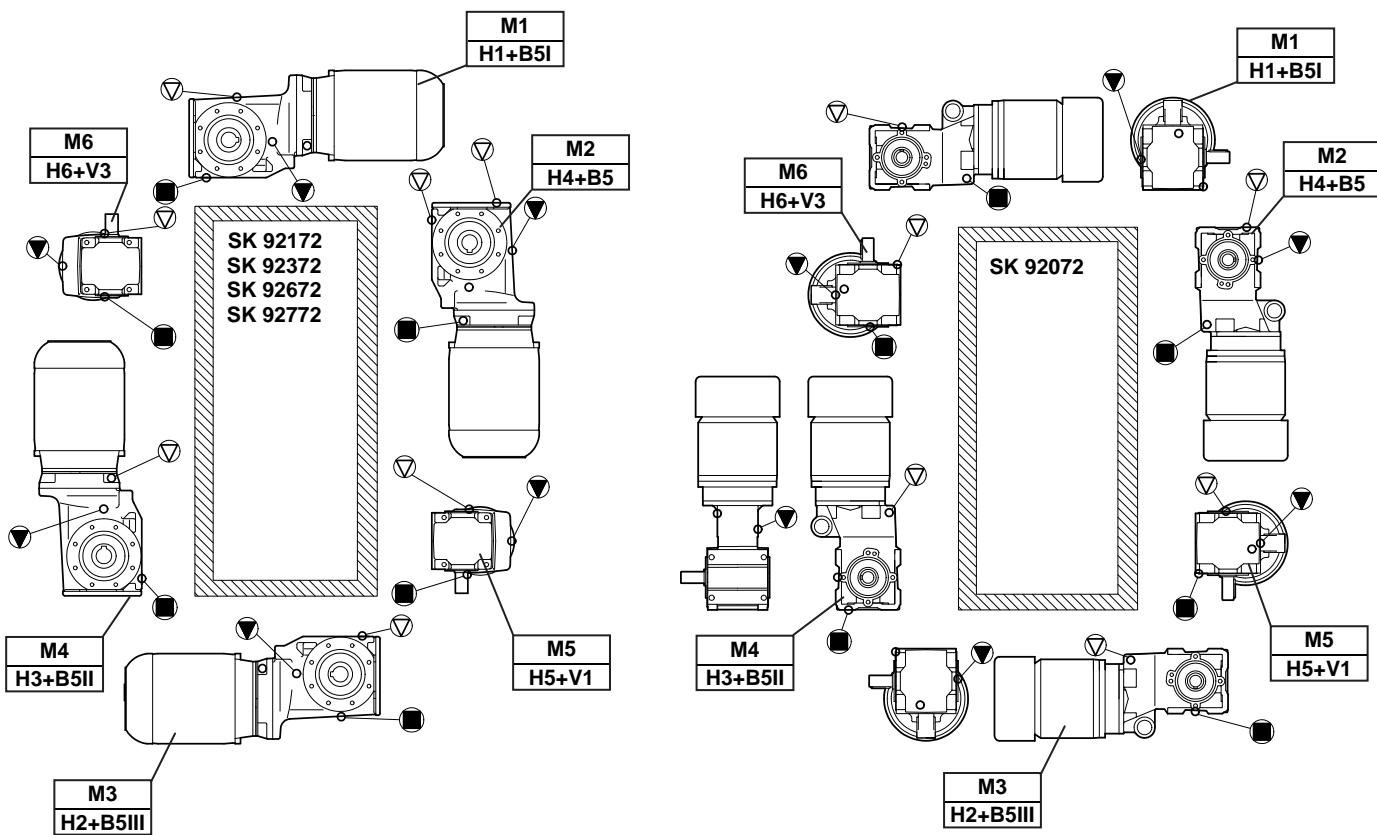
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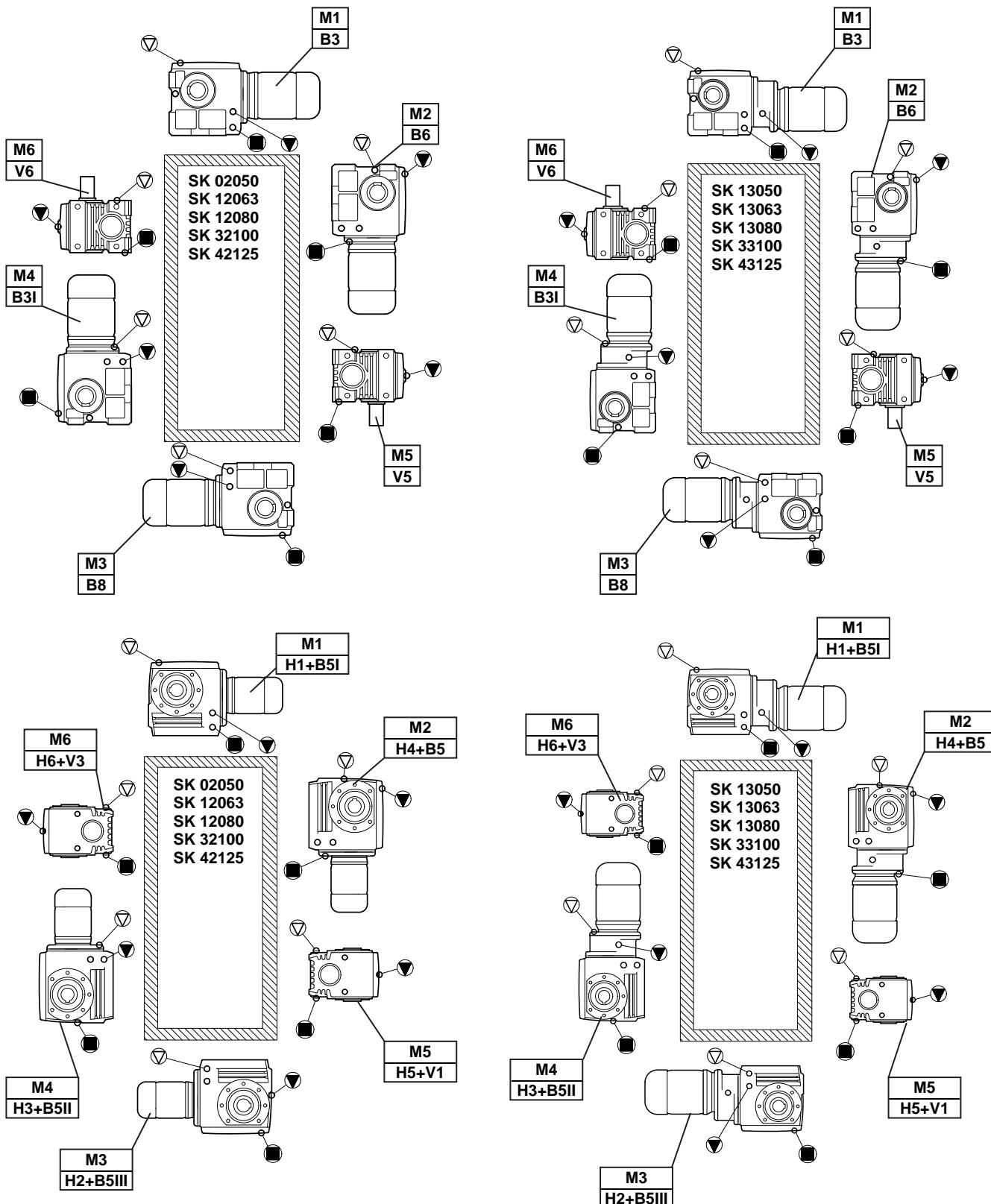


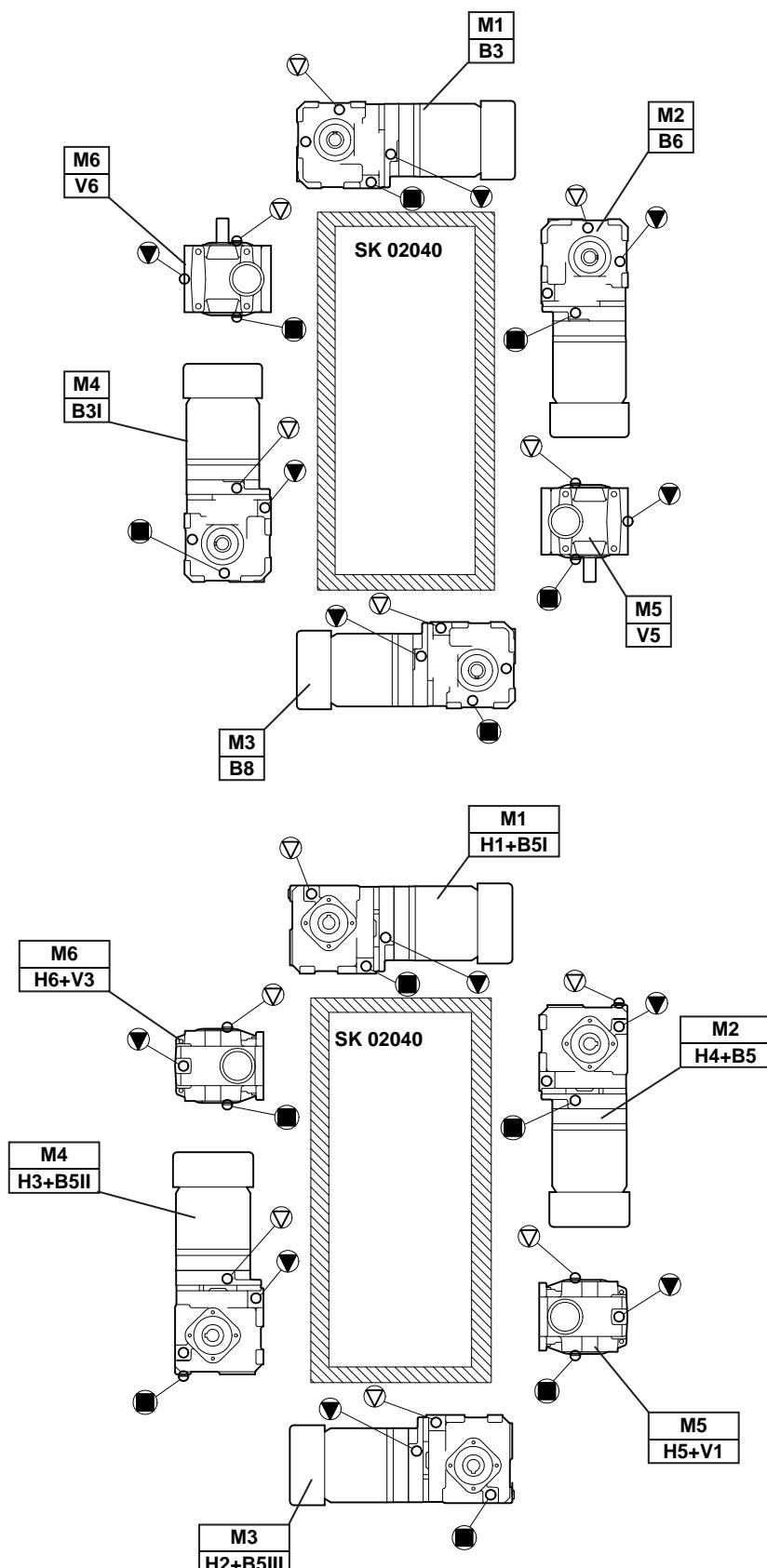
⇒ 43





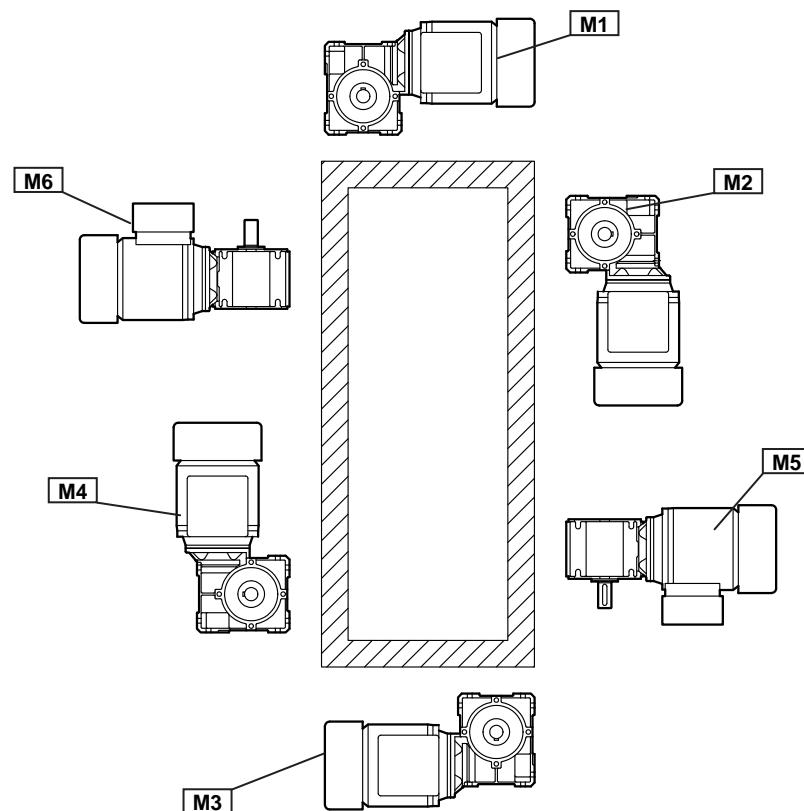








SK 1SI31 – SK 1SI75
SK 1SIS31 – SK 1SIS75
SK 1SIS-D31 – SK 1SIS-D63
SK 2SIS-D40 – SK 2SIS-D63
SK 1S32 - SK 1S63
SK 2S32NB – SK 2S63NB
SK 1SU32 – SK 1SU63
SK 2SU32NB- SK 2SU63NB
SK 1SM31 – SK 1SM63
SK 2SM40 – SK 2SM63



⇒ 26



6. Appendix



6.2 Torque values

| Size | Screw connections in the strength classes | | | Sealing screws | Threaded pin on coupling | Screw connections on protective covers |
|------|---|------|------|----------------|--------------------------|--|
| | 8.8 | 10.9 | 12.9 | | | |
| M4 | 3.2 | 5 | 6 | - | - | |
| M5 | 6.4 | 9 | 11 | - | 2 | |
| M6 | 11 | 16 | 19 | - | - | 6.4 |
| M8 | 27 | 39 | 46 | 5 | 10 | 11 |
| M10 | 53 | 78 | 91 | 8 | 17 | 27 |
| M12 | 92 | 135 | 155 | 27 | 40 | 53 |
| M16 | 230 | 335 | 390 | - | - | 92 |
| M20 | 460 | 660 | 770 | - | - | 230 |
| M24 | 790 | 1150 | 1300 | 80 | - | 460 |
| M30 | 1600 | 2250 | 2650 | 170 | - | |
| M36 | 2780 | 3910 | 4710 | - | - | |
| M42 | 4470 | 6290 | 7540 | - | - | |
| G1½ | - | - | - | 20 | - | |

6.3 Troubleshooting

| Gear unit malfunctions | | |
|---|---|---|
| Fault | Possible cause | Remedy |
| Unusual running noises, vibrations | Oil too low or bearing damage or toothed wheel damage | Consult NORD Service |
| Oil escaping from gear unit or motor | Defective seal | Consult NORD Service |
| Oil escaping from pressure vent | Incorrect oil level or incorrect, contaminated oil or unfavourable operating conditions | Oil change Use oil expansion tank (Option OA) |
| Gear unit becomes too hot | Unfavourable installation conditions or gear unit damage | Consult NORD Service |
| Shock when switched on, vibrations | Defective motor coupling or loose gear unit mounting or defective rubber element | Replace elastomer gear rim, tighten motor and gear unit fastening bolts, replace rubber element |
| Drive shaft does not rotate although motor is running | Fracture in gear unit or defective motor coupling or shrink disc slippage | Consult NORD Service |

| | |
|--|--|
| | Attention! |
| | Warning: shut down the gear unit immediately should any of the above faults occur! |



6. Appendix



6.4 Lubricants

With the exception of type SK 11282, SK 11382 and SK 12382 gear units, all gear units are filled with lubricant ready for operation in the required installation position when delivered. This initial filling corresponds to a lubricant from the column for the ambient temperatures (normal version) in the lubricant table.

Roller bearing greases

This table shows comparable roller bearing greases from various manufacturers. The manufacturer can be changed for a given grease type. Getriebebau NORD must be contacted in case of change of grease type or ambient temperature range, as otherwise no warranty for the functionality of our gear units can be accepted.

| Lubricant type | Ambient temperature | | | | | | |
|------------------------------------|---------------------|---------------------------------------|---------------|---------------------------------|--|--------------------------|----------------------|
| Mineral oil-based grease | -30 ... 60°C | Energrease LS 2 Energrease LS-EP 2 | Longtime PD 2 | RENOLIT GP 2 RENOLIT LZR 2 H | - | Mobilux EP 2 | Gadus S2 V100 2 |
| | -50 ... 40°C | - | Optitemp LG 2 | RENOLIT JP 1619 | - | - | - |
| Synthetic grease | -25 ... 80°C | Energrease SY 2202 | Tribol 4747 | RENOLIT HLT 2 RENOLIT LST 2 | PETAMO GHY 133 N Klüüberplex BEM 41-132 | Mobiltemp SHC 32 | Cassida EPS2 |
| Biodegradable grease | -25 ... 40°C | Biogrease EP 2 | - | PLANTOGEL 2 S | Klüüberbio M 72-82 | Mobil SHC Grease 102 EAL | Naturelle Grease EP2 |
| Foodstuff-compatible grease | -25 ... 40°C | - | Obeen UF 2 | RENOLIT G 7 FG 1 | Klübersynth UH1 14-151 | Mobilgrease FM 222 | Cassida RLS2 |



Lubricant table

This table shows comparable lubricants from various manufacturers. The manufacturer can be changed within a particular viscosity or lubricant type. Getriebbau NORD must be contacted in case of change of viscosity or lubricant type, as otherwise no warranty for the functionality of our gearboxes can be accepted.

| Lubricant type | Details on type plate | DIN (ISO) / Ambient temperature |  |  |  |  |  |  |
|-----------------------------|-----------------------|---------------------------------|---|---|---|--|---|---|
| Mineral oil | CLP 680 | ISO VG 680 0...40°C | Energol GR-XP 680 | Alpha EP 680 Alpha SP 680 Optigear BM 680 Tribol 1100/680 | RENOLIN CLP 680 RENOLIN CLP 680 Plus | Klüberoil GEM 1-680 N | Mobilgear 600 XP 680 | Omala S2 G 680 |
| | CLP 220 | ISO VG 220 -10...40°C | Energol GR-XP 220 | Alpha EP 220 Alpha SP 220 Optigear BM 220 Tribol 1100/220 | RENOLIN CLP 220 RENOLIN CLP 220 Plus | Klüberoil GEM 1-220 N | Mobilgear 600 XP 220 | Omala S2 G 220 |
| | CLP 100 | ISO VG 100 -15...25°C | Energol GR-XP 100 | Alpha EP 100 Alpha SP 100 Optigear BM 100 Tribol 1100/100 | RENOLIN CLP 100 RENOLIN CLP 100 Plus | Klüberoil GEM 1-100 N | Mobilgear 600 XP 100 | Omala S2 G 100 |
| Synthetic oil (Polyglycol) | CLP PG 680 | ISO VG 680 -20...40°C | - | Alphasyn GS 680 Tribol 800/680 | RENOLIN PG 680 | Klübersynth GH 6-680 | Mobil Glygoyle 680 | Omala S4 WE 680 |
| | CLP PG 220 | ISO VG 220 -25...80°C | Enersyn SG-XP 220 | Alphasyn GS 220 Alphasyn PG 220 Tribol 800/220 | RENOLIN PG 220 | Klübersynth GH 6-220 | Mobil Glygoyle 220 | Omala S4 WE 220 |
| Synthetic oil (hydrocarbon) | CLP HC 460 | ISO VG 460 -30...80°C | - | Alphasyn EP 460 Tribol 1510/460 Optigear Synthetic X 460 | RENOLIN Unisyn CLP 460 | Klübersynth GEM 4-460 N | Mobil SHC 634 | Omala S4 GX 460 |
| | CLP HC 220 | ISO VG 220 -40...80°C | - | Alphasyn EP 220 Tribol 1510/220 Optigear Synthetic X 220 | RENOLIN Unisyn CLP 220 | Klübersynth GEM 4-220 N | Mobil SHC 630 | Omala S4 GX 220 |
| Bio-degradable oil | CLP E 680 | ISO VG 680 -5...40°C | - | - | PLANTOGEAR 680 S | - | - | - |
| | CLP E 220 | ISO VG 220 -5...40°C | - | Tribol BioTop 1418/220 | PLANTOGEAR 220 S | Klübersynth GEM 2-220 | - | Naturelle Gear Fluid EP 220 |
| Food grade oil | CLP PG H1 680 | ISO VG 680 -5...40°C | - | Tribol FoodProof 1800/680 | - | Klübersynth UH1 6-680 | Mobil Glygoyle 680 | Cassida Fluid WG 680 |
| | CLP PG H1 220 | ISO VG 220 -25...40°C | - | Tribol FoodProof 1800/220 | - | Klübersynth UH1 6-220 | Mobil Glygoyle 220 | Cassida Fluid WG 220 |
| | CLP HC H1 680 | ISO VG 680 -5...40°C | - | Optileb GT 680 | GERALYN SF 680 | Klüberoil 4 UH1-680 N | - | Cassida Fluid GL 680 |
| | CLP HC H1 220 | ISO VG 220 -25...40°C | - | Optileb GT 220 | GERALYN SF 220 | Klüberoil 4 UH1-220 N | Mobil SHC Cibus 220 | Cassida Fluid GL 220 |
| Gear unit liquid grease | | -25 ... 60°C | Energrease LS-EP 00 | Longtime PD 00 Tribol 3020/1000-00 | RENOLIT DURAPLEX EP 00 RENOLIT LST 00 | MICROLUBE GB 00 Klübersynth GE 46-1200 | Mobil Chassis Grease LBZ Mobil Glygoyle Grease 00 | Alvania EP(LF)2 Tivela GL00 |

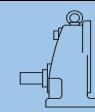
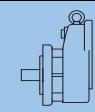
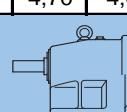
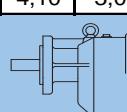
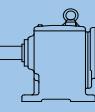
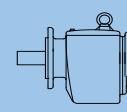
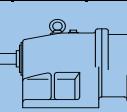
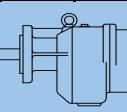
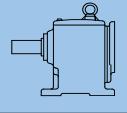
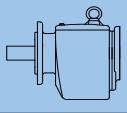


6. Appendix

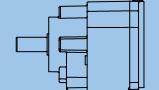
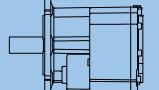
6.5 Lubricant quantities

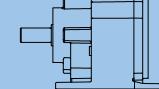
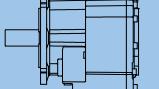
| | Note! |
|--|--|
| | <p>After changing the lubricant, and in particular after the initial filling, the oil level may change during the first few hours of operation, as the oil galleries and hollow spaces only fill gradually during operation. The oil level is still within the permissible tolerance.</p> <p>If at the express request of the customer, an oil inspection glass is installed at an additional charge, we recommend that the customer corrects the oil level after an operating period of approx. 2 hours, so that when the gear unit is at a standstill and has cooled down, the oil level is visible in the inspection glass. Only then, is it possible to check the oil level by means of the inspection glass.</p> <p>The filling quantities stated in the following tables are for guidance only. The precise quantities vary depending on the exact gear ratio. When filling, always observe the oil level screw hole as an indicator of the precise quantity of oil.</p> |

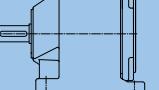
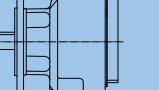
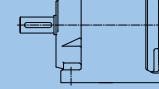
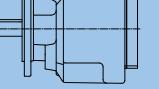
*Type SK11282, SK11382 and SK12382 gear units are normally supplied without oil.

| | | | | | | | | | | | | |
|---|---|-----------|-----------|-----------|-----------|-----------|---|-----------|------------|-----------|-------------|--------------|
|  [L] |  | | | | | |  | | | | | |
| ⇒  6.1 | M1 | M2 | M3 | M4 | M5 | M6 | M1 | M2 | M3 | M4 | M5 | M6 |
| ⇒  6.1 | B3 | V6 | B8 | V5 | B6 | B7 | B5 | V3 | B5I | V1 | B5II | B5III |
| SK11E | 0,25 | 0,50 | 0,55 | 0,40 | 0,35 | 0,35 | 0,30 | 0,35 | 0,50 | 0,30 | 0,40 | 0,40 |
| SK21E | 0,60 | 1,20 | 1,20 | 1,00 | 1,00 | 1,00 | 0,50 | 1,40 | 1,10 | 0,70 | 0,90 | 0,90 |
| SK31E | 1,10 | 2,70 | 2,20 | 2,30 | 1,70 | 1,70 | 0,80 | 1,30 | 1,65 | 1,10 | 2,00 | 2,00 |
| SK41E | 1,70 | 2,60 | 3,30 | 2,50 | 2,60 | 2,60 | 1,00 | 2,60 | 2,80 | 1,60 | 3,30 | 3,30 |
| SK51E | 2,20 | 4,40 | 4,70 | 4,00 | 3,40 | 3,40 | 1,80 | 3,50 | 4,10 | 3,00 | 3,80 | 3,80 |
|  [L] |  | | | | | |  | | | | | |
| SK02 | 0,15 | 0,60 | 0,70 | 0,60 | 0,40 | 0,40 | 0,25 | 0,60 | 0,60 | 0,60 | 0,50 | 0,50 |
| SK12 | 0,25 | 0,75 | 0,85 | 0,75 | 0,50 | 0,50 | 0,35 | 0,85 | 0,90 | 0,90 | 0,60 | 0,60 |
| SK22 | 0,50 | 1,80 | 1,80 | 1,80 | 1,35 | 1,35 | 0,70 | 2,00 | 2,00 | 1,80 | 1,55 | 1,55 |
| SK32 | 0,90 | 2,50 | 2,50 | 2,90 | 2,00 | 2,00 | 1,30 | 2,90 | 3,30 | 3,10 | 2,40 | 2,40 |
| SK42 | 1,30 | 4,50 | 4,50 | 4,30 | 3,20 | 3,20 | 1,80 | 4,40 | 4,50 | 4,00 | 3,70 | 3,70 |
| SK52 | 2,50 | 7,00 | 6,80 | 6,80 | 5,10 | 5,10 | 3,00 | 6,80 | 6,20 | 7,40 | 5,60 | 5,60 |
|  [L] |  | | | | | |  | | | | | |
| SK62 | 6,50 | 15,00 | 13,00 | 16,00 | 15,00 | 15,00 | 7,00 | 15,00 | 14,00 | 18,50 | 16,00 | 16,00 |
| SK72 | 10,00 | 23,00 | 18,00 | 26,00 | 23,00 | 23,00 | 10,00 | 23,00 | 18,50 | 28,00 | 23,00 | 23,00 |
| SK82 | 14,00 | 35,00 | 27,00 | 44,00 | 32,00 | 32,00 | 15,00 | 37,00 | 29,00 | 45,00 | 34,50 | 34,50 |
| SK92 | 25,00 | 73,00 | 47,00 | 76,00 | 52,00 | 52,00 | 26,00 | 73,00 | 47,00 | 78,00 | 52,00 | 52,00 |
| SK102 | 36,00 | 79,00 | 66,00 | 102,00 | 71,00 | 71,00 | 40,00 | 81,00 | 66,00 | 104,00 | 72,00 | 72,00 |
|  [L] |  | | | | | |  | | | | | |
| SK03 | 0,30 | 1,00 | 0,80 | 0,90 | 0,60 | 0,60 | 0,50 | 0,80 | 0,90 | 1,10 | 0,80 | 0,80 |
| SK13 | 0,60 | 1,25 | 1,10 | 1,20 | 0,70 | 0,70 | 0,85 | 1,20 | 1,20 | 1,20 | 0,95 | 0,95 |
| SK23 | 1,30 | 2,40 | 2,30 | 2,35 | 1,60 | 1,60 | 1,50 | 2,60 | 2,50 | 2,80 | 2,80 | 2,80 |
| SK33N | 1,60 | 2,90 | 3,20 | 3,70 | 2,30 | 2,30 | 2,50 | 3,40 | 3,50 | 4,40 | 2,60 | 2,60 |
| SK43 | 3,00 | 5,60 | 5,20 | 6,60 | 3,60 | 3,60 | 3,50 | 5,70 | 5,00 | 6,10 | 4,10 | 4,10 |
| SK53 | 4,50 | 8,70 | 7,70 | 8,70 | 6,00 | 6,00 | 5,20 | 8,40 | 7,00 | 8,90 | 6,70 | 6,70 |
|  [L] |  | | | | | |  | | | | | |
| SK63 | 13,00 | 14,50 | 14,50 | 16,00 | 13,00 | 13,00 | 13,50 | 14,00 | 15,50 | 18,00 | 14,00 | 14,00 |
| SK73 | 20,50 | 20,00 | 22,50 | 27,00 | 20,00 | 20,00 | 22,00 | 22,50 | 23,00 | 27,50 | 20,00 | 20,00 |
| SK83 | 30,00 | 31,00 | 34,00 | 37,00 | 33,00 | 33,00 | 31,00 | 34,00 | 35,00 | 40,00 | 34,00 | 34,00 |
| SK93 | 53,00 | 70,00 | 59,00 | 72,00 | 49,00 | 49,00 | 53,00 | 70,00 | 59,00 | 74,00 | 49,00 | 49,00 |
| SK103 | 74,00 | 71,00 | 74,00 | 97,00 | 67,00 | 67,00 | 69,00 | 78,00 | 78,00 | 99,00 | 67,00 | 67,00 |



| | | | | | | | | | | | | | |
|--|---|-----------|-----------|-----------|-----------|-----------|--|---|-----------|-----------|-----------|-----------|-----------|
|  [L] |  | | | | | |  [L] |  | | | | | |
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 |
| SK072.1 | 0,16 | 0,32 | 0,21 | 0,23 | 0,18 | 0,20 | SK072.1 F | 0,16 | 0,32 | 0,21 | 0,23 | 0,18 | 0,20 |
| SK172.1 | 0,27 | 0,59 | 0,42 | 0,45 | 0,32 | 0,39 | SK172.1 F | 0,27 | 0,59 | 0,42 | 0,45 | 0,32 | 0,39 |
| SK372.1 | 0,45 | 1,05 | 0,75 | 1,00 | 0,60 | 0,65 | SK372.1 F | 0,45 | 1,05 | 0,75 | 1,00 | 0,60 | 0,65 |
| SK572.1 | 0,75 | 1,90 | 1,50 | 2,00 | 1,10 | 1,15 | SK572.1 F | 0,75 | 1,90 | 1,50 | 2,00 | 1,10 | 1,15 |
| SK672.1 | 1,10 | 2,60 | 2,15 | 2,70 | 1,55 | 1,65 | SK672.1 F | 1,10 | 2,60 | 2,15 | 2,70 | 1,55 | 1,65 |
| SK772.1 | 1,15 | 3,65 | 2,25 | 3,15 | 1,35 | 2,15 | SK772.1 F | 1,15 | 3,65 | 2,25 | 3,15 | 1,35 | 2,15 |
| SK872.1 | 3,20 | 8,00 | 5,30 | 7,00 | 2,80 | 4,60 | SK872.1 F | 2,60 | 8,00 | 5,30 | 7,00 | 2,80 | 4,60 |
| SK972.1 | 4,50 | 12,90 | 8,10 | 12,70 | 4,60 | 7,80 | SK972.1 F | 4,50 | 12,90 | 8,10 | 12,70 | 4,60 | 7,80 |

| | | | | | | | | | | | | | |
|--|---|-----------|-----------|-----------|-----------|-----------|--|---|-----------|-----------|-----------|-----------|-----------|
|  [L] |  | | | | | |  [L] |  | | | | | |
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 |
| SK373.1 | 0,45 | 1,05 | 0,75 | 1,00 | 0,60 | 0,65 | SK373.1 F | 0,45 | 1,05 | 0,75 | 1,00 | 0,60 | 0,65 |
| SK573.1 | 0,75 | 1,90 | 1,50 | 2,00 | 1,10 | 1,15 | SK573.1 F | 0,75 | 1,90 | 1,50 | 2,00 | 1,10 | 1,15 |
| SK673.1 | 1,10 | 2,60 | 2,15 | 2,70 | 1,55 | 1,65 | SK673.1 F | 1,10 | 2,60 | 2,15 | 2,70 | 1,55 | 1,65 |
| SK773.1 | 1,95 | 3,50 | 3,20 | 2,90 | 2,25 | 2,95 | SK773.1 F | 1,95 | 3,50 | 3,20 | 2,90 | 2,25 | 2,95 |
| SK873.1 | 4,05 | 7,60 | 6,85 | 6,55 | 5,00 | 6,55 | SK873.1 F | 4,05 | 7,60 | 6,85 | 6,55 | 5,00 | 6,55 |
| SK973.1 | 7,40 | 12,20 | 11,10 | 11,60 | 8,00 | 10,90 | SK973.1 F | 7,40 | 12,20 | 11,10 | 11,60 | 8,00 | 10,90 |

| | | | | | | | | | | | | | | | |
|--|---|-----------|-----------|-----------|-----------|-----------|-----------|---|------------|-----------|-------------|--------------|-----------|-----------|-----------|
|  [L] |  | | | | | | |  | | | | | | | |
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | M1 | M2 | M3 | M4 | M5 | M6 | M1 | M2 | M3 |
| ⇒ 6.1 | B3 | V6 | B8 | V5 | B6 | B7 | B5 | V3 | B5I | V1 | B5II | B5III | | | |
| SK172 | 0,35 | 0,50 | 0,50 | 0,50 | 0,50 | 0,50 | 0,35 | 0,50 | 0,50 | 0,50 | 0,50 | 0,50 | | | |
| SK272 | 0,60 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 0,60 | 1,00 | 1,00 | 1,00 | 1,00 | | | |
| SK372 | 0,60 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 0,60 | 1,00 | 1,00 | 1,00 | 1,00 | | | |
| SK472 | 1,00 | 1,90 | 1,90 | 2,00 | 1,80 | 1,80 | 1,00 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | | | |
| SK572 | 1,00 | 1,90 | 1,90 | 2,00 | 1,80 | 1,80 | 1,00 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | | | |
| SK672 | 1,40 | 3,40 | 3,10 | 3,15 | 1,45 | 3,15 | 1,15 | 3,40 | 2,70 | 2,80 | 1,25 | 2,70 | | | |
| SK772 | 2,00 | 3,30 | 3,50 | 4,20 | 2,70 | 3,30 | 1,60 | 3,30 | 3,50 | 3,30 | 3,10 | 3,10 | | | |
| SK872 | 3,70 | 9,60 | 9,10 | 7,30 | 4,70 | 8,00 | 3,50 | 9,00 | 7,90 | 7,70 | 3,90 | 7,20 | | | |
| SK972 | 6,50 | 16,00 | 15,70 | 14,70 | 8,50 | 14,00 | 6,50 | 15,00 | 13,00 | 13,50 | 6,50 | 12,00 | | | |
|  [L] |  | | | | | | |  | | | | | | | |
| SK273 | 0,62 | 1,10 | 1,10 | 1,10 | 1,10 | 1,10 | 0,62 | 1,10 | 1,10 | 1,10 | 1,10 | 1,10 | | | |
| SK373 | 0,55 | 1,10 | 1,10 | 1,10 | 1,10 | 1,10 | 1,10 | 0,55 | 1,10 | 1,10 | 1,10 | 1,10 | | | |
| SK473 | 1,30 | 2,50 | 2,10 | 2,40 | 2,10 | 2,10 | 1,25 | 2,40 | 2,10 | 2,50 | 2,10 | 2,10 | | | |
| SK573 | 1,30 | 2,50 | 2,10 | 2,40 | 2,10 | 2,10 | 1,25 | 2,40 | 2,10 | 2,50 | 2,10 | 2,10 | | | |
| SK673 | 1,80 | 3,80 | 3,20 | 3,40 | 2,90 | 3,00 | 1,70 | 3,80 | 3,00 | 3,20 | 3,00 | 3,00 | | | |
| SK773 | 2,50 | 4,50 | 3,70 | 4,60 | 3,30 | 3,30 | 2,30 | 5,00 | 3,60 | 4,50 | 3,90 | 3,90 | | | |
| SK873 | 6,20 | 8,40 | 7,50 | 9,10 | 7,50 | 7,50 | 5,00 | 8,80 | 7,60 | 8,00 | 8,00 | 8,00 | | | |
| SK973 | 11,00 | 15,80 | 13,00 | 16,00 | 13,30 | 13,00 | 10,30 | 16,50 | 13,00 | 16,00 | 14,00 | 14,00 | | | |

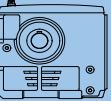
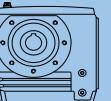
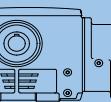
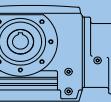
| [L] | | | | | | | [L] | | | | | | |
|--------------|------|------|------|------|------|------|----------------|------|------|------|------|------|------|
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 |
| SK0 | 0,13 | 0,22 | 0,13 | 0,22 | 0,13 | 0,13 | SK0 F | 0,13 | 0,22 | 0,13 | 0,22 | 0,13 | 0,13 |
| SK01 | 0,22 | 0,38 | 0,22 | 0,38 | 0,22 | 0,22 | SK01 F | 0,22 | 0,38 | 0,22 | 0,38 | 0,22 | 0,22 |
| SK20 | 0,55 | 1,00 | 0,55 | 1,00 | 0,55 | 0,55 | SK20 F | 0,35 | 0,60 | 0,35 | 0,60 | 0,35 | 0,35 |
| SK25 | 0,50 | 0,90 | 0,50 | 0,90 | 0,50 | 0,50 | SK25 F | 0,50 | 0,90 | 0,50 | 0,90 | 0,50 | 0,50 |
| SK30 | 0,80 | 1,40 | 0,70 | 1,40 | 0,70 | 0,70 | SK30 F | 0,80 | 1,40 | 0,70 | 1,10 | 0,70 | 0,70 |
| SK33 | 0,80 | 1,60 | 1,00 | 1,60 | 0,80 | 1,00 | SK33 F | 1,00 | 1,60 | 1,00 | 1,60 | 0,80 | 1,00 |
| SK000 | 0,24 | 0,41 | 0,24 | 0,41 | 0,24 | 0,24 | SK000 F | 0,24 | 0,41 | 0,24 | 0,41 | 0,24 | 0,24 |
| SK010 | 0,38 | 0,60 | 0,38 | 0,60 | 0,38 | 0,38 | SK010 F | 0,38 | 0,60 | 0,38 | 0,60 | 0,38 | 0,38 |
| SK200 | 0,80 | 1,30 | 0,80 | 1,30 | 0,80 | 0,80 | SK200 F | 0,60 | 1,04 | 0,60 | 1,04 | 0,60 | 0,60 |
| SK250 | 1,40 | 1,50 | 1,40 | 1,50 | 1,40 | 1,40 | SK250 F | 1,40 | 1,50 | 1,40 | 1,50 | 1,40 | 1,40 |
| SK300 | 1,40 | 1,50 | 1,40 | 1,50 | 1,40 | 1,40 | SK300 F | 1,40 | 1,50 | 1,40 | 1,50 | 1,40 | 1,40 |
| SK330 | 1,50 | 1,58 | 1,50 | 1,58 | 1,50 | 1,50 | SK330 F | 2,00 | 1,58 | 1,50 | 2,80 | 1,50 | 1,50 |

| [L] | | | | | | | [L] | | | | | | |
|-------------------|-------|-------|-------|-------|-------|-------|-------------------|-------|-------|-------|-------|-------|-------|
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | ⇒ 6.1 | H1 | H6 | H2 | H5 | H4 | H3 |
| SK0182NB A | 0,40 | 0,55 | 0,60 | 0,55 | 0,35 | 0,35 | | | | | | | |
| SK0282NB A | 0,70 | 1,00 | 0,80 | 1,10 | 0,90 | 0,90 | | | | | | | |
| | | | | | | | SK1382NB A | 1,30 | 2,30 | 1,40 | 2,10 | 2,00 | 1,90 |
| [L] | | | | | | | [L] | | | | | | |
| SK1282 A | 0,90 | 1,30 | 0,90 | 1,20 | 0,95 | 0,95 | | | | | | | |
| SK2282 A | 1,65 | 2,40 | 1,90 | 2,00 | 1,80 | 1,80 | SK2382 A | 1,70 | 2,60 | 1,90 | 3,10 | 1,50 | 1,50 |
| SK3282 A | 3,15 | 4,10 | 3,25 | 4,10 | 3,15 | 3,15 | SK3382 A | 4,10 | 4,90 | 3,30 | 5,60 | 3,30 | 3,30 |
| SK4282 A | 4,70 | 6,10 | 4,75 | 5,40 | 4,70 | 4,70 | SK4382 A | 5,90 | 6,80 | 4,90 | 8,30 | 4,90 | 4,90 |
| SK5282 A | 7,50 | 8,80 | 7,50 | 8,80 | 7,20 | 7,20 | SK5382 A | 12,50 | 12,00 | 6,70 | 14,00 | 8,30 | 8,30 |
| [L] | | | | | | | [L] | | | | | | |
| SK6282 A | 17,00 | 14,00 | 12,00 | 17,50 | 10,00 | 14,00 | SK6382 A | 16,50 | 13,00 | 9,60 | 18,00 | 14,00 | 12,50 |
| SK7282 A | 25,00 | 21,00 | 20,00 | 27,00 | 16,00 | 21,00 | SK7382 A | 22,00 | 20,00 | 16,00 | 25,00 | 23,00 | 19,00 |
| SK8282 A | 37,00 | 33,00 | 30,00 | 41,00 | 31,00 | 31,00 | SK8382 A | 34,00 | 32,00 | 25,00 | 38,00 | 35,00 | 30,00 |
| SK9282 A | 74,00 | 70,00 | 55,00 | 72,00 | 60,00 | 59,00 | SK9382 A | 73,00 | 70,00 | 45,00 | 74,00 | 65,00 | 60,00 |
| [L] | | | | | | | [L] | | | | | | |
| SK10282 A | 90 | 90 | 40 | 90 | 60 | 82 | SK10382 A | 85 | 100 | 73 | 100 | 80 | 80 |
| SK11282 A | 165 | 160 | 145 | 195 | 100 | 140 | SK11382 A | 160 | 155 | 140 | 210 | 155 | 135 |
| | | | | | | | SK12382 A | 160 | 155 | 140 | 210 | 155 | 135 |

* ⇒ 38



| [L] | | | | | | | | | | | | |
|-----------------|-------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|
| ⇒ 6.1 | M1 | M2 | M3 | M4 | M5 | M6 | M1 | M2 | M3 | M4 | M5 | M6 |
| ⇒ 6.1 | B3 | B6 | B8 | B3I | V5 | V6 | B5I | B5 | B5III | B5II | V1 | V3 |
| SK92072 | 0,40 | 0,60 | 0,50 | 0,50 | 0,40 | 0,40 | 0,40 | 0,60 | 0,50 | 0,50 | 0,40 | 0,40 |
| SK92172 | 0,55 | 0,90 | 0,95 | 1,10 | 0,75 | 0,62 | 0,50 | 0,92 | 0,87 | 1,05 | 0,75 | 0,65 |
| SK92372 | 0,90 | 1,30 | 1,45 | 1,60 | 1,20 | 1,20 | 1,15 | 1,50 | 1,20 | 1,70 | 1,15 | 1,15 |
| SK92672 | 1,80 | 3,50 | 3,20 | 3,40 | 2,60 | 2,60 | 1,55 | 2,80 | 2,50 | 3,30 | 2,40 | 2,40 |
| SK92772 | 2,30 | 4,50 | 4,60 | 5,30 | 4,10 | 4,10 | 2,75 | 4,40 | 4,50 | 5,50 | 3,50 | 3,50 |
| [L] | | | | | | | | | | | | |
| SK9012.1 | 0,70 | 1,60 | 1,90 | 2,40 | 1,20 | 1,70 | 0,70 | 1,90 | 1,90 | 2,10 | 1,20 | 1,70 |
| SK9016.1 | 0,70 | 1,60 | 1,90 | 2,40 | 1,20 | 1,70 | 0,70 | 1,90 | 1,90 | 2,10 | 1,20 | 1,70 |
| SK9022.1 | 1,30 | 2,60 | 3,50 | 4,20 | 2,00 | 2,80 | 1,30 | 2,60 | 3,50 | 4,20 | 2,00 | 2,80 |
| SK9032.1 | 1,70 | 4,80 | 6,40 | 6,70 | 4,10 | 5,10 | 1,90 | 5,20 | 6,40 | 7,30 | 3,30 | 5,10 |
| SK9042.1 | 4,40 | 8,70 | 10,00 | 9,80 | 6,80 | 7,50 | 3,60 | 9,70 | 11,40 | 11,50 | 6,50 | 8,20 |
| SK9052.1 | 6,50 | 16,00 | 19,00 | 21,50 | 11,00 | 15,50 | 7,50 | 16,50 | 20,00 | 22,50 | 11,50 | 18,00 |
| SK9062.1 | 10,00 | 27,50 | 32,00 | 36,00 | 18,00 | 24,00 | 12,00 | 27,50 | 33,00 | 38,50 | 19,00 | 26,00 |
| SK9072.1 | 10,00 | 27,50 | 32,00 | 36,00 | 18,00 | 24,00 | 12,00 | 27,50 | 33,00 | 38,50 | 19,00 | 26,00 |
| SK9082.1 | 17,00 | 51,50 | 62,50 | 71,50 | 33,00 | 46,50 | 21,00 | 54,00 | 66,00 | 80,00 | 38,00 | 52,00 |
| SK9086.1 | 29,00 | 73,00 | 85,00 | 102,00 | 48,00 | 62,00 | 36,00 | 78,00 | 91,00 | 107,00 | 53,00 | 76,00 |
| SK9092.1 | 41,00 | 157,00 | 170,00 | 172,00 | 80,00 | 90,00 | 40,00 | 130,00 | 154,00 | 175,00 | 82,00 | 91,00 |
| SK9096.1 | 70,00 | 187,00 | 194,00 | 254,00 | 109,00 | 152,00 | 80,00 | 187,00 | 193,00 | 257,00 | 113,00 | 156,00 |
| [L] | | | | | | | | | | | | |
| SK9013.1 | 1,20 | 2,00 | 2,20 | 3,00 | 1,40 | 1,90 | 1,20 | 2,30 | 2,20 | 3,00 | 1,40 | 1,90 |
| SK9017.1 | 1,20 | 2,00 | 2,20 | 3,00 | 1,40 | 1,90 | 1,20 | 2,30 | 2,20 | 3,00 | 1,40 | 1,90 |
| SK9023.1 | 2,40 | 3,00 | 3,80 | 5,30 | 2,20 | 3,10 | 2,40 | 3,00 | 3,80 | 5,30 | 2,20 | 3,10 |
| SK9033.1 | 3,30 | 6,60 | 7,00 | 7,80 | 4,30 | 5,10 | 3,80 | 5,70 | 6,90 | 8,50 | 3,60 | 5,60 |
| SK9043.1 | 4,60 | 10,20 | 10,70 | 12,80 | 5,20 | 6,70 | 5,70 | 10,20 | 14,70 | 14,70 | 6,60 | 9,60 |
| SK9053.1 | 10,00 | 17,00 | 20,00 | 24,20 | 11,50 | 16,50 | 12,50 | 18,00 | 21,50 | 26,50 | 13,00 | 17,00 |

| | | | | | | | | | | | | | | |
|--|---|-----------|-----------|------------|-----------|-----------|--|---|------------|-----------|--------------|-------------|-----------|-----------|
|  [L] |  | | | | | |  [L] |  | | | | | | |
| ⇒  6.1 | M1 | M2 | M3 | M4 | M5 | M6 | | | M1 | M2 | M3 | M4 | M5 | M6 |
| ⇒  6.1 | B3 | B6 | B8 | B3I | V5 | V6 | | | B5I | B5 | B5III | B5II | V1 | V3 |
| ⇒  6.1 | | | | | | | | | H1 | H4 | H2 | H3 | H5 | H6 |
| SK02040 | 0,45 | 0,60 | 0,60 | 0,60 | 0,50 | 0,50 | SK02040 A | 0,40 | 0,80 | 0,65 | 0,60 | 0,50 | 0,50 | |
| SK02050 | 0,40 | 1,20 | 0,70 | 1,15 | 0,70 | 0,70 | SK02050 A | 0,45 | 1,10 | 0,90 | 1,10 | 0,80 | 0,80 | |
| SK12063 | 0,60 | 1,70 | 1,20 | 1,55 | 1,00 | 1,00 | SK12063 A | 0,50 | 1,45 | 1,20 | 1,40 | 1,10 | 1,10 | |
| SK12080 | 0,80 | 2,60 | 1,70 | 2,70 | 1,70 | 1,70 | SK12080 A | 0,90 | 3,10 | 3,00 | 3,00 | 2,20 | 2,20 | |
| SK32100 | 1,60 | 5,50 | 3,40 | 5,40 | 3,20 | 3,20 | SK32100 A | 1,50 | 5,20 | 3,80 | 5,30 | 3,80 | 3,80 | |
| SK42125 | 2,80 | 11,00 | 6,20 | 10,30 | 5,80 | 5,80 | SK42125 A | 3,20 | 12,90 | 6,10 | 10,50 | 6,30 | 6,30 | |
|  [L] |  | | | | | |  [L] |  | | | | | | |
| SK13050 | 0,95 | 1,55 | 1,10 | 1,45 | 0,95 | 0,95 | SK13050 A | 0,85 | 1,75 | 1,25 | 1,35 | 1,15 | 1,15 | |
| SK13063 | 0,85 | 2,30 | 1,60 | 2,00 | 1,25 | 1,25 | SK13063 A | 0,90 | 2,10 | 1,55 | 2,10 | 1,45 | 1,45 | |
| SK13080 | 1,70 | 3,20 | 2,10 | 3,40 | 1,95 | 1,95 | SK13080 A | 1,70 | 3,75 | 3,60 | 3,60 | 2,55 | 2,55 | |
| SK33100 | 2,10 | 7,60 | 4,00 | 6,80 | 3,70 | 3,70 | SK33100 A | 2,10 | 6,10 | 4,80 | 6,60 | 4,20 | 4,20 | |
| SK43125 | 7,80 | 14,00 | 7,20 | 13,50 | 6,70 | 6,70 | SK43125 A | 4,80 | 13,50 | 7,40 | 14,50 | 8,00 | 8,00 | |
|  [L] |  | | | | | |  [L] |  | | | | | | |
| SK02040 F | 0,50 | 0,80 | 0,75 | 0,60 | 0,50 | 0,50 | | | | | | | | |
| SK02050 F | 0,45 | 1,40 | 0,90 | 1,25 | 1,00 | 1,00 | SK13050 F | 0,90 | 1,80 | 1,15 | 1,75 | 1,25 | 1,25 | |
| SK12063 F | 0,50 | 1,60 | 1,40 | 1,80 | 1,50 | 1,50 | SK13063 F | 0,95 | 2,10 | 1,65 | 2,15 | 1,75 | 1,75 | |
| SK12080 F | 0,95 | 3,20 | 3,10 | 3,70 | 2,50 | 2,50 | SK13080 F | 1,40 | 4,20 | 3,35 | 4,20 | 2,75 | 2,75 | |
| SK32100 F | 1,50 | 7,10 | 4,90 | 7,10 | 4,40 | 4,40 | SK33100 F | 2,30 | 7,60 | 5,50 | 7,80 | 4,85 | 4,85 | |
| SK42125 F | 3,30 | 11,20 | 6,10 | 10,40 | 6,80 | 6,80 | SK43125 F | 4,30 | 14,50 | 7,10 | 12,10 | 7,70 | 7,70 | |



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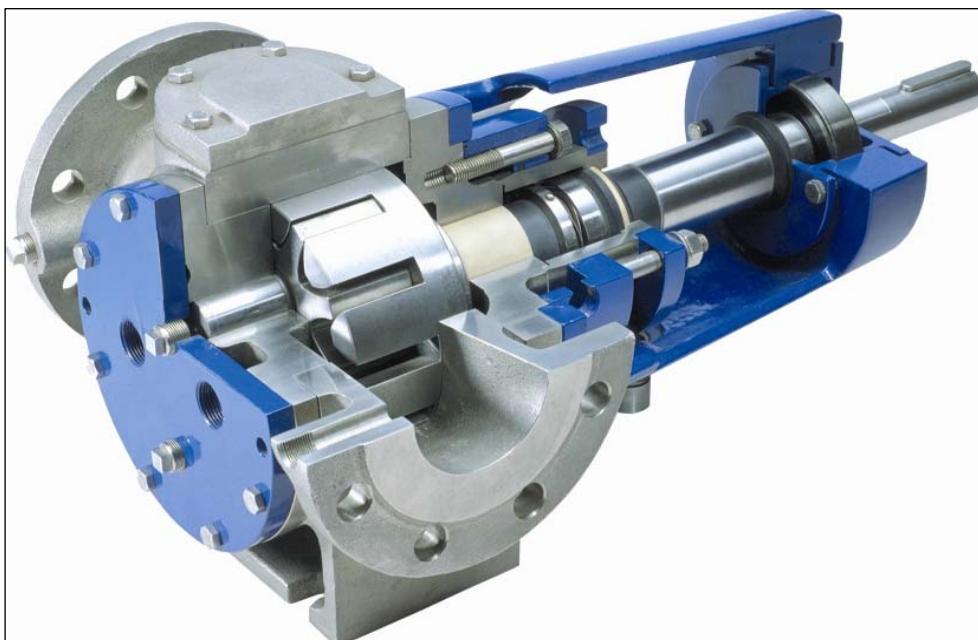
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T1456UK-V9.3

EC Declaration of Conformity

The Machinery Directive 2006/42/EC

Manufacturer: DESMI A/S
Address: Tagholm 1, DK-9400 Nørresundby, Denmark
Tel.: +45 96 32 81 11
E-mail: desmi@desmi.com



DESMI A/S hereby declares that the product in question has been produced in accordance with the following essential health and safety requirements of the Machinery Directive 2006/42/EC Annex I.

Product: ROTAN pumps complete with motor
Type: HD, CD, PD, GP, CC, ED(MD)
which are installed and applied in conformity with DESMI A/S' user manual.

The following harmonised standards have been applied:
EN 294:1994 Safety distances
EN 809:2002 + AC – Pumps and pump units for liquids
EN 12162:2001 – Procedures for hydrostatic testing of liquid pumps
EN 60204-1:2006 Electrical equipment on machines (item 4, general requirements)

Reservations For application in explosive atmospheres the pump with motor must also comply with ATEX Directive 94/9/EC.
If applied for hazard-classified liquids, the user company's attention is drawn to the section of the user manual on emptying and cleaning of the pump.

Nørresundby 2010



Kurt Bech Christensen
Technical Director
DESMI A/S

Component Declaration

Manufacturer: DESMI A/S
Address: Tagholm 1, DK-9400 Nørresundby, Denmark.
Tel.: +45 96 32 81 11
E-mail: desmi@desmi.com

Product: ROTAN pumps
Type: HD, CD, PD, GP, CC, ED(MD)
which are installed and applied in conformity with DESMI A/S' user manual

DESMI A/S hereby declares that the product in question has been produced in accordance with the essential health and safety requirements of the Machinery Directive 2006/42/EC Annex I.

The following harmonised standards have been applied:

EN 294:1994 Safety distances

EN 809:2002 + AC – Pumps and pump units for liquids

EN 12162:2001 – Procedures for hydrostatic testing of liquid pumps

The pump is designed for use when connected to an electric motor, with the aim of creating a joint machine.

Reservation For application in explosive atmospheres the pump must also comply with ATEX Directive 94/9/EC.

If applied for hazard-classified liquids, the user company's attention is drawn to the section of the user manual on emptying and cleaning of the pump.

The pump must not be put into use until pump, motor and control have been risk assessed and the unit has been CE marked in conformity with the provisions of the Machinery Directive.

Nørresundby 2010



A handwritten signature in black ink.

Kurt Bech Christensen

Technical Director

DESMI A/S

EC Declaration of Conformity

ATEX – 94/9/EC

Manufacturer: DESMI A/S
Address: Tagholm 1, DK-9400 Nørresundby, Denmark.
Tel.: +45 96 32 81 11
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Product: ROTAN pumps
Type: HD, CD, PD, GP, CC, ED(MD)

which are marked:  II category 2 or 3, "c" X and with temperature class and installed and applied in conformity with DESMI A/S' user manual

The entire user manual must be read thoroughly before a ROTAN ATEX pump is installed and put into use

DESMI A/S hereby declares that the product in question has been produced in accordance with ATEX Directive 94/9/EC.

The following harmonised standards have been applied: EN13463-1:2002
EN13463-5:2004

The product is designed for use when connected to an electric motor, with the aim of creating a joint machine. The conformity also applies to complete pumps with motor if, according to the manufacturer, the motor conforms to a corresponding category and temperature class and has been fitted in conformity with DESMI A/S' user guide. If DESMI A/S supplies pump and electric motor connected, the EC Declaration of Conformity and user manual for the electric motor will be attached.

Nørresundby 2010



A handwritten signature in black ink, appearing to read 'Kurt Bech Christensen', is placed over a horizontal line.

Kurt Bech Christensen
Technical Director
DESMI A/S

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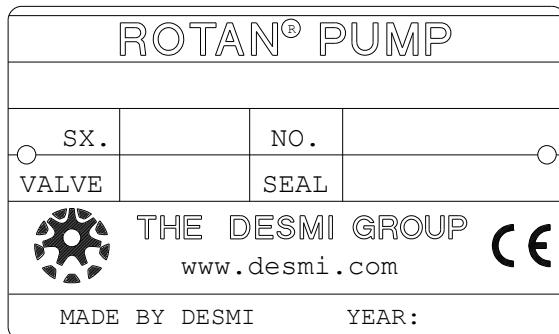
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*ED operations and service instructions. See manual T1386

Name plate



The above shows the name plate fixed on the ROTAN pump.

If the pump's and the motor's name plate bears an and the designation **group II, zone 2 or 3, G or GD, c X and T-klassen – e.g. II 3 GD c T4 X**, the unit is prepared for use in a potentially explosive environment. As a standard ROTAN pump units are nor prepared fro use in a potentially explosive environment.



The name plate must never be removed from the pump.

If the name plate is removed, the pump cannot be identified immediately, and therefore warnings in this manual cannot be compared with the specific pump application.

The pump's order number and serial number are displayed on the flange.

General information

This user manual relates to ROTAN internal gear pumps.

The entire user manual must be read thoroughly before the pump is transported, lifted, installed, assembled and any other activity described in this user manual.

Everyone who is to work with this pump must read this user manual before it is taken into operation.

Upon receipt, check that the delivery is complete and undamaged. Any deficiencies or damage must be reported immediately to the transport company and the supplier, in order that a claim may be valid.

The user is responsible for compliance with the safety requirements described in this user manual.

If people who are expected to have a need to refer to the user manual are of a different linguistic origin than the language in which the user manual has been supplied, it is recommended that the user manual is translated into the language in question.

In addition to the instructions contained in this user manual, we also refer to the prevailing local national laws and regulations. The user is responsible for compliance with these.

The owner of the pump is responsible for ensuring that everyone who works with the pump has the necessary background.

In the event that this user manual or other regulations recommend the use of personal protective equipment or limitations on the use of labour and the pump, such instructions must be observed.

The pump may only be used under the operating conditions specified when the order was placed. Any deviation from this requires DESMI's consent.

The owner or user of the pump must ensure that this manual is updated if there are any modifications to the pump. Especially the description of safety must be emphasised.

In the event that the pump is transferred to a third party, this user manual with any updated amendments and the operating conditions defined when the order was submitted *must* accompany the pump.

DESMI assumes no liability for any personal injury or damage to the pump or other material damage resulting from:

- any amendments to the pump not approved by DESMI A/S
- a failure to observe the safety regulations or other instructions in this user manual
- the use of non-original spare parts that do not satisfy precisely the same, strict quality requirements as original DESMI spare parts
- any fault, blockage or breakdown in the pipe system

The owner or user is responsible for protecting the pipe system against faults, blockages and explosions.

Quality management system:

ROTAN pumps are manufactured in accordance with DESMI's quality management system, which is certified by BVQI in accordance with the requirements of ISO 9001.



Testing of pumps:

All ROTAN pumps have been *statically* and *dynamically* tested in the factory except pump versions "CHD" and "EPDM".

All bypass valves have been *statically* tested in the factory.

Static pressure testing is conducted to ensure that the pumps do not leak, and that they can maintain the specified maximum operating pressure.

The dynamic test is conducted to ensure that the pump can deliver the specified volume of liquid at the specified pressures.

The pumps are tested and preserved with oil type GOYA 680 transmission oil (Q8) with a viscosity of about 70 cSt. Pumps in versions "CHD" and "EPDM" are preserved in the factory using vegetable oil.

Pumps fitted with a heating jacket/cooling jacket are also specially tested to achieve extra safety to ensure that the heating liquid in the front cover and the cooling jacket on the rear cover cannot pass into the pump liquid.

After testing the pump is emptied, but it has not been cleaned for test oil in the factory.

All pumps are supplied with a signed test certificate.

The tests described are conducted in accordance with the procedures set out in DESMI's quality management system and in accordance with international classification companies.

Explosion-proof pumps:

DESMI produces pump units for potentially explosive environments, but as a standard ROTAN pump units are not prepared for use in potentially explosive environments, and therefore they must not be used in such contexts without DESMI's consent. The information on the pump's name plate will define whether it can be used in a potentially explosive environment.

DESMI can supply pump units for potentially explosive environment within the areas indicated in Figure 1: Shows the group (G=Gas/D=Dust), the categories, zones and temperature classes (T1/T2/T3/T4) for which DESMI A/S can supply pump units within potentially explosive environments.

| Atex | | | |
|---------------------|---------|--------------------|---------|
| Group II - G/D | | | |
| Category 2 | | Category 3 | |
| Zone 1 | Zone 21 | Zone 2 | Zone 22 |
| Gas / steam / mist | Dust | Gas / steam / mist | Dust |
| T1 / T2 / T3 / T4 / | | | |

Figure 1: Shows the group (G=Gas/D=Dust), the categories, zones and temperature classes (T1/T2/T3/T4) for which DESMI A/S can supply pump units within potentially explosive environments.

If the pump is required to be used in a potentially explosive environment, this must be stated when ordering so that the pump unit can be supplied especially for such conditions.

DESMI A/S can supply the following control equipment to pumps in a potentially explosive environment:

| Control equipment | Protection |
|--------------------|--|
| Thermal sensor | For registration of surface temperature (to be connected to control) |
| Temperature labels | Temperature labels indicate the max. temperature reached |
| Bypass valve | The bypass valve protects pumps and motors in the event of brief pulsating excess pressures in the system. The bypass valve does not give protection against the pipe system |
| Liquiphant™ | The Liquiphant™ provides protection against dry running |



All pump types and pump sizes must always be protected against dry running either by means of a Liquiphant™ or other comparable devices



Pumps supplied with a soft stuffing box must always be fitted with a thermal sensor or other comparable devices



Pump type ED must always be fitted with a thermal sensor

ATEX

Temperature labels can be used as extra control together with the thermal sensor. However, the thermal sensor cannot be replaced by temperature labels. When using temperature labels, the manufacturer's instructions must be observed.

Any other issues in connection with purchase of pump units for potentially explosive environments are to be clarified with our sales department when ordering.

Before ordering, you must first as a customer fulfil the minimum requirements in the current, relevant EF ATEX Directive concerning improvement of safety and health protection for employees who may be exposed to danger resulting from potentially explosive environments and have prepared an overall risk assessment in conformity with the mentioned directive in collaboration with the local fire authorities. This risk assessment must be in conformity with the ATEX labelling DESMI A/S has stated on the name plate of the supplied pump – before start-up of the pump is allowed.



Prepare an overall risk assessment must be in conformity with the current relevant EC Directives on potentially explosive atmosphere in collaboration with the local fire authorities – if the pump is to be used in a potentially explosive atmosphere – and check that this risk assessment against the labelling DESMI A/S has stated on the supplied pump before commissioning of the pump is allowed.

Special protective measures for ROTAN pump units in connection with potentially explosive environments to be considered and observed appear continuously from this manual under the relevant sections – se these!

*

Flow:

The sketch below shows a cross section of the ROTAN pump seen from the front end – see Figure 2.

The sketch shows the principle of the liquid flow through the ROTAN pump.

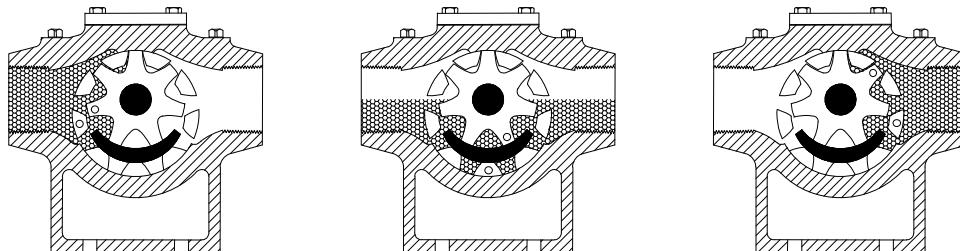


Figure 2: Shows the liquid flow through the ROTAN pump – seen from the front end.

Pump versions:

This user guide covers all standard versions of the ROTAN pump.

It applies to pump types described in Figure 4: A list of the various pump types, their designation and application.

, pump sizes described in Figure 5: A list of pump sizes based on the internal diameter of the pump's inlet/outlet in inches and millimetres.

, pump versions described in the section entitled "Pump models", and the versions shown in Figure 8: The codes of the various pump versions together with an explanation of what they mean.

In this manual the front and the rear ends of the ROTAN pump are referred to. shows which end is called front and which is called rear.

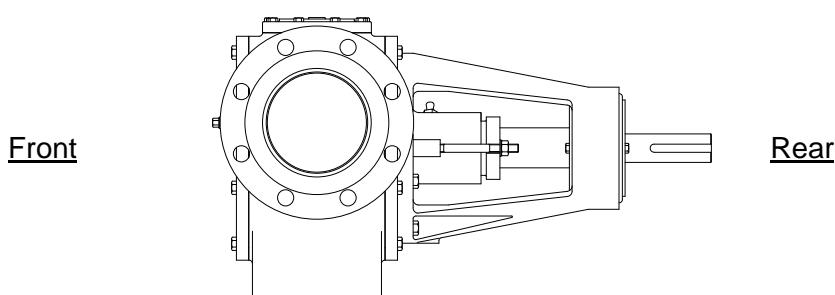


Figure 3: Shows what is designated as front and rear of the ROTAN pump.

The ROTAN pump has a modular construction, and can be supplied in a great number of options.

Because of the large number of possible combinations, it is not possible to cover all models or special versions available in this user manual.

If the user manual proves to be incomplete with regard to the above or to the item supplied, you are of course welcome to contact DESMI.

This user manual differentiates between the terms:

- pump types
- pump sizes
- pump models
- pump versions

Pump types:

The Rotan pump is supplied in the following pump types:

| Pump types - application | | |
|---------------------------------|---------------------|---|
| Pump type: | Designation: | Application: |
| GP | General Purpose | Mainly pumping of clean oils |
| HD | Heavy Duty | Mainly pumping of highly viscous liquids <u>Typical applications:</u> oils, asphalt, chocolate, paint, lacquer, molasses, soap and similar liquids <u>Used for processes in:</u> process industry |
| PD | Petrochemical Duty | <u>Typical applications:</u> lubricating oil, petrol, lubricants and other hydrocarbons. <u>Used for processes in:</u> refineries and the petrochemical industry |
| CD | Chemical Duty | To pump corrosive liquids <u>Typical applications:</u> organic acids, fatty acids, alkalis, caustic soda, polymer solutions, soap, shampoo, animal fat, vegetable fat, chocolate and other special liquids <u>Used for processes in:</u> chemical industry, food industry and the cosmetic industry |
| ED | Environmental Duty | Used to pump all the above liquids ED pumps are particularly environment-friendly, and provide a 100% guarantee against liquid or air leakage |
| CC | Closed Coupled | Particularly for pumping oil products <u>Used for processes in:</u> engineering industry |

Figure 4: A list of the various pump types, their designation and application.

Pump sizes:

The ROTAN pump is supplied in various pump sizes.

The pump size is defined on the basis of the pump's inlet/outlet.

By measuring the internal diameter of the pump's inlet/outlet, you can find the pump size in the table below.

| Pump size | | |
|-------------------|-------------------------------|------------------------------------|
| Pump sizes | Nominal diameter i mm. | Internal diameter in inches |
| 26 | 25 | 1" |
| 33 | 32 | 1 1/4" |
| 41 | 40 | 1 1/2" |
| 51 | 50 | 2" |
| 66 | 65 | 2 1/2" |
| 81 | 80 | 3" |
| 101 | 100 | 4" |
| 126 | 125 | 5" |
| 151* | 150 | 6" |
| 152* | 150 | 6" |
| 201 | 200 | 8" |

Figure 5: A list of pump sizes based on the internal diameter of the pump's inlet/outlet in inches and millimetres.

*Pump sizes 151 and 152 are pumps of two different displacements, but with the same size inlet/outlet.

The various pump types are available in the pump sizes listed in Figure 6: A list of the various pump sizes together with the pump types available in the various pump sizes.

| Pump size | Pump types/sizes | | | | | |
|------------------|-------------------------|-----------|-----------|-----------|-----------|-----------|
| | GP | HD | PD | CD | ED | CC |
| 26 | | | | | | |
| 33 | | | | | | |
| 41 | | | | | | |
| 51 | | | | | | |
| 66 | | | | | | |
| 81 | | | | | | |
| 101 | | | | | | |
| 126 | | | | | | |
| 151 | | | | | | |
| 152 | | | | | | |
| 201 | | | | | | |

Figure 6: A list of the various pump sizes together with the pump types available in the various pump sizes.

Fields that are shaded grey indicate the sizes available in the pump types listed.

The pump's inlet/outlet can be supplied with internal threads or flanges.

All pump types and pump sizes can be supplied with flanges to match connecting objects. The pump is supplied with an internal thread in the pump types and pump sizes listed in Figure 7.

| Pump size | Pumps with internal thread | | | | | |
|-----------|----------------------------|----|----|------------|-----------|----|
| | GP | HD | PD | Pump types | | CC |
| | | | | CD | ED | |
| | | | | stainless | cast iron | |
| 26 | | | | | | |
| 33 | | | | | | |
| 41 | | | | | | |
| 51 | | | | | | |
| 66 | | | | | | |
| 81 | | | | | | |
| 101 | | | | | | |
| 126 | | | | | | |
| 151 | | | | | | |
| 152 | | | | | | |
| 201 | | | | | | |

Figure 7: A list of the various pump sizes and pump types supplied with an internal thread. Fields that are shaded grey indicate the pump types and pump sizes supplier with an internal thread.

Heating/cooling jackets:

Rotan pumps can be fitted with a heating jacket or a cooling jacket on the front cover and/or the rear cover. Heating jackets are used to keep the pump liquid fluid, and are often necessary when pumping highly viscous liquids or liquids that tend to coagulate. The heating jacket on the rear cover can also be used to heat liquid-lubricated shaft seals.

The jacket can also be used as a cooling jacket for the shaft seal on the rear cover or a cooling jacket to cool the pump liquid on the front cover.

We recommend that the pump be heated before operation.

The heating/cooling chambers are heated or cooled by connecting a separate circulatory system that circulates heating liquids such as water, steam or oil.



The pressure in the heating jacket on the front cover and the cooling jacket on the rear cover may not exceed 10 bar.



The liquid in the heating chambers must have an ignition temperature of at least 50°C above the pump's maximum surface temperature.

ATEX

1. EC Declaration of Conformity

ROTAN pumps are CE-labelled from the factory and supplied with an EC Declaration of Conformity or an EC Component Declaration – depending on whether the pump has been bought with or without a motor.

When fitting a ROTAN pump in an existing system and connecting pumps and motors, we would point out that the whole plant/combination of motor and pump must be assessed and given a new CE label in order to ensure that the combination represents no new hazards with regard to health and safety.



Please note that pumps supplied by DESMI without a motor must be connected using an explosion-proof motor if you intend to use the pump in a potentially explosive atmosphere.

A ROTAN pump may not be put into operation until this CE labelling procedure has taken place. The manufacturer that ultimately assembles the final system is responsible for ensuring that such compliance is achieved.

DESMI is not responsible for this compliance.

The above requirement is valid within the EC.



2. Safety warnings – in general

- The pressure in the heating jacket on the front cover and the cooling jacket on the rear cover may not exceed 10 bar.
- Lift the pump mechanically, if the pump's weight is more than the permitted number of kilos that people may lift.
- Do not place fingers in the pump's ports when lifting or handling the pump.
- Motors fitted with lifting eyes must not be used to lift the whole pump, but only to lifting the motor separately.
- Lift of the pump should be performed in stable suspension points so that the pump is balanced and the lifting straps are not placed over sharp edges
- Lift of the pump shall be performed in conformity with the lifting instructions in Figure 10 – Figure 12
- Carefully shield the coupling between the pump and motor
- Bolt the pump securely to the foundation.
- Clean out any impurities from the pipe system before the pump is connected to it
- Remove the protective plugs from the pump ports before connecting the pipes.
- Flange couplings must always be undertaken by skilled professionals.
- Achieve parallelism between the flanges and observe the maximum tightening torque to prevent tension in the pump casing
- Threaded couplings must always be made by skilled professionals
- Connecting a pump with an internal thread to a pipe with a conical thread can cause the pump casing to burst if the coupling is over-tightened.
- Fit the pump unit with an emergency stop
- Connect and adjust any monitoring and safety systems – controls, manometers, flowmeters, etc. – according to the operating condition for safe operation
- Clean the pump for test oil before operation
- Use suitable safety equipment when aerating the pump such as gloves, protective goggles etc. – depending on the pump liquid
- Never bleed the pump in operation on account of the danger of squirting cold, hot, etching or poisonous liquids under pressure
- The pipe system must be secured against excess pressure in other ways than using the ROTAN bypass valve
- In the event of liquid properties which may block the bypass valve in its function, other comparable devices should be used instead of the ROTAN bypass valve.
- Pumps without a ROTAN bypass valve must use another equivalent safety device which protects pump and motor

- Any change to the pump's max. operating pressure must be followed by a change to the valve's setting - the working pressure must however not exceed the maximum allowable pressure of the pump/valve – see Figure 49.
- Check daily that the max. allowed temperature is observed
- The pump must be shielded when pumping hot liquids that create a surface temperature on the pump of more than +80° C
A warning sign must be displayed in a clearly visible location!
- When pumping hot liquids, the pipes must be fitted with compensators to prevent tensions in the pump casing
- ROTAN pumps may not be used to pump liquids at a temperature higher than the liquid's ignition temperature, and with reference to the maximum temperatures specified in the table Figure 30 and no higher than the temperature in the table Figure 31 – depending on the type of elastomer used – and for pumps with bypass valve max. 150°C. The lowest +temperature identified of the four mentioned constitutes the maximum temperature.
- The ED pump may not be used to pump liquids at a temperature that is higher than the liquid's ignition temperature, and with reference to the maximum temperatures specified in the table Figure 30 depending on the magnetic material, and no higher than the temperature stated in the table – Figure 31 – depending on the type of elastomer used - and for pumps with bypass valve max. 150°C.
The lowest +temperature identified of the four mentioned constitutes the maximum temperature.
The maximum temperature limit identified must be further reduced by the temperature increase generated by the magnets.
- ROTAN pumps are not approved for pumping foods requiring FDA and 3 A – approval
- Use appropriate hearing protection if necessary!
If necessary, display a sign stating that hearing protection must be worn!
- The shaft seal must not be adjusted during operation
- Ball bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C.
- Slide bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C.
- The lubricant for chocolate pumps must not be harmful. The lubricant must be compatible with the chocolate mix
- Observe the safety instructions in the data sheet for the liquid in question and use the specified safety equipment in the form of protective clothing, a breathing mask or similar necessary safety equipment
- Use suitable safety equipment with pump liquids at temperatures of more than +60°C.
- When pumping hazardous liquids, circulate neutralising liquid before emptying the pump.
- The system must be depressurised before emptying the pump.
- The safety instructions in the data sheet for the liquid in question must be observed, and the safety equipment specified must be used.



3. Safety warnings – electricity

- Electrical couplings must always be established by authorised professionals, in accordance with the prevailing standards and directives.
- Set the protective motor switch
Set the protective motor switch maximum to the motor's rated current



4. Safety warnings – ATEX

- All pump types and pump sizes must always be protected against dry running either by means of a Liquiphant™ or other comparable devices
- Pipe systems after the pump (the pressure side) must be secured with a safety/pressure relief valve which can return the whole liquid quantity to the tank in accordance with the pressure equipment directive 97/23/EC
- If the pump is not protected by the pipe system's safety valve/pressure relief valve or is protected in any other way, a bypass valve must be fitted on the pump
- If the pump is fitted with Rotan bypass valve, a thermal sensor must be fitted to ensure that the pump stops at 80% of the max. allowed surface temperature unless this is secured on other ways.
- Prepare an overall risk assessment in conformity with the current, relevant EC directives on potentially explosive atmosphere in collaboration with the local fire authorities
- The liquid in the heating chambers must have an ignition temperature of at least 50°C above the pump's maximum surface temperature
- Use only instruments and help systems approved by ATEX – such as gears, motors, liquid blocking systems etc. in connection with ROTAN pumps to function in potentially explosive environments
- If you intend to use the pump in a potentially explosive environment, the pump must be connected to an explosion-proof motor
- Use coupling approved by ATEX
- Set the axial clearance to prevent heat generation and the subsequent risk of explosion
- Position and fit vertical pumps in conformity with DESMI's instructions in order to avoid dry running and the subsequent risk of explosion in Ex pumps
- Pump type ED and pumps supplied with a soft stuffing box must always be fitted with a thermal sensor if they are positioned in potentially explosive environments
- Connect the control in conformity with the instructions from the control supplier
- Connect and pre-set the thermal sensor before starting up the pump

- Do not set the control – coupled to the thermal sensor – to a higher temperature than the one specified in the table in Figure 22
- Observe the inspection and maintenance instructions contained in this manual to achieve explosion protection for Ex-labelled pumps.
- Ball bearings must be lubricated to ensure explosion protection.
- Ball bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C – to guarantee explosion protection.
- Ball bearings must be replaced as indicated in Figure 37 to ensure explosion protection
- Slide bearings must be lubricated to guarantee explosion protection.
- Slide bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C – to guarantee explosion protection.
- Use spark-free tools when assembling and dismantling the pump and pump parts in potentially explosive atmospheres
- Pumps must not be used in a potentially explosive environment unless the pump's name plate is labelled EEx II 2GD c X – see the pump's name plate!

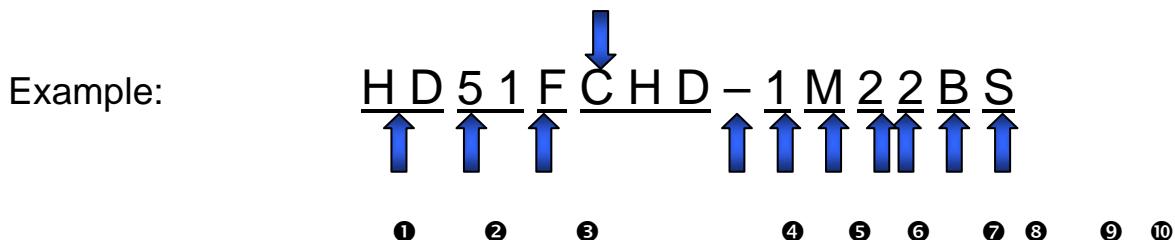
5. Pump models

The ROTAN pump has a modular construction, and can be supplied in a large number of models.

The pump's designation is made up of a series of codes which describe various features of the pump.

Below is an example of some of the codes.

Pump versions – see section: "11. Pump versions"



The numbers in the above example refer to the numbers on the next page.

This particular pump's designation is displayed on the pump's name plate – refer to that!

5.1 Pump models

1) Pump types

| | | |
|----|----------------------|---|
| GP | "General Purpose" | monoblock pump in cast iron |
| HD | "Heavy Duty" | cast iron pump |
| PD | "Petrochemical Duty" | steel pump |
| CD | "Chemical Duty" | stainless steel pump |
| ED | "Environmental Duty" | pump with magnetic coupling, made of cast iron, Steel and stainless steel |

2) Pump sizes

| | |
|-----|---------------|
| 26 | DN25 - 1" |
| 33 | DN32 - 1 1/4" |
| 41 | DN40 - 1 1/2" |
| 51 | DN50 - 2" |
| 66 | DN65 - 2 1/2" |
| 81 | DN80 - 3" |
| 101 | DN100 - 4" |
| 126 | DN125 - 5" |
| 151 | DN150 - 6" |
| 152 | DN150 - 6" |
| 201 | DN200 - 8" |

3) Versions

| | |
|---|-------------------------------|
| | Coated |
| E | Straight-through pump |
| B | Angle pump (not standard) |
| F | Flange |
| | Other versions, see next page |
| R | Bypass valve |

4)

- Hyphen

5) Material codes for main parts

| Code | Type | Pump casing/Covers | Rotor/St.wheel | Shaft |
|------|-------|--------------------|-------------------|-------------|
| 1 | GP/HD | GG-25 | GG-25 | St.60.2 |
| 3 | CD | G-X 6 CrNiMo 18 10 | X 8 CrNiMo 27 5X8 | CrNiMo 27 5 |
| 4 | PD | GS-52.3 | GG-25 | St.60.2 |

All material codes can be used for ED pumps.

6) Lubrication

| | |
|---|---|
| U | Idler bearing and main bearing lubricated by pump liquid. |
| M | Externally lubricated idler bearing and main bearing. |

7) Material codes for idler bearing

| Code | Idler Bush | Idler Pin;GP-HD-PD | Idler pin: CD |
|------|-----------------|---|--------------------|
| 1 | Cast iron | Hardened 16 MnCr 5 | X 8 CrNiMo 27 5 |
| 2 | Bronze | Hardened 16 MnCr 5 | X 8 CrNiMo 27 5 |
| 3 | Carbon | Hardened 16 MnCr 5 | X 8 CrNiMo 27 5 |
| 4 | Al.oxide | Cr.oxide coated 16 MnCr5 Cr.oxide coated X 8 CrNiMo 27 5 | |
| 5 | Carbon | Al.oxide, polished | Al.oxide, polished |
| 8 | Tungsten carbid | Tungsten carbide | Tungsten carbide |

8) Material codes for main bearing

| Code | Bearing Bush | Shaft: GP-HD-PD | Shaft: CD |
|------|------------------|---|-----------------|
| 1 | Cast iron | St.60.2 | X 8 CrNiMo 27 5 |
| 2 | Bronze | St.60.2 | X 8 CrNiMo 27 5 |
| 3 | Carbon | St. 60.2 | X 8 CrNiMo 27 5 |
| 4 | Al.oxide | Cr.oxide coated St.60.2Cr.oxide coated X 8 CrNiMo 27 5 | |
| 8 | Tungsten carbide | | Coated St.60.2 |
| | | | X 8 CrNiMo 27 5 |
| B | Ball bearing | St.60.2 | Not available |

9) Shaft seal

| | |
|----|--|
| B | Packing cord, teflon-impregnated |
| 2 | Mechanical shaft seal, EN12756-KU, with O-ring or bellows |
| 22 | Double mechanical shaft seal, EN12756-KU, O-ring type |
| | For ED pumps only: |

| | |
|-----|---------------------------------------|
| /XX | Magnet length: XX cm. |
| N | Magnet material: Neodymium-iron-boron |
| C | Magnet material: Samarium cobalt |

10) Special configurations

S All special configurations are marked with "S"

DESMI A/S

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Fax 98 17 54 99
E-mail: desmi@desmi.com
www.desmi.com



5.2 Pump versions

| | | |
|--|--|--|
| | | |
| Sealing with packing coil, with or without lantern ring for external lubrication. Used for liquids with high viscosities and where leaking is allowed. | M - GP/HD Sealing with single mechanical shaft seal, DIN 24960/EN 12756-KU, together with ball bearing as main bearing. Used where only minor leaking can be accepted. | M - PD/CD Sealing with single mechanical shaft seal, DIN 24960/EN 12756-KU, together with media-lubricated slide bearing as main bearing. Used where only minor leaking can be accepted. |
| | | |
| MM (tandem) - MMP (back to back) Double mechanical shaft seal, DIN 24960/EN 12756-KU, in tandem or back-to-back, with main bearing in the blocking liquid. Used where no leaking is allowed. A differential pressure of up to 6 bar above the pump is allowed. | MMW (tandem) - MMPW (back to back) Double mechanical shaft seal, DIN 24960/EN 12756-KU, in tandem or back-to-back, with main bearing in the liquid. Used where no leaking is allowed. A differential pressure of up to 16 bar above the pump is allowed. | T Special tolerances. Increased tolerances are used for liquids with viscosity above 7500 cSt or at temperature above 150°C. |
| | | |
| D Heating jackets on front cover is often necessary when pumping highly viscous liquids or liquids that tend to coagulate. | K Heating jacket on the rear cover is often necessary when pumping highly viscous liquids or liquids that tend to coagulate. Can also be used as cooling jacket for shaft sealing. | CHD Combination of special tolerances and heating jackets together with external lubrication of main bearing. Used in the chocolate industry. |

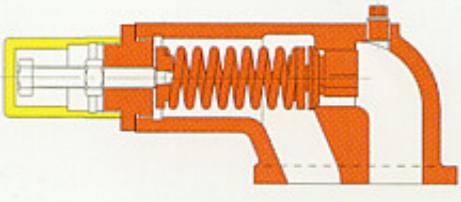
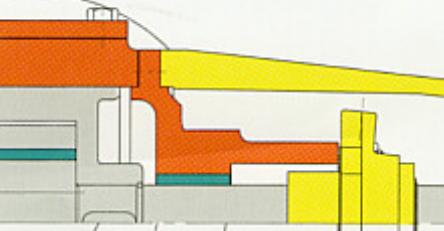
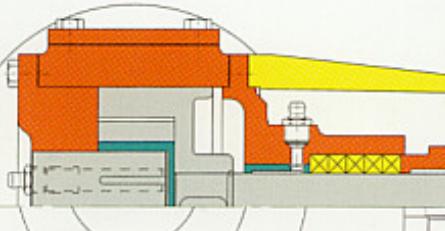
| | | |
|---|--|--|
|  |  |  |
| R Bypass valve. Single-acting (one direction). Used to protect the pump against brief excess pressures. | S - Special configurations Example: Construction of a cartridge sealing is possible. | Lubrication Externally lubricated idler bearing and main bearing. Used when pumping non-greasing media or media with high viscosity. |

Figure 8: The codes of the various pump versions together with an explanation of what they mean.

6 Transporting the pump

The pump must be secured properly on pallets or similar before transport and shipment.

The pump should be transported in such a way that it is not damaged by impacts or blows during transit.

7 Lifting the pump

If the pump's weight is more than the permitted number of kilos that people may lift in accordance with the prevailing national rules at the location, it must be lifted mechanically.

We refer to the prevailing national rules at the location!

The table below – Figure 9 - shows the weight in kg of the various pump types in the various pump.

Pump weight excl. /incl. valve

| Pump size | Pump type | | | | |
|------------|-----------|-----------|-----------|-----------|-----------|
| | GP/CC | HD | PD | CD | ED |
| 26 | 11 (13) | 5,5 (7,5) | 7 (9) | 7 (9) | 29 (31) |
| 33 | 12 (14) | 6 (8) | 10 (12) | 10 (12) | 30 (32) |
| 41 | 20 (22) | 14 (16) | 18 (20) | 18 (20) | 40 (42) |
| 51 | 50 (56) | 35 (41) | 36 (42) | 36 (42) | 90 (96) |
| 66 | 55 (61) | 40 (46) | 43 (49) | 43 (49) | 95 (101) |
| 81 | 80 (90) | 65 (75) | 70 (80) | 70 (80) | 180 (190) |
| 101 | 105 (115) | 90 (100) | 96 (106) | 96 (106) | 200 (210) |
| 126 | - | 140 (160) | 152 (172) | 152 (172) | 350 (370) |
| 151 | - | 190 (210) | 205 (225) | 205 (225) | 400 (420) |
| 152 | - | 280 (340) | 335 (395) | 335 (395) | - |
| 201 | - | 460 (520) | 500 (560) | 500 (560) | - |

Figure 9: Table showing the weight in kg of the various pump types in the various pump sizes.

Weights are excl. valve – the figures in brackets are incl. valve.

Weights are excl. motor/gear and base frame (if any).



Lift the pump mechanically, if the pump's weight is more than the permitted number of kilos that people may lift.



Do not place fingers in the pump's ports when lifting or handling the pump.



Motors fitted with lifting eyes must not be used to lift the whole pump, but only to lifting the motor separately.



Lift of the pump should be performed in stable suspension points so that the pump is balanced and the lifting straps are not placed over sharp edges



Lift of the pump shall be performed in conformity with the lifting instructions in Figure 10 – Figure 12

Lifting instructions for pumps

Pump with free shaft end / with flange

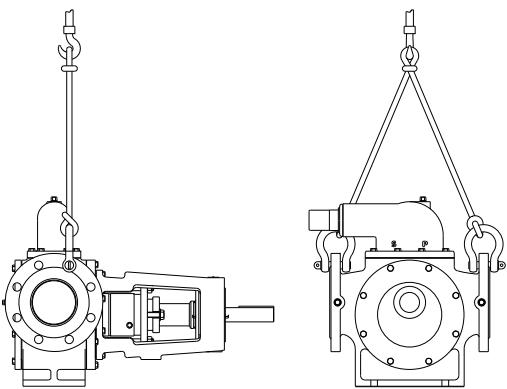


Figure 10:
Lifting instructions for pump with free shaft end with flange.
Attach 2 shackles to the flanges on the pump for lifting straps.
The shackles must be placed in the flanges at the pump's centre of gravity.

Pump with free shaft end / with thread

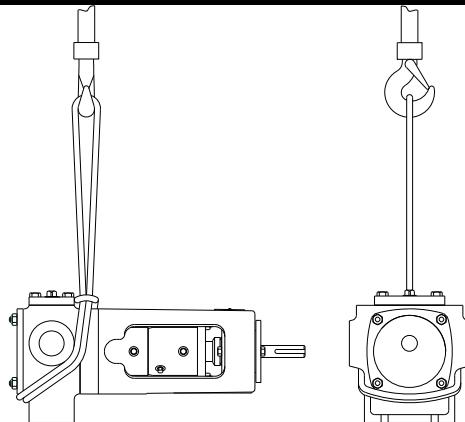


Figure 11
Lifting instructions for pump with free shaft end with thread.

Pump type GP with thread

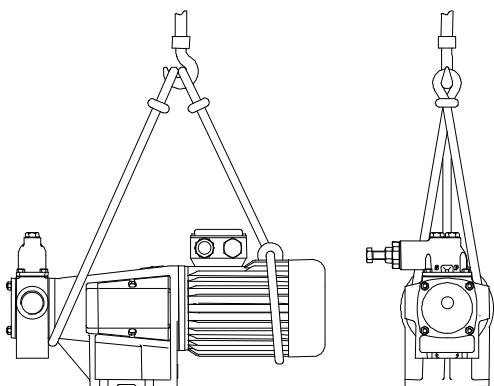


Figure 12:
Lifting instructions for GP pump type with thread.

Pump type GP with flange

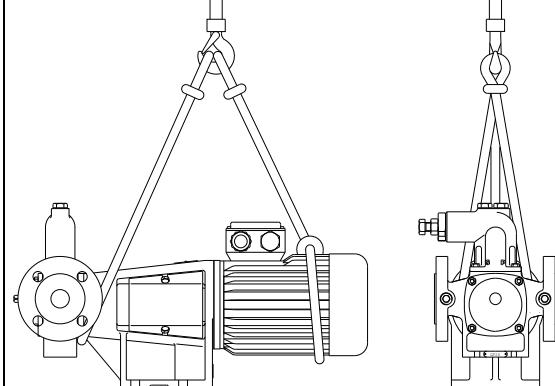
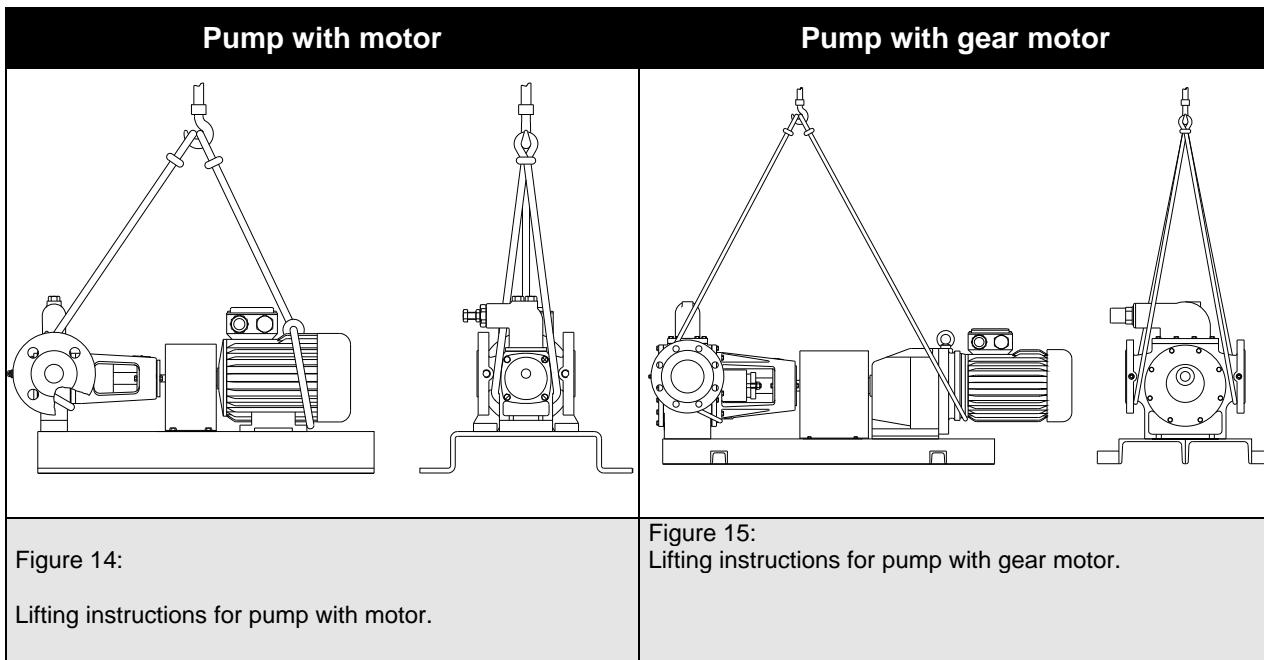


Figure 13:
Lifting instructions for GP pump type with flange.



8 Storage, long-term preservation and frost protection of the pump

Rotan pumps are protected against corrosion at the factory.

The pumps are preserved internally using oil, and pumps for the food industry are preserved using vegetable oil.

External, non-stainless surfaces are covered with primer and protective paint – except the shaft.

Flanges and pipe couplings are closed using plastic plugs.

This protection will last for approximately six months, on the condition that the pump is stored indoors in a dry, dust-free, non-aggressive atmosphere.

8.1 Storage

When stored for a longer period of time, the pump must be inspected after no more than six months – depending on the storage conditions. The pump shaft must however be turned manually approx. every 4 weeks to avoid standstill damages to bearings and seals.

Avoid storage:

- in an environment containing chloride
- on foundations with continuous vibrations as the bearings may be damaged
- in unventilated rooms

Recommended storage:

- indoors in a dry, dust-free, non-aggressive atmosphere
- in well-ventilated rooms to prevent condensation
- flanges and pipe couplings using plastic plugs
- pump packed if necessary in plastic film with moisture-absorbing Silica Gel bags

8.2 Preservation procedure

Make sure that the pump does not corrode or dry out, as drying out between the sliding surfaces of the bearings can cause them to become damaged when the pump is put into operation.

Preservation of the pump is necessary on untreated surfaces – both external and internal. Rustproof surfaces do not require any special protection.

1. If the pump has been in operation it must be emptied – see section entitled: "Emptying and cleaning the pump"!
2. Rinse the pump with clean, hot water, then empty it and dry it.
The pump must not be left with damp surfaces on the inside.
3. Spray on an anti-corrosion oil, such as: Q8 Ravel D/EX, Mobiarma 777 or equivalent.
Alternatively, it is also possible to use acid-free oil, such as hydraulic oil.
Pumps fitted with EPDM rubber seals do not tolerate mineral oil-based oils and certain food oils. As an alternative, in this instance you can use silicon oil or a fire-resistant type of polyglycol-based hydraulic oil.
Pumps for the food industry are preserved with vegetable oil.
This can be applied by spraying in through both the inlet and outlet ports – if necessary by means of compressed air.
4. For pumps intended for integration in an existing pipe system, the anti-corrosion oil can be sprayed in through the manometer holes in the inlet and outlet ports, or through the bore that has been provided to connect a manometer.
5. Fill the pump with sufficient oil for the oil to start running out of the pump.
6. Then rotate the pump shaft manually so that all internal surfaces are lubricated.
7. This process must be repeated every six months.
8. In addition, the pump shaft should be rotated about 1/1 turn every month during the whole preservation period
9. If the pump is to be stored outside the pipe system, pipe plugs should be fitted on the pump ports during the whole preservation period

8.3 Frost protection

Pumps that are out of operation during periods of frost must be emptied of liquid to avoid frost damage. You can use anti-frost liquids, but you must make sure that the elastomers used in the pump will not be damaged by the liquid used.

9 Installation

All items in this section must be read and observed when installing ROTAN pumps.

9.1 Selecting the motor etc.

All instruments and help systems used in connection with the ROTAN pump in potentially explosive environments such as gears, motors and blocking liquid systems etc. should all be approved by ATEX.



Use only instruments and help systems approved by ATEX – such as gears, motors, liquid blocking systems etc. in connection with ROTAN pumps to function in potentially explosive environments

ATEX

The flange motor in and GP pumps must have a locked bearing at the end of the shaft end – as well as vertically positioned pumps, to ensure that the pump's axial clearance falls within permitted parameters.

CC pump must have a angle bearing in non drive end and wave springs in drive end

9.2 Connecting the motor and the pump



If you intend to use the pump in a potentially explosive environment, the pump must be connected to an explosion-proof motor/gear

ATEX



Use coupling approved by ATEX

ATEX



Carefully shield the coupling between the pump and motor

1. Before connecting the motor and the pump, check that the pump shaft can revolve easily and regularly.
2. When connecting the motor with the pump, you must make sure that the pump shaft and the motor shaft are on precisely the same centre line and that there are a few mm between the shaft ends
3. Pump types HD, CD, PD and ED must be connected to the motor by means of an elastic coupling.

4. If a ROTAN standard coupling is used, the pump and the motor are aligned as described in the following section.
Other couplings are fitted and aligned in accordance with the coupling supplier's instructions – refer to these!

9.3 Aligning the motor and the pump

If a ROTAN standard coupling is used, the motor and the pump are aligned as follows.
Other couplings are aligned in accordance with the coupling supplier's instructions with regard to the maximum permitted tolerances for eccentricity and non-parallelism.

1. Check the centring between the pump shaft and the motor shaft by means of a straightedge. Place the straightedge over the two coupling pieces 2-3 places on the circumference – 90° apart. Any misalignment will become evident in the form of a gap of light between the straightedge and the coupling hub.
2. Centring may deviate by a maximum of 0.05 mm when both halves of the coupling rotate.
3. Check the parallelism/gap between the halves of the coupling, using an air gap gauge. The gap may be a maximum of 0.5° – or when both halves rotate the gap deviation may not exceed 0.05 mm on the same point.
4. Alignment is corrected by inserting suitable intermediate layer of material between the pump's or the motor's base and base frame.

Insufficient alignment between pump and motor causes increased wear on the coupling elements.

9.4 Axial clearance



Set the axial clearance to prevent heat generation and the subsequent risk of explosion

After coupling and alignment between motor and pump has been completed, the pump's axial clearance must be set correctly, see section entitled: "Setting the axial clearance".

The axial clearance does not have to be set for pumps purchased with a motor, as this is set in the factory.

9.5 Horizontal/vertical positioning of the pump

The standard position is for the pump to be horizontal to the foundation, i.e. with a horizontal pump shaft and the valve/blank flange on top and the suction port along. Normally other positions are not recommended.

In special cases the ROTAN pump may however be placed horizontally with the suction port upwards or downwards, or the pump could be placed vertically, but only if it is designed especially for this purpose and the instructions below are observed.

9.5.1 Horizontal positioning of the pump



Position and fit horizontal pumps required to be positioned with the suction port upwards or downwards as described below to avoid dry running and the subsequent risk of explosion in **Ex** pumps

If the pump is positioned with the suction port upwards or downwards instead of horizontally, a water trap must be used – see Figure 16.. The water trap must be used to ensure that the pump does not lose the sealing liquid and in this way its priming ability and to prevent dry running as dry running is not allowed – see section 11. 8 – Dry running

In this context water trap is defined as an "S"-shaped duct run – see Figure 16 or an "U"-shaped duct run – see Figure 17. When using a water trap, the pump must be placed at the lowest point in the pipe system, so that it retains its priming ability – dry running is not permitted. In addition, ensure that the system's liquid container on the suction side does not run dry.

The top point of the water trap – see point A, Figure 16 - must be above the level of the pump. Point A must be at a higher level than the uppermost flange of the pump to ensure that the pump is full of liquid. If point A is not above the level of the pump, the function of the water trap will be abolished.

The pump "housing" itself can be located on the side where it is most expedient.

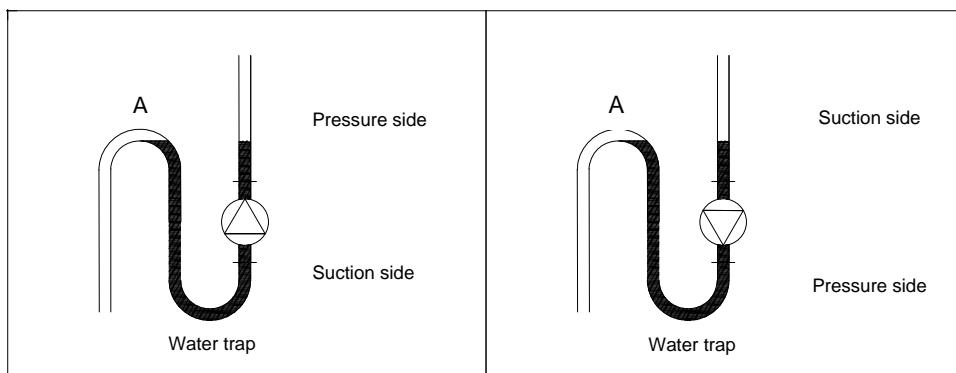


Figure 16: Shows a simplified sketch of a pump (the circle) fitted in a water trap. The pump is fitted so that the shaft is horizontal. Point "A" shows the top point of the water trap which must be above the upper flange of the pump.

9.5.2 Vertical positioning of the pump



The ROTAN pump may only be positioned vertically if it has been produced especially for this purpose at the factory.



Position and fit vertical pumps as described below, to avoid dry running and the subsequent risk of explosion in Ex pumps.

ATEX

A ROTAN pump should as a rule *not* be positioned vertically, i.e. with a vertical pump shaft and the motor on top. A pump may only be positioned vertically if it has been produced *especially* for this purpose at the factory.

In the event of vertical positioning of the pump, it must be placed at the lowest point in the pipe system so that it retains its priming ability as dry running is not permitted – see section 11.8 – Dry running

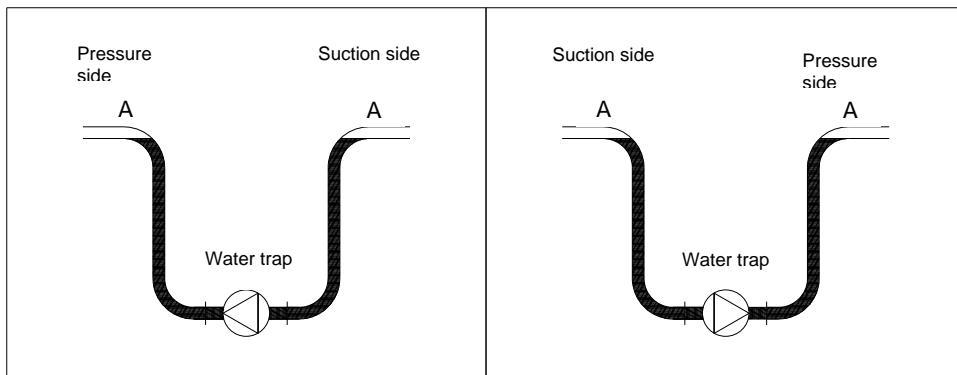
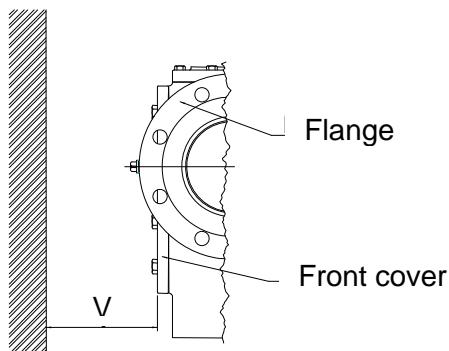


Figure 17: Shows a simplified sketch of a pump (the circle) fitted in a water trap. The pump is fitted so that the shaft is vertical. Point "A" shows the top point of the water trap which must be higher up than the pump.

9.6 Positioning of the pump on foundation

There must, to the extent possible, be plenty of room around the pump to allow for repairs and maintenance.



| Distance between pump and wall | | | | | | | | | | | |
|---------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|
| Pump size | 26 | 33 | 41 | 51 | 66 | 81 | 101 | 126 | 151 | 152 | 201 |
| W-dist. in mm | 50 | 60 | 65 | 70 | 80 | 100 | 115 | 140 | 165 | 180 | 215 |

Figure 18: The minimum distance to the wall – WV-dist. in mm - – to enable removal of the front cover.
The table shows the size of the W-dist. for the various pump types.
This distance must be observed for both horizontally and vertically positioned pumps.

The pump must be placed on a sturdy, vibration-free foundation with a level surface and bolted firmly to the foundation.

If the surface is not level, compensation must be made for this using a suitable intermediate layer so that preloads are avoided.

Bolt the pump securely to the foundation.

You must also take into account the pump's suction lift – see section entitled: "Suction lift" under "Technical specifications".

If the pump has a soft shaft seal, a drainage pipe must be connected to the bracket's drainage hole.

Vertical pumps are bolted securely to an existing wall or a vertically cast foundation. The minimum distance between front cover and floor appears from Figure 18.

9.7 Before connecting the pipes

In order that the pump is able to draw, it must be filled with liquid before it is started.
Before the pipes are fitted, the pump is filled with a volume of liquid that enables the liquid to start running out of the pump.

Vertically positioned pumps are filled with liquid after the pipes are connected.



Clean out any impurities from the pipe system before the pump is connected to it



Remove the protective plugs from the pump ports before connecting the pipes.

The pump must be installed so that there is no tension between the pipe and the pump casing. The permitted loads on the pump flanges are described in the following section: "External loads on pump flanges".

9.7.1 External loads on pump flanges

There must be no tensions between the pipe and the pump casing when the pump is installed. Tension in the pump casing as a result of preloaded pipes will create a significant increase in the rate of wear.

Pipes and wires must be supported as close to the pump casing as possible.

The diagram below shows the maximum permitted external force and torque that can be applied to the pump flanges.

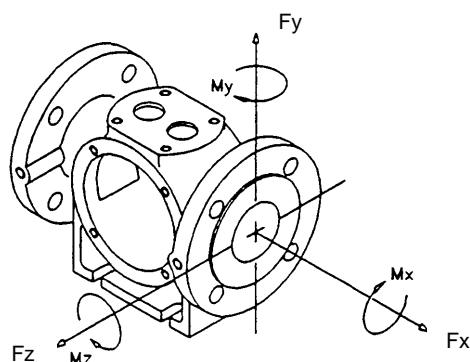


Figure 19: The location of forces and torque on the pump casing.

| Pump size | Forces | | Torque | |
|------------------|---------------------------|---------------------------|----------------------------|----------------------------|
| | F _(x,y,z) N | F _(Total) N | M _(x,y,z) Nm | M _(Total) Nm |
| 26 | 190 | 270 | 85 | 125 |
| 33 | 220 | 310 | 100 | 145 |
| 41 | 255 | 360 | 115 | 170 |
| 51 | 295 | 420 | 145 | 210 |
| 66 | 360 | 510 | 175 | 260 |
| 81 | 425 | 600 | 215 | 315 |
| 101 | 505 | 720 | 260 | 385 |
| 126 | 610 | 870 | 325 | 480 |
| 151 / 152 | 720 | 1020 | 385 | 565 |
| 201 | 930 | 1320 | 500 | 735 |

Figure 20: The maximum permitted external forces and torque that may be applied to pump flanges for the various pump sizes.

x, y and z appear from Figure 19: The location of forces and torque the pump casing.

The forces F (Total) in N and torque M (Total) in Nm are calculated as follows:

$$F_{(total)} = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

$$M_{(total)} = \sqrt{M_x^2 + M_y^2 + M_z^2}$$

- on the condition that the x, y and z components cannot all have the maximum value at the same time.

If the maximum permitted force and torque loads specified cannot be observed, compensators must be built into the pipe system.

When pumping hot liquids, the pipes must always be fitted with compensators so that the pipes and the pump are able to expand.

If a ROTAN pump with belt drive is required, the permitted power on the outlet shaft is provided on request.

9.7.2 Flange coupling



Flange couplings must always be undertaken by skilled professionals.



Achieve parallelism between the flanges and observe the maximum tightening torque to prevent tension in the pump casing

1. Before connecting the flange, check that the flanges are parallel, as any variance in parallelism will create tension in the pump casing. Parallelism is achieved by aligning the pipe system or fitting compensators.
2. Select the bolt size for the flanges on the basis of the pump size in the table in Figure 21. You should not use bolts with a yield stress of more than 240 N/mm², corresponding to quality 4.6 – for pumps manufactured in grey cast iron, material code “1”.
3. Find the maximum tightening torque in the table in Figure 21. Please note that the table contains the maximum tightening torque. The necessary tightening torque depends on: packing, form, material and the pump liquid’s temperature. The values in column A are valid for pumps manufactured in grey cast iron – material code “1”. The values in column B are valid for pumps manufactured in steel – material codes “3” or “4”.
3. Cross-tighten the bolts using the uniform tightening torque shown in the table below.

| Bolt size / max. tightening torque | | | |
|---|---------------|-------------------------------|----------|
| Pump size | Bolt * | Max. tightening torque | |
| | | A | B |
| 26 | M12 | 30 Nm | 80 Nm |
| 33-126 | M16 | 75 Nm | 200 Nm |
| 151-201 | M20 | 145 Nm | 385 Nm |

Figure 21: The bolt sizes available for connecting flanges, together with the maximum tightening torque depending on the pump size and material stated.

Column A contains the maximum tightening torque for pumps manufactured in grey cast iron – material code “1”.

Column B contains the maximum tightening torque for pumps manufactured in steel – material codes “3” or “4”.

*You should not use bolts with a yield stress of more than 240 N/mm², corresponding to quality 4.6, for pumps manufactured in grey cast iron – material code “1”.

9.7.3 Threaded coupling



Threaded couplings must always be made by skilled professionals



Connecting a pump with an internal thread to a pipe with a conical thread can cause the pump casing to burst if the coupling is over-tightened.

We recommend that you connect pumps with an internal thread to pipes with a cylindrical thread.

9.8 Dry running

The pump should be secured against dry running as otherwise it will result in unnecessary wear or destruction. Dry running results in heat development and potential spark formation at pump casing, bearings and shaft sealings.

Pump supplied for potentially explosive environments must therefore always be secured against dry running as otherwise there is a risk of explosion on account of overheating and spark formation.

Pumps for potentially explosive environments must be secured against dry running either by means of fitting a Liquiphant™ or other comparable devices with at least the same safety effect. The Liquiphant™ should be fitted to the inlet pipe according to the manufacturer's installation instructions.

The Liquiphant™ may normally be used for liquids up to 10,000 cSt and a pressure up to 64 bar. However, the manufacturer's technical data shall apply if they deviate from what is mentioned.

See the supplier's technical data!

For pumps used for pumping of liquids with a higher viscosity and/or operating under a higher pressure than mentioned – such as pump types HD, PD, CD – another device comparable to the Liquiphant™ should be used. Dry running may for example be secured in the pipe construction, at the inlet on the suction side of the pump so that it is ensured that there is always liquid in the pump, and at the same time it may be secured that the system's liquid tank on the suction side does not run dry for liquid.



All pump types and pump sizes must always be protected against dry running either by means of a Liquiphant™ or other comparable devices

9.9 Thermal sensor

Pump type ED and pumps supplied with a soft stuffing box must always be fitted with a thermal sensor if the pump is designed for use in a potentially explosive environment. The sensor is fitted to secure that the pump's max. allowed surface temperature is not exceeded during operation.



Pump type ED and pumps supplied with a soft stuffing box must always be fitted with a thermal sensor if they are installed in a potentially explosive environment.

ATEX

Pumps not designed for potentially explosive environments are only supplied with thermal sensor according to customer requests.

When installing the pump, the thermal sensor must always be connected to a control, and the control must be connected before starting to use the pump. The control is to be connected in conformity with the supplier's instructions.



Connect the control in conformity with the supplier's instructions

ATEX

The thermal sensor must always be connected to the control, and the control must be set according to the temperature class for which the pump is approved and according to the environment in which the pump is to operate. It appears from the ATEX labelling on the pump's name plate for which environment and which temperature class the pump is approved. See the pump's name plate!



Connect the thermal sensor to the control, and set it before starting up the pump

ATEX

The table below shows which temperature the control should be set to on the basis of the temperature class and whether it is an environment containing gas or dust.

| Setting of control for thermal sensor | | |
|--|------------|-------------|
| T-class | Gas | Dust |
| T1 (450°C) | 360°C | 300°C |
| T2 (300°C) | 240°C | 200°C |
| T3 (200°C) | 160°C | 133°C |
| T4 (135°C) | 108°C | 90°C |
| T5 (100°C) | 80°C | 66°C |
| T6 (85°C) | 68°C | 56°C |

Figure 22: The table shows which temperature the control should be set to on the basis of the determined T-class – which appears from the name plate – and if it is environment containing gas or dust.

The control connected to the thermal sensor must not be set to a temperature exceeding the one stated in the table – Figure 22.



Do not set the control – connected to the thermal sensor – to a temperature exceeding what is stated in the table in Figure 22

It, however, it is deemed necessary to set the control to a higher temperature than indicated in the table, special approval has to be obtained from DESMI A/S, and a separate, unique assessment should be prepared. As a customer, you should also be able to present documentation that no sparks are formed in the area in question in the event a deviation is requested from the temperatures prescribed in the table. The documentation is to be submitted to DESMI A/S, and together with DESMI's assessment/approval it will be submitted for filing with an approved, authorised authority!

9.10 Emergency stop



Fit the pump unit with an emergency stop

If the pump is fitted as part of a total system, this must be provided with an emergency stop. The emergency stop is not included in DESMI's delivery.

When installing the pump, the emergency stop must be:

- Designed, set up and installed, and function in accordance with the prevailing standards and directives
- Positioned within easy reach, so that it is accessible to the operator/engineer during repairs, adjustment and maintenance of the pump

- Be tested regularly to check that it is in full working order

9.11 Electrical coupling



Electrical couplings must always be established by authorised professionals, in accordance with the prevailing standards and directives



Set the protective motor switch
Set the protective motor switch maximum to the motor's rated current.

When installing the pump, check:

- That the local mains voltage is the same as stated on the motor's name plate.
- That the motor's direction of rotation corresponds with the desired pump direction.
When the pump unit is viewed from the motor end, and you require the pump direction to the left, the motor's rotation must be clockwise

9.12 Monitoring



Connect any monitoring and safety systems that are necessary for safe operation



Connect and adjust any monitoring and safety systems – manometers, flowmeters, etc. – according to the operating condition

10 Before starting the pump

The pumps are tested and preserved with oil type GOYA 680 transmission oil (Q8) with a viscosity of about 70 cSt. Pumps in versions "CHD" and "EPDM" are preserved in the factory using vegetable oil. The pump is emptied for oil, but it has not been cleaned for test oil from the factory.

The pump must be cleaned for test oil before starting up the pump if the test oil is not compatible with the pump liquid. In each individual case it is to be estimated the degree of cleaning which is deemed necessary. The cleaning should be of such a magnitude that no damage to humans, animals, materials or pump liquid occurs.



Clean the pump for test oil before start-up

Before starting the pump, check:

- That the pump shaft can be turned around freely
- That the pump is connected to an explosion-proof motor, if the pump is set up in a potentially explosive atmosphere
That the pump's and the motor's name plates are labelled with explosion protection
- That the pump and motor are aligned precisely – see section entitled: "Alignment between motor and pump"
- That the bearings – if they have lubrication nipples – are lubricated
- That the ball bearings' maximum service life is observed
- That the thread of the thermal sensor has not broken off during transportation, handling or installation – if the pump is fitted with thermal sensor (applies to ATEX pumps)
- That the thermal sensor is connected – if the pump is fitted with thermal sensor
- That all isolating valves in the suction and pressure pipe are fully open, to avoid the pressure being too high and the pump running dry
- That any by-pass valve is fitted correctly – see section entitled: "Positioning of valve"
- That any bypass valve is adjusted to the correct opening pressure – see section entitled: "Setting of bypass valve"
- That the pump casing is filled with liquid to ensure the ability to self-prime – see section entitled: "Before connecting the pipes"
- That there is no coagulated liquid in the pump or the pipe system – after the last operation – that may cause blockage or breakdown
- That the necessary monitoring and safety systems are connected and adjusted according to the operating conditions/instructions in this manual

10.1 Before starting after preservation

If the pump has been in storage for a long period of time, you must also check the following:

Before starting - after preservation - check:

- That the pump is not corroded or dried out – see section entitled – see section entitled: “Storage and protection of pump”. Check that the pump shaft rotates freely
- That any preservative or anti-frost liquid is cleaned off before starting the pump – if these are not compatible with the pump liquid
- That elastomers are replaced if they have been damaged by the anti-frost liquid used
- That ball bearings and any elastomers are replaced if the pump has been in storage for more than 6 years, as the lubricating grease used for elastomers and ball bearings has a limited service life

11 After starting the pump

ROTAN pumps may only run without liquid flow for the short period required for self-priming – with regard to the slide bearings and shaft seals.

After starting the pump, check:

- That the pump is drawing the liquid
- That there is no cavitation in the pump casing
- That the speed is correct.
- That the direction of rotation is correct.
Viewed from the motor side, liquid is pumped to the left when the shaft rotates clockwise.
- That the pump is not vibrating or emitting a jarring sound
- That the stuffing box and bearings are not becoming hot.
If the pump has been fitted with lip seals, these will normally cause the shaft to heat up during the ring's running-in period, which lasts approx. 2 hours.
- That there are no leaks by the pump
- That the mechanical shaft seal is fully sealed
Stuffing boxes with packing rings may, however, permitted a low level of leakage – 10-100 drops of leakage per minute – see section entitled: "Adjustment of soft shaft seal"
- That the operating pressure is correct
- That the by-pass valve opens at the correct pressure
- That the pressure in the heating jacket does not exceed 10 bar – if the pump has one
- That the magnetic clutch (type ED) is not slipping and thus causing an inadequate flow, and that the temperature in the magnetic clutch does not exceed the permissible value
- That the power consumption is correct
- That all monitoring equipment is in full working order
- That any pressurised water pipes, heating/cooling systems and lubricating systems, etc. are operating and in full working order
- Running in the soft shaft seal – see section entitled: "Running in the soft shaft seal"

11.1 Cavitation

There must be no cavitation in the pump casing as this results in extensive damage to the pump. The cause of cavitation should be found and the problem solved.

Cavitation is defined as formation and deflation of steam-filled bubbles. This process may exist in areas within the pump where the pressure falls to a level below the steam pressure of the liquid. Always ensure that there is adequate pressure at the pump inlet to avoid cavitation so

that the liquid does not boil or evaporate. Always check that the pump suction pressure is greater than the liquid's steam pressure irrespective of the temperature.

Cavitation can be ascertained in the form of vibrations and jarring sound from the pump. It may sound as if gravel was running through the pump. Cavitation arises when the vacuum in the pipe on the suction side is too high.

The increased vacuum may be caused by the following:

- That any filters in front of the pump are blocked or too narrow
- That the liquid viscosity is too high
- That the suction pipe is too long
- That the suction pipe is too narrow

Check if any filters fitted in front of the pump are blocked. If so, clean the filter thoroughly. If there is feed flow to the pump, you should bleed the pump before starting again. If there is no feed flow to the pump, the pump should be filled with liquid before start-up to avoid dry running as no dry running is allowed – see section 11.8 - Dry running.

If this does not solve the problem, you should check some of the other options.

If cavitation is due to too high viscosity, the problem may be remedied by fitting a suction pipe with a larger diameter or by heating the pump liquid so to increase the fluidity of the liquid and in this way a lower viscosity.

If cavitation is due to the suction pipe being too long, this may be remedied by moving the pump closer to the tank from which the pump is drawing or by fitting a suction pipe with a larger diameter.

After this, bleed the pump of fill in liquid before starting again.

Bleed the pump by turning the screw on top of the bypass valve fitted on the pump. Bleeding of the pump is completed when excess liquid flows out above.

Never bleed the pump in operation on account of the danger of squirting cold, hot, etching or poisonous liquids under pressure.



Use suitable safety equipment when bleeding the pump— such as gloves, protective goggles etc. – depending on the pump liquid



Never bleed the pump in operation on account of the danger of squirting cold, hot, etching or poisonous liquids under pressure

If the pump is not fitted with a valve, you may bleed the pump casing by removing the blank flange on top of the pump.

11.2 Running in the soft shaft seal – when starting the pump



A soft shaft seal may only be used on pumps in potentially explosive environments if the soft shaft seal is equipped with thermal sensors to control the temperature.

When starting a new pump, the shaft seal must be run in as described below:

1. Once the pump has started, the shaft seal must leak more than 200 drops per minute to saturate the rings.
2. When the shaft seal is saturated – after approx. 30 minutes' operation – the packing gland screws must be tightened gradually, so that the leakage is reduced.
3. Check that the stuffing box does not become hot.
If the stuffing box becomes hot, loosen the packing rings slightly, after which you must check that the temperature is falling.
4. When the leakage is between 10 – 100 drops per minute, do not tighten the screws any more.
The number of drops per minute depends on the pump size, pressure and speed.
5. The soft shaft seal must not be tightened so much that there is no leakage.
The soft shaft seal must leak continuously.
6. The leakage rate must be checked at regular intervals, see section entitled "Maintenance"

If necessary, see also the section entitled: "Adjustment of soft shaft seal"

12 Bypass valve

The section below uses both the designations *bypass valve* and *safety valve*.

Safety valve is defined as a valve fitted on the pressure pipe in the pipe system and which secures the whole pipe system in the event of constant pressure increase. The safety valve has return flow to the liquid tank.

Bypass valve is defined as the valve supplied by DESMI A/S and which is fitted on the ROTAN pump – see Figure 25. The bypass valve secures only pump and motor. The bypass valve does not secure the whole pipe system. The bypass valve protects pumps in the event of brief pulsating excess pressures and not in the event of constant pressure increase. The function of the valve is described in detail under the section: 14.3 Operating principle - valve.

ROTAN pumps are supplied both *with* and *without* a bypass valve.



The bypass valve is not approved for protection of the pipe system, and therefore it must not be used for this purpose



The pipe system must be protected against excess pressure in other ways than by use of the ROTAN bypass valve

If a pipe system contains a facility to block the pump's pressure line, the pressure line must be fitted with a bypass valve to take the full liquid volume - as pumping up against a blocked outlet line causes rapid pressure increase and results in heat accumulation inside the pump. This heat accumulation inside the pump is transferred to the pump surface and therefore constitutes a risk of explosion as for pumps functioning in a potentially explosive environment.



If the possibility exists to block the pump's pressure line, the pressure line must be fitted with a bypass valve to take the full liquid volume - as otherwise there is a risk of explosion

The ROTAN bypass valve must not be used for constant pressure control – such as "keep-pressure valve".

If a need for constant pressure control exists, another solution should be found leading to the same result - such as frequency converter or gear.



Do not use the valve for constant pressure control – such as "keep-pressure valve"



The liquid volume may not circulate through the bypass valve for a long period of time. Circulation over a long period of time through the bypass valve causes a significant heating up of the pump and pump liquid, and this may result in destruction of the pump



The liquid volume may not circulate through the bypass valve for a long period of time. Circulation over a long period of time through the bypass valve causes a significant heating up of the pump and pump liquid, and this can create a risk of explosion



Fit equipment preventing against bypass

The ROTAN bypass valve is also supplied as a double-action bypass valve

If there is a need to pump in both directions, the pump may be fitted with a double-action bypass valve.



If there is a need to pump in both directions, fit a double-action bypass valve

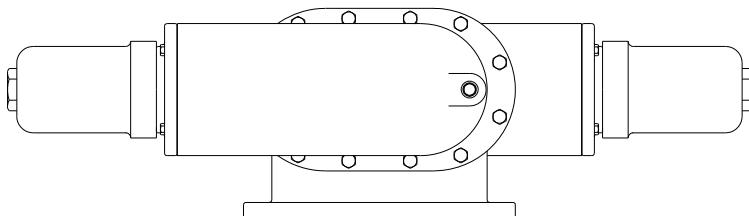


Figure 23: A double-action bypass valve.

Please note that certain liquids' properties or heated liquids may block the bypass valve's function, e.g. paint, chocolate, asphalt, etc.

Blocking of the valve may be caused by the liquid containing particles or the liquid being heated and subsequently coagulating in connection with bypass in the valve.

In such cases it is recommended not to use a ROTAN bypass valve, but another device instead.

If liquids possess properties which may block the bypass valve and prevent it from working, you must use another equivalent device rather than a ROTAN by-pass valve.

However, in some cases a special ROTAN bypass valve can be supplied with heating jacket for connection to heating to prevent coagulation of the liquid – see Figure 24.

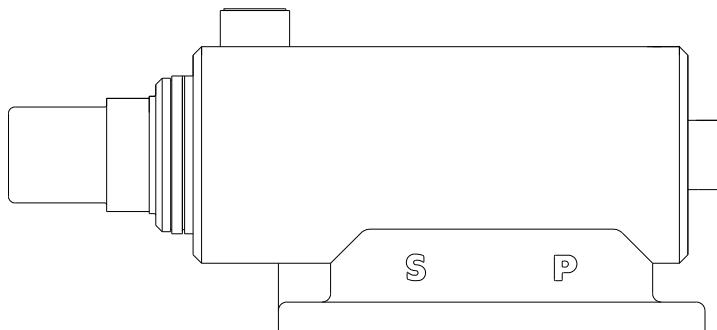


Figure 24: A ROTAN bypass valve with heating jacket for connection to heating.

If you wish to have the pump supplied without a ROTAN bypass valve, another equivalent safety device must be used, so that you can still ensure that the pump cannot generate a pressure that is higher than the maximum specified when placing the order and the max. pressure which appears from Figure 49..



Pumps without a ROTAN bypass valve must use another equivalent safety device which protects pump and motor.

If a pump is supplied without a ROTAN bypass valve, it will be fitted with a blind cover.

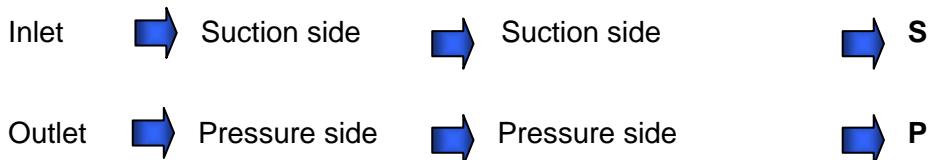
A ROTAN bypass valve is always provided with a bore for connection of manometer. The bore is covered by a pipe plug.

12.1 Valve configurations

For pumping liquids at high temperatures, the valve can be supplied with a heating jacket. The heating jacket prevents the pump liquid from coagulating when passing through the valve.

12.2 Positioning the valve

The bypass valve is fitted with an inlet and an outlet. The inlet and outlet are named as follows:



The suction side and pressure side are indicated on the valve by the letters **S** and **P** – see figure 5.

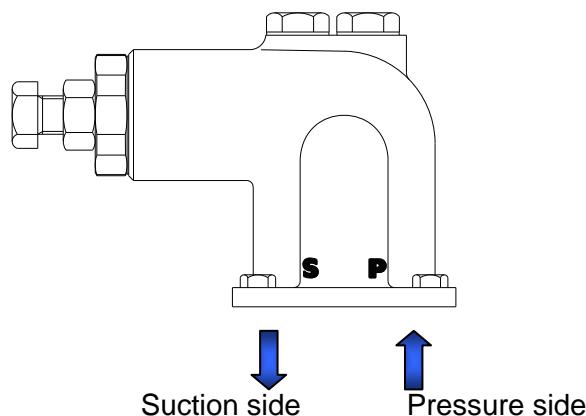


Figure 25: Shows how **S** for suction side and **P** for pressure side are indicated on the valve.

If the pump has been bought with a valve, it is always fitted to the pump in the factory.

Before the pump is installed in a pipe system, the valve must be positioned correctly with regard to the desired direction of circulation, as incorrect positioning of the valve will stop it from working.

The valve's **S** inlet must be placed by the pump's suction side, so that the regulating screw points towards the suction side.



Position the valve correctly, with **S** over the inlet/suction side and **P** over the outlet/pressure side.

12.3 Operating principle – valve

When the pressure increases in the pump, the pump liquid is forced into the valve's pressure side – **P**.

If the valve's preset pressure is exceeded, the internal spring is depressed, after which the pump liquid is forced out of the outlet side of the valve and down into the pump again.

In this way recirculation of the pump liquid is created.

This recirculation may not last for a long period of time, as this will cause the liquid and the pump to heat up significantly.



The pump must not pump with the valve open for a long period of time.



Recirculation through the bypass valve over a long period of time causes the liquid and the pump to heat up significantly



Recirculation through the bypass valve over a long period of time can destroy the pump.

12.4 Setting the by-pass valve

The by-pass valve is set by adjusting the regulating screw which is located on the end of the valve, see figure 26.

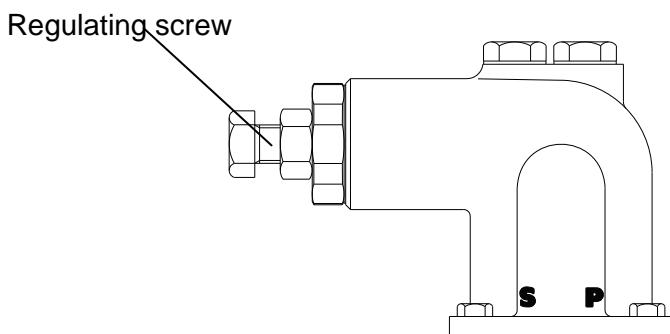


Figure 26: The location of the regulating screw on the ROTAN bypass valve.

The bypass valve is always set at the factory.
The valve is set in accordance with either

- customer instructions
- or DESMI's default setting

If the valve has been set in accordance with customer instructions, this setting must correspond with the other instructions prescribed in this user manual, in the section entitled "Bypass valve".

If the setting is DESMI's default setting, this has been made on the basis of the tables – Figure 28 or Figure 29. Figure 28 covers valves fitted with a *non-stainless key* and Figure 29 covers valves fitted with a *stainless key*.

It appears from the pump designation on the pump's name plate if the valve is supplied with a stainless or non-stainless key.

Example

Pump designation: HD/PD/GP/ED 26-201 - "1U..." + "4U..."

 Non-stainless key


Pump designation: CD/ED 26-201

- "3U..."

 Stainless key

All settings of the regulating screw must be made on the basis of the tables – Figure 28 – or Figure 29 – or by means of pressure gauge.

As a default, the valve is always set to an operating pressure of 8 bar from the factory.

The default setting of the valve has been made as follows:

1. The valve has a number, and this number can be read on the pump's name plate
2. The obtained valve number is found in the table Figure 28 or Figure 29
3. If the valve number obtained cannot be found in the table, go in under pump type and pump size at the extreme left in the table Figure 28 or Figure 29
4. Pump type and pump size can be read on the pump's name plate
5. It appears from the pump designation on the pump's name plate if the valve is supplied with a stainless or non-stainless spring – see above! Use figure 22 for non-stainless keys and figure 23 for stainless keys
6. Next to the valve number or pump type/pump size there are several different setting measurements. The A-value corresponding to 8 bar in the table is selected.

Example

HD26/Valve no.: **8300** (non-stainless key)



Operating pressure: 8 bar



A-value = 23.9 mm.

In the case of valves that have been set in accordance with customer instructions, you can identify the operating pressure to which the valve has been set as follows:

The operating pressure to which the valve has been set:

1. The valve has a number, and this number can be read on the pump's name plate
2. The obtained valve number is found in the table Figure 28 (non-stainless key) or Figure 29 (stainless key)
3. If the valve number obtained cannot be found in the table, go in under pump type and pump size at the extreme left in the table Figure 28 or Figure 29
4. Pump type and pump size can be read on the pump's name plate
5. Measure the valve's setting value as shown in Figure 27.
6. The value can be seen in the table on the basis of the valve number obtained, and the operating pressure is read off according to this

Example:

HD26 / Valve no.: 8300 (non-stainless key) ➔ A-value: 23.9 mm. ➔

Operating pressure = 8 bar.

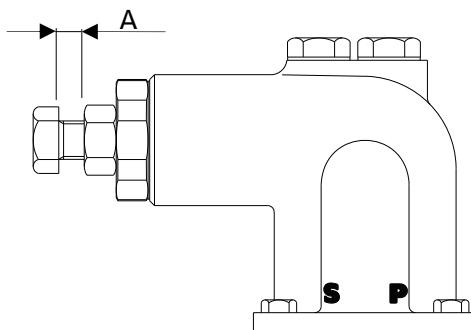


Figure 27: The setting value "A" for ROTAN valves.

Setting of valve**Type HD / GP / PD / ED (non-stainless)**

| Pump type | Pump size | Valve no. | A-value w/non-compressed spring | Operating pressure / bar | | | | | | | |
|-------------|-----------|----------------------------------|---------------------------------|--------------------------|------|------|------|------|------|------|------|
| | | | | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
| HD/PD/GP/ED | 26/33/41 | 8300, 8301 8302, 8303 8304 | 27,2 | 26,6 | 25,7 | 24,7 | 23,9 | 23,0 | 22,2 | 21,3 | 20,3 |
| | 51/66 | 8308, 8309 | 31,8 | 31,4 | 31,2 | 30,4 | 28,8 | 27,5 | 26,7 | 25,3 | 23,6 |
| | 81 | 8311, 8312 | 34,5 | 33,1 | 31,6 | 30,2 | 28,7 | 27,3 | 25,7 | 24,7 | 23,2 |
| | 101 | 8311, 8312 | 34,5 | 33,1 | 31,6 | 30,2 | 28,7 | 27,3 | | | |
| | 126/151 | 8313, 8315 | 46 | 44,4 | 42,0 | 40,4 | 38,3 | 36,1 | | | |
| | 152/201 | 8316, 8318 | 63,3 | 62,1 | 59,6 | 57,6 | 55,3 | 53,7 | | | |

Figure 28: Setting value "A" in mm, based on the valve number or on pump type/pump size and the valve's operating pressure in bar. The shaded field indicates that the pump sizes 101 +126 + 151 + 152 + 201 cannot operate with an operating pressure exceeding 10 bar – see figure 44.

The table applies to valves fitted with a non-stainless key.

Setting of valve**Type CD / ED (stainless)**

| Pump type | Pump size | Valve no. | A-value w/non-compressed spring | Operating pressure/bar | | | | | | | |
|-----------|-----------|------------|---------------------------------|------------------------|------|------|------|------|------|------|------|
| | | | | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
| CD/ED | 26/33/41 | 8305, 8306 | 26,1 | 25,7 | 24,8 | 23,8 | 22,9 | 22,0 | 21,1 | 20,1 | 19,3 |
| | 51/66 | 8307 | 32 | 31,5 | 31,2 | 30,2 | 28,4 | 27,3 | 26,2 | 24,8 | 23,3 |
| | 81 | 8310 | 34,55 | 33,5 | 31,7 | 30,2 | 28,7 | 26,9 | 25,2 | 23,6 | 21,9 |
| | 101 | 8310 | 34,55 | 33,5 | 31,7 | 30,2 | 28,7 | 26,9 | | | |
| | 126/151 | 8314 | 45,6 | 43,6 | 41,3 | 38,9 | 36,9 | 34,6 | | | |
| | 152/201 | 8317 | 62,3 | 60,4 | 57,9 | 55,6 | 52,4 | 50 | | | |

Figure 29: Setting value "A" in mm, based on valve number or pump type/pump size and the valve's operating pressure in bar. The table applies to valves fitted with a stainless spring.



Any change to the pump's operating pressure must be followed by a change to the valve's setting - the working pressure must however not exceed the maximum allowable pressure of the pump/valve - see Figure 49

If the valve is not reset, this will mean either

- that the valve's safety function fails so that there is a risk of pressure accumulation
- or that the valve remains open permanently, creating a significant heating up of the pump and pump liquid – which must **not** last for a long period of time



The liquid volume may **not** circulate through the bypass valve for a long period of time

Circulation over a long period of time through the bypass valve causes a significant heating up of the pump and pump liquid, and this can create a risk of explosion



The liquid volume may **not** circulate through the bypass valve for a long period of time.

Recirculation through the bypass valve over a long period of time can cause destruction of the pump.



Never set or adjust the bypass valve in operation on account of the danger of squirting cold, hot, etching or poisonous liquids under pressure



Whenever the valve is set or readjusted, the regulating screw **must** be repacked with thread tape.

13 Pump liquids

13.1 Hot liquids

When pumping hot liquids at high temperatures, suitable procedures must be drawn up to prevent any danger of injury caused by touching or standing close to the pump.



Check daily that the max. allowed temperature is observed



The pump must be shielded when pumping hot liquids that create a surface temperature on the pump of more than +80°C
A warning sign must be displayed in a clearly visible location!



When pumping hot liquids, the pipes must be fitted with compensators to prevent tensions in the pump casing

There are various maximum temperatures for ROTAN pumps, depending on the pump type and the type of elastomer used, see Figure 19 – Figure 31.



ROTAN pumps may not be used to pump liquids at a temperature that is higher than the liquid's ignition temperature, and with reference to the maximum temperatures specified in the table in the table below – Figure 20 - depending on the type of elastomer used - and for pumps with bypass valve max. 150°C.

The lowest +temperature identified of the four mentioned above constitutes the maximum temperature.

The maximum liquid temperature for ED pumps also depends on the magnetic material used, see Figure 19.

The temperature of the liquid also increases during operation, through the heat generated by the magnets, depending on the liquid's flow rate and viscosity.

The temperature increases up to 30°C.

The ED pump may not be used to pump liquids at a temperature that is higher than the liquid's ignition temperature, and with reference to the maximum temperatures specified in the table in Figure 30 depending on the magnetic material, and no higher than the temperature stated in the table below – Figure 31 – depending on the type of elastomer used – and for pumps with bypass valve max. 150°C.

The lowest +temperature identified of the four mentioned above constitutes the maximum temperature.

The maximum temperature limit identified must be further reduced by the temperature increase generated by the magnets.

| Max. liquid temperature | |
|-------------------------|--|
| Pump type | Temperature |
| GP | Max. 150°C |
| HD/PD/CD* | Max. 250°C |
| ED | Max. 130°C (Magnetic material: Neodym-Iron-Bor) Max. 250°C (Magnetic material: Samarium – Cobalt) |
| CC | Max. 80°C |

Figure 30: The pump liquid's maximum permitted temperature for the various pump types.

For pumps with a bypass valve the temperature is limited to a maximum of 150°C due to the valve spring.

However, the valve can be supplied with a different key, enabling the pump's temperature range to be fully utilised.

The ED pump's maximum temperature depends on factors such as the magnetic material.

* Pump types HD, CD og PD – designed with special tolerances – may in certain cases be used up to 300° C.

| Min./max. elastomer temperature | | |
|---------------------------------|-------------------------|----------------------|
| Elastomer type | Elastomer brand | Temperature |
| FPM | Viton® | About -20°C / +200°C |
| FEP | Teflon® with Viton core | About -60°C / +205°C |
| EPDM | Ethylene-propylene | About -65°C / +120°C |
| FFKM | Kalrez® | About -50°C / +316°C |
| NBR | Nitril | About -30°C / +70°C |
| PTFE | Teflon | About -15°C / +170°C |

Figure 31: The pump liquid's minimum/maximum temperature limits for the various elastomers used in ROTAN pumps.



Extra shielding may be purchased from DESMI

13.2 Foods



ROTAN pumps must not be used to pump foods requiring FDA or 3A approval.

14. Noise

The noise level of ROTAN pumps depends on various parameters.

The different parameters that can influence the sound pressure level are:
differential pressure, viscosity, installation conditions, pump size and flow.

The curves shown in Figure 32 denote standard units with ROTAN pumps' A-weighted sound pressure levels, in relation to pump size and flow.

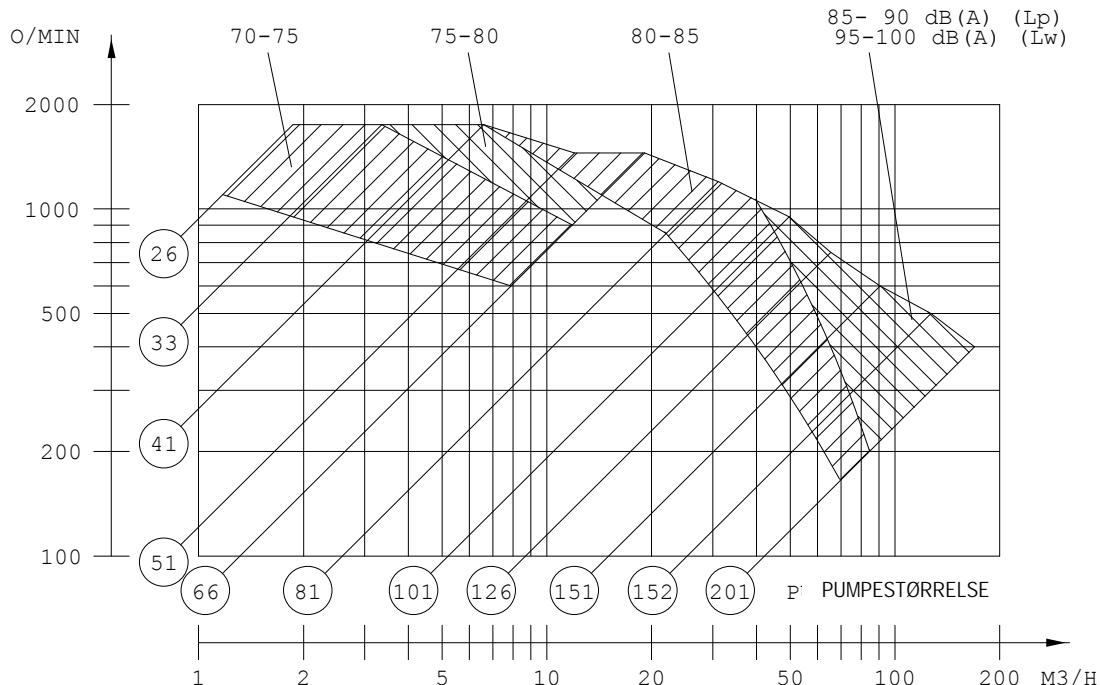


Figure 32: The maximum A-weighted sound pressure level in dB(A)(Lp) for the various pump sizes in relation to the pumps' flow. The range above 85 dB(A) is also expressed as sound power level (Lw).

The sound pressure curves shown are measured at a distance of 1 metre from the pump's surface and at a height of 1.60 metres above the floor. The dB(A) curves shown are calculated on the basis of measurements taken when pumping mineral oil with a viscosity of 75 cSt at a differential pressure of 5 bar. The curves are based on normal industrial use, and not on laboratory conditions.

If people are working by the pump, we refer to the prevailing local national laws and regulations on noise limits at the workplace.

We refer to the prevailing local national laws and regulations on noise limits at the workplace.

Appropriate noise reduction measures must be implemented in accordance with the aforementioned local national laws and regulations, if so required.



Use appropriate hearing protection if necessary!
If necessary, display a sign stating that hearing protection must be worn!

14 Storing the user manual

This user manual must be retained throughout the pump's full service life, and must always accompany the pump.

The user manual must be available to operators, repair engineers and any maintenance staff or other people who may be considered to have a need to refer to it.

The user manual must also be stored visible, in the immediate vicinity of the pump.
If this is not possible, there must be a prominent sign by the pump stating where the user manual is kept.

It is also recommended that a copy of the user manual is stored somewhere else.

If people who are expected to have a need to refer to the user manual are of a different linguistic origin than the language in which the user manual has been legally supplied, it is recommended that the user manual is translated into the language in question.

15 Maintenance

The pump must be inspected and maintained on an ongoing basis in accordance with the schedule below – Figure 33.

Compliance with regular maintenance in accordance with the schedule below is particularly important for explosion-proof pumps (ATEX), as inspection and maintenance of the pump constitutes a part of the explosion protection.



Observe the inspection and maintenance instructions contained in this manual to achieve explosion protection for Ex-labelled pumps.

| Maintenance | |
|---|--------------------------------|
| During daily inspection, check: | Solution: |
| That the pump does not vibrate or emit jarring sounds | |
| That there is no cavitation inside the pump casing | |
| That lubricated slide bearings are lubricated | |
| That open ball bearings are lubricated | |
| That there is liquid in connection with liquid-greased slide bearing | |
| That any lubricating devices are in working order | |
| That any circulation pipes – cooling, heating or pressurised water pipes are in working order | |
| That power output and power consumption are correct | |
| That flow and operational pressure is correct | |
| That the max. allowed temperature is observed | |
| During weekly inspection, check: | |
| That any filters and drainage holes are clean | |
| That the soft stuffing box is leaking 10-100 drops per minute | |
| That mechanical shaft seals are not leaking | |
| That the surroundings of the stuffing box and bearings are free from dirt | |
| Whether flexible connecting elements are worn | To be replaced if worn |
| During inspection every 2 months, check: | |
| That the bearings do not have too much play | |
| That the bypass valve, if any, functions correctly and opens at the right pressure | |
| That the stuffing box is intact | To be after-packed or repacked |
| | |
| In connection with service work, check: | |
| All parts for wear and tear | Replace worn parts |
| That all parts are located correctly in connection with assembly | |

Figure 33: The figure shows which parts or what must be checked and maintained on the pump, and at what intervals this must be undertaken.

16.1 Adjusting the soft shaft seal



The shaft seal must not be adjusted during operation

It is important that the soft shaft seal leaks during operation, as this provides lubrication and also releases the frictional heat that is generated.

The shaft seal with packing coil requires continuous adjustment, to make sure that the volume of leakage by the stuffing box is correct.

Depending on the speed, pressure, pump size and viscosity, the stuffing box must leak 10-100 drops per minute to remove the frictional heat that is generated between the shaft and the packing rings. If there is insufficient leakage, the heat generated can cause the gasket rings to harden and create increased wear on the shaft.

The leakage described above is achieved by tightening the packing rings axially, so that they apply a pressure against the shaft. This pressure restricts the flow of the liquid, as the play between the shaft and the packing ring is in the order of a few thousandths of a millimetre. Soft shaft seal

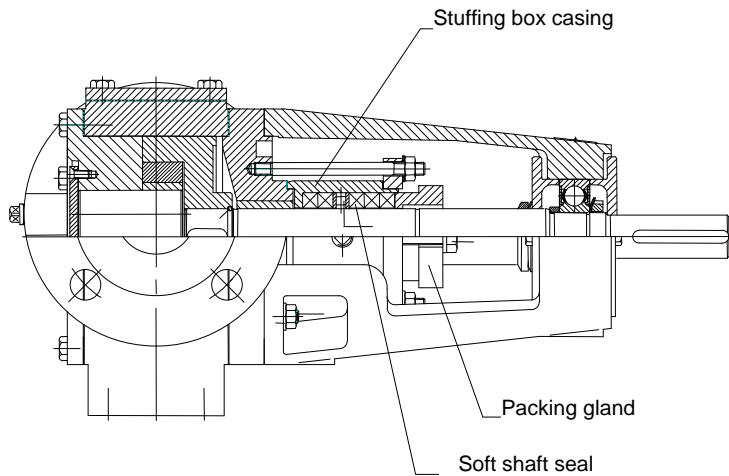


Figure 34: The location of the soft shaft seal, the shaft seal casing and the packing gland on the pump.
The design of the shaft seal casing, does, however, depend on the individual pump application.

16.1.1. Repacking – soft shaft seal

1. Pull the packing gland back on the shaft once the screws have been removed.
2. The packing rings can now be pulled out using a packing extractor.
3. Check the shaft and the shaft seal housing thoroughly for wear, scratches and deposits.
4. Replace worn parts and remove deposits with care.
5. Always conduct a control measurement of the shaft and the shaft seal housing before specifying the packing dimension.

!! Never use old packing rings when measuring

The packing dimension is defined on the basis of the following:

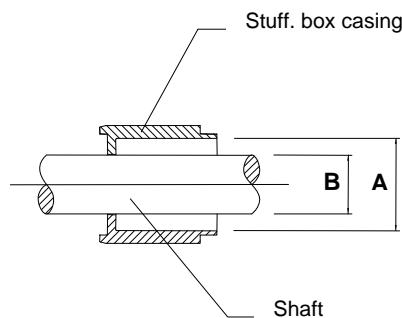


Figure 35: The A and B dimensions on the shaft and the shaft seal housing

The A and B dimensions obtained are inserted in the following formula to determine the packing dimension.

$$\frac{A - B}{2} = \text{packing dimension}$$

6. New packing rings are bought as spare parts or produced as described in step 7.
7. Trim the new packing rings on the shaft or a mandrel of the same diameter as the shaft. Wrap the packing around the shaft/mandrel the number of times that packing rings are to be used, and cut through with a sharp knife.
8. If the packing rings are difficult to move into position, they can be rolled with a pipe or similar item.

Never strike a gasket, as the fibres in the material will be destroyed and the sealing property will be significantly worsened.

9. Lubricate the individual rings with a little oil to facilitate installation.
10. Turn the ring openings so that the two rings lying alongside one another are diametrically offset.
11. Finally, tighten the packing gland gently by hand, and restart the pump.

16.2 Ball bearings

The pump is fitted with a ball bearing – pos. CU – at the pump's free shaft end. Some pumps are fitted with two ball bearings – pos. CU + BC – see the position numbers on the spare part drawings. ED pumps are fitted with two ball bearings – pos. NB – on pumps with a free shaft end. See ED manual T1386

All bearings are model 63 deep-groove ball bearings, fitted with two rubber seal rings, no seal rings or one single seal ring.

16.2.1 Lubrication of ball bearings



Ball bearings must be lubricated to ensure explosion protection



Ball bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C – to guarantee explosion protection.



Ball bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C.

Ball bearings with two seal rings do not require re-lubrication, as they are filled with a suitable amount of grease in the factory.

Ball bearings with *one single* seal ring or *no* seal ring require re-lubrication via the lubrication nipple.

If the ball bearings require lubrication, they are fitted with a lubrication nipple.

The bearings must be lubricated at the lubrication intervals and using the volume of grease as stated in the table in Figure 36.

The re-lubrication interval is halved for every 15°C that the temperature exceeds 70°C.

| Lubrication of ball bearings | | | | |
|------------------------------|-----------|-------------------|--|--|
| Pump sizes | Pump type | Ball bearing type | Relubrication interval in hours at max. 70°C | Amount of grease required per relubrication in grams |
| 41 | HD | 6305* | 3,500 hours | 6 g |
| 51 | CD | 6306 | 3,500 hours | 7 g |
| 51 | HD | 6307* | 3,500 hours | 9 g |
| | | | | |
| 66 | CD | 6306 | 3,500 hours | 7 g |
| | HD | 6307 | 3,500 hours | 9 g |
| 81 | HD | 6310 | 3,500 hours | 15 g |
| 101 | CD | 6308** | 3,500 hours | 11 g |
| | HD | 6310*** | 3,500 hours | 15 g |
| 126 | CD HD | 6310 | 3,000 hours | 15 g |
| 151 | CD | 6310 | 2,500 hours | 15 gr. |
| 152 | HD | 6312 | 2,500 hours | 21 gr. |
| 201 | HD | 6315 | 2,500 hours | 30 gr. |
| | | 6317 | 2,500 hours | 40 gr. |

Figure 36: Shows ball bearing types, relubrication interval in hours at max. 70°C, and the amount of grease required per relubrication in grams for the pump types and sizes indicated.

* = C3 bearing

** = bracket bearing

*** = main bearing

16.2.2 Service life – ball bearings



Ball bearings must be replaced as indicated below, to ensure explosion protection.

Ball bearings with two seal rings have a limited service life, after which they must be replaced. The ball bearings' minimum service life is shown in the tables in Figure 37 – Figure 38. The ball bearings' service life is reduced to 90% of the value indicated if the pump is to be used in a potentially explosive environment.

Example: Ball bearing's service life = 10,000 hours (non-ATEX)
= 9,000 hours (ATEX)

The bearing's service life is also halved for every temperature increase of 15°C above 70°C – for both Atex pumps and non-Atex pumps.

Service life of ball bearings in ROTAN pumps @ 1000 cSt

| Pump type | Pump size | Ball bearing type | Min. service life in hours at 70°C | Max. operating pressure |
|-----------|-----------|-------------------|------------------------------------|-------------------------|
| GP | 26 / 33 | 6302 2RS1 | 10,000 hours | 16 bar |
| | | 6304 2RS1 | 27,000 hours | 16 bar |
| | 41 | | | |
| | | 6304 2RS1 | 12,000 hours | 16 bar |
| | 51 / 66 | 6305 2RS1 | 18,000 hours | 16 bar |
| | | | | |
| | 81 | 6306 2RS1 | 8,000 hours | 16 bar |
| | | 6307 2RS1 | 8,000 hours | 16 bar |
| | PD | | | |
| | | 6308 2RS1 | 7,000 hours | 16 bar |
| HD | 101 | 6310 2RS1 | 9,000 hours | 16 bar |
| | | | | |
| | 126 | 6308 2RS1 | 25,000 hours | 10 bar |
| | | 6310 2RS1 | 36,000 hours | 10 bar |
| | 151 | | | |
| | | 6310 2RS1 | 30,000 hours | 10 bar |
| | | 6312 2RS1 | 32,000 hours | 10 bar |
| | 152 | | | |
| | | 6310 2RS1 | 12,000 hours | 10 bar |
| | 201 | 6312 2RS1 | 11,000 hours | 10 bar |
| | | | | |
| | | 6310 2RS1 | 4,000 hours | 10 bar |
| | | 6314 2RS1 | 5,000 hours | 10 bar |
| | | 6312 2RS1 | 9,000 hours | 10 bar |
| | | | | |

Figure 37: Ball bearing types and the minimum service life in hours for the various pump types and sizes.
 The service life is calculated on the basis of a temperature of 70°C and a viscosity of 1000 cSt., and based on the maximum operating pressure of the various pump types.

The bearings' service life is reduced at temperatures above 70°C and in ATEX pumps – see section above.

| Service life of ball bearings in ROTAN high-pressure pumps @ 1000 cSt | | | | |
|--|-----------|-------------------|------------------------------------|-------------------------|
| Pump type | Pump size | Ball bearing type | Min. service life in hours at 70°C | Max. operating pressure |
| GP | 27 / 34 | 6304 2RS1 | 12,000 hours | 25 bar |
| | | | | |
| | 42 | 6305 2RS1 | 13,000 hours | 25 bar |
| | | | | |
| | 52 / 67 | 6307 2RS1 | 8,000 hours | 25 bar |
| | | | | |
| | 82 | 6310 2RS1 | 8,000 hours | 25 bar |

Figure 38: Ball bearing types and the minimum service life in hours for pump type GP in the sizes indicated. The service life is calculated on the basis of a temperature of 70°C and a viscosity of 1000 cSt., and based on the maximum operating pressure of ROTAN high-pressure pumps.

The bearings' service life is reduced at temperatures above 70°C and in ATEX pumps – see above.

16.3 Lubrication of slide bearings



Slide bearings must be lubricated to guarantee explosion protection

ATEX



Slide bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C – to guarantee explosion protection

ATEX



Slide bearings must be lubricated with heat-resistant grease when pumping liquids over 100°C

The ROTAN pump is designed with an idler bearing and a main bearing.

The idler bearing is a slide bearing, and the main bearing can be either a slide bearing or a ball bearing.

The table below shows what the various pump types are equipped with. The position numbers refer to the section entitled "Spare parts drawings".

| | |
|---------------------|--|
| Type HD: | Idler bearing* pos. AD/main bearing pos. BC Main bearing = slide bearing at soft shaft seal Main bearing = ball bearing at mechanical shaft seal |
| Type CD, PD: | Idler bearing* pos. AD/main bearing pos. BC Main bearing = slide bearing |
| Type GP: | Idler bearing* pos. AD/main bearing pos. BC Main bearing = slide bearing at soft shaft seal Main bearing = ball bearing at mechanical shaft seal |
| Type ED: | Idler bearing* pos. AD/main bearing pos. BC Main bearing = slide bearing |
| Type CC: | Idler bearing pos. AD Main bearing = none |

* The idler bearing is, however, not fitted to pump sizes 26 + 33, where the idler is made of bronze or cast iron. The idler is instead fitted with a plate, so that the idler/idler pin can be lubricated.

The pump can be supplied with internal or external lubrication. If the pump liquid itself has a lubricating effect or is of sufficiently high viscosity, the bearings are lubricated by the pump liquid – otherwise the bearings must be lubricated via the lubrication nipple.

If the pump is supplied with an idler bearing and a main bearing for external lubrication, the pump designation will include an “M” – see the pump’s name plate! – if not, there is a “U” in the place indicated.

Example: HD51BDK-1**M**22BS = External lubrication

 HD51BDK-1**U**22BS = Internal lubrication

The bearings must be lubricated in accordance with the table in Figure 39, but the relubrication intervals and grease volumes are only guidelines, as the re-lubrication interval in particular is largely dependant on the conditions. Contact the supplier for correct guidance!

The bearings must be lubricated with a grease type suitable for the liquid and liquid temperature.

Contact the supplier for selection of the correct grease type!

In connection with chocolate pumps – pump version "CHD" – a vegetable fat type must be used which is compatible with the chocolate mass so that no harmful substances are transferred to the chocolate. Contact the supplier for selection of the correct grease type!



"CHD" pumps with lubrication connection in the back cover must not be pressure-lubricated with more than 20 bar



The lubricant for chocolate pumps must not be harmful. The lubricant must be compatible with the chocolate mass

Lubrication of slide bearings

Fat quantity in grams

| Pump type: HD, GP, CD, PD, ED, CC | Relubrication interval in hours | Main bearing | Idler bearing |
|---|------------------------------------|--------------|---------------|
| 26 | 8 hours | 1 | 1 |
| 33 | | 1 | 1 |
| 41 | | 1 | 1 |
| 51 | | 1.5 | 1.5 |
| 66 | | 1.5 | 1.5 |
| 81 | | 2 | 2 |
| 101 | | 2 | 2.5 |
| 126 | | 2.5 | 4 |
| 151 | | 2.5 | 6 |
| 152 | | 4 | 10 |
| 201 | | 8 | 14 |

Figure 39: Re-lubrication intervals and amounts of grease in grams for lubrication of slide bearings – main bearing and idler bearing.

17 Troubleshooting

Problem:
8. Lack of co-ordination between pressure and capacity
7. The pump cannot self-prime
6. The pump loses liquid after self-priming
5. The capacity is too low
4. The pump is making a noise
3. The motor is overloaded
2. The pump has jammed
1. The pump wears quickly
Cause:

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Too great a vacuum | | | | X | X | X | X | |
| 2. Cavitation | | | | X | X | X | | |
| 3. Viscosity too high | | | X | X | X | | X | X |
| 4. Temperature too high | | X | X | | | | X | |
| 5. The pump is drawing air | | | | X | X | X | X | X |
| 6. Pressure too high | X | X | X | | X | | | |
| 7. Defective valve | | | X | X | X | | | |
| 8. The pump is corroded | X | | | | X | | X | |
| 9. The pump is worn | | | | | X | | X | |
| 10. Impurities in the pump | X | X | X | | | | | |
| 11. The stuffing box is over-tightened* | X | | X | | | | | |
| 12. Fault in the motor | | | X | | | | | |
| 13. Pipe too constricted or blocked | | | | | X | | X | |
| 14. Wrong speed | | | | | | | X | |
| 15. The pump runs without liquid | X | X | | | | | X | |
| 16. Liquid temp. too high – lack of lubricant | X | X | | | | | | |
| 17. Speed too low | | | | | X | | | |
| 18. Speed too high | | | | X | | | | X |
| 19. Suction line not dipped in liquid | | | | | | | X | |
| 20. Liquid being fed above liquid level | | | | X | | | | |
| 21. Valve incorrectly adjusted | | | | | X | | | |
| 22. The pump's shaft end is bent | X | | | X | | | | |
| 23. Coupling incorrectly aligned | X | | | X | | | | |
| 24. Pump twisted in relation to pipe system | X | X | X | X | | | | |
| 25. Leaking pipes/assemblies | | | | | | | X | |

Figure 40: Various problems that can arise and possible causes of the problems.

*Point 11 does not apply for pump type ED.

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Because of the ROTAN pump's large number of possible combinations and the many pump liquids used, it is not possible to provide instructions on the rectification of the problems in this manual.

If the pump has been bought in Denmark, we therefore refer to DESMI's service centres at the back of this manual. If the pump was bought outside Denmark, we refer to the relevant distributor.

18 Emptying and cleaning the pump

If the liquid being pumped is inflammable, toxic, corrosive or hazardous in any other way, or if the liquid has a temperature of more than 60°C, special safety measures must be implemented before the pump is emptied.

The liquid's safety data sheet must be obtained and read before emptying the pump.

Please refer to the relevant liquid's safety data sheet.



Observe the safety instructions in the data sheet for the liquid in question and use the specified safety equipment in the form of protective clothing, a breathing mask or similar necessary safety equipment



Use suitable safety equipment with pump liquids at temperatures of more than +60°C



When pumping hazardous liquids, circulate neutralising liquid before emptying the pump



The system must be depressurised before emptying the pump.



Use spark-free tools when removing the front cover/dismantling the pump in potentially explosive atmospheres

ATEX

1. When pumping hazardous liquids, circulate a liquid that has a neutralising effect in relation to the pump liquid.

We recommend the use of thin neutralising liquids to facilitate drainage.

2. Empty the pipe system.

Note that there is still liquid in the bottom of the pump casing and in the shaft seal housing, even if the pipe system is empty, and in the case of the ED pump there will also be liquid in the magnetic coupling's canister.

3. Stop the unit

4. Close the valves on the suction side and the pressure side, if the system is equipped with these, so that the system is depressurised.
5. Place a collecting tank under the pump to take the volume of liquid contained in the part of the system to be emptied.
6. Remove the front cover and the heating jacket
7. Remove the pump and place it with the ports pointing up/down, and then rotate the shaft manually to empty

Please note that the drainage time is longer for highly-viscous liquids, as these find it difficult to make their way from the stuffing box house through the chamber between the rotor and the rear cover to the pump casing.

Some special versions of the pump are fitted with one or more draining plugs, to facilitate the drainage of highly-viscous liquids.

19 Disposal of liquid

The safety data sheet for the liquid used must be obtained, and the liquid must be disposed of in accordance with the safety data sheet's instructions.

Please refer to the relevant liquid's safety data sheet!



The safety instructions in the data sheet for the liquid in question must be observed, and the safety equipment specified must be used.

20 Repairs



Use spark-free tools when assembling and dismantling the pump and pump parts in potentially explosive atmospheres.

Pumps that are sent to DESMI for repair must have been emptied and cleaned before our factory can accept them, and the pumps must be accompanied by information about the pump liquid used.

Cleaning and emptying of the pump must be undertaken with due regard to the safety of our repair engineers.

We would point out that certain liquids coagulate and harden before arrival at our factory, which makes any repairs fully or partly impossible if the pump has not been emptied and cleaned before shipment.

In such cases, inadequate emptying and cleaning will generate increased repair costs, or in the worst case mean that the pump has to be scrapped.

ROTAN pumps must be emptied and cleaned in accordance with the instructions in the section "Emptying and cleaning the pump" – see this!

20.1 Reinstallation of thermal sensor

If the thermal sensor has been dismantled during repair work, the sensor must be reinstalled.

1. Check that the sensor is intact
2. Apply heat-conducting paste to the tip of the sensor in order to secure good heat transmission
3. Check that the thermal sensor is fitted correctly – see installation instructions for the thermal sensor
4. Control/see to it that the thermal sensor is connected to the control
5. Control/see to it that the control is connected
6. Check that the thermal sensor/control functions correctly.



Remember to connect the thermal sensor to the control and reconnect the control again after finishing repairs

20.2 Axial clearance

The axial clearance is the distance between the rotor/idler and the front cover.

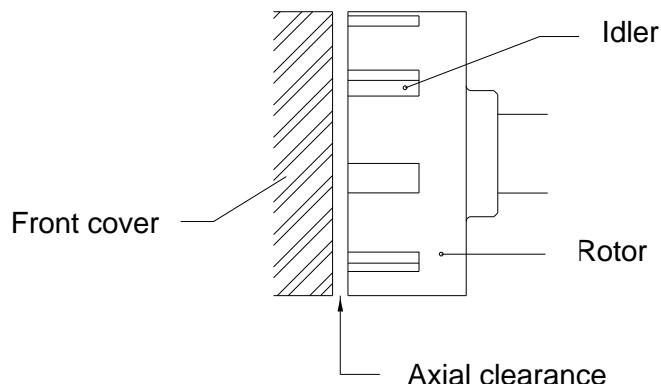


Figure 41: The axial clearance between the rotor/idler and the front cover.

The axial clearance is set in the factory in accordance with the section entitled "Setting of axial clearance".

The axial clearance must be reset after the pump has been repaired or if the pump is worn.

There are various ways of setting the axial clearance, depending on the pump type and whether or not the pump is installed in a pipe system. See the section entitled: "Setting of axial clearance".

20.1.1 Checking the axial clearance

The axial clearance can be checked as described below:

Non-installed pump:

The pump's axial clearance can be checked with an air gap gauge which is passed in through one of the pump's ports between the rotor/idler and the front cover.

The axial clearance identified must correspond to the values in the table in Figure 42.

Installed pump:

The axial clearance cannot be checked when the pump is installed in a pipe system.

The play must therefore be reset as described in the section entitled: "Setting of axial clearance".

| Axial clearance | | | | | | | | |
|--------------------------------------|-------------|---|-----------|--------------|---------------|----------------|------------|------------|
| Pump size | | 26/33 | 41 | 51/66 | 81/101 | 126/151 | 152 | 201 |
| Normal axial clearance* | Min. | 0.10 | 0.10 | 0.15 | 0.20 | 0.30 | 0.35 | 0.40 |
| | Max. | 0.125 | 0.15 | 0.20 | 0.25 | 0.375 | 0.45 | 0.50 |
| Pumps with spec. tolerances** | Min. | 0.20 | 0.20 | 0.30 | 0.40 | 0.60 | 0.70 | 0.80 |
| | Max. | 0.25 | 0.30 | 0.40 | 0.50 | 0.75 | 0.90 | 1.0 |
| Stainless pumps* | - | To be set with 0.10 mm more play than specified above | | | | | | |

Figure 42: The axial clearance in mm for the various pump sizes for standard pumps and pumps with special tolerances respectively. This table applies to pump types HD, CD, PD, GP, CC and ED.

The pump size appears from the pump designation. Example: CD26EFMDK-3U332.

* Pumps made of stainless steel are set with 0.10 mm more play than specified. Pumps made of stainless steel are characterised by the figure "3" in the pump designation. Example: CD26EFMDK-3U332

** Pumps with special tolerances are identified by the inclusion of a "T" or "CHD" in the designation.
Example: HD/CD41EFCHD-1M22B or GP101EDT-1U22B – see also the section "Pump versions".

20.2.2 Setting the axial clearance

The axial clearance is set by means of the regulating screws:

Type HD, CD, PD: Adjusting screws pos. CT/bearing covers pos. CS/CR

Type GP: Adjusting screws pos. KX/KY/sleeve coupling pos. DB

Type ED: Adjusting screws pos. E/NM/front cover pos. AA

Type CC: Adjusting screws pos. E/NM/front cover pos. AA **or**
Adjusting screws pos. E/front cover pos. AA/shim ring(s)
pos AS

See position numbers under the section: "Spare part drawings"/"Spare part list"!

As for pumps installed in a pipe system, the axial clearance is set by turning the pump's adjusting screw to a specific angle. Find the angle in the table below.

| | | Adjusting screws' min./max. angle turn in degrees | | | | | | | | |
|--------------------------------|-----------------------------|---|------|-------|--------|------|------|------|------|------|
| Pump type | Version | 26/33 | 41 | 51/66 | 81/101 | 126 | 151 | 152 | 201 | |
| HD (cast iron) | Standard | Min. | 45° | 36° | 54° | 58° | 86° | 84° | 82° | |
| | Special tolerances * | Max. | 56° | 54° | 72° | 72° | 108° | 108° | 108° | 103° |
| PD (steel) | Standard | Min. | 90° | 72° | 108° | 115° | 173° | 168° | 165° | |
| | Special tolerances * | Max. | 113° | 108° | 144° | 144° | 216° | 216° | 206° | 206° |
| CD (stainless steel) | Standard | Min. | 90° | 72° | 90° | 86° | 115° | 115° | 108° | 103° |
| | Special tolerances * | Max. | 101° | 90° | 108° | 101° | 137° | 137° | 132° | 123° |
| GP (cast iron) | Standard | Min. | 90° | 72° | 108° | 115° | 173° | 173° | 168° | 165° |
| | Special tolerances * | Max. | 113° | 108° | 144° | 144° | 216° | 216° | 216° | 206° |
| ED (cast iron/steel) | Standard | Min. | 36° | 29° | 43° | 58° | | | | |
| | Special tolerances * | Max. | 45° | 43° | 58° | 72° | | | | |
| CC (cast iron) | Standard | Min. | 72° | 58° | 86° | 115° | | | | |
| | Special tolerances * | Max. | 90° | 86° | 115° | 144° | | | | |
| ED (stainless steel) | Standard | Min. | 36° | 36° | 43° | 58° | 72° | 72° | 72° | |
| | Special tolerances * | Max. | 45° | 54° | 58° | 72° | 90° | 90° | 90° | |
| CC (cast iron) | Standard | Min. | 72° | 72° | 86° | 115° | 144° | 144° | 144° | |
| | Special tolerances * | Max. | 90° | 108° | 115° | 120° | 180° | 180° | 180° | |

Figure 43: Adjusting screws' min./max. angle turn in degrees – when setting the axial clearance – for the shown pump types, in the specified materials and versions.

* Pumps with special tolerances are identified by the inclusion of a "T" or "CHD" in the designation.

Example: HD/CD41EFCHD-1M22B or GP101EDT-1U22B – see also the section "Pump versions".

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The pump's adjusting screws are turned in pairs to the ascertained angle – appearing from Figure 43 – to ensure straight fitting. The size of the adjusting screw angle appears from Figure 44.

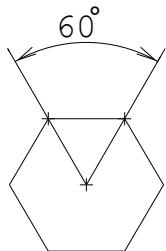


Figure 44: The size of the angle for a single surface on the hexagonal bolt head on the adjusting screws.

The procedure for setting the axial clearance in the various pumps for installed and non-installed pumps respectively. – appears from Figure 45.

| Setting of axial clearance | |
|--|--|
| Non-installed pump: | Installed pump: |
| Type HD, CD, PD: | Type HD, CD, PD: |
| <p>1. Loosen bearing covers pos. CS/CR so that the shaft can be pushed axially</p> <p>2. The pump's axial clearance can be found in the table Figure 42</p> <p>3. Insert an air gap gauge between the front cover and the rotor/idler</p> <p>4. Push the shaft towards the front cover until the air gap gauge becomes jammed</p> <p>5. Tighten the bolts in pairs so that the bearing covers do not force the ball bearing to one side</p> <p>6. When adjustment is complete, make sure that the pump shaft turns easily and regularly, and that no jarring noises can be heard.</p> | <p>1. Loosen bearing cover pos. CS</p> <p>2. Tighten bearing cover pos. CR.</p> <p>3. Loosen bearing cover pos. CR in accordance with the number of degrees obtained in the formula – Figure 43:</p> <p>4. Tighten bearing cover pos. CS</p> <p>Tighten the bolts in pairs so that the bearing covers do not force the ball bearing to one side</p> <p>5. When adjustment is complete, make sure that the pump shaft turns easily and regularly, and that no jarring noises can be heard</p> |
| Type CC (with shim rings): | Type CC (with shim rings): |
| <p>1. Remove set screws pos. E</p> <p>2. Remove front cover pos. AA</p> <p>3. Remove shim ring(s) pos. AS</p> <p>4. Loosely attach front cover and set screws</p> <p>5. The pump's axial clearance is obtained from the table in Figure 32</p> <p>6. Insert an air gap gauge between the front cover and the rotor/idler</p> <p>7. Tighten the front cover until the air gap gauge becomes jammed</p> <p>8. Measure the distance between the pump casing pos. A and the front cover pos. AA:_____</p> <p>9. The figure obtained is the thickness of the new shim ring</p> <p>10. Requisition and fit the shim ring or shim rings pos. AS according to the above!</p> <p>11. When adjustment is complete, make sure that the pump shaft turns easily and regularly, and that no jarring noises can be heard</p> | <p>1. Remove set screws pos. E</p> <p>2. Remove front cover pos. AA</p> <p>3. Remove shim ring(s) pos. AS</p> <p>4. Re-attach the front cover and set screws, and screw the front cover to the idler</p> <p>5. Check that the pump shaft <u>cannot</u> be turned (If the pump shaft can turn, this is because the front cover and/or rotor/idler are worn, and the play can thus not be set correctly. Worn items must then be replaced before resetting the axial clearance)</p> <p>6. Measure the distance between the pump casing pos. A and the front cover pos. AA:_____</p> <p>7. The pump's axial clearance can be seen in the table in Figure 32:_____</p> <p>8. The two figures obtained together define the thickness of the new shim ring:_____</p> <p>9. Requisition and fit the shim ring or shim rings pos. AS according to the above!</p> <p>10. When adjustment is complete, make sure that the pump shaft turns easily and regularly, and that no jarring noises can be heard</p> |

Non-installed/installed pump:**Type ED, CC (with set screws):**

1. Loosen set screws pos. NM
2. Tighten adjusting screws pos. E until the front cover is positioned against the rotor/idler.
3. Check that the pump shaft cannot be turned
4. (If the pump shaft can turn, this is because the front cover and/or rotor/idler are worn, and the play can thus not be set correctly. Worn items must then be replaced before resetting the axial clearance)
5. Loosen adjusting screw pos. E according to the number of degrees obtained in the formula in Figure 43
6. Tighten set screws pos. NM.
7. In non-installed pumps, once adjusted the play must be checked with an air gap gauge in at least 3 different points, to ensure that the front cover is parallel with the rotor.

Finally, make sure that the pump shaft can turn easily and regularly and that no jarring sound can be heard. Finally, make sure that the pump shaft can turn easily and regularly and that no

Type GP:

1. Loosen set screw pos. DC on sleeve coupling pos. DB
2. Loosen the short set screws pos. KY
3. Tighten the long set screws pos. KX until the rotor is positioned against the front cover
4. Loosen the long set screws pos. KX according to the no. of degrees obtained in the formula in Figure 43
5. Tighten the short set screws pos. KY
6. Tighten set screw pos. DC
7. When adjustment is complete, make sure that the pump shaft turns easily and regularly, and that no jarring noises can be heard.
(The flange motor in GP pumps must have a locked bearing at the end of the shaft end, to ensure that the pump's axial clearance falls within permitted parameters)

Figure 45: The procedure for setting the axial clearance in the various pumps for installed and non-installed pumps respectively.

21 Spare parts

We recommend that you use original spare parts.

DESMI accepts no liability for any personal injury or damage to the pump as a consequence of the use of non-original spare parts that do not satisfy precisely the same strict quality requirements as original DESMI spare parts.

22 Ordering spare parts

When ordering spare parts, the following information must be provided:

| | |
|---|-----------------------|
| - The pump's serial number | 252756 |
| - The pump's SX no. | 5310 |
| - The pump type | HD81ERM-1U332 |
| - If relevant, the code of the mechanical shaft seal | AD |
| - If relevant, the number of the magnetic coupling (seal) | - |
| - If relevant, the number of the bypass valve | - |
| - The spare part's position designation | Pos. CJ |
| - The spare part's designation | Mechanical shaft seal |

The above information may be found on the pump's name plate – Figure 45.
The serial number is also embossed on the pump's left port.

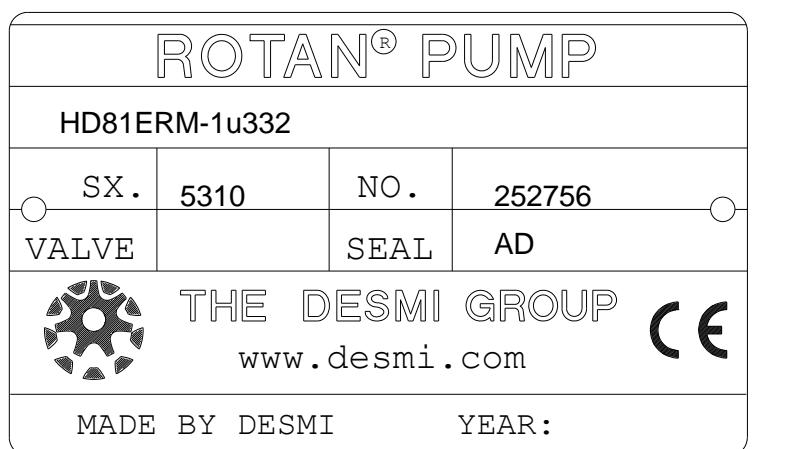
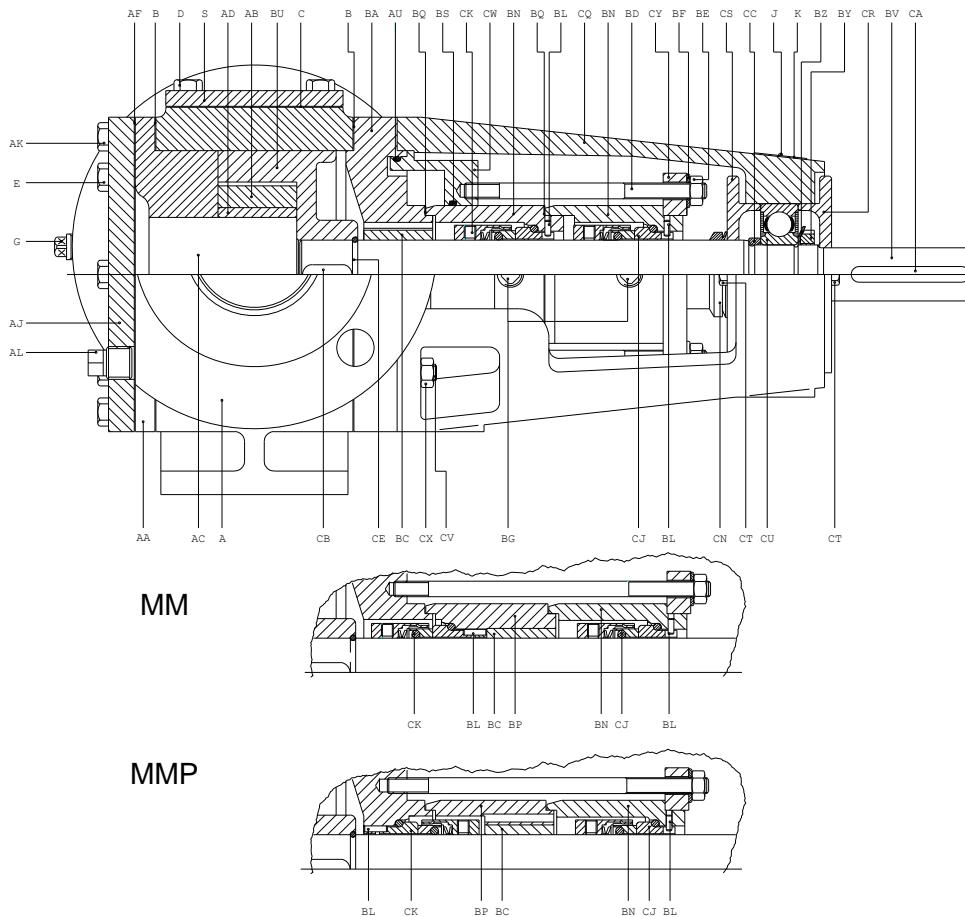


Figure 46: An example of a pump's name plate.

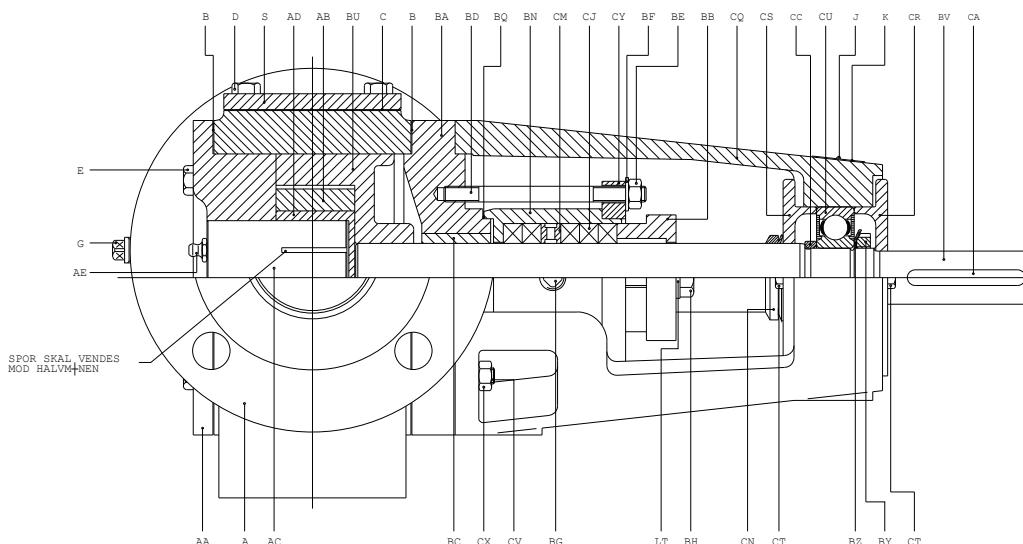
22.1 Spare parts drawings

This section contains a representative selection of ROTAN sectional drawings. Not all pump configurations are included, but taken together the drawings selected show the most common position designations and designs.

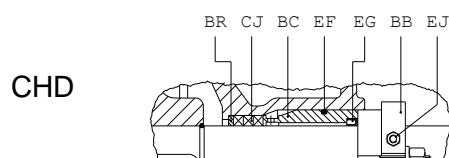
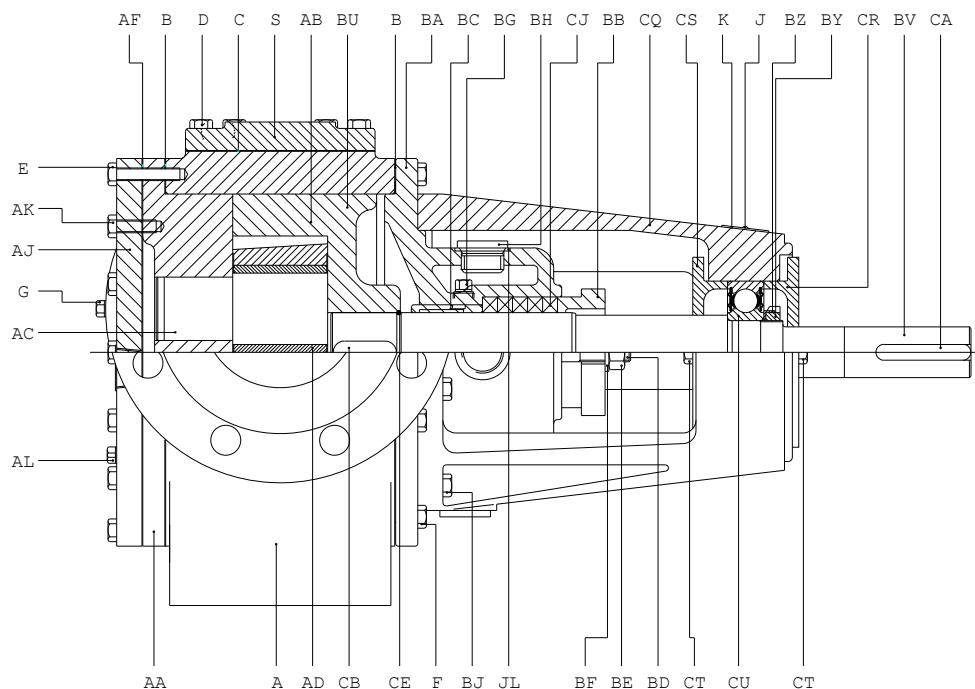
CD/PD..EFDKMMW - (CD/PD..EFMM) - (CD/PD..EFMMP)



CD/PD..EF

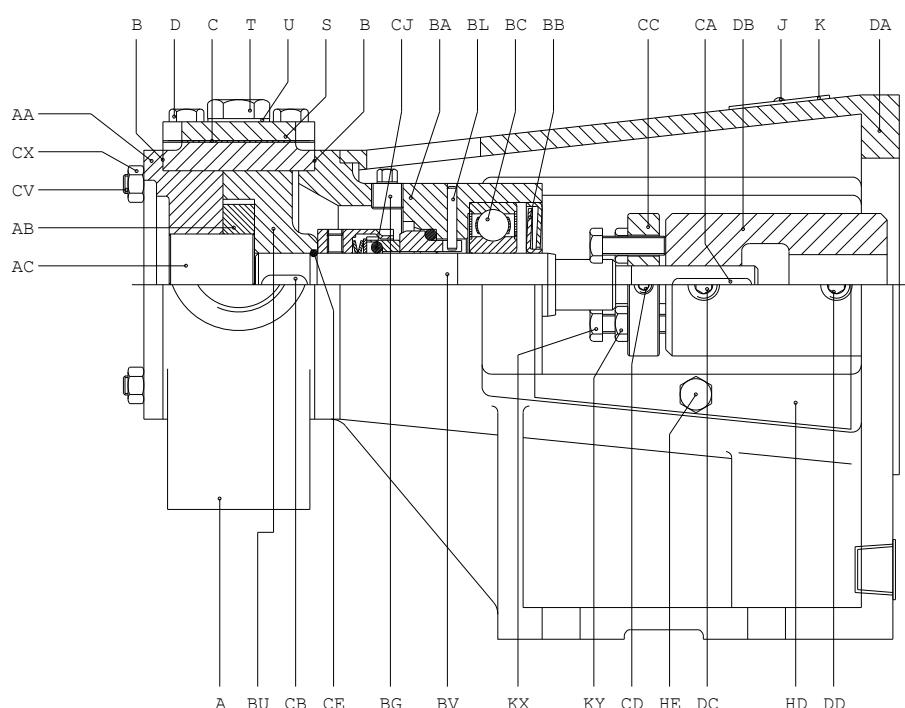


HD..EDK
(GP..E)
(HD..ECHD)



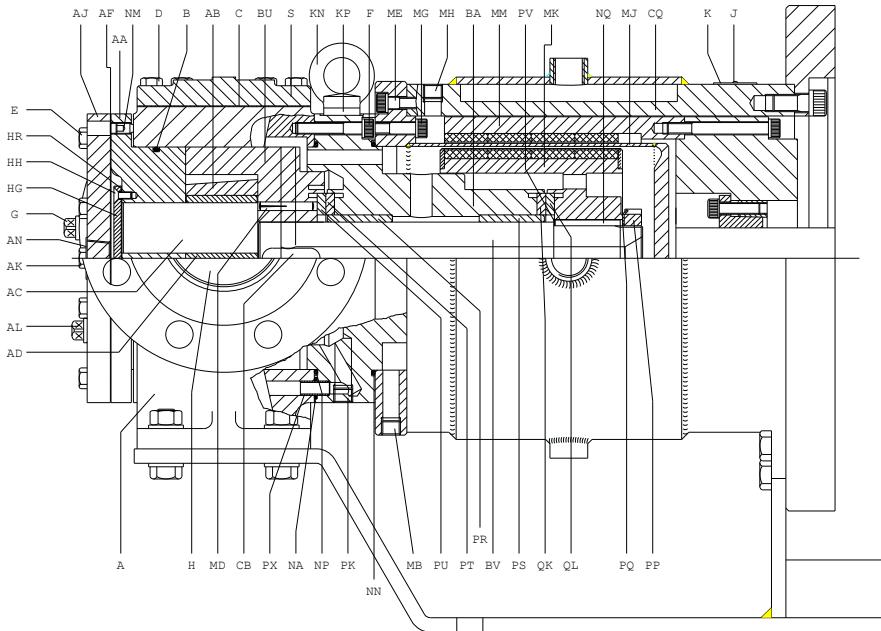
GP..EM
(HD..EM)

Grove must
face
crescent

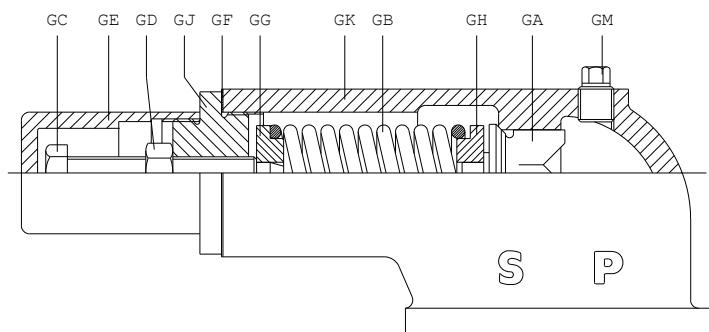


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ED...EFDK

Bypass valve for HD, GP (CD, PD, ED)



23 spare part list

| <u>Pos.</u> | <u>Designation</u> | <u>Pos.</u> | <u>Designation</u> |
|-------------|------------------------------------|-------------|------------------------------------|
| A | Pump casing | BN | Shaft seal housing |
| B | Gasket/O-ring | BP | Intermediate bearing |
| C | Gasket | BQ | Gasket |
| D | Bolt | BR | Spacer ring |
| E | Bolt | BS | O-ring |
| F | Bolt | BU | Rotor |
| G | Pipe plug | BV | Shaft |
| J | Drive screw | BY | Ball bearing nut |
| K | Name plate | BZ | Ball bearing lock ring |
| S | Blind cover | CA | Key |
| T | Pipe plug | CB | Key |
| U | Gasket | CC | Fixing ring/spacer ring |
| AA | Front cover | CD | Threaded screw |
| AB | Idler | CE | Snap ring |
| AC | Idler pin | CJ | Packing coil/mechanical shaft seal |
| AD | Idler bush | CK | Mechanical shaft seal |
| AE | Lubrication nipple/pipe plug | CM | Lantern ring |
| AF | Gasket | CN | V-ring |
| AJ | Heating jacket | CQ | Bearing bracket |
| AK | Bolt | CR | Bearing cover |
| AL | Pipe plug | CS | Bearing cover |
| AU | O-ring | CT | Bolt |
| BA | Rear cover | CU | Ball bearing |
| BB | Packing gland/bearing cover | CV | Stud bolt |
| BC | Main bearing bush/ Ball bearing | CW | Heating jacket |
| BD | Stud bolt/bolt | CX | Nut |
| BE | Nut | CY | Retaining flange |
| BF | Washer | DA | Motor bracket |
| BG | Pipe plug/lubrication nipple | DB | Coupling |
| BH | Bolt/pipe plug | DC | Threaded screw |
| BJ | Bolt | DD | Threaded screw |
| BL | Priming pin | EF | O-ring |

| <u>Pos.</u> | <u>Designation</u> | <u>Pos.</u> | <u>Designation</u> |
|--------------------|---------------------------|--------------------|---------------------------|
| EG | Seal ring | MP | Bolt |
| EJ | Bolt | MQ | Bolt |
| GA | Valve cone | MR | Lock ring |
| GB | Key | MS | Key |
| GC | Adjusting screw | MT | Seal ring |
| GD | Nut | MU | Connecting flange |
| GE | Canister | MV | Complete main bearing |
| GF | Gasket | MW | Spacer ring |
| GG | Pressure plate | MX | Bolt |
| GH | Pressure plate | MY | Cylindrical pin |
| GJ | Valve cover | MZ | O-ring |
| GK | Valve casing | NA | O-ring |
| GM | Pipe plug | NB | Ball bearing |
| GN | Gasket | NC | Thermal sensor |
| GQ | Bolt | ND | Bearing cover |
| GR | Washer | NE | Shaft |
| HD | Shield | NF | Cover |
| HE | Bolt | NG | Disc spring |
| JL | Gasket | NJ | Bolt |
| KX | Bolt | NK | O-ring |
| KY | Bolt | NM | Set screw |
| LT | Washer | NN | O-ring |
| MA | O-ring | NP | O-ring |
| MB | Pipe plug | NQ | Key |
| MC | O-ring | NS | Intermediate piece |
| MD | Roll pin | NT | Thread fitting |
| ME | Bolt | NU | O-ring |
| MF | Bolt | NZ | Draining plug |
| MG | Bolt | | |
| MJ | Canister | | |
| MK | Inner magnetic rotor | | |
| ML | Bolt | | |
| MM | Outer magnetic rotor | | |
| MN | Washer | | |

24 Technical specifications

Because of the ROTAN pump's large number of possible combinations and the many pump liquids used, the following values should be viewed as guideline maximum values, as an individual ROTAN pump may have further limitations due to the pump liquid, the shaft seal selected and in particular the motor selected.

If the pump was bought in Denmark, we therefore refer to DESMI's service centres at the back of this manual.

If the pump was bought outside Denmark, we refer to the relevant distributor.

The technical specifications of the motor are contained in the manual supplied by the motor manufacturer.

24.1 Capacity

| Pump type | Capacity |
|-----------------|----------------------------|
| GP | Max. 50 m ³ /h |
| ED | Max. 90 m ³ /h |
| HD/PD/CD | Max. 170 m ³ /h |
| CC | Max. 6,8 m ³ /h |

Figure 47: The maximum capacity in m³/h for the various pump types.

24.2 Speed

| Pump size | Speed |
|---------------------|-------------------|
| 26 / 33 / 41 | Max. 1,750 o/min. |
| 51 / 66 | Max. 1,450 o/min. |
| 81 | Max. 1,200 o/min. |
| 101 | Max. 950 o/min. |
| 126 | Max. 750 o/min. |
| 151 | Max. 600 o/min. |
| 152 | Max. 500 o/min. |
| 201 | Max. 400 o/min. |

Figure 48: The maximal speed per minute for the various pump sizes – for pump liquids with viscosities under 400 cSt. Reduce the speed in the event of higher viscosities in order to avoid cavitation.

The table applies to all pump types: GP/HD/PD/CD/ED/CC.

24.3 Operational pressure

| Pump type/size | Operat. pressure – pump casing | Operat. press. – heating chamber |
|--|--------------------------------|----------------------------------|
| GP*/HD/PD/CD/ED 26 / 33 / 41 / 51 / 66 / 81 | Max. 16 bar (max. 25 bar*) | Max. 10 bar |
| GP*/HD/PD/CD/ED 101 / 126 / 151 / 152 / 201 | Max. 10 bar (max. 25 bar*) | Max. 10 bar |
| CC | Max. 10 bar | |

Figure 49: Maximum operational pressure in bar for the various pump types.

The stated max. operational pressure depends on the inlet pressure to the pump and the pump size.

* Pump type GP is also supplied in a special high-pressure version which manages a max. of 25 bar.

The high-pressure version is available in pump sizes: 27 / 34 / 42 / 52 / 67 / 82 / 102

It appears from the pump size on the name plate if the pump can manage max. 25 bar.

System pressure + differential pressure must not exceed 25 bar.

The differential pressure must not exceed 16 bar for pump size up to 82 and 10 bar for size 102.

24.4 Suction height

| Pump type | Suction height |
|--------------------------|---|
| GP/HD/PD/CD/ED/CC | Max. 0.5 bar priming vacuum Max. 0.8 bar vacuum in operation |

Figure 50: The max. suction height in bar for priming vacuum and operational vacuum.

24.5 Viscosity

| Pump type | Viscosity |
|-----------------|------------------|
| GP | Max. 7,500 cSt |
| ED | Max. 10,000 cSt |
| HD/PD/CD | Max. 250,000 cSt |
| CC | Max. 1,000 cSt |

Figure 51: States the max. allowed viscosity in cSt. of the pump liquid – for standard versions of the various pump types.

24.6 Temperature

| Pump type | Temperature |
|-----------|--|
| GP | Max. 150°C |
| HD/PD/CD* | Max. 250°C |
| ED | Max. 130°C (Magnetic material: Neodym-Iron-Bor) Max. 250°C (Magnetic material: Samarium-Cobalt) |
| CC | Max. 80°C |

Figure 52: The pump liquid's minimum/maximum temperature limits for the various pump types.
 For pumps with bypass valve the temperature is limited to 150°C on account of the valve spring.
 The valve may however be supplied with another spring so that the temperature span of the pump can be utilised fully.
 As or additional temperature limits, see the section: "Hot liquids".
 * Pump types HD, CD og PD – designed with special tolerances – may in certain cases be used up to 300°C.

| ED pump | | |
|----------------|------------------------|--------------------|
| Elastomer type | Elastomer brand | Temperature |
| FPM | Viton® | Ca. -20°C / +200°C |
| FEP | Teflon® med Viton core | Ca. -60°C / +205°C |
| EPDM | Ethylene-propylene | Ca. -65°C / +120°C |
| FFKM | Kalrez® | Ca. -50°C / +316°C |

Figure 53: The pump liquid's minimum/maximum temperature limits for the various elastomers used in an ED pump.

25. Installation of ATEX pumps with PT100 sensor

To ensure that a ROTAN ATEX pump is safe to use in an ATEX-defined area the following instructions must be followed.

ED pumps and pumps with soft shaft seal, must always be installed with a PT100 sensor according to DESMI A/S instructions.

If the ROTAN ATEX pump is fitted with a bypass valve, a PT100 sensor has to be mounted on the bypass valve.

If a ROTAN ATEX pump is ordered with PT100 sensor, the PT100 sensor is not mounted from the factory, due to the risk of damaging it during transport.

Before the first start up of the pump the PT100 sensor must be mounted in accordance with DESMI A/S instructions.

25.1 Installation of the PT100 sensor

25.1.1 PT100 sensor installed in an intrinsically safe electrical circuit

If the PT100 sensor is installed in an intrinsically safe electrical circuit, it is not required that the PT100 sensor is ATEX certified. It is a simple apparatus which is accordance with EN60079-14:2004 §3.4.5

The intrinsically safe electrical circuit is to be installed according to EN 60079-14:2004.

DESMI A/S recommends mounting of intrinsically safe electrical circuit

25.1.2 PT100 sensor installed as an intrinsically safe equipment

The PT100 sensor must be classified according to the same ATEX zone as the pump.

The PT100 sensor must be certified according to the ATEX zone in which it is installed.

The installation is to be made in accordance with the requirements set up in EN 60079-14:2004.

When ordering a ROTAN ATEX pump, it is important to state whether the pump is to be delivered with or without PT100 sensor.

If DESMI is to deliver the PT100 sensor it is important that it is informed whether the PT100 sensor is installed in a intrinsically safe electrical circuit or not. If this information not can be given, DESMI will deliver a PT100 sensor according to 25.1.b

25.2 Mounting the PT100 sensor to the pump

The following mounting instruction must be followed to insure that the ROTAN ATEX pump is safe to use in an ATEX zone.

ROΤAN ATEX pumps that are to be installed with PT100 sensors are always factory prepared for this. If a pump is ordered without PT100 sensors, the factory prepared threaded holes must be used for possible subsequent PT100 mounting.

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25.2.1 Pumps with soft shaft seal

When mounting the PT100 sensor in the pump, apply a small amount of heating conductive paste on the tip of the sensor, in order to ensure good heat transfer between the soft seal, the rear cover, and the sensor.

Mount the counter nut and turn it as far backwards as possible. Lead the PT100 sensor through the bracket, and into the hole in the rear cover. When the sensor tip touches the bottom of the hole, turn the sensor $\frac{1}{4}$ revolution backwards and tighten the counter nut.

25.2.2 ED Pumps

When mounting a PT100 sensor on an ED pump, apply a small amount of heating conductive paste on the tip of the sensor, to ensure good heat transfer from the canister that surrounds the media in the pump and the sensor.

Mount the counter nut and turn it as far backwards as possible. Mount the PT100 sensor on the pump rear cover. Turn the sensor in until it touches the canister, when the sensor tip touches the canister turn it $\frac{1}{4}$ revolution back and tighten the counter nut.

25.2.3 Bypass valve

When mounting a PT100 sensor on a bypass valve, the sensor is to be mounted in a sensor pocket. The sensor pocket is always mounted on the bypass valve pressure side, marked "P". Apply a small amount of heating conductive paste on the tip of the sensor, to ensure good heating transfer between the sensor pocket and the sensor. The counter nut is turned as far backwards as possible, and the sensor is mounted in the sensor pocket. Turn the sensor in the sensor pocket until the tip of the sensor touches the bottom, then turn it $\frac{1}{4}$ revolution back and tighten the counter nut.

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Nørresundby

Tagholm 1
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Fax: +45 9817 5499

Harlev

Lilleringvej 20
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Fax: +45 8694 2292

Odense

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Tel: +45 9632 8111
Fax: +45 6595 7565

Kolding

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DK-6000 Kolding
Tel: +45 7023 6363
Fax: +45 75 58 34 65

Hvidovre

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DK-2650 Hvidovre
Tel: +45 9632 8111
Fax: +45 3677 3399

27 Subsidiary companies – DESMI A/S

DESMI Denmark A/S

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Tel: +45 7244 0250
Fax: +45 9817 5499

DESMI Contracting A/S

Address: Tagholm 1
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