

Intelligent Drivesystems, Worldwide Services



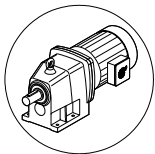
GB

B1000

Operating and Maintenance Instructions for
Gear Units and Geared Motors


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

If you do not understand the contents of this Operating Manual, please consult Getriebebau 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. **Operation of the system is prohibited until the final product complies with the regulations of the EU Machinery Directive 98/37.**

A manufacturer's declaration regarding the Machinery Directive is available on request.

	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. Notes

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!
	Installation and maintenance work may only be performed when gear units are at a standstill. The drive must be isolated and secured to prevent accidental start-up. Tighten the drive elements or secure the parallel key before switching on.

	Danger!
	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.

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!
	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.



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
- Operating instructions for attached options, if applicable

1.6 Disposal

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

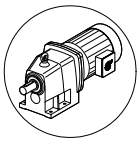
Gear unit components:	Material:
Toothed wheels, shafts, rolling bearings, parallel keys, locking rings, ...	Steel
Gear unit housing, housing components, ...	Grey cast iron
Light alloy gear unit housing, light alloy gear unit housing components, ...	Aluminium
Worm gears, bushes, ...	Bronze
Radial seals, 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. Description of gear units

2.1 Type designations and gear unit types

	Helical gear units
	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) 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)
	<u>NORDBLOC helical gear units</u>
	SK 320, SK 172, SK 272, SK 372, SK 472, SK 572, SK 672, SK 772, SK 872, SK 972 (2-stage) SK 273, SK 373, SK 473, SK 573, SK 673, SK 773, SK 873, SK 973 (3-stage) 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) SK 373.1, SK 573.1, SK 673.1, SK 773.1, SK 873.1, SK 973.1 (3-stage)
	<u>Standard helical gear units</u>
	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)
	<u>Parallel shaft gear units</u>
	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) 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)
	<u>Bevel gear units</u>
	SK 92072, SK 92172, SK 92372, SK 92672, SK 92772 (2-stage) 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) SK 9013.1, SK 9017.1, SK 9023.1, SK 9033.1, SK 9043.1, SK 9053.1 (4-stage)
	<u>Contrate worm gear unit</u>
	SK 02040, SK 02050, SK 12063, SK 12080, SK 32100, SK 42125 (2-stage) SK 13050, SK 13063, SK 13080, SK 33100, SK 43125 (3-stage)
	<u>MINIBLOC worm gear units</u>
	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)
	<u>UNIVERSAL worm gear units</u>
	SK 1SI31, SK 1SI40, SK 1SI50, SK 1SI63, SK 1SI75, SK 1SI83,..., SK 1SI875, SK 1SD31, SK 1SD40,SK 1SD50, SK 1SD63, SK 1SIS-D31,..., SK 1SIS-D63 (single-stage) SK 2SD40, SK 2SD50, SK 2SD63, SK 1SI.../31, SK 1SI.../H10, SK 2SIS-D40,..., SK 2SIS-D63 (2-stage)
	<u>Versions / Options</u>
-	Foot mounting with solid shaft
A	Hollow shaft version
V	Solid shaft version
L	Solid shaft both sides
Z	Drive flange B14
F	Output flange B5
X	Foot mounting
XZ	Base and output flange B14
XF	Base and output flange B5
AL	Reinforced axial drive bearings
5	Reinforced output shaft (Standard helical gear unit)
V	Reinforced drive shaft (Standard helical gear unit)
D	Torque support
K	Torque console
S	Shrink disc
VS	Reinforced shrink disc
EA	Hollow shaft with internal spline
G	Rubber buffer
VG	Reinforced rubber buffer
R	Back stop
B	Fixing element
H	Covering cap as contact guard
H66	Covering cap IP66
VL	Reinforced bearings
VLII	Agitator design
VLIII	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



2. Description of Gear Units



2.2 Type plate

		Getriebebau NORD	
		GmbH&Co KG	
		D-22934 Bargteheide	
Type	SK	(1)	
No.	(2)		
i=	(3)		
n2=	(4)	min ⁻¹	
Siehe Wartungsanleitung See maintenance instructions Voir instructions d`entretien			

Explanation of the Rating Plate

- | | |
|---|--------------------------------------|
| 1 | NORD gear unit type |
| 2 | Serial number |
| 3 | Overall gear unit ratio |
| 4 | Rated speed of gear unit drive shaft |

3. Storage, preparation, installation

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 $+50^{\circ}\text{C}$
- 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, Getriebebau 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. Storage, Preparation, Installation



3.3 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.

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)



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 Getriebebau 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 expansion tanks (Option OA) must be fitted in accordance with the attached works standard WN 0-521 30.

If a vent plug is fitted, the sealing cord must be removed from the vent plug before commissioning. Position of the vent plug: see Section 6.1.

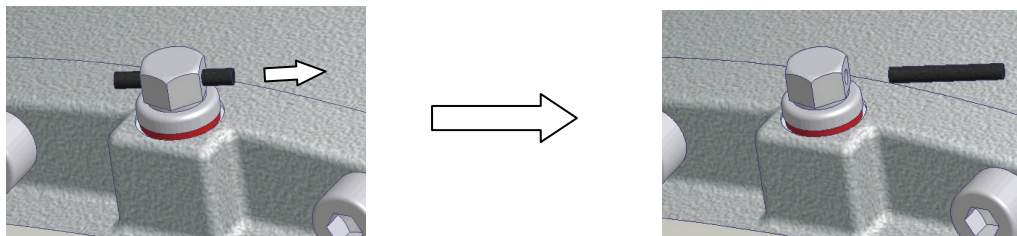


Figure 3-1: Activating the vent plug

If in case of drive units with the option DR the pressure vent is not fitted, the vent plug must be replaced with the supplied pressure vent before commissioning. 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.

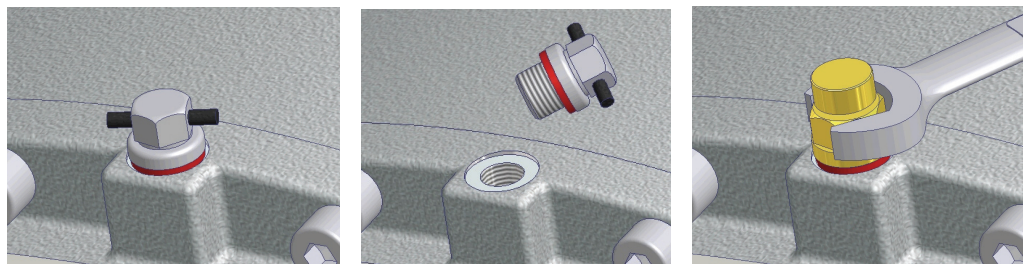


Figure 3-2: Removing vent plug and fitting the pressure vent

3.4 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.

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). For changes to the installation position, the vent plug and the oil level must be modified (see Section 6.1). 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: • 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. Storage, Preparation, Installation



3.5 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.

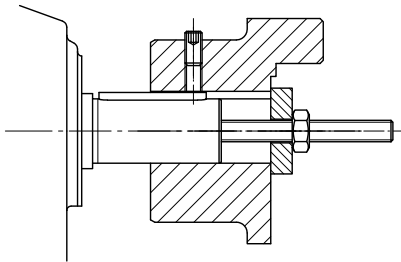


Figure 3-3: Example of a simple pulling device

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

Drive and driven elements may only subject the drive units to the maximum radial forces F_{R1} and F_R and axial forces F_{A1} and 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.

3.6 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.

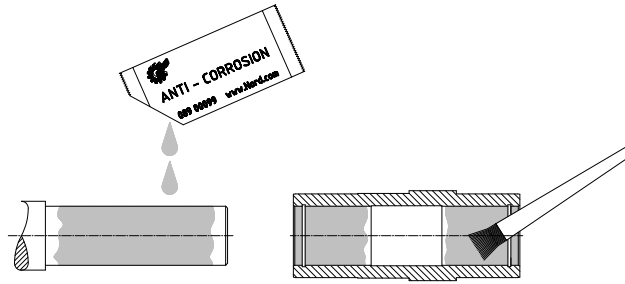


Figure 3-4: Applying lubricant to the shaft and the hub



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)

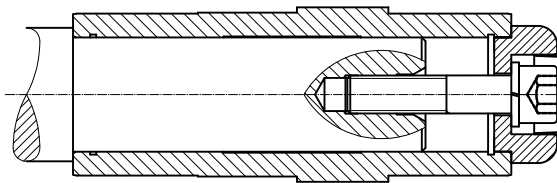


Figure 3-5: Gear unit mounted to shaft with a shoulder using the fastening element

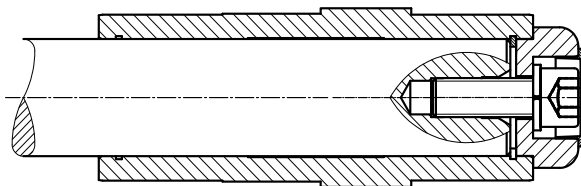


Figure 3-6: Gear unit mounted to shaft without a shoulder using the fastening element

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

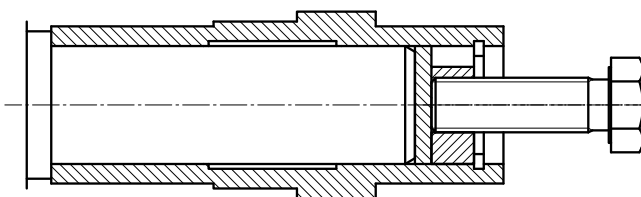


Figure 3-7: Dismantling using dismantling device

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).



3. Storage, Preparation, Installation

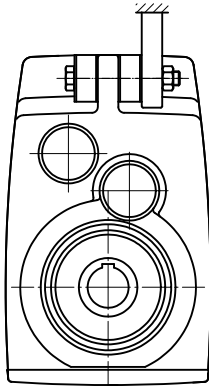


Figure 3-8: Mounting the rubber buffer (Option G and/or VG) on parallel shaft gear units

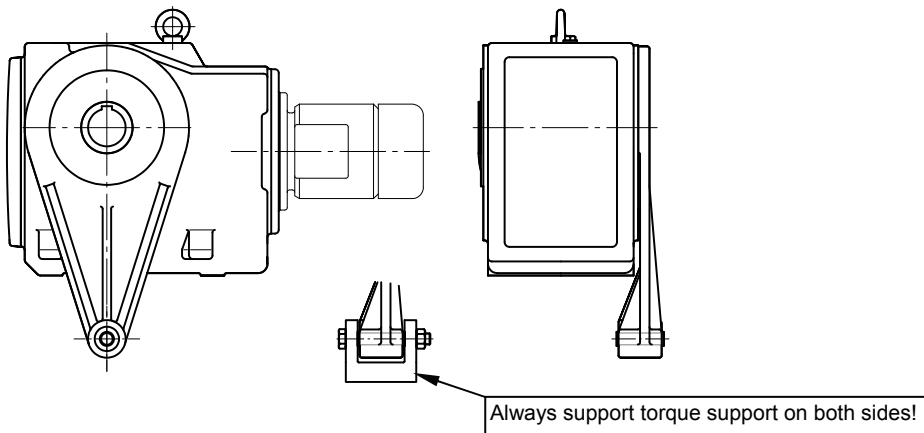


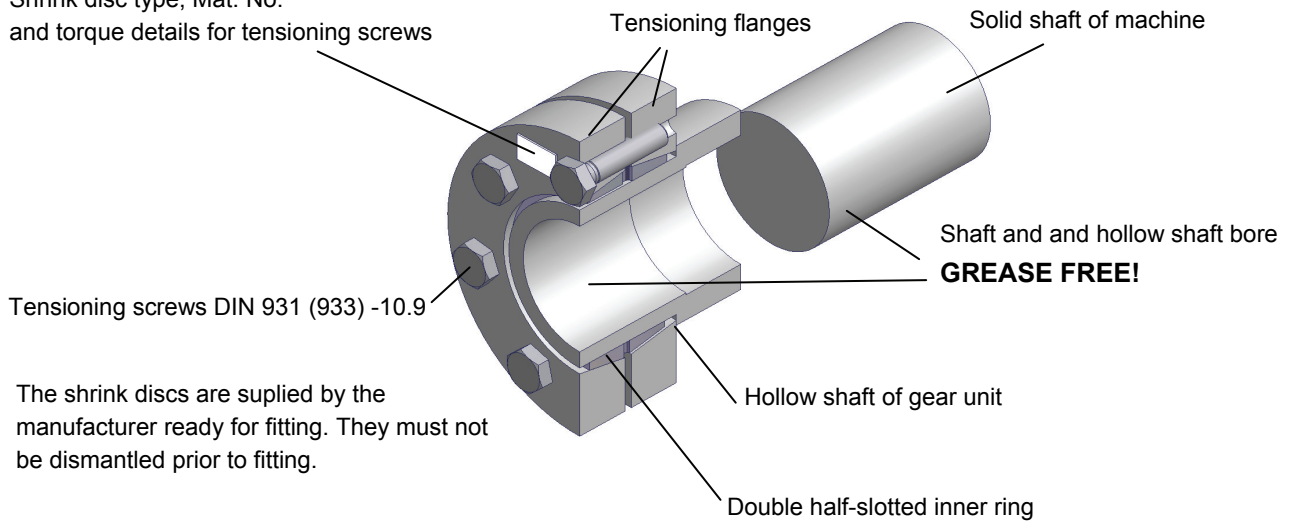
Figure 3-9: Attaching the torque support on bevel gear and worm gear units

Tighten the bolts on the rubber buffer and 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).

3.7 Fitting shrink discs

Shrink disc type, Mat. No.

and torque details for tensioning screws



The shrink discs are supplied by the manufacturer ready for fitting. They must not be dismantled prior to fitting.

Figure 3-10: 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. 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.



3. Storage, Preparation, Installation



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.

3.8 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 by means of special attached components.

All fixing screws must be used and tightened to the correct torque. (See Section 6.2 for torque values) With Option H66 covers, lightly press in the cover cap by means of light hammer blows.



Figure 3-11: Fitting the covers, Option SH, Option H, and Option H66

3.9 Fitting a standard motor

The maximum permitted motor weights indicated in the table below must not be exceeded:

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 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. 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 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 adapter, do not forget to fit the gear rim or the sleeve. (See Figure 3-12)
7. Tighten the adapter bolts to the correct torque. (See Chapter 6.2 for torque values)

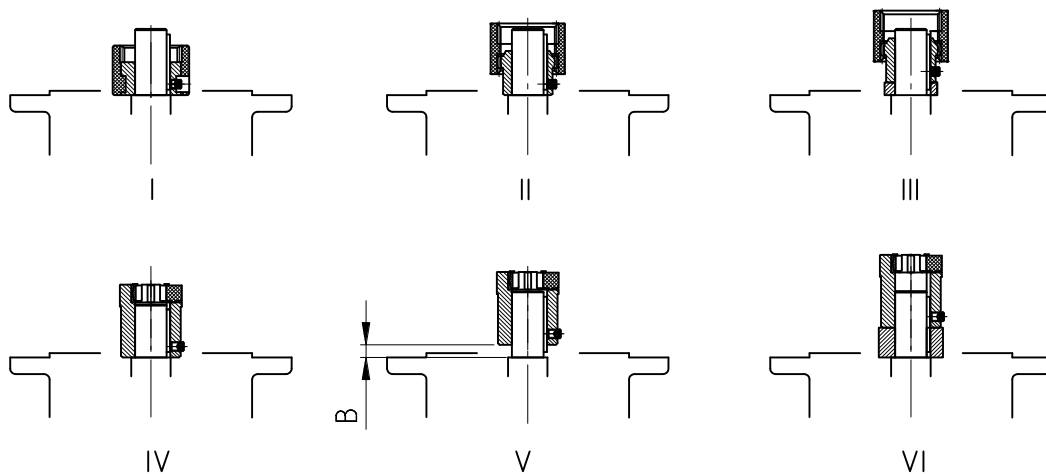


Figure 3-12: Fitting the coupling onto the motor shaft - various types of coupling



3. Storage, Preparation, Installation



- I Gear coupling (BoWex®), one-part
- II Gear coupling (BoWex®), two-part
- III Gear coupling (BoWex®), two-part with spacer bush
- IV Claw coupling (ROTEX®), two-part
- V Claw coupling (ROTEX®), 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. 3-12V)	B = 4.5mm	B = 11.5 mm

- VI Claw coupling (ROTEX®), two-part with spacer bush

3.10 Retrospective paintwork

	Attention!
	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.

3.11 Fitting the cooling coil to the cooling system

Cutting ring screw threads (see Item 1, Figs. 3-13) 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. 3-13). You must ensure that no external forces act on the cooling coil.

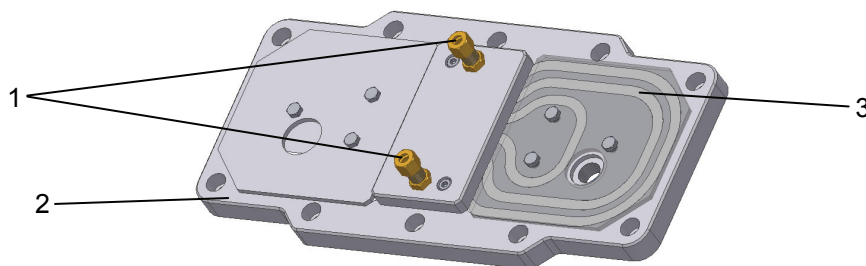


Figure 3-13: Cooling cover

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

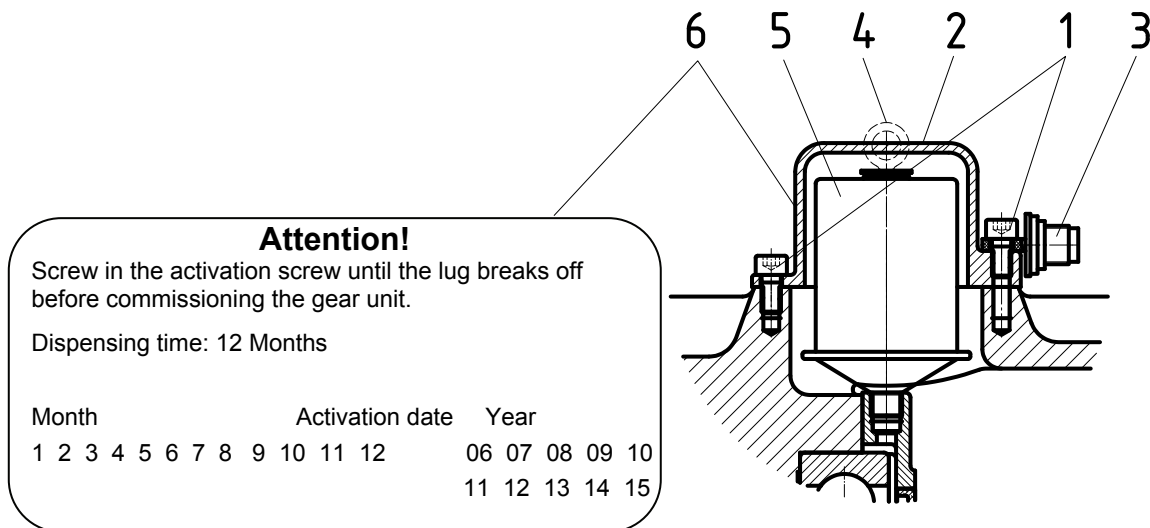


Figure 4-1: Activating the automatic lubricant dispenser with standard motor mounting



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		
Object of the check	Checked on:	Information – see Section
Is the vent plug activated or the pressure vent screwed in?		Sec. 3.3
Does the required configuration conform with the actual installation?		Sec. 6.1
Are the external gear shaft forces within permitted limits (chain tension)?		Sec. 3.5
Is the torque support correctly fitted?		Sec. 3.6
Are contact guards fitted to rotating components?		Sec. 3.8
Is the automatic lubricant dispenser activated?		Sec. 4.2
Is the cooling cover connected to the cooling circuit?		Sec. 3.14/4.3

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	- Visual inspection - Check for running noises - Check oil level - Re-grease (applicable only to free drive shaft / Option W and on agitator bearings / Option VLII / VLIII) - 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
Every 10000 operating hours, at least every 2 years	- Change oil (if filled with synthetic oil, this period is doubled) Reduction of lubricant replacement interval under extreme operating conditions (high humidity, aggressive environment and high temperature fluctuations)	5.2
At least every 10 years	- 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.

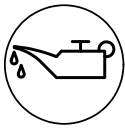
Check for running noises

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")



5. Service and Maintenance

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)



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. 5-1). 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.

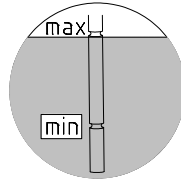


Figure 5-1: Check the oil level with a dipstick

Regreasing

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

For agitator versions VLII and VLIII, 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
2. Completely remove oil level screw, screwed sealing plug with dipstick if an oil level tank is being used and oil drain screw.

5. Service and Maintenance

	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 G1¼) 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.

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

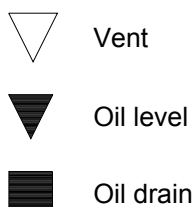
The general overhaul must be carried out by a specialist workshop with appropriate equipment and qualified specialist personnel. We recommend that the general overhaul is carried out by the NORD service department.



6. Appendix

Versions and maintenance

Explanation of symbols for the following version illustrations:

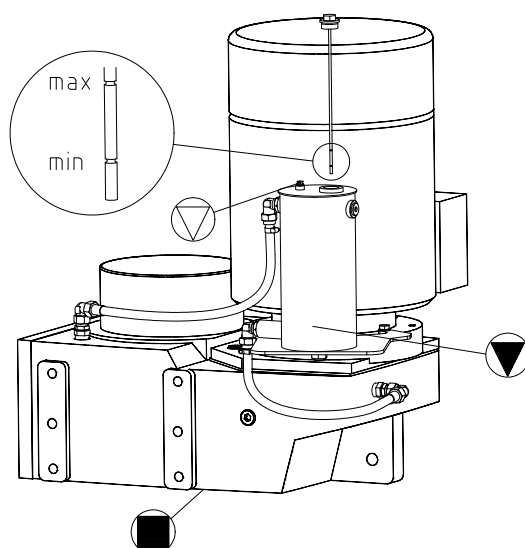


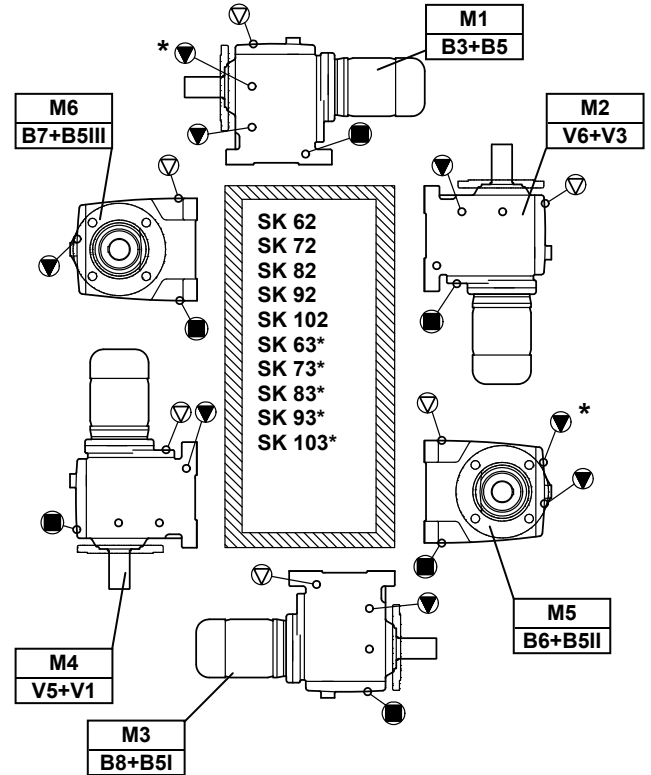
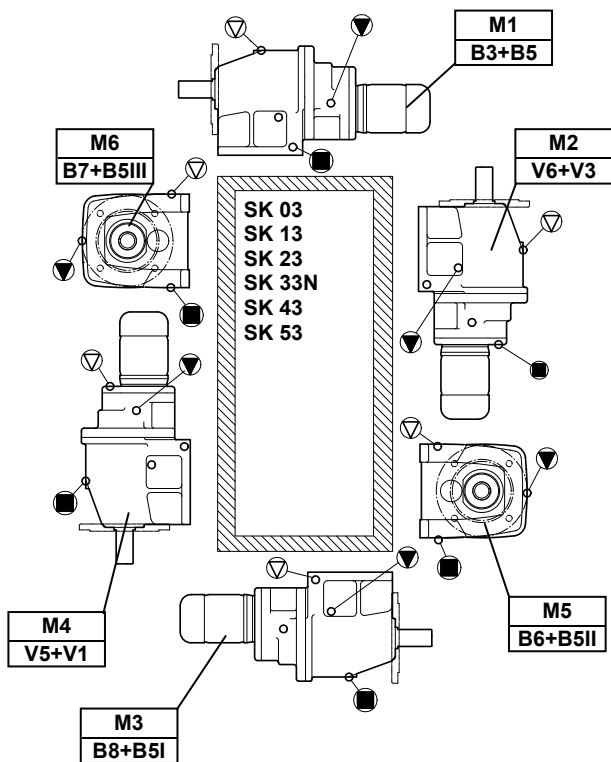
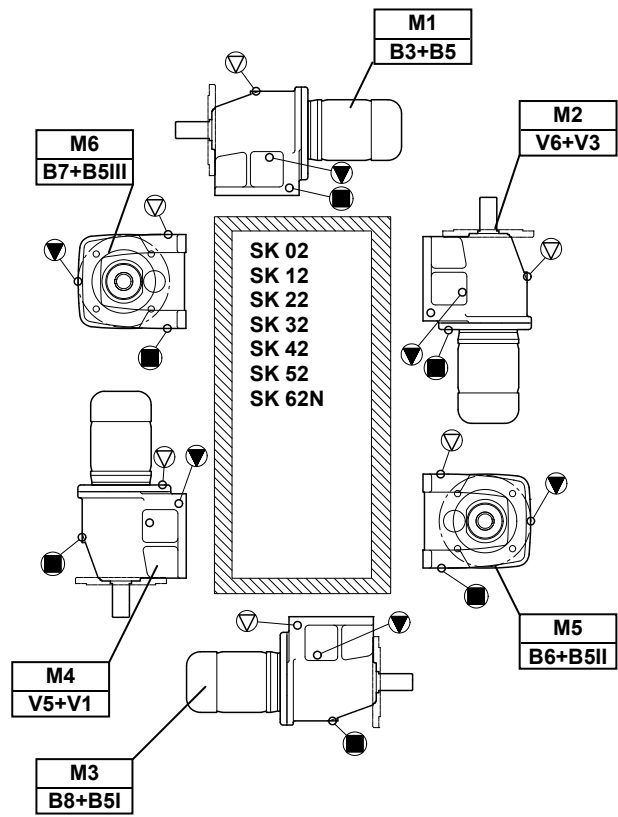
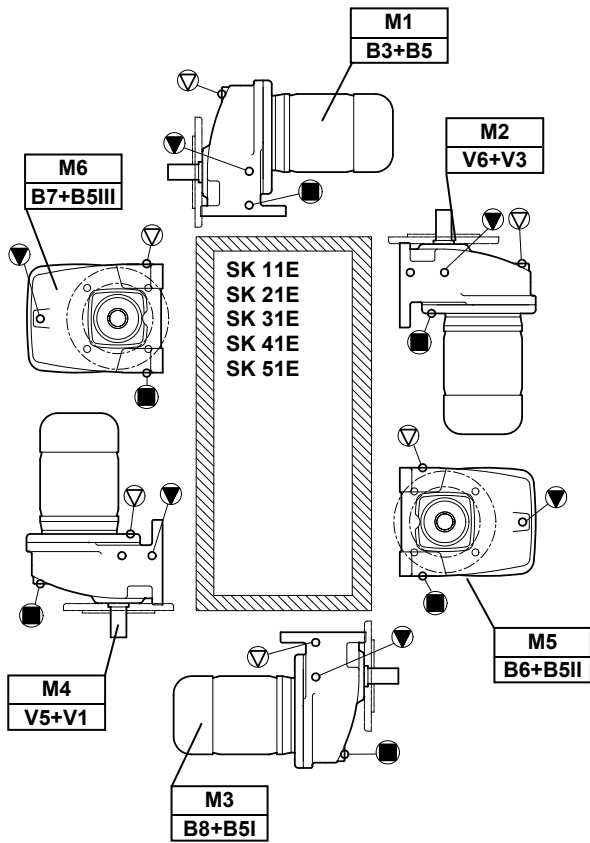
Note!

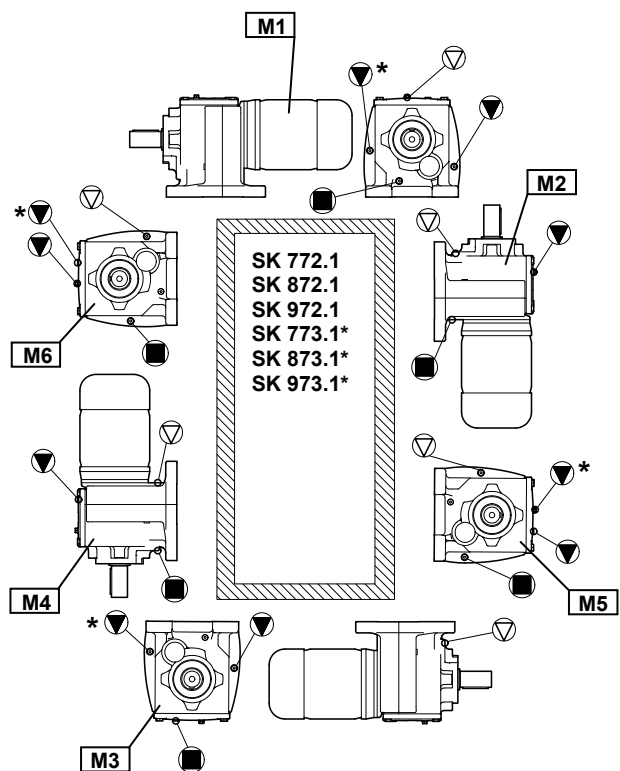
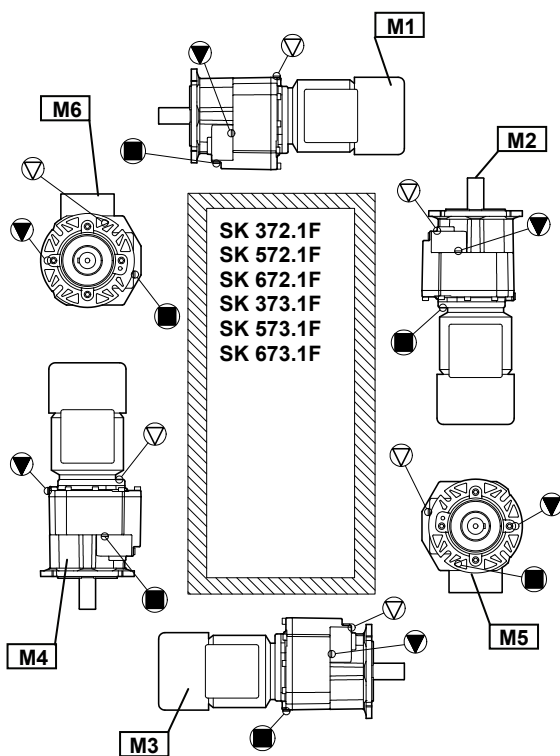
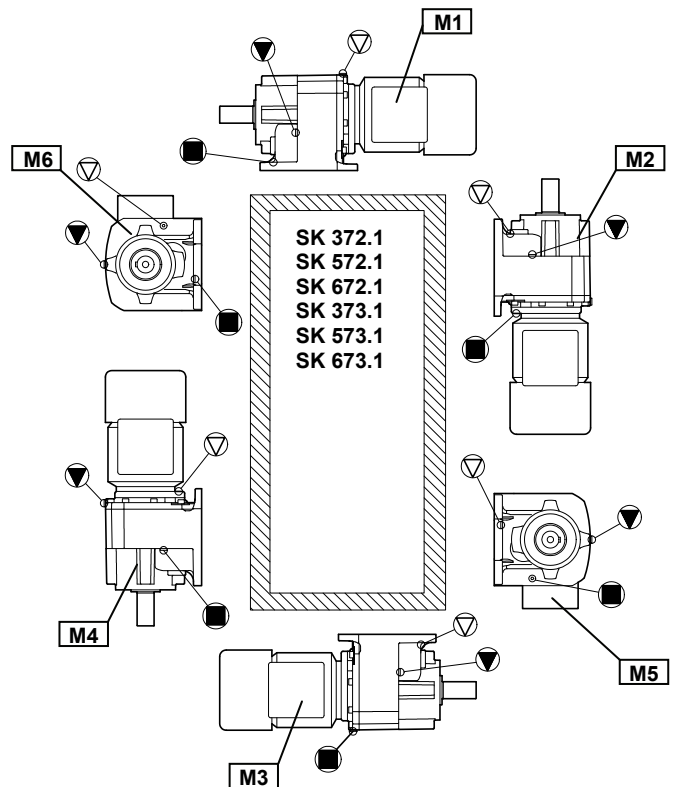
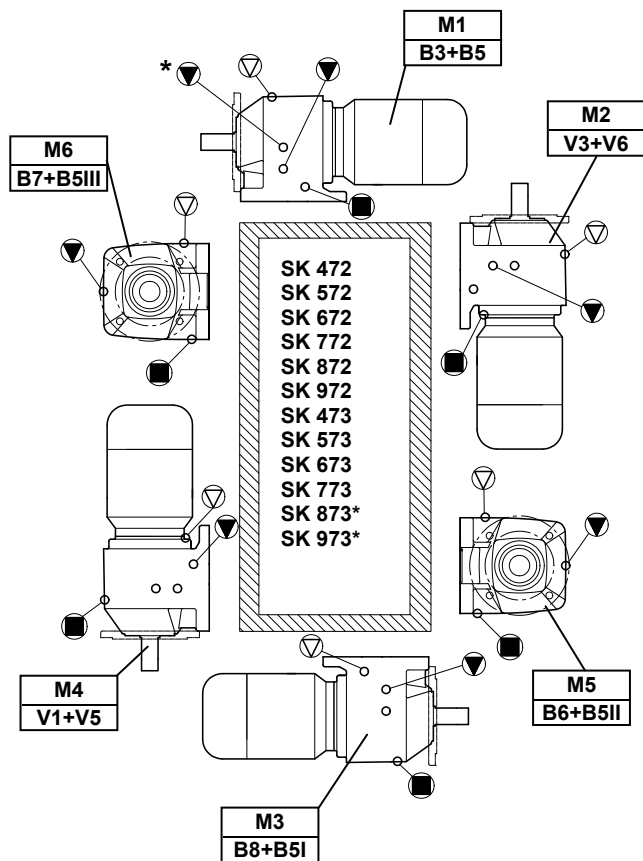
SK 320, SK 172, SK 272, SK 372K, SK 273 and SK373 as well as SK 01282 NB, SK 0282 NB, SK 1382 NB and UNIVERSAL / Minibloc gear units are lubricated for life. These gear units do not have an oil filler screw.

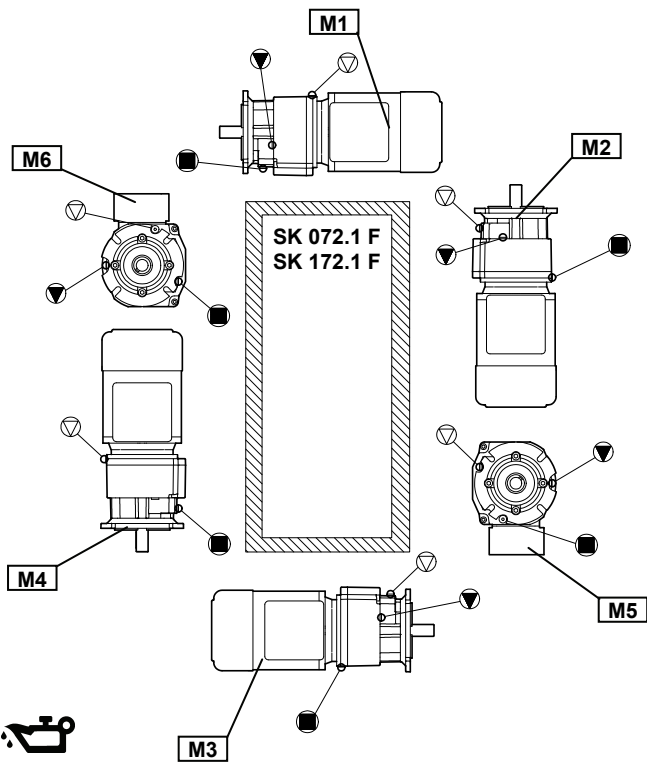
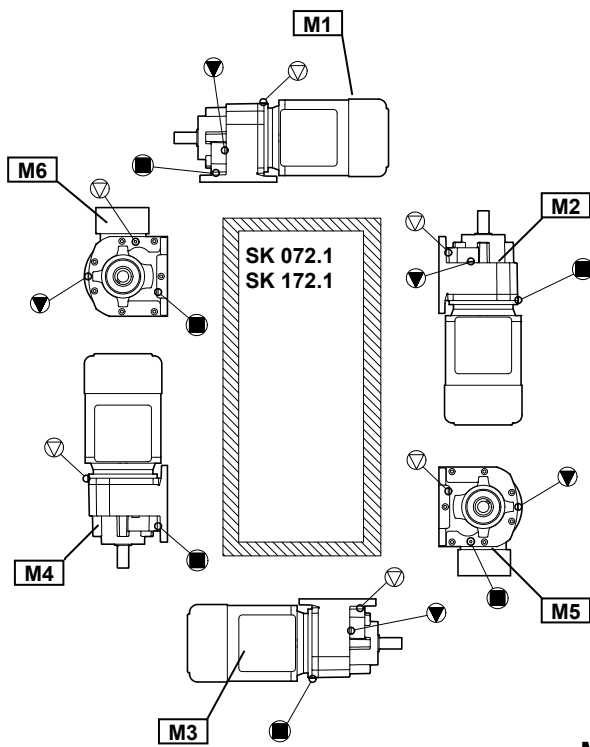
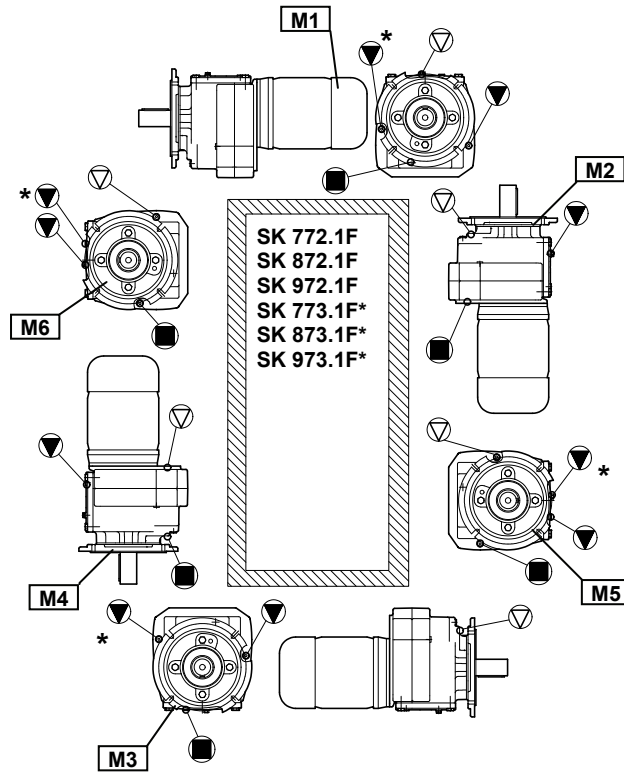
Parallel shaft gear units with oil level vessel

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:



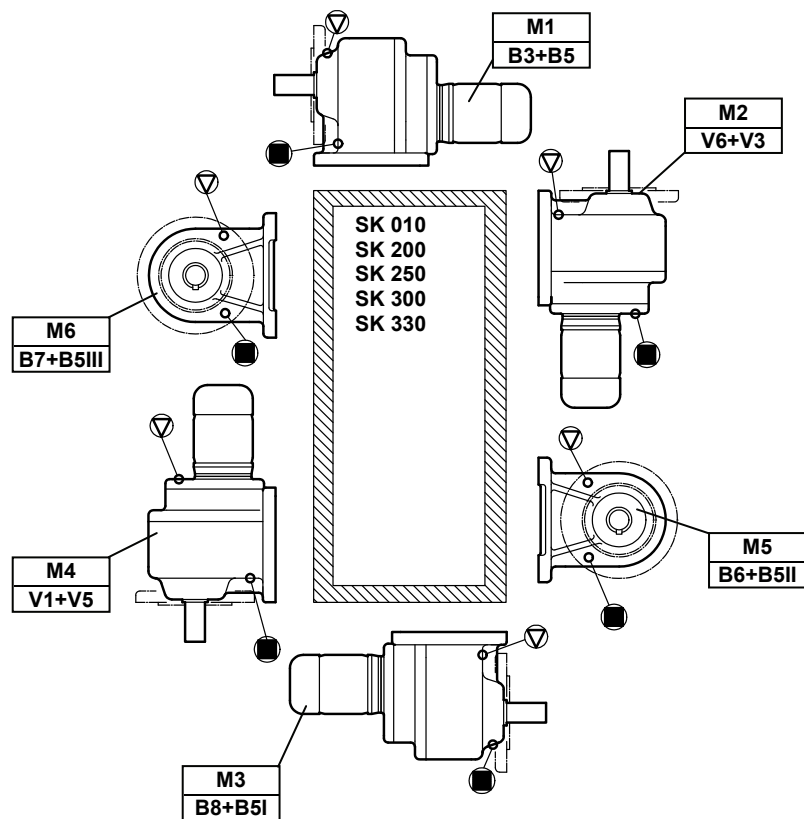
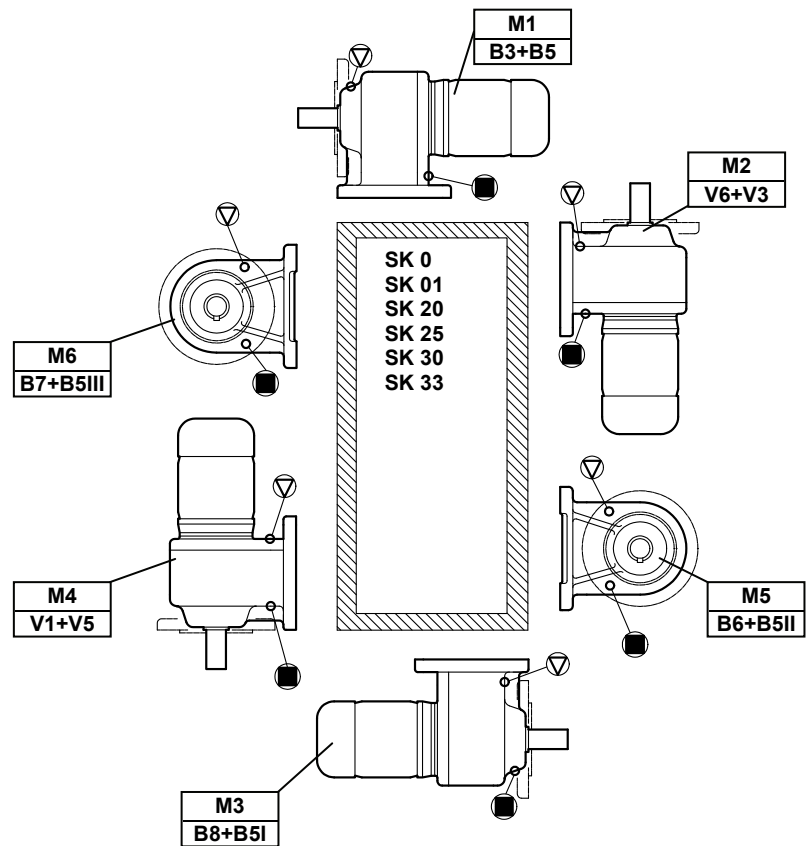


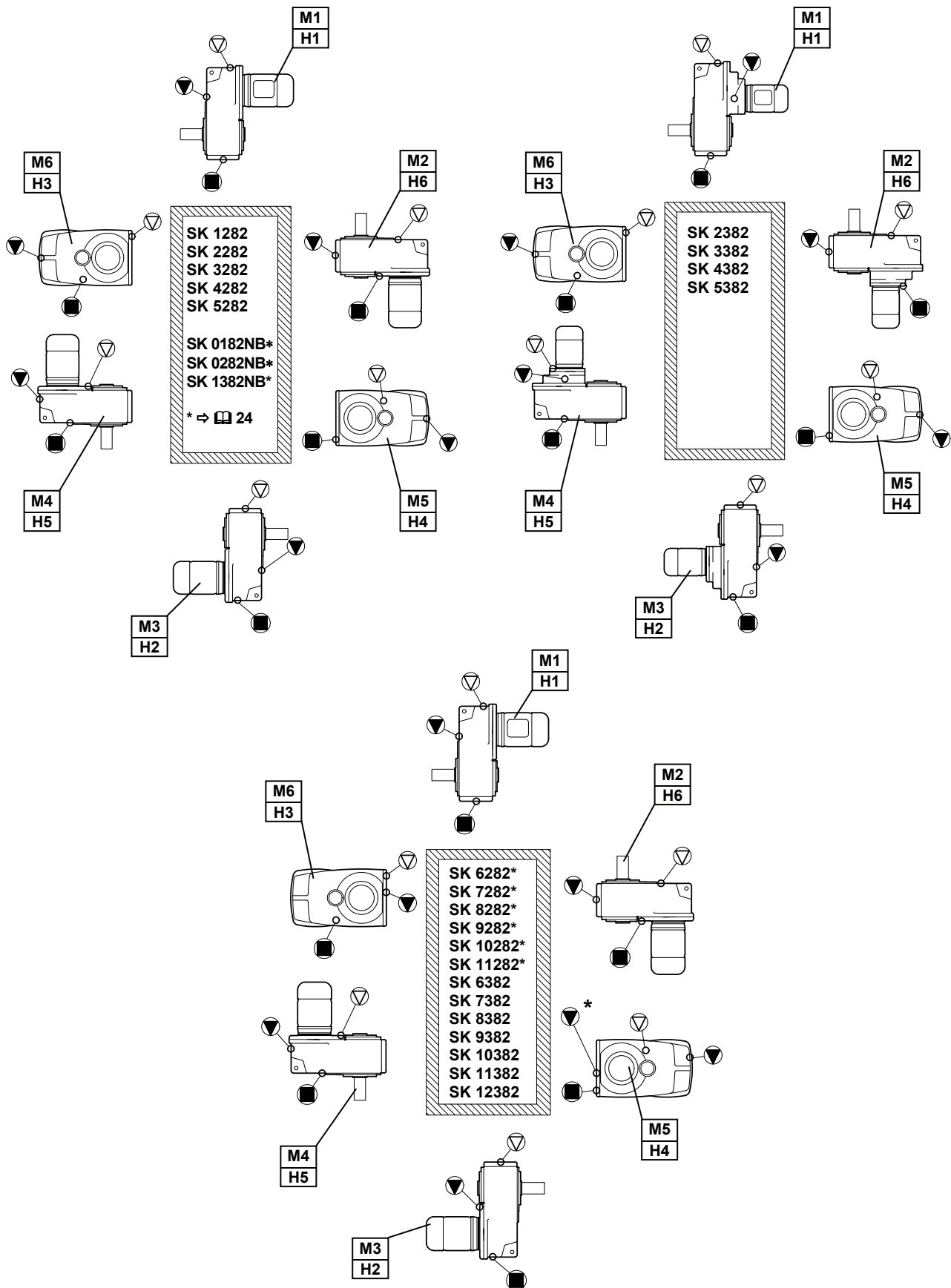


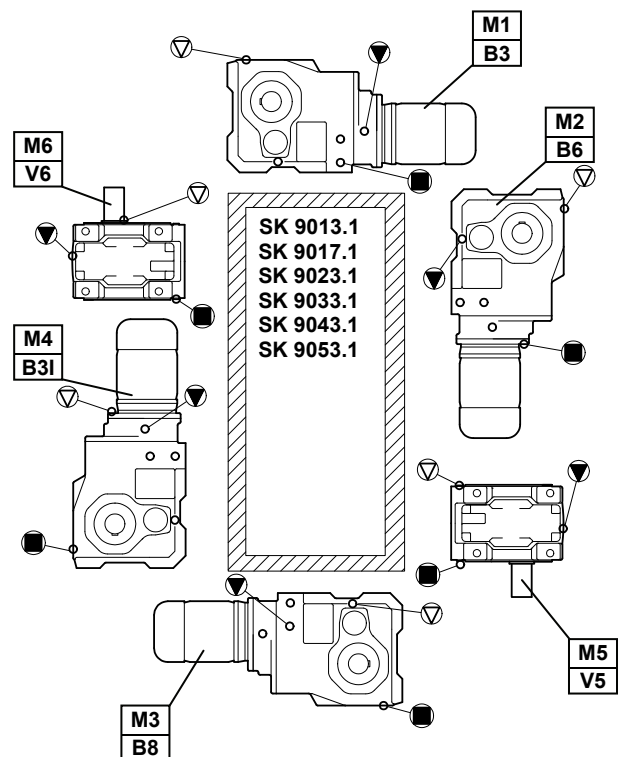
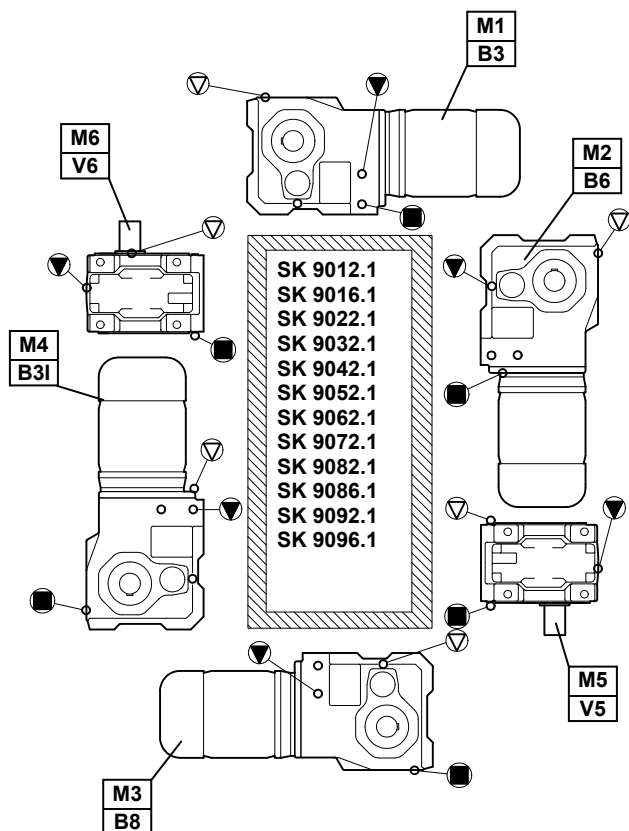
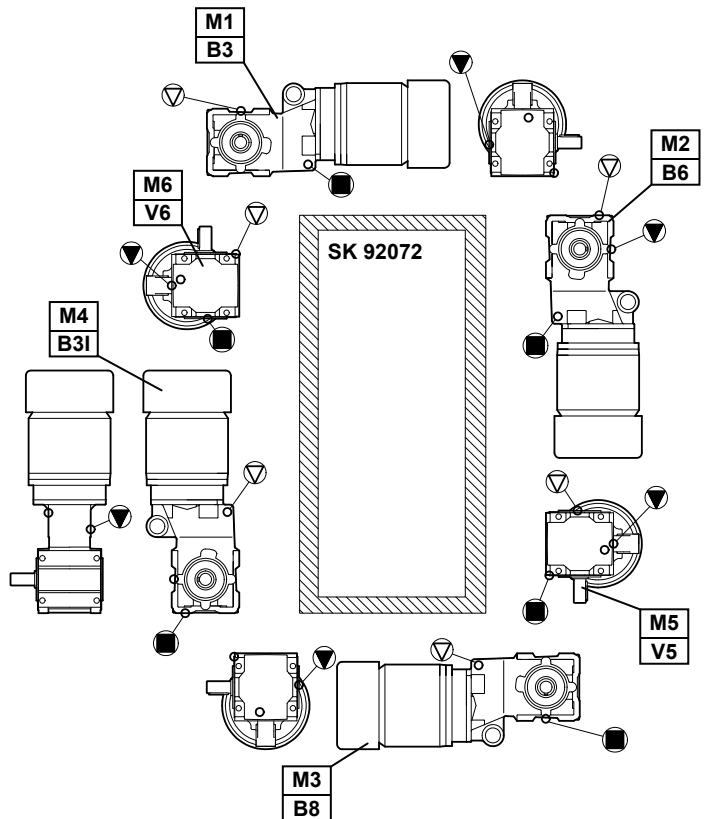
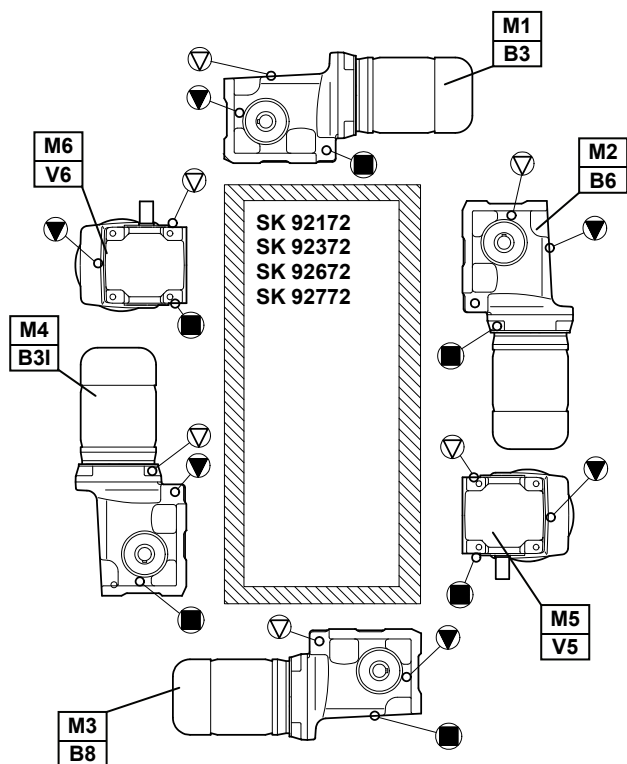


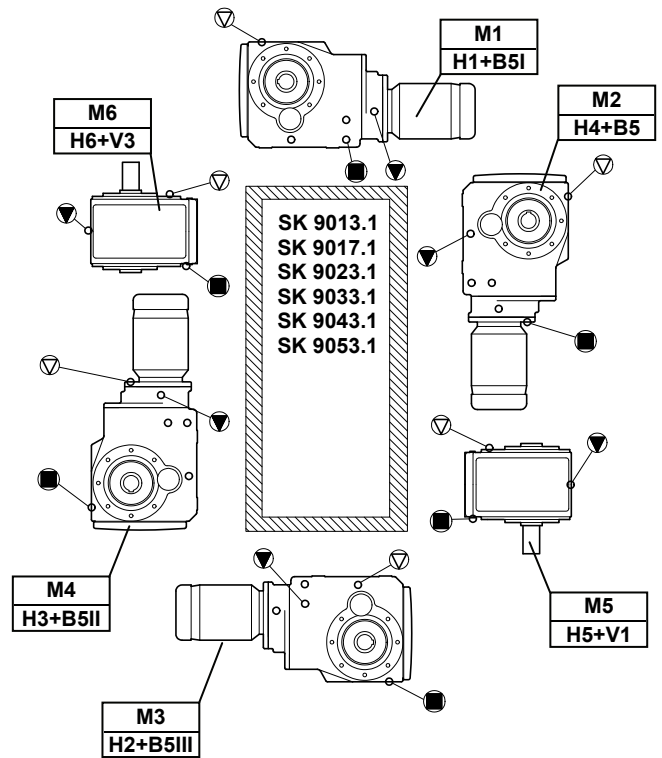
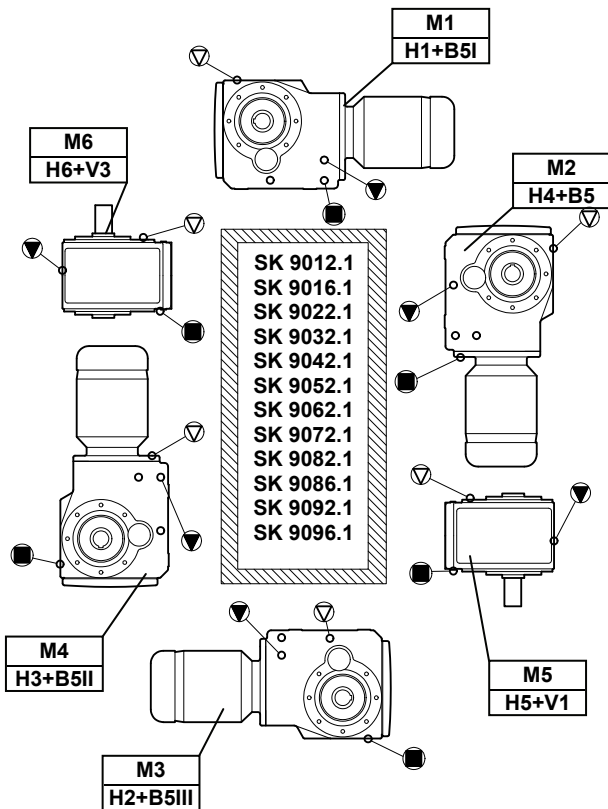
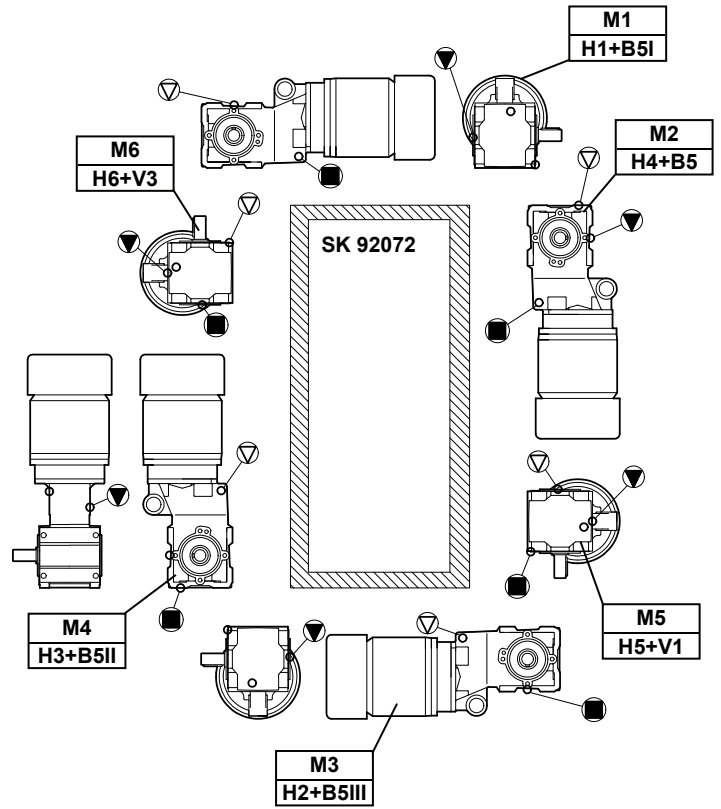
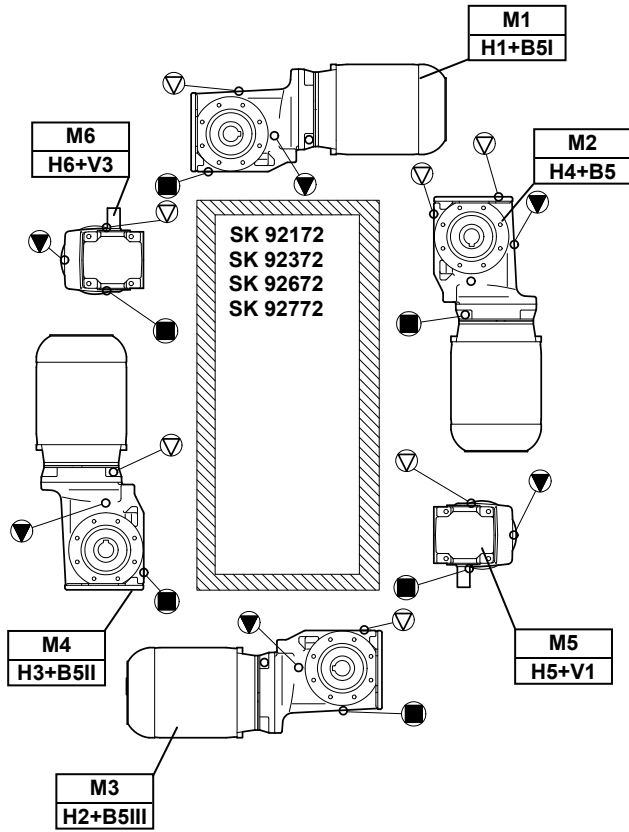
M4 

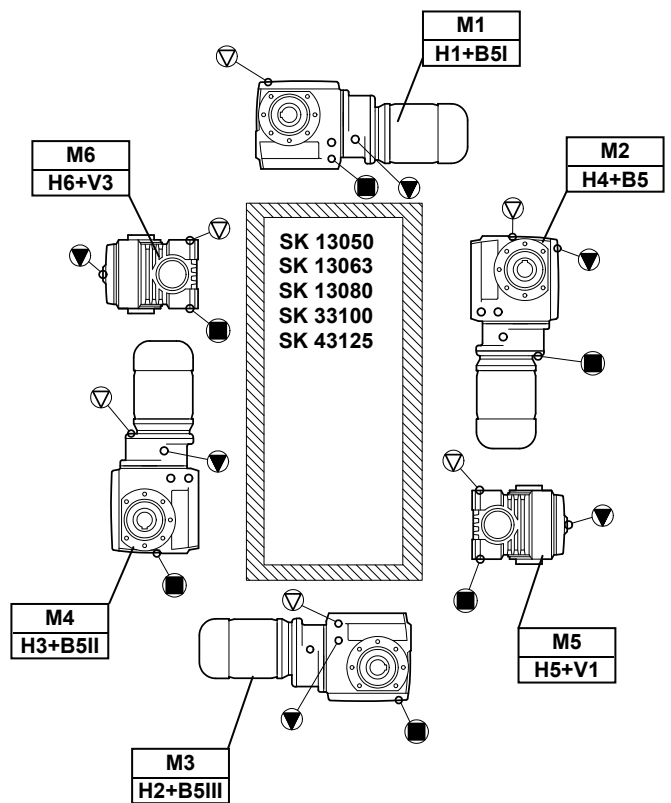
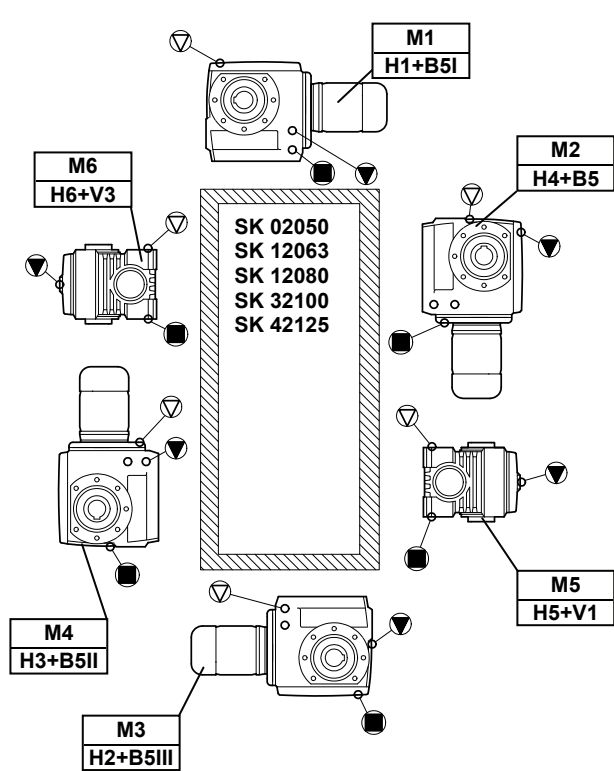
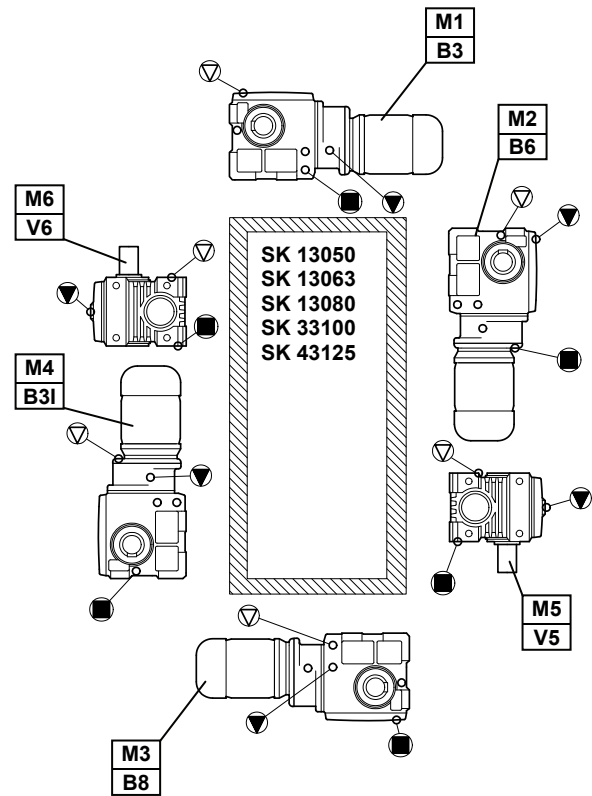
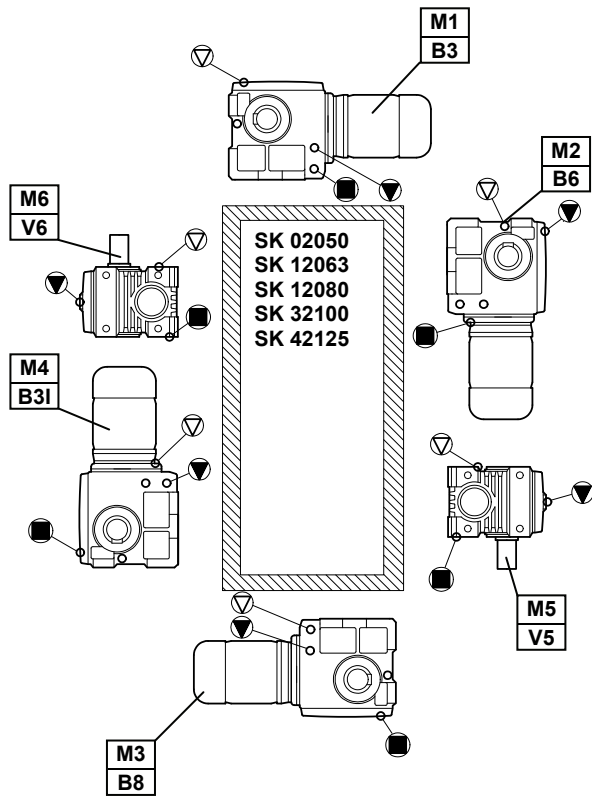
⇒ 40

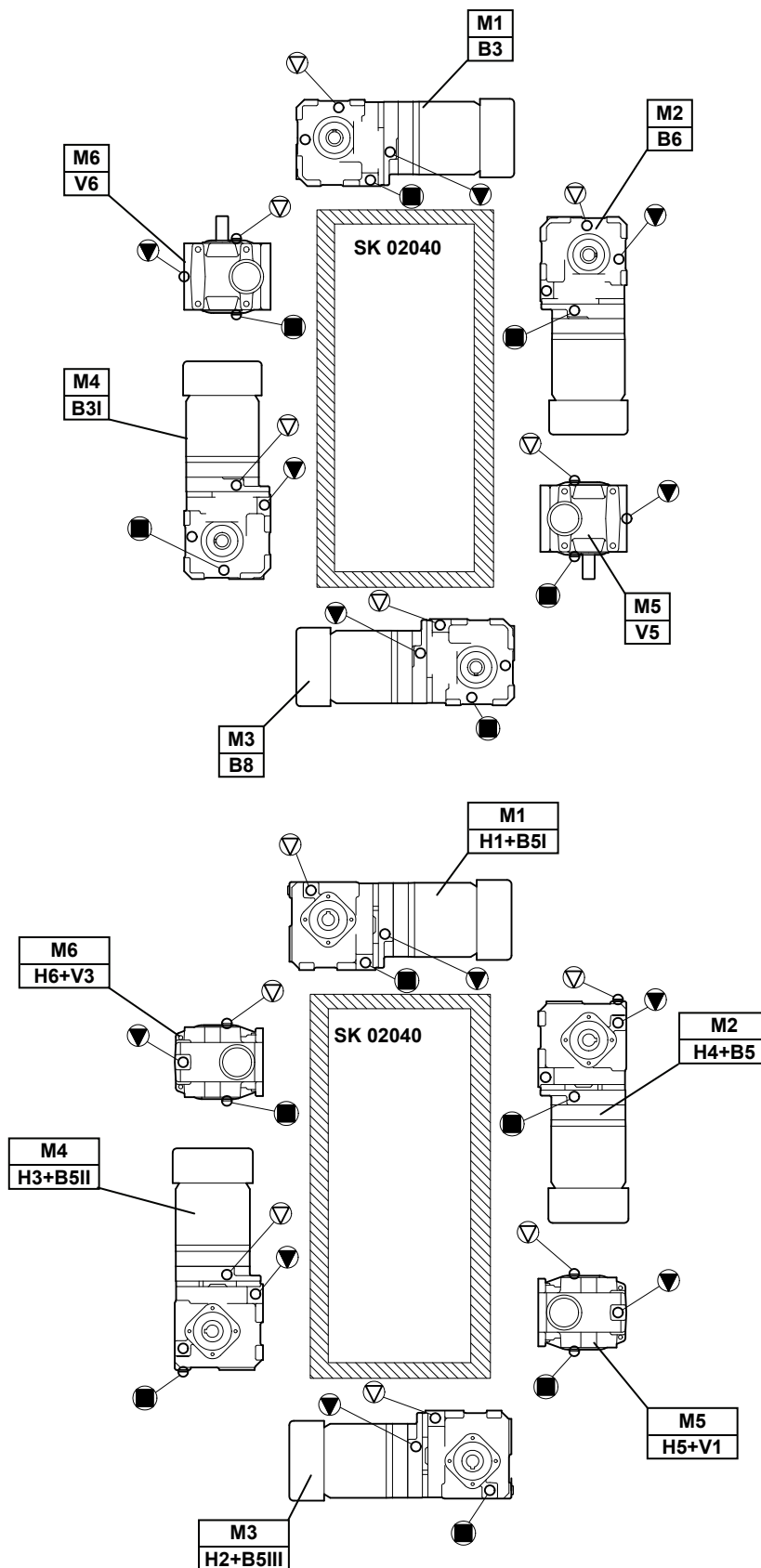






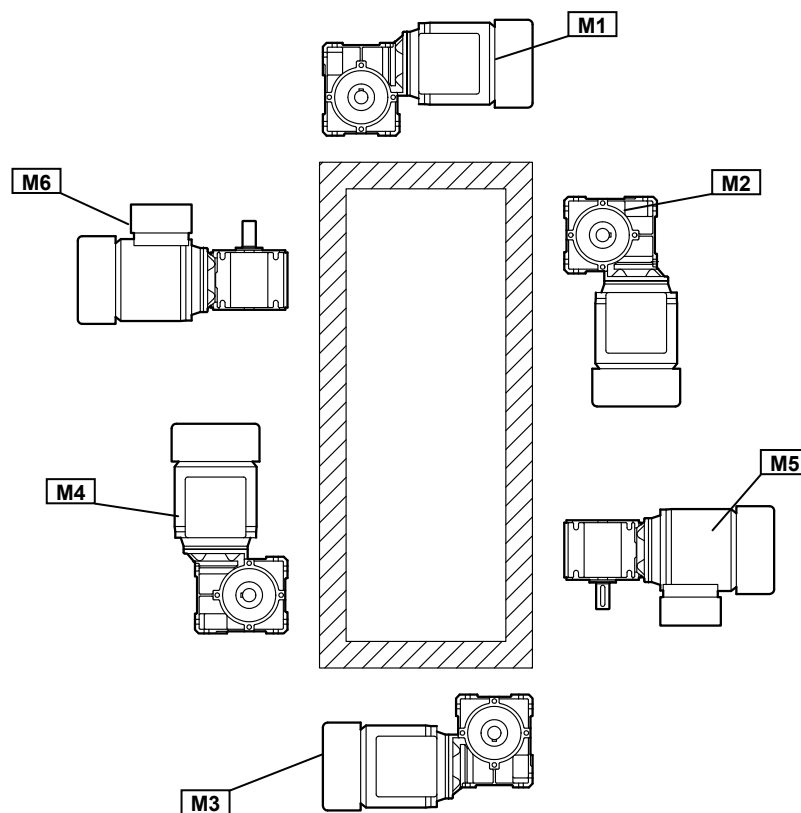








SK 1SI31 – SK 1SI75
SK 1SIS31 – SK 1SIS75
SK 1SIS-D31 – SK 1SIS-D63
SK 2SIS-D40 – SK 2SIS-D63
SK 1S32 - SK 1S63
SK 2S32NB – SK 2S63NB
SK 1SU32 – SK 1SU63
SK 2SU32NB- SK 2SU63NB
SK 1SM31 – SK 1SM63
SK 2SM40 – SK 2SM63



⇒ 24

6.2 Torque values

Bolt Torques [Nm]					
Size	Screw connections in the strength classes			Sealing screws	Threaded pin on coupling
	8.8	10.9	12.9		
M4	3,2	5	6	-	-
M5	6,4	9	11	-	2
M6	11	16	19	-	-
M8	27	39	46	5	10
M10	53	78	91	8	17
M12	92	135	155	27	40
M16	230	335	390	-	-
M20	460	660	770	-	-
M24	790	1150	1300	80	-
M30	1600	2250	2650	170	-
M36	2780	3910	4710	-	-
M42	4470	6290	7540	-	-
G1¼	-	-	-	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!



6.4 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								
Grease (mineral oil based)	-30 ... 60°C (Normal version)	Aralub HL 2	Enegrease LS 2	Sheerol AP 2 LZV-EP	Mehrzweckfett Beacon 2	Renolit FWA 160	Klüberplex BEM 41-132	Mobilux 2	—
	-50 ... 40°C	Aralub SEL 2	—	Spheerol EPL 2	—	Renolit JP 1619	—	—	Alvania RL 2
Synthetic grease	-25 ... 80°C	Aralub SKL 2	—	Product 783/46	Beacon 325	Renolit S2 Renolit HLT 2	Isoflex Topas NCA 52 Petamo GHY 133 N	Mobiltemp SHC 32	Aero Shell Grease 16 or 7
Biodegradable grease	-25 ... 40°C	Aralub BAB EP 2	Biogrease EP 2	Biotec	—	Plantogel 2 S	Klüberbio M 72-82	Schmierfett UE 100 B	Alvania RLB 2
Food compatible grease	-25 ... 40°C	Eural Grease EP 2	Energrease FM 2	Vitalube HT Grease 2	Carum 330	Renolit G 7 FG 1	Klübersynth UH1 14-151	Mobilgrease FM 102	Cassida RLS 2

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.

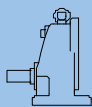
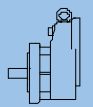
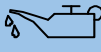
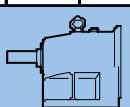
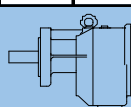
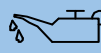
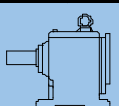
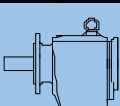
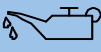
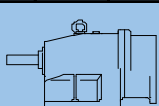
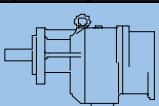
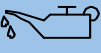
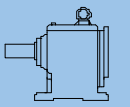
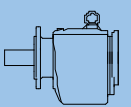
Lubricant type	Ambient temperature	ARAL	BP	Castrol	ESSO	FUCHS	KLOBER LUBRICATION	Mobil	Shell
Mineral oil	Worm gear ISO VG 680 0 ... 40°C	Degol BG 680 Degol BG 680 plus	–	Alpha SP 680	Spartan EP 680	Renolin CLP 680 CLP 680 Plus	Klüberoil GEM 1-680N	Mobilgear 636 XMP 680	Omala 680
	ISO VG 220 -10 ... 40°C (Normal version)	Degol BG 220 Degol BG 220 plus	Energol GR-XP 220	Alpha SP 220 Alpha MW 220 Alpha MAX 220	Spartan EP 220	Renolin CLP 220 Renolin CLP 220 Plus	Klüberoil GEM 1-220	Mobilgear 630 XMP 220	Omala 220
	ISO VG 100 -15 ... 25°C	Degol BG 100 Degol BG 100 plus	Energol GR-XP 100	Alpha SP 100 Alpha MW 100 Alpha MAX 100	Spartan EP 100	Renolin CLP 100 Renolin CLP 100 Plus	Klüberoil GEM 1-100	Mobilgear 627 XMP 110	Omala 100
Synthetic oil (Polyglycol)	Worm gear ISO VG 680 -20 ... 60°C (Normal version)	Degol GS 680	Enersyn SG-XP 680	–	–	Renolin PG 680	Klübersynth GH 6-680	Glygoile HE 680	Tivela S 680
	ISO VG 220 -25 ... 80°C	Degol GS 220	Enersyn SG-XP 220	Alphasyn PG 220	Glycolube 220	Renolin PG 220	Klübersynth GH 6-220	Glygoile HE 220	Tiveal S 220
Synthetic oil (hydrocarbons)	Worm gear CLP HC ISO VG 460 -30 ... 80°C	–	–	–	–	–	Klübersynth EG 4-460	Mobil SHC 634	Omala 460 HD
	CLP HC ISO VG 220 -40 ... 80°C	Aral Degol PAS 220	–	–	–	Renolin Unisyn CLP 220	Klübersynth EG 4-220	Mobil SHC 630	Omala 220 HD
Bio-degradable oil	Worm gear ISO VG 680 -5 ... 40°C	–	–	–	–	Plantogear 680 S	–	–	–
	ISO VG 220 -5 ... 40°C	Degol BAB 220	Biogear SE 220	Carelub GES 220	–	Plantogear 220 S	Klübersynth- GEM 2-220	–	Naturelle Gear Oil EP 220
Food compatible oil as per regulation H1 / FDA 178.3570	Worm gear ISO VG 680 -5 ... 40°C	–	–	–	–	Geralyn SF 680	Klüberoil 4UH1-680N Klübersynth UH1 6-680	Mobil DTE FM 680	Cassida Fluid GL 680
	ISO VG 220 -25 ... 40°C	Eural Gear 220	–	Vitalube GS 220	Gear Oil FM 220	Geralyn AW 220 Geralyn SF 220	Klüberoil 4UH1-220N Klübersynth UH1 6-220	Mobil DTE FM 220	Cassida Fluid GL 220
Synth. Synthetic liquid grease	-25 ... 60°C	Aralub BAB EP0	–	Alpha Gel 00	Fließfett S 420	Renolit LST 00	Klübersynth GE 46-1200 UH1-220N Klübersynth UH1 14-1600	Glygoile Grease 00	Tivela GL 00

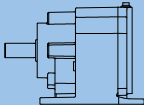
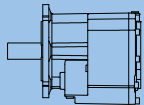
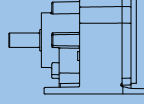
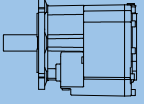


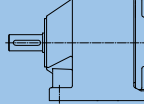
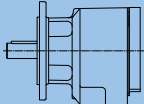
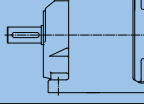
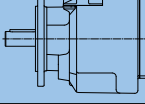
6.5 Lubricant quantities

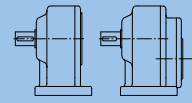
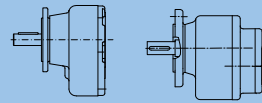
	Note!
	After changing the lubricant, and in particular after the initial filling, the oil level may change during the first few hours of operation, as the oil galleries and hollow spaces only fill gradually during operation. The oil level is still within the permissible tolerance. If at the express request 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.

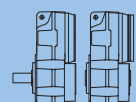
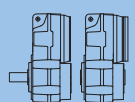
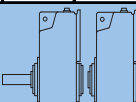
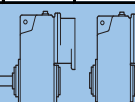
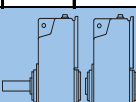
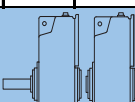
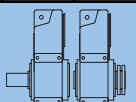
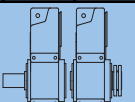
*Type SK11282, SK11382 and SK12382 gear units are normally supplied without oil.

 [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	2,00	1,80	1,35	1,35	0,70	2,00	2,00	1,80	1,55	1,55
SK32	0,90	2,50	3,00	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	1,90	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	2,60	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

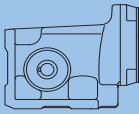
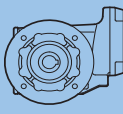
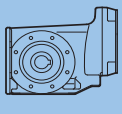
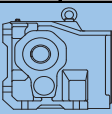
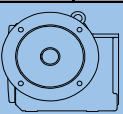
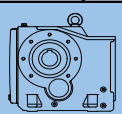
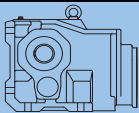
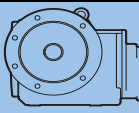
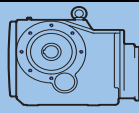
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⇒ 6.1	B3	V6	B8	V5	B6	B7	B5	V3	B5I	V1	B5II	B5III
SK172	0,35	0,50	0,50	0,50	0,50	0,50	0,35	0,50	0,50	0,50	0,50	0,50
SK272	0,60	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00
SK372	0,60	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00
SK472	1,00	1,90	1,90	2,00	1,80	1,80	1,00	1,90	1,90	1,90	1,90	1,50
SK572	1,00	1,90	1,90	2,00	1,80	1,80	1,00	1,90	1,90	1,90	1,90	1,50
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	0,55	1,10	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

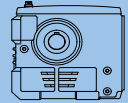
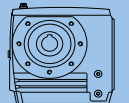
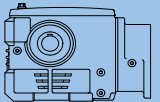
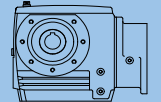
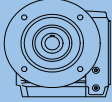
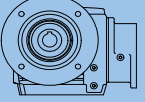
 [L]							 [L]						
⇒ 6.1	M1	M2	M3	M4	M5	M6	⇒ 6.1	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7		B5	V3	B5I	V1	B5II	B5III
SK0	0,13	0,22	0,13	0,22	0,13	0,13	SK0 F	0,13	0,22	0,13	0,22	0,13	0,13
SK01	0,22	0,38	0,22	0,38	0,22	0,22	SK01 F	0,22	0,38	0,22	0,38	0,22	0,22
SK20	0,55	1,00	0,55	1,00	0,55	0,55	SK20 F	0,35	0,60	0,35	0,60	0,35	0,35
SK25	0,50	1,00	0,50	1,00	0,50	0,50	SK25 F	0,50	1,00	0,50	1,00	0,50	0,50
SK30	0,70	1,40	0,70	1,40	0,70	0,70	SK30 F	0,70	1,40	0,70	1,40	0,70	0,70
SK33	0,80	1,60	0,80	1,60	0,80	0,80	SK33 F	0,80	1,60	0,80	1,60	0,80	0,80
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	1,50	1,58	1,50	1,58	1,50	1,50

 [L]							 [L]						
⇒ 6.1	M1	M2	M3	M4	M5	M6	⇒ 6.1	M1	M2	M3	M4	M5	M6
⇒ 6.1	H1	H6	H2	H5	H4	H3	⇒ 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]							 					
	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
							H1	H4	H2	H3	H5	H6
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	SK9016.1	SK9022.1	SK9032.1	SK9042.1	SK9052.1	SK9062.1	SK9072.1	SK9082.1	SK9086.1	SK9092.1	SK9096.1
	0,70	1,60	1,90	2,40	1,20	1,70	0,70	1,90	1,90	2,40	1,20	1,70
	0,70	1,60	1,90	2,40	1,20	1,70	0,70	1,90	1,90	2,40	1,20	1,70
	1,30	2,60	3,50	4,20	2,00	2,80	1,30	2,60	3,50	4,20	2,00	2,80
	1,70	4,80	6,40	6,70	4,10	5,10	1,90	5,20	6,40	7,30	3,30	5,10
	4,40	8,70	10,00	9,80	6,80	7,50	3,60	9,70	11,40	11,50	6,50	8,20
	6,50	16,00	19,00	21,50	11,00	15,50	7,50	16,50	20,00	22,50	11,50	18,00
	10,00	27,50	32,00	36,00	18,00	24,00	12,00	27,50	33,00	38,50	19,00	26,00
	10,00	27,50	32,00	36,00	18,00	24,00	12,00	27,50	33,00	38,50	19,00	26,00
	17,00	51,50	62,50	71,50	33,00	46,50	21,00	54,00	66,00	80,00	38,00	52,00
	29,00	73,00	85,00	102,00	48,00	62,00	36,00	78,00	91,00	101,00	53,00	76,00
	41,00	157,00	170,00	172,00	80,00	90,00	40,00	130,00	154,00	175,00	82,00	91,00
	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	SK9017.1	SK9023.1	SK9033.1	SK9043.1	SK9053.1	SK9013.1	SK9017.1	SK9023.1	SK9033.1	SK9043.1	SK9053.1
	1,20	2,00	2,20	3,00	1,40	1,90	1,20	2,30	2,20	3,00	1,40	1,90
	1,20	2,00	2,20	3,00	1,40	1,90	1,20	2,30	2,20	3,00	1,40	1,90
	2,40	3,00	3,80	5,30	2,20	3,10	2,40	3,00	3,80	5,30	2,20	3,10
	3,30	6,60	7,00	7,80	4,30	5,10	3,80	5,70	6,90	8,50	3,60	5,60
	4,60	10,20	10,70	12,80	5,20	6,70	5,70	10,20	14,70	14,70	6,60	9,60
	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	12,90	7,10	12,10	7,70	7,70



6.6

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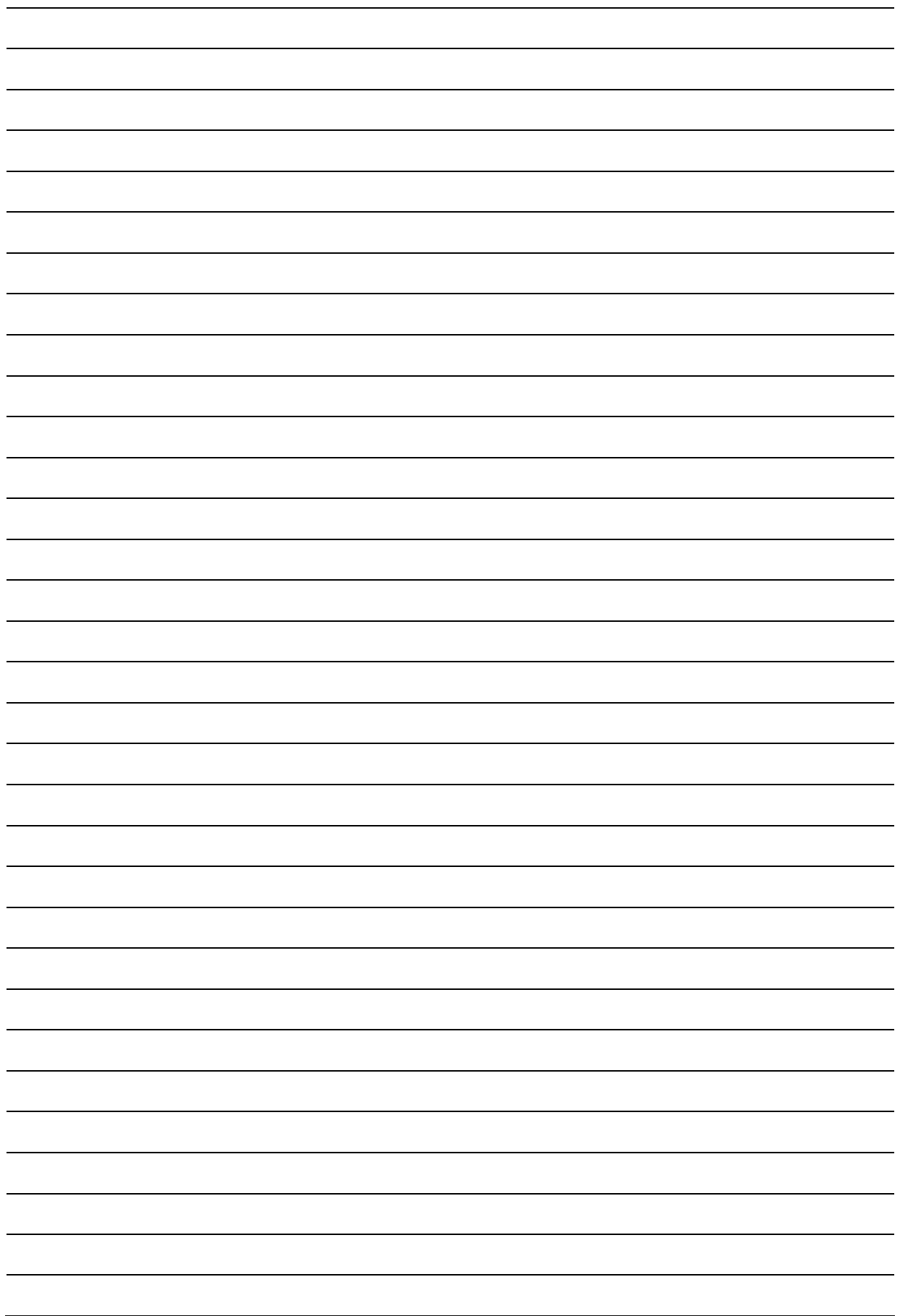
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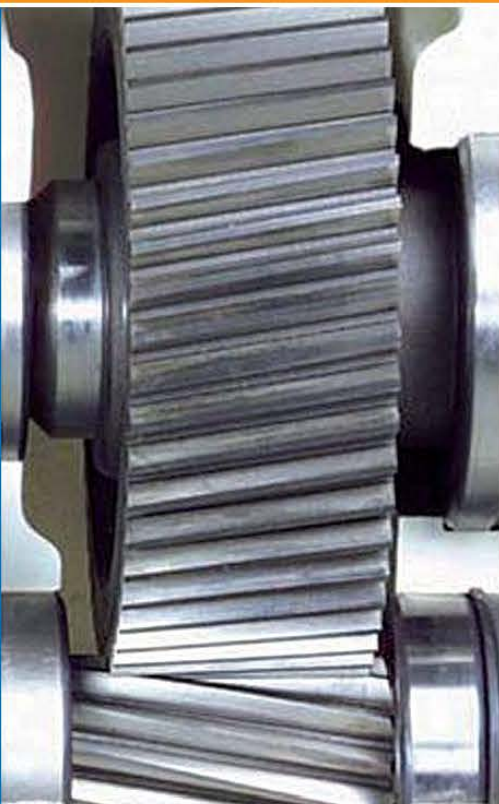
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