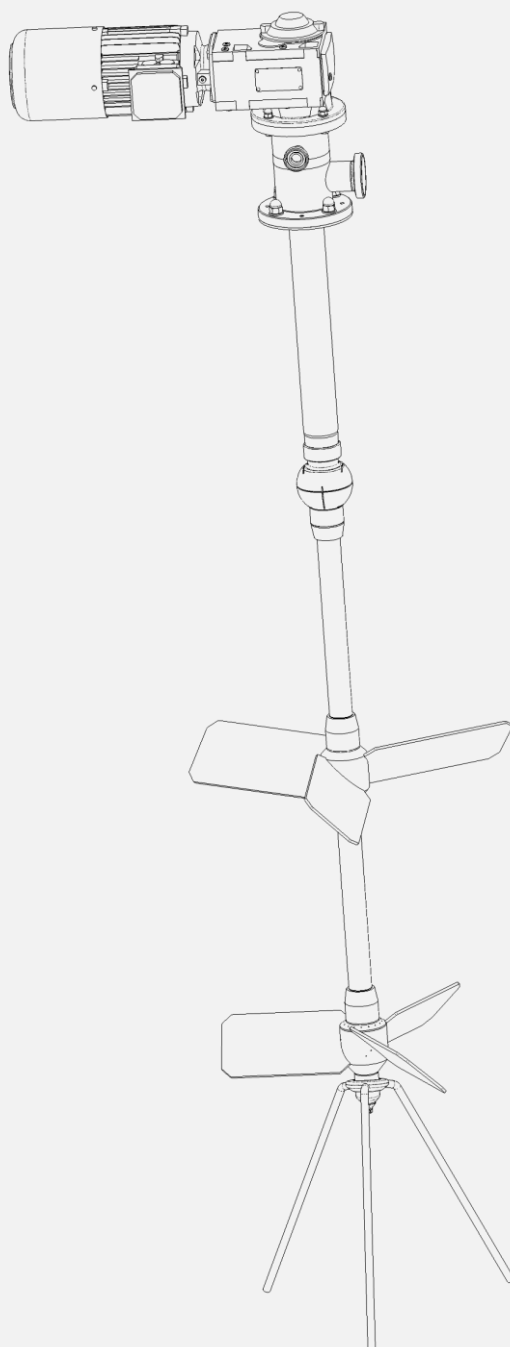




Instruction Manual

ALTB-SB-35



100006450EN

2022-04

Original manual

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1 EC Declaration of Conformity

1 EC Declaration of Conformity

The Designation company:

Alfa Laval Kolding A/S

Company Name

Albuen 31, DK-6000 Kolding, Denmark

Address

+45 7932 2200

Phone No.

Hereby declare that:

ALTB-SB

Denomination

35

Type

Is in conformity with the following directives:

- Machine Directive 2006/42/EC
- FDA 21CFR§177
- Regulation (EC) 1935/2004

The person authorized to compile the technical file is the signer of this document.

Global Product Quality Manager, Pumps, Valves, Fittings and Tank Equipment

Title

Lars Kruse Andersen

Name

2022-01-01

Date

Kolding

Place



Signature



2 Safety

Unsafe practices and other important information are emphasized in this manual.
Warnings are emphasized by means of special signs.

All warnings in the manual are summarised on this page.

Pay special attention to the instructions below so that serious personal injury and/or damage to the Agitator are avoided.

The instruction manual is part of delivery. Study the instructions carefully.

The Agitator is for permanent fastening.

Make sure the motor corresponds to the environment.

Check the direction of rotation before operation.

2.1 Important information

Always read the manual before using the Agitator!

WARNING

Indicates that special procedures must be followed to avoid severe personal injury.

CAUTION

Indicates that special procedures must be followed to avoid damage to the Agitator.

NOTE

Indicates important information to simplify or clarify practices.

2.2 Warning signs

General warning:

Caustic agents:

Dangerous electric voltage:



2.3 Intended use

- The Agitator is only for mixing / conditioning / stirring of liquids in a tank.
- The Agitator is only made for top mounting position on the top plate / welding flange on the tank.

2 Safety

2.4 Safety precautions

2.4.1 Installation:

- **Always** read the technical data thoroughly (see chapter 6).
- **Always** follow installation instructions thoroughly (see chapter 3).
- **Never** expose the Agitator to undue vibrations or shocks.
- **Never** start the Agitator in the wrong direction of rotation.
- **Ensure** that the tank media is not corrosive to the Agitator.
- **Only** install the Agitator in environments within temperature limit: -20°C and +40°C.
- **Only** install the Agitator in altitudes less than 1.000 m above sea level.
- **Only** use authorized personnel when electrical equipment is connected.



2.4.2 Operation:

- **Always** read the technical data thoroughly (see chapter 6).
- **Never** start Agitator in the wrong direction of rotation.
- **Beware** of Agitator in operation can produce sound levels higher than 85dB(A).
- **Always** handle lye and acid with great care.
- **Always** rinse well with clean water after cleaning.
- **Never** run the agitator without product, water or cleaning liquid in the tank.



2.4.3 Maintenance:

- **Always** follow the maintenance instruction thoroughly (see chapter 5).
- **Always** follow the maintenance instruction for gear motor thoroughly (see section 8.3).
- **Always** study the parts list and assembly drawing carefully (see chapter 7).
- **Never** touch the moving parts while the Agitator is connected to the power supply.
- **Always** disconnect the power supply while servicing the Agitator.
- **Ensure** correct rotation direction of propeller before start-up and after any maintenance.
- **Never** service the agitator or tank with product or cleaning liquid in the tank.



2.4.4 Transportation

- **Always** transport the Agitator in original packaging.
- **Never** transport the Agitator mounted in a tank.
- **Always** support the shaft adequately, to protect shaft and bearings.
- **Never** expose the Agitator to undue vibrations or shocks.
- **Ensure** control for oil leakage on gears with vent screw.

Ensure correct rotation direction of impeller before start-up and after any maintenance.

3 Installation

The instruction manual is part of the delivery – study the instructions carefully.

The Agitator is for permanent fastening.

Make sure the motor corresponds to the environment.

Check the direction of rotation before operation.

All position numbers and item numbers refer to the drawings shown and specified in chapter 7.

The installation can be done in many ways depending on tank type, equipment and working space around the tank. Three possible installations methods are described in below sections:

3.3 Installation in an accessible tank with crane / hoist above tank (see page 10):

- Installation of agitator in a tank that is accessible for a person through manhole in tank top or tank side or through cone in bottom of tank – installation with crane / hoist and sufficient head room above tank top which makes handling of the complete Agitator Drive Unit possible.

3.4 Installation in a none-accessible tank (no manhole) with no crane / hoist above tank (see page 16):

- Installation of agitator in a tank that is only accessible through tank top when the agitator is not installed – installation with no crane / hoist and with limited head room above tank top.

3.5 Installation in a none-accessible tank (no manhole) with crane / hoist above tank (see page 27):

- Installation of agitator in a tank that is only accessible through tank top when the agitator is not installed – installation with crane / hoist and sufficient head room above tank top which makes handling of the complete Agitator Drive Unit possible.

This work should be carried out by at least two persons. For safety reasons a platform or a scaffolding should be established around the tank top.

During installation ensure to use sufficient lighting.

The tank top must be horizontal during installation.

Ensure that the tank does not contain neither dangerous liquid nor gasses and that good ventilation is established.

Always have safety elements removed by authorized personnel.

Never cover or remove nameplates.

Always use approved lifting equipment when handling heavy parts of the Agitator.



Never connect to power during installation.

Always have the Agitator connected to power supply by authorized personnel.



Note:

Alfa Laval highly recommends installing motor protection guard and a soft starter, or a frequency converter, with a ramp up and down time about 2-7 sec. to the Agitator.

3.1 Unpacking / Delivery

Always use approved lifting equipment when handling the Agitator.

Alfa Laval cannot be held responsible for incorrect unpacking.



3.1.1 Step 1

Inspect the delivery for visible transportation damages (crates and packaging) - all issues to be reported to carrier.

3 Installation

3.1.2 Step 2

Check that deliveries are according to delivery notes.

Complete Agitators can be delivered in more than one shipment.

3.1.3 Step 3

Inspect Agitator parts for visible transport damage.

3.1.4 Step 4

Do NOT use eye bolts on gear motor to lift the Agitator. They are only for gear motor removal.



3.1.5 Step 5

During lifting:

- Always support the shaft adequately to protect shaft and bearings.
- Be careful not to damage shaft-end with treads.
- Never expose the Agitator to undue vibrations or shocks.
- Control gearbox for oil leaks – leave vent plug un-activated on gear until gear is installed and in correct position (see Figure 1).

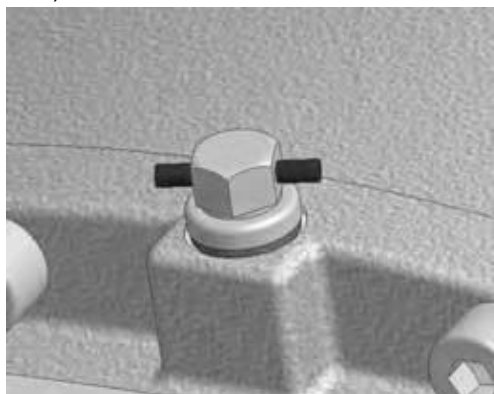


Figure 1, un-activated vent plug

3.2 Requirement for installation, personnel

Erectors:

- Experience from similar types of installation.
- Proven skills in reading installation guidelines and drawings ensuring that the installation is safely carried out for personnel and property.

**Electrician:**

- Certified according to local regulations and experience from similar types of installation.
- Proven skills in reading installation guidelines and drawings ensuring that the installation is safely carried out for personnel and property.

**Welder:**

- Experience from similar types of installation, covering TIG, MIG and MAG welding procedures in stainless steel thin-walled material.
- Proven skills in reading installation guidelines and drawings ensuring that the installation is safely carried out for personnel and property.



3 Installation

3.3 Installation in an accessible tank with crane / hoist above tank

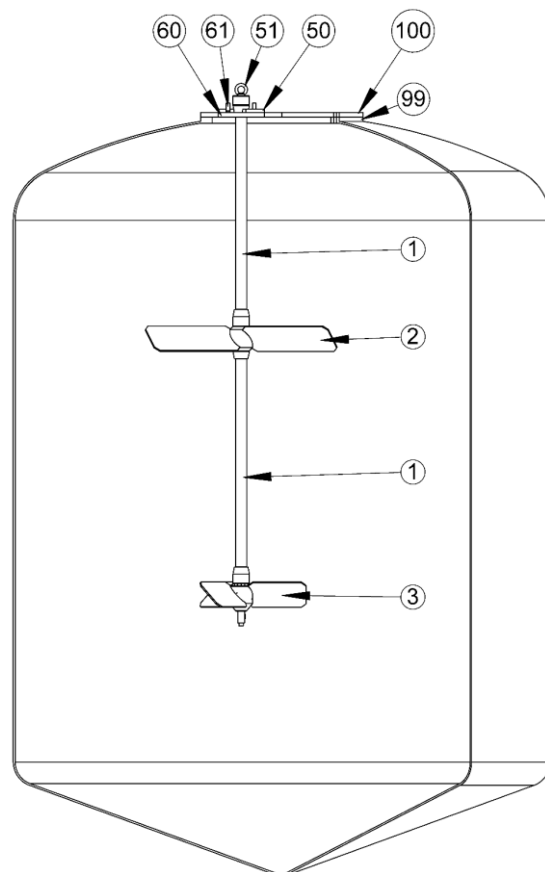
All position numbers and item numbers refer to the drawings shown and specified in chapter 7.

When the inside of the tank is accessible with the agitator mounted to the top plate the agitator can be installed in different ways depending on tank type, equipment and working space around the tank and tank top.

The below described procedure can be used, if suitable crane or hoist facilities above the tank top can lift the complete Agitator Drive Unit (which includes the gear motor) about 1.300 mm above the tank top, – if that is not the case, please see section 3.3.3

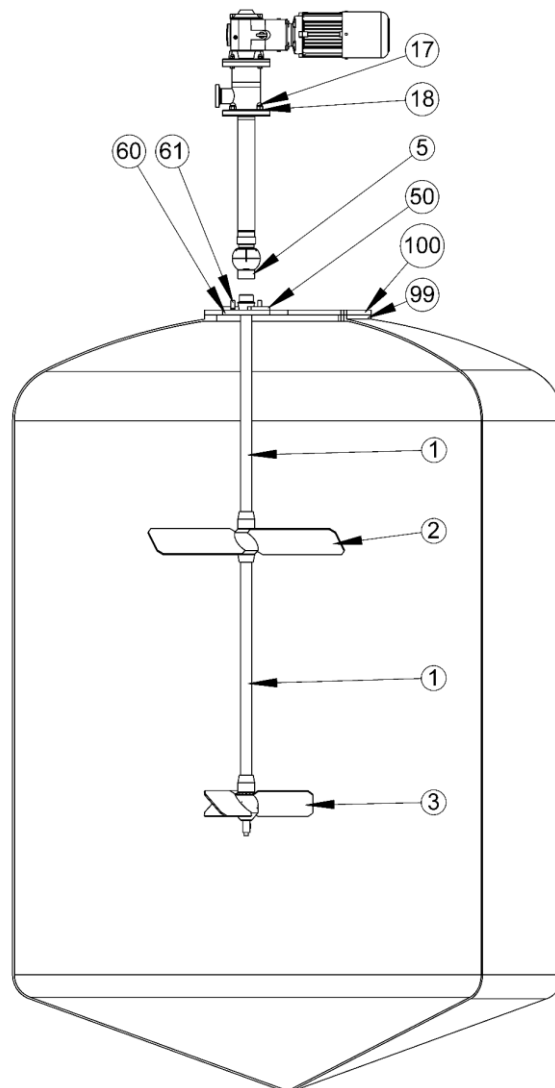
3.3.1 Step 1

1. Weld the welding flange pos. 60 (if used) into the top plate pos. 100 (the welding flange pos. 60 is normally integrated into the AL top plate pos. 100).
2. Clean shaft and propeller threads.
3. Add some food approved grease to the threads to prevent them from galling.
4. Assemble the shafts, propellers, gaskets and O-rings: pos. 1, 2, 3, 32 and 33.
5. The propellers and shafts can be assembled outside the tank, if the size of the counter flange pos. 99 and the head room above the tank is sufficient – otherwise the shaft and propeller unit must be assembled one by one inside the tank. The shaft and propeller unit can consist of one or two shafts and one or two propellers – see order confirmation.
6. Mount the top plate pos. 100 onto the counter flange pos. 99.
7. Final tightening (between 100 Nm and 300 Nm) of all shaft connections can be postponed until the complete agitator is assembled and mounted on the tank top.
8. Screw the lifting eye tool pos. 51 onto the upper shaft part pos. 1 and lift the shaft and propeller unit using a hoist.
9. Ensure that the studs pos. 61 are screwed into the welding flange pos. 60.
10. Temporarily place the complete shaft and propeller unit in the mounting tool pos. 50.
11. Unscrew the lifting eye tool pos. 51 and store it.



3.3.2 Step 2

1. Clean the connection threads in pos. 1 and pos. 5.
2. Add some food approved grease to the threads to prevent them from galling.
3. Mount the gasket and O-ring pos. 32 and 33 into the shaft pos. 1.
4. Ensure that the O-ring pos. 34 is installed in flange on pos. 10.
5. Lift the complete Agitator Drive Unit using a hoist (do not use the lifting eye on the gear motor) and screw on the shaft pos. 1 into the thread in pos. 5.
6. Lift the complete agitator a little further enabling the mounting tool pos. 50 to be removed and stored.
7. Position the complete agitator onto the welding flange pos. 60.
8. Mount the washers pos. 18 and nuts pos. 17 to the studs pos. 61 and tighten them sequentially to 150 Nm to 200 Nm.



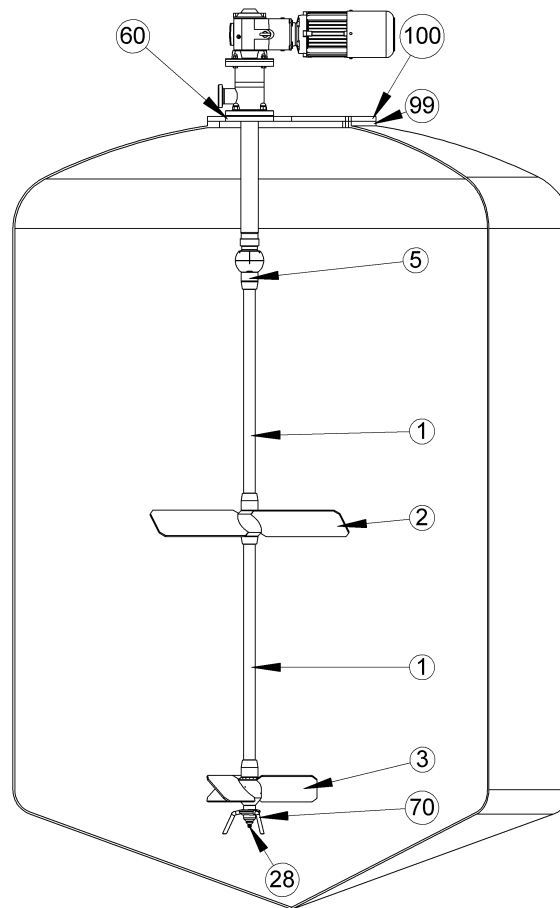
3 Installation

3.3.3 Alternative to 3.3.1 and 3.3.2 (if reduced headroom above tank – tank with manhole)

1. If manhole in tank is too small for propellers use hole in counter flange pos. 99 to place propellers inside tank.
2. Weld the welding flange pos. 60 (if used) into the top plate pos. 100.
3. Mount the top plate pos. 100 onto the counter flange pos. 99.
4. Ensure that the studs pos. 61 are screwed into the welding flange pos. 60.
5. Ensure that the O-ring pos. 34 is installed in flange in pos. 10.
6. Lift the complete Agitator Drive Unit using a hoist (do not use the lifting eye on the gear motor) onto the top of the tank and slide the shaft with pos. 5 through the hole of the welding flange pos. 60.
7. Position the complete agitator onto the welding flange pos. 60.
8. Mount the washers pos. 18 and nuts pos. 17 to the studs pos. 61 and tighten them sequentially to 150 Nm to 200 Nm.
9. Clean all shaft and propeller threads in pos. 1, 2, 3 and 5.
10. Add some food approved grease to the threads to prevent them from galling.
11. Equip the tank with sufficient scaffolding ensuring safe working conditions inside the tank.
12. Insert O-ring and gasket pos. 32 and 33 in the upper shaft pos. 1 and screw it onto the Agitator Drive Unit pos. 5.
13. Insert O-ring and gasket pos. 32 and 33 in the upper propeller pos. 2 and screw it onto the upper shaft pos. 1.
14. Repeat step 12 and step 13 for lower shaft pos. 1 and propeller pos. 3 installation.

3.3.4 Step 3

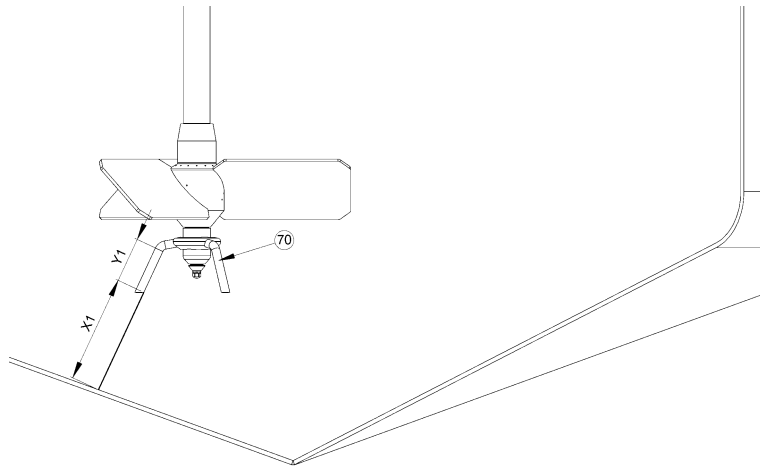
1. Equip the tank with sufficient scaffolding ensuring safe working conditions inside the tank.
2. Enter the tank and tighten the lower propeller pos. 3 between 100 Nm and 300 Nm ensuring that all shaft and propeller connections are tightened.
3. Slide on the mounting tool pos. 70 onto the propeller pos. 3.
4. Fasten the mounting tool pos. 70 with the screw pos. 28 (1-2 Nm) enable the mounting tool pos. 70 to rotate freely.
5. Rotate the mounting tool pos. 70 until the legs are pointing in the direction and position of where the legs of the bottom bearing stand pos. 29 are required to touch the tank bottom.
6. Fix the mounting tool pos. 70 by tightening screw pos. 28 (5-10 Nm).



3 Installation

3.3.5 Step 4

1. Note that each leg of mounting tool pos. 70 is numbered 1, 2 and 3 (which has the same geometry as the upper part of the bottom steady bearing pos. 29 and the bushing pos. 38).
2. Carefully measure the distance X_1 in mm from the end of leg number 1 to the surface of the tank bottom, where leg number 1 would touch if it was extended.
3. Do the same measurement for leg number 2 and leg number 3 and note the distance X_2 and X_3 for the other legs. Mark the three touching points in the tank bottom.
4. Dismantle the mounting tool pos. 70 and store it.



3.3.6 Step 5

1. Below figure shows the correct vertical and horizontal position of the bottom bearing support pos. 29 which guides the bushing pos. 38.
2. To calculate the length Z1, that must be cut of the bottom bearing support leg number 1, the following equation is used:

Leg length of new bottom bearing support pos. 29 (use actual length if it differs):

$$Z1 + X1 + Y1 = 523 \text{ mm}$$

Leg length of mounting tool pos. 70 (use actual length if it differs):

$$Y1 = 82 \text{ mm}$$

Merging the two equations into one:

$$Z1 = 523 \text{ mm} - Y1 - X1 = 523 \text{ mm} - 82 \text{ mm} - X1 = 441 \text{ mm} - X1$$

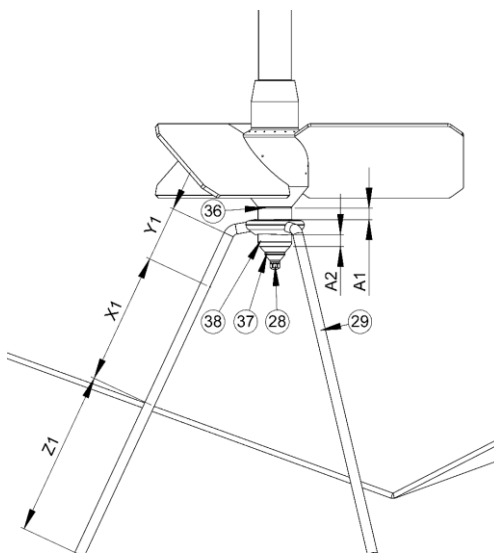
The cut-of length for each leg Z1, Z2 and Z3 are therefore calculated as (use actual length if it differs):

$$Z1 = 441 - X1$$

$$Z2 = 441 - X2$$

$$Z3 = 441 - X3$$

3. Shorten the legs of the bottom bearing stand support pos. 29 as calculated in step 2 and adjust angle at leg ends to fit tank bottom. If the legs of the bottom-bearing-stand-support are too short, the legs can be extended by welding a stainless-steel rod of the same diameter and material to the current leg. The agitator may optionally be delivered with an extra leg.
4. Place the bottom bearing stand pos. 29 inside the tank.
5. Gently pull the shaft to one side to allow the bottom bearing stand to be positioned around the tap-end (the lower part of propeller pos. 3 that is used for bushing pos. 38. If that is not possible due to tank geometry, the complete agitator must be lifted a little by use of a hoist.
6. Position the legs at the marked points in tank bottom as when the measuring with the mounting tool pos. 70 was done (in section 3.3.4-5).
7. Temporary mount the bushing pos. 38.
8. Measure the distance A1 and A2 and verify that they are the same within $\pm 10 \text{ mm}$ and that the top of the bottom bearing stand are horizontal within $\pm 1,5^\circ$. If that is not the case the legs of the bottom bearing stand must be modified.
9. Weld in the three legs to the tank bottom and grind the surfaces as required.
10. Mount the bushing pos. 38 together with the two O-rings pos. 36, 37 using the screw pos. 28 and tighten it to 15 Nm.



3 Installation

3.4 Installation in a none-accessible tank (no manhole) with no crane / hoist above tank

All position numbers and item numbers refer to the drawings shown and specified in chapter 7.

When the inside of the tank is not accessible with the agitator mounted on the top plate, the agitator can be installed as described below.

The purpose of this description is to position the agitator shafts and propellers in the precise same vertical position (as when it is mounted on the top plate) without the top plate pos. 100 (see section 3.3). To do that the mounting tool pos. 80 or 81 and 90 must be available.

Before installation can be done the Agitator Drive Unit must be disassembled as described in section 3.4.6 to 3.4.9 but read and done in reverse order.

3.4.1 Step 1

When the horizontal groove in shaft pos. 5 is in the slot in the mounting tool pos. 90, which is positioned on top of the mounting tool pos. 80 or pos. 81, the shaft pos. 5 is in the same vertical position as when the complete agitator is mounted on the welding flange pos. 60 – see Figure 2 and Figure 3 (and figure in section 3.4.5).

If the thickness of the top plate pos. 100 is different than the thickness of the mounting tool pos. 80, the vertical position of the mounting tool pos. 90 holding the shaft pos. 5 in place must be adjusted (illustrated below with top plate pos. 100 and tool pos. 80 both being 20 mm in thickness).

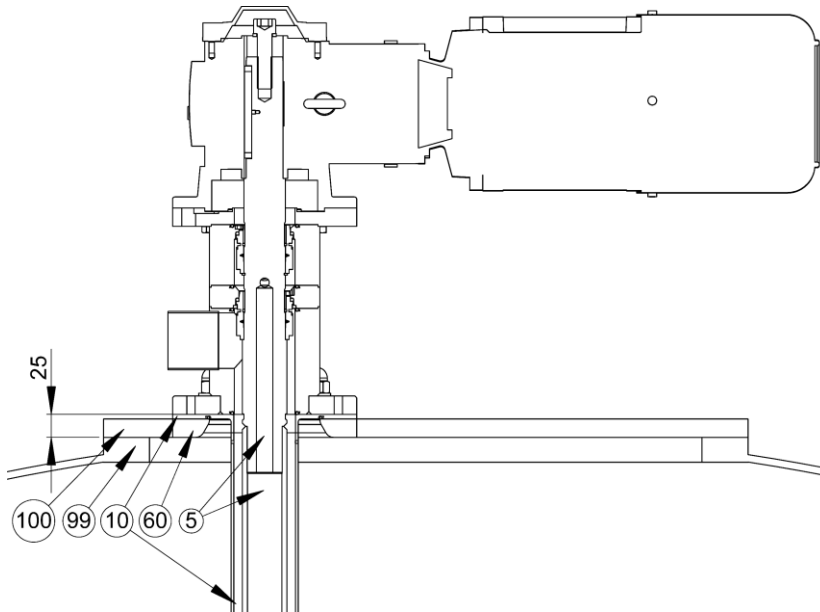


Figure 2, Agitator mounted on tank top

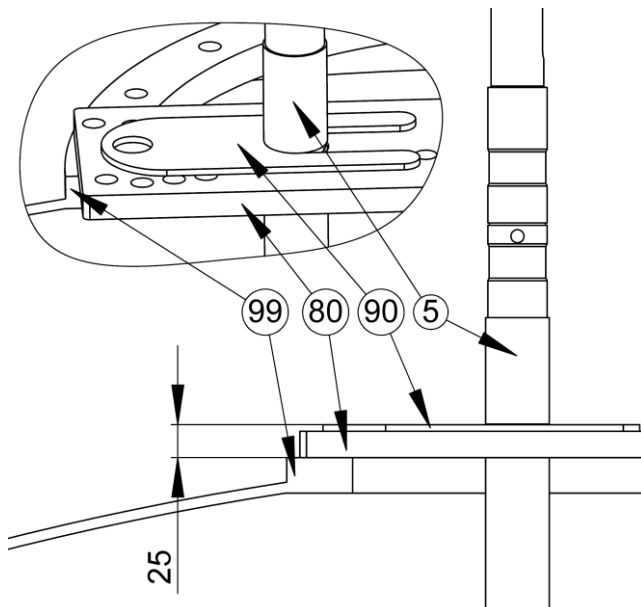
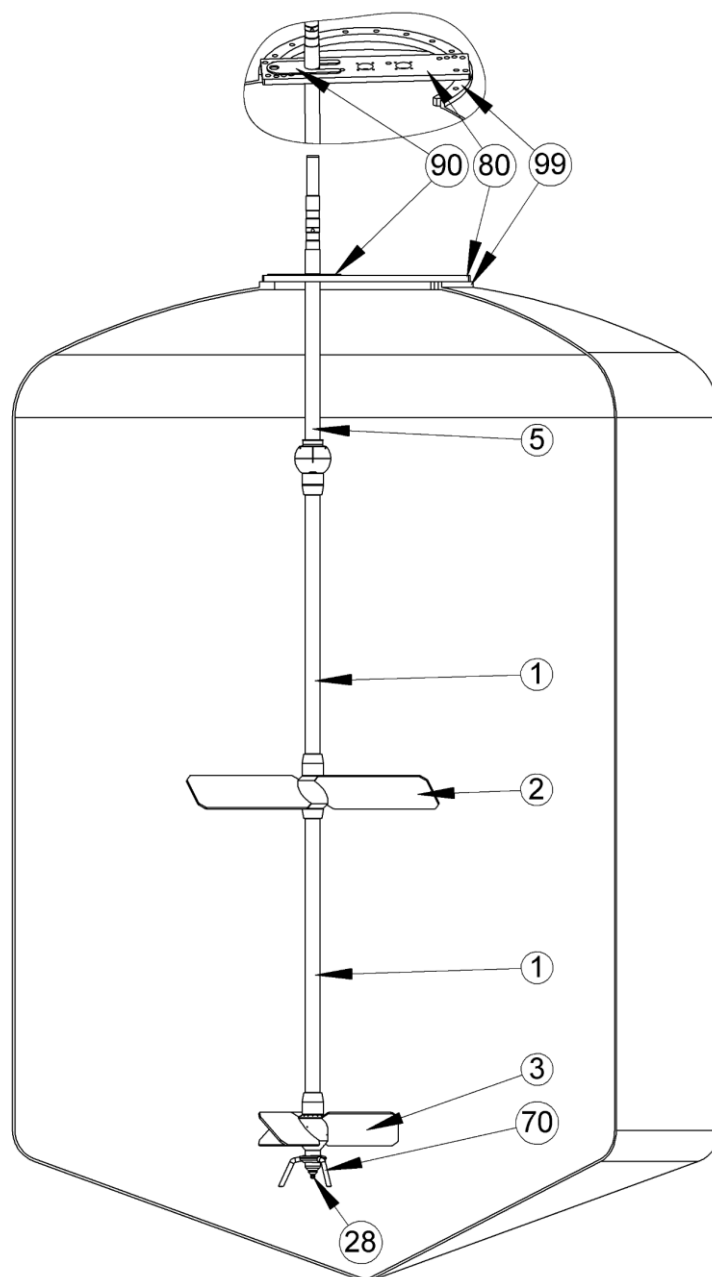


Figure 3, Shaft positioned with mounting tool pos. 80 or 81 and 90

3 Installation

3.4.2 Step 2

1. Clean shaft and propeller threads.
2. Add some food approved grease to the threads to prevent them from galling.
3. The propellers and shafts can be assembled outside the tank, if the size of the counter flange pos. 99 and the head room above the tank is sufficient – otherwise the shaft and propeller unit must be assembled one by one inside the tank. The shaft and propeller unit can consist of one or two shafts and one or two propellers – see order confirmation.
4. Assemble the shafts, propellers, gaskets and O-rings: pos. 1, 2, 3, 32 and 33
5. Tighten all shaft and propeller connections between 100 Nm and 300 Nm – can be done by tighten the lower propeller pos. 3 between 100 Nm and 300 Nm when the shaft pos. 5 is fixed and secured.
6. Equip the tank with sufficient scaffolding ensuring safe working conditions inside the tank.
7. Enter the tank and slide on the mounting tool pos. 70 onto the propeller pos. 3.
8. Loosely install mounting tool pos. 70 loose with the screw pos. 28 (1-2 Nm). Mounting tool must be able to rotate freely.
9. Rotate the mounting tool pos. 70 until the legs is pointing in the direction and position of where the legs of the bottom bearing stand pos. 29 are required to touch the tank bottom.
10. Tighten the screw pos. 28 (5-10 Nm).



3.4.3 Step 3

1. Continue as described in section 3.3.5

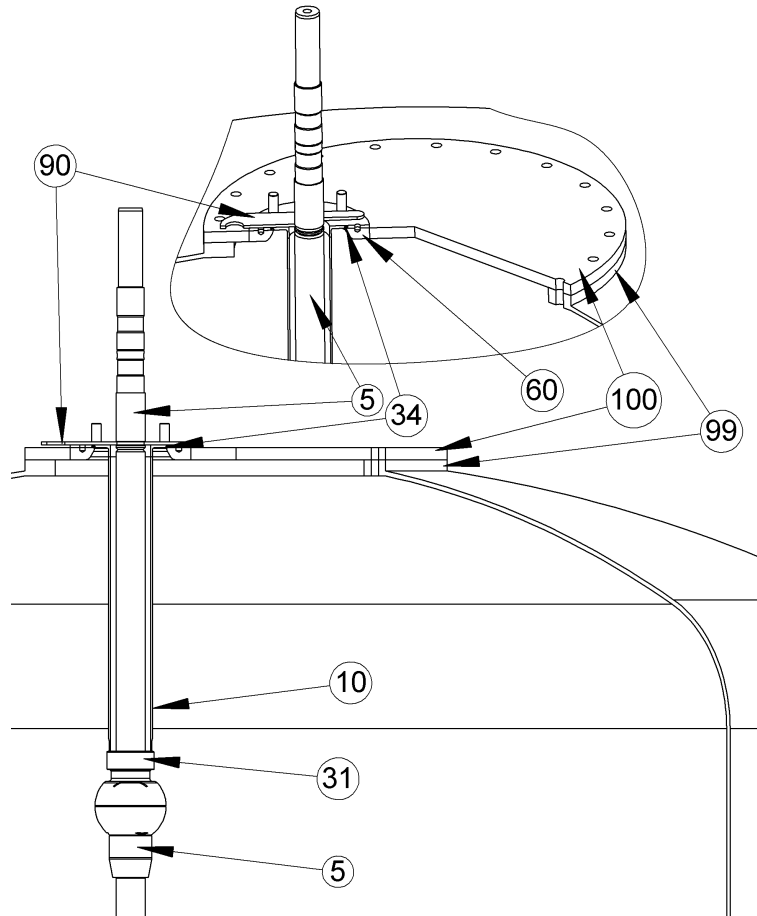
3.4.4 Step 4

1. Continue as described in section 3.3.6

3 Installation

3.4.5 Step 5

1. Lift the complete shaft and impeller unit pos. 5 vertical (2-5 mm) and remove the mounting tool pos. 90.
2. Lower the complete shaft and impeller unit pos. 5 slowly and let it rest on top of the bottom bearing stand pos. 29 – secure the shaft pos. 5 in horizontal direction.
3. Remove the mounting tool pos. 80.
4. Mount the top plate pos. 100 on the counter flange pos. 99.
5. Ensure that the O-ring pos. 34 is mounted in the flange in pos. 10.
6. Install spray ball bearing pos. 31 on tube pos. 10.
7. Lift the complete shaft and impeller unit pos. 5 vertical until the mounting tool pos. 90 can be slid into the horizontal slot again in the shaft in pos. 5.



3.4.6 Step 6

1. Mount the two O-rings pos. 35 in the console pos. 9 (see section 3.4.10).
2. Mount the console pos. 9 on top of the mounting tool pos. 90 – see overview on figure in 3.4.7).
3. Apply some food approved grease to the shaft pos. 5 and to the inside of the rotating part pos. 30B of the seal pos. 30.
4. Remove the PTFE sliding part (see Figure 4) of the rotating part pos. 30B of the seal pos. 30 and slide the rotating part pos. 30B along the shaft pos. 5 to the shoulder of the shaft - sliding the part along the shaft can be difficult – it will require some force.
5. Remount the PTFE sliding part of the rotating part pos. 30B (ensure that the groove in the PTFE part is placed at the counter metal part as shown on Figure 4).
6. Mount the O-ring pos. 35 in pos. 8 (see section 3.4.10).

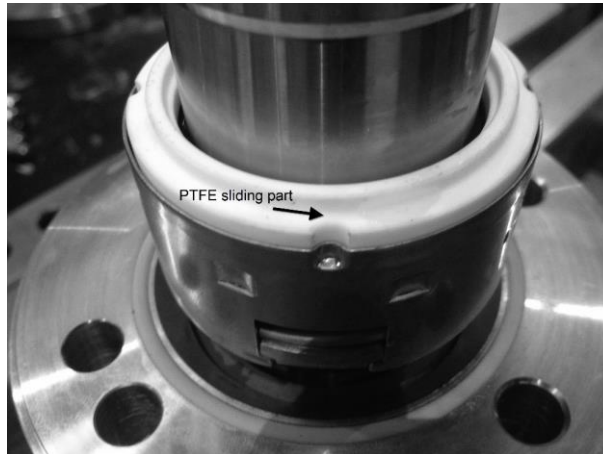


Figure 4, PTFE sliding part of seal pos. 30B

3 Installation

3.4.7 Step 7

1. Mount the O-ring on the stationary part pos. 30A (see section 3.4.11).
2. Mount the stationary part pos. 30A into pos. 8 (see Figure 5).
3. Mount the gasket support pos. 12 into pos. 8 – use some food approved grease to keep it in place.
4. Clean sealing surfaces on pos. 30A and 30B with some alcohol.
5. Ensure that the two holes in pos. 8 and pos. 9 for the two guide pins pos. 13 are aligned and positioned in a way that still enables access to the four threads in the pos. 9.
6. Mount pos. 8 onto the pos. 9.
7. Press / gently hammer down the two guide pins pos. 13.

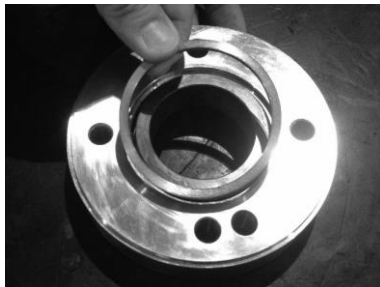
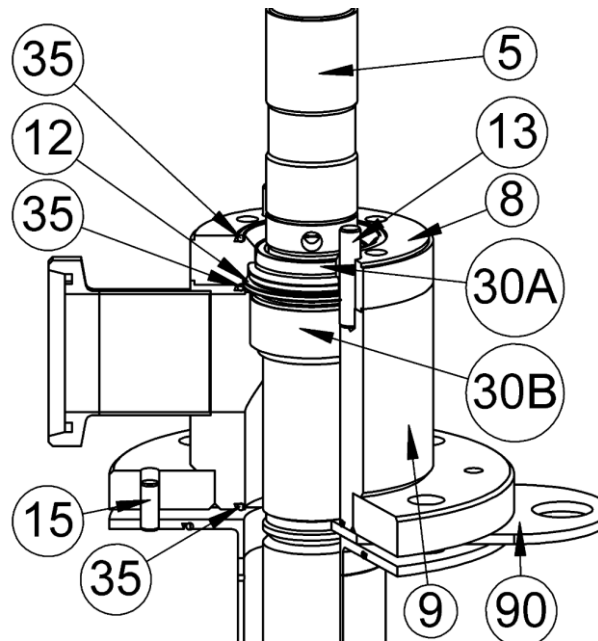


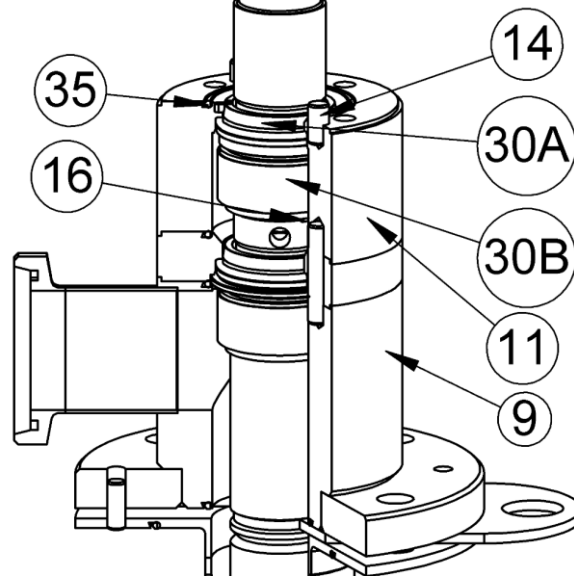
Figure 5, Stationary seal part and gasket support



Figure 6, Gasket support in place

3.4.8 Step 8 (only for agitators with aeration)

1. Mount the circlip pos. 16 on the shaft pos. 5.
2. Apply some food approved grease to the shaft pos. 5 and to the inside of the rotating part pos. 30B of the seal pos. 30.
3. Remove the PTFE sliding part (see Figure 4 in 3.4.6) of the rotating part pos. 30B of the seal pos. 30 and slide the rotating part pos. 30B along the shaft pos. 5 to the circlip pos. 16.
4. Remount the PTFE sliding part of the rotating part pos. 30B (ensure that the groove in the PTFE part is placed at the counter metal part as shown on Figure 4 in 3.4.6).
5. Mount the O-ring pos. 35 into the console pos. 11 (see section 3.4.10).
6. Mount the O-ring on the stationary part pos. 30A (see section 3.4.11).
7. Mount the stationary part pos. 30A into the console pos. 11.
8. Clean sealing surfaces on pos. 30A and 30B with some alcohol.
9. Mount the console pos. 11 in a way that still enables access to the four threads in pos. 9.
10. Press / gently hammer down the two pins pos. 14.



3 Installation

3.4.9 Step 9

1. Position the flange pos. 7 in a way that enables access to the four threads in pos. 9. Ensure oil leakage control drain is positioned as required.
2. Add some thread locker to the four screws pos. 25 and tighten them sequentially to 51 Nm.
3. Mount the parallel key pos. 6 with the screw pos. 24 (not shown here) onto the shaft pos. 5.
4. Clean and gently grease the shaft pos. 5 and the hollow shaft in the gear motor pos. 4.
5. Lower the gear motor pos. 4 gently to the shaft pos. 5 onto the flange pos. 7 (use a hoist).
6. The four sets of screws, washers and nuts pos. 19, 20, 21 are mounted using thread locker and tightened sequentially to 51 Nm.
7. The washer pos. 23 consists of two parts attached to each other with some silicone as shown on Figure 7. It is important that the parts are positioned as shown on Figure 7. The bushing (that comes with the gear motor), screw (pos. 22) and washer (pos. 23) are shown on Figure 8.
8. Mount the washer pos. 23 and screw pos. 22 and tight it (without using thread locker) to 51 Nm.
9. The cover that follows the gear motor is mounted on the gear motor covering the shaft and bushing and all screws are tightened.
10. Lift the complete agitator vertically (2-5 mm) using a hoist by use of a sling and remove the mounting tool pos. 90.
11. Lower the complete agitator to the welding flange pos. 60.
12. Mount the washers pos. 18 and nuts pos. 17 to the studs pos. 61 and tighten them sequentially to 150 Nm to 200 Nm.

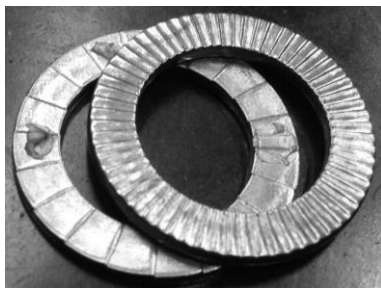
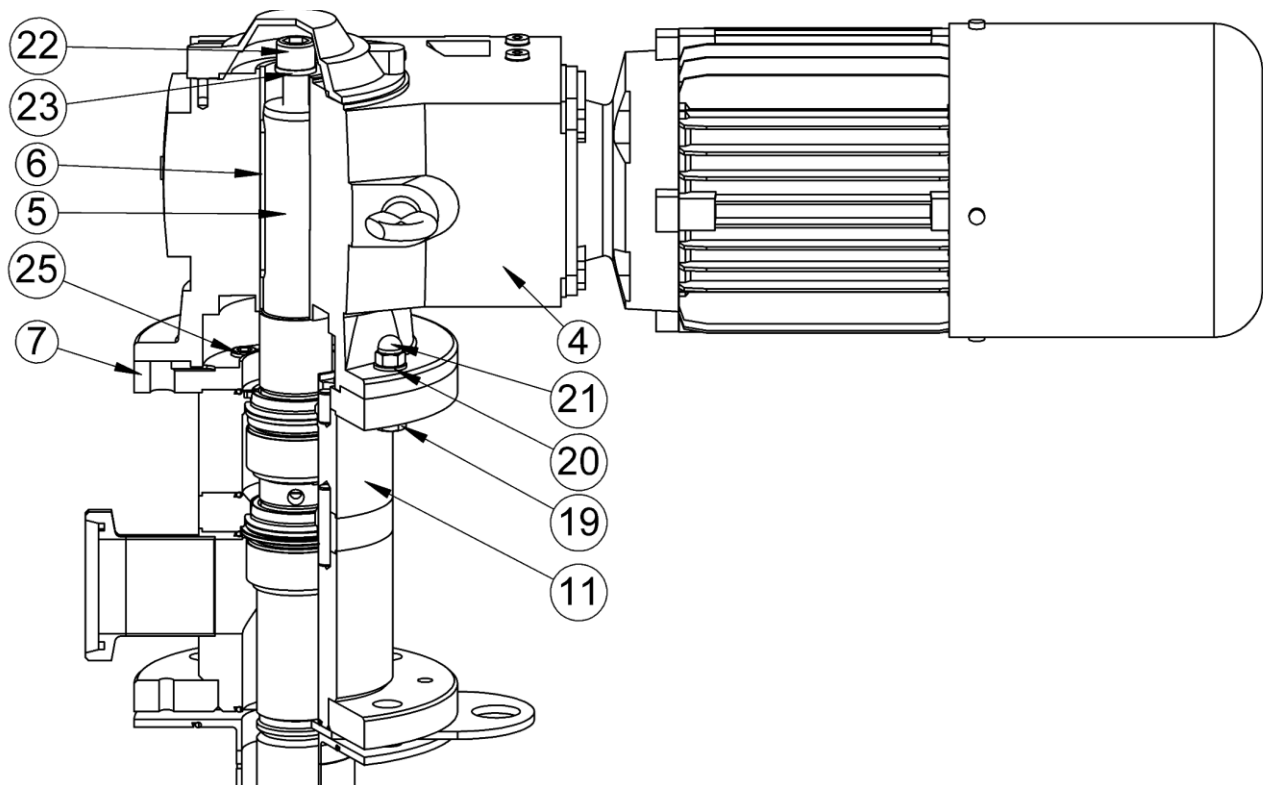


Figure 7, One washer pos. 23



Figure 8, Bushing, screw and washer for shaft



3.4.10 Mounting of O-rings in general

1. Apply some food-approved grease to the O-ring.



Figure 9, Greasing O-ring

2. Press the O-ring into the appropriated groove at position 0° and 180°.



Figure 10, Inserting O-ring

3. Press the O-ring into the appropriated groove at position 90° and 270°.



Figure 11, Inserting O-ring

3 Installation

3.4.11 Mounting of mechanical seals

1. Apply some food-approved grease to the O-ring mounted on the stationary part of the seal pos. 30A.
2. Mount O-ring on the stationary part of the seal pos. 30A without twisting it "inside out".
3. Clean both seal surfaces on the seal pos. 30A and 30B with some alcohol.



Figure 12, O-ring for seal part 30A

3.5 Installation in a none-accessible tank (no manhole) with crane / hoist above tank

All position numbers and item numbers refer to the drawings shown and specified in chapter 7.

When the inside of the tank is not accessible with the agitator mounted on the top plate, the agitator can be installed as described below.

The purpose of this description is to position the agitator shafts and propellers in the precise same vertical position (as when it is mounted on the top plate) without the top plate pos. 100 (see section 3.3). To do that the mounting tool pos. 80 or 81 and 90 must be available.

To avoid disassembling the Agitator Drive Unit as required in 3.4 an extra complete shaft pos. 5 must be available during the installation process used as installation tool.

3.5.1 Step 1

1. Continue as described in section 3.4.1

3.5.2 Step 2

1. Continue as described in section 3.4.2 but instead of disassembling the Agitator Drive Unit use the extra complete shaft pos. 5 as installation tool. The thread connection between pos. 5 and pos. 1 does not need to be tightened to final torque as the connection must be disassembled later in the installation process.

3.5.3 Step 3

1. Continue as described in section 3.3.5

3.5.4 Step 4

1. Continue as described in section 3.3.6

3.5.5 Step 5

1. See figure in 3.4.2.
2. Lift the complete shaft and impeller unit pos. 5 vertically (2-5 mm) and remove the mounting tool pos. 90.
3. Lower the complete shaft and impeller unit pos. 5 slowly and let it rest on top of the bottom bearing stand pos. 29 – secure the shaft pos. 5 in horizontal direction.
4. Remove the mounting tool pos. 80.
5. See figure in 3.4.5.
6. Mount the top plate pos. 100 on the counter flange pos. 99.
7. See figure in 3.3.1.
8. Mount the mounting tool pos. 50 on top of the welding flange pos. 60 (if used - the welding flange pos. 60 is normally integrated into the AL top plate pos. 100).
9. Lift up the complete agitator shaft and propellers incl. the installation tool pos. 5 and place it temporary into the cone of the mounting tool pos. 50.
10. Unscrew the installation tool pos. 5 from the agitator shaft pos. 1 (not shown on any pictures)

3.5.6 Step 6

1. See figure in 3.3.2.
2. Clean the connection threads in pos. 1 and pos. 5.
3. Add some food approved grease to the threads to prevent them from galling.
4. Mount the gasket and O-ring pos. 32 and 33 into the shaft pos. 1.
5. Ensure that the O-ring pos. 34 is installed in flange on pos. 10.
6. Lift the complete Agitator Drive Unit using a hoist (do not use the lifting eye on the gear motor) and screw on the shaft pos. 1 into the thread in pos. 5 and tight it between 100 Nm and 300 Nm.
7. Lift the complete agitator a little further enabling the mounting tool pos. 50 to be removed and stored.

3 Installation

8. If the tank has no sight glasses unscrew two (possible) connections in the top plate pos. 100 enable light and visibility into the tank bottom and bottom bearing support pos. 29.
9. Lower the complete agitator slowly onto the welding flange pos. 60 while ensuring that the bushing pos. 38 enter the bottom bearing stand pos. 29.
10. Mount the washers pos. 18 and nuts pos. 17 to the studs pos. 61 and tighten them sequentially to 150 Nm to 200 Nm.

3.6 Installation, electrical

- Operation by unauthorized personnel may endanger personnel and property.
- Treat all electrical equipment as powered.
- Switch off the power before maintenance and repair.
- The electrician must be certified according to local regulations and with at least 3 years of experience from similar types of installations.
- The electrician must have proven skills in reading and working from drawings and cable lists.
- The electrician must have knowledge of local electrical safety regulations for power and automation and furthermore making sure that any work carried out is safe for personnel and property before the equipment is put back into operation.



If you need assistance or have questions – please contact Alfa Laval

- The motor requires the power supply as indicated on the name plate.
- It is recommended to secure the motor with a motor protection.
- We recommend starting the motor by use of a soft starter, or a frequency converter, with ramp up and down time of 2-7 sec.
- We recommend installation of a service switch at the agitator to ensure the safety of personnel during service work.
- Perform a visual inspection of the direction of rotation. The direction required is indicated on the name plate.
- Rotation of agitator must be clockwise looking from the tank top and down. Otherwise, the agitator will be damaged.



3 Installation

3.7 Pre-use check

3.7.1 Step 1

Go through chapter 2 Safety.

3.7.2 Step 2

Check fastenings.

3.7.3 Step 3

Ensure that the oil vent plug is activated on the gear motor (see Figure 13 or chapter 8.3).

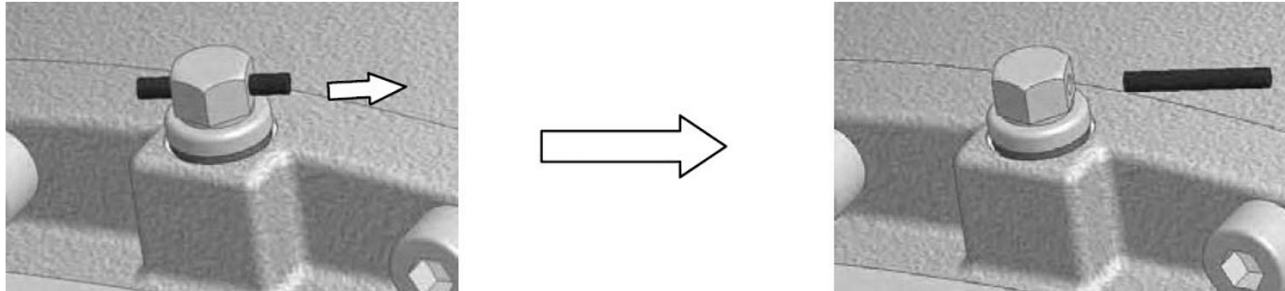


Figure 13, Activation of gear vent plug

3.7.4 Step 4

Rotation of agitator must always be clockwise looking from the tank top and down.

Use of gear motor cover is not permitted due to risk of reduced cooling on motor.

4 Operation

Study the instructions carefully and pay special attention to warnings! Always check the Agitator before operation. Alfa Laval recommends using a soft starter or a frequency converter with a ramp up and down time of 2-7 sec. for the Agitator to increase gear motor lifetime and to reduce the load on tank and Agitator.

All position numbers and item numbers refer to the drawings shown and specified in chapter 7.

4.1 General information

Rotation of agitator must always be clockwise.

Use of gear motor cover is not permitted due to risk of reduced cooling on motor.



If batch rotation is observed during operation the optimum effect of the agitator is achieved by interval agitation instead. If interval agitation is used the gear motor must be installed with a soft starter or a frequency converter to increase gear motor life time and reduce forces on the tank top system.

If a sensitive product is processed, agitation speed and time should be reduced as much as possible.

If the agitator is equipped with an aeration valve it is possible to aerate the product through the shaft during the agitation.

4.2 Aeration

If Agitator is equipped with Aeration feature the connection in pos. 11 (NW25) can be used letting sterile air into the batch through the inside of the shafts and out at the lower propeller. The flow versus pressure can be calculated from the formula described in section 6.1.

4 Operation

4.3 Inspection

Part	Inspection interval
Gear motor <ul style="list-style-type: none">- Clean surfaces to avoid overheating- Check for oil leakages	Monthly Monthly
Sealing <ul style="list-style-type: none">- Verify that the seals are not leaking	Monthly

4.4 Troubleshooting

Problem	Cause/result	Remedy
Not starting		
Gear motor	<ul style="list-style-type: none">- Defect- Fault at power supply	<ul style="list-style-type: none">- Dismantle gear motor, check for correct rotation- Replace gear motor- Check power supply connection- Check voltage and frequency correspond with motor name plate- Check frequency converter adjustment correspond with motor name plate
Agitator	<ul style="list-style-type: none">- Obstructed	<ul style="list-style-type: none">- Check that Agitator can rotate freely without striking anything
Vibrations		
Propeller	<ul style="list-style-type: none">- Damaged	<ul style="list-style-type: none">- Contact Alfa Laval
	<ul style="list-style-type: none">- Unbalanced	<ul style="list-style-type: none">- Clean propeller
Shaft	<ul style="list-style-type: none">- Damaged	<ul style="list-style-type: none">- Contact Alfa Laval
Unusual sounds		
	<ul style="list-style-type: none">- Find root cause of sound	<ul style="list-style-type: none">- Change and / or repair parts
Leakage		
Gear motor	<ul style="list-style-type: none">- Oil leakage	<ul style="list-style-type: none">- Renovate or replace gear motor
	<ul style="list-style-type: none">- CIP fluid or other from drain	<ul style="list-style-type: none">- Replace sealing
Performance		
	<ul style="list-style-type: none">- Deviation from normal operation	<ul style="list-style-type: none">- Operation must be according to specification

4.5 Cleaning

4.5.1 General information

The agitator is fitted with a rotating spray ball designed to clean agitator and tank as part of the cleaning process CIP (Cleaning In Place).



The lower propeller is equipped with nozzles that can clean the propeller itself, the bottom bearing stand and the surfaces of the upper propellers down facing propeller blades.

The surfaces of the upper propellers upper facing propeller blades are cleaned by the spray ball.

Cleaning, Agitator with Aeration:

- Requires CIP fluids to be connected to connections in pos. 9 and pos. 11 (NW65 and NW25).

Cleaning, Agitator without Aeration:

- Requires CIP fluids to be connected to connection in pos. 9 (NW65).

The Agitator itself does not require a special cleaning procedure but the process can be integrated in the usual tank cleaning concept. However, hot caustic cleaning is always recommended.

It is recommended to run the agitator at variable speeds (if frequency converter is used) ramping slowly up and down from 5 Hz to 50 Hz during the cleaning process – it ensures that the spray pattern from the spray ball and propeller nozzles, impact the tank walls and agitator surfaces as diverse as possible.

The Agitator must not be run at temperatures above 90° C.

(applies for e.g. tank CIP and hot water sterilization)

Maximum SIP temperature when the agitator is NOT activated is 120°C.

(applies for e.g. steam sterilization)

Ensure that all surfaces in contact with product are totally clean so product is not contaminated and that the Agitator itself is not exposed to pitting corrosion.

Pay special attention to:

- Impeller device surfaces.
- Surfaces between propellers and shaft.
- Surfaces around sealing and bushings.
- Surfaces around weldings.

4 Operation

4.5.2 Cleaning example



The cleaning should be made as soon as possible after emptying the tank, while the inside surfaces are still wet.

CIP fluids to be connected.

The agitator should be running continuously at variable speeds (if frequency converter is used) ramping slowly up and down from 5 Hz to 50 Hz during the CIP process.

The recommended CIP flow at 2-3 bar can be calculated from the formula in chapter 6.

1. Pre-rinse with cold water for approximately 5 minutes.
2. Cleaning with hot caustic 60-70°C approximately 30 minutes.
3. Rinse with hot water approximately 3 minutes.
4. Final-rinse with cold water approximately 3 minutes and continue again until last rinsing water is free from chemicals.

5 Maintenance

Ensure totally clean surfaces during mounting. Always use original Alfa Laval parts.

If product wetted parts are soiled during de-commissioning or installation, these must be manually cleaned prior commissioning of the equipment.

5.1 General maintenance

- Maintenance of the Agitator should only be performed by authorized personnel.
- For maintenance instructions of gear motor please see section 8.3.
- Ensure totally clean surfaces during maintenance.
- For lifting instruction, please see chapter 3.
- Always disconnect the power supply when servicing the Agitator.
- Always use proper tools.
- Always replace worn sealing elements before reassembling.
- Follow the dismantling and assembly instructions to the letter.
- All scrap must be stored/disposed of in accordance with current rules and directives.
- Always use original Alfa Laval spare parts.



Part	Replace every
Sealing (Mechanical, PTFE and O-rings)	3.000 hour or 2 nd year
Bushing in bottom console (pos. 38)	3.000 hour or 2 nd year

5.2 Disassembly of Agitator

See section 3.4 in reverse order.

5.3 Replacement of gear motor

See section 3.4 in reverse order.

5.4 Replacement of seals

See section 3.4 in reverse order.

5.5 Replacement of busing pos. 38 in bottom console

See section 3.3.6 paragraph 10.

6 Technical Data

6 Technical Data

6.1 ALTB-SB-35, With Aeration (item number 8010010025)

Environmental requirements:	
Temperature:	10°C - 40°C
Relative humidity:	20% - 80%
Size:	
See order confirmation / delivery note:	Dimensions to be found in chapter 7
Power supply:	
See order confirmation / delivery note:	Data to be found on motor name plate
CIP (through connections in pos. 9 (NW65) and pos. 11 (NW25)):	
Temperature, agitator running:	≤ 90°C, recommended about 65°C
Temperature, agitator stopped:	≤ 120°C
Pressure:	1-3 bar above tank pressure depending on tank size
Quantity:	20-33 m³/h
Flow [m³/hour]:	19,1 x p ^{0,5} , at pressure p [barg]
Detergent:	Suitable for: steel EN 1.4404, PTFE, EPDM and PEEK
Aeration (sterile air):	
Pressure:	0-1 barg (tank pressure + 1 bar)
Quantity:	35-100 ltr/min depending on tank size (100 ltr/min = 6 m³/hour)
Flow [m³/hour]:	98 x p ^{0,5} , at pressure p [barg]
Material:	
See order confirmation / delivery note:	Data to be found in chapter 7

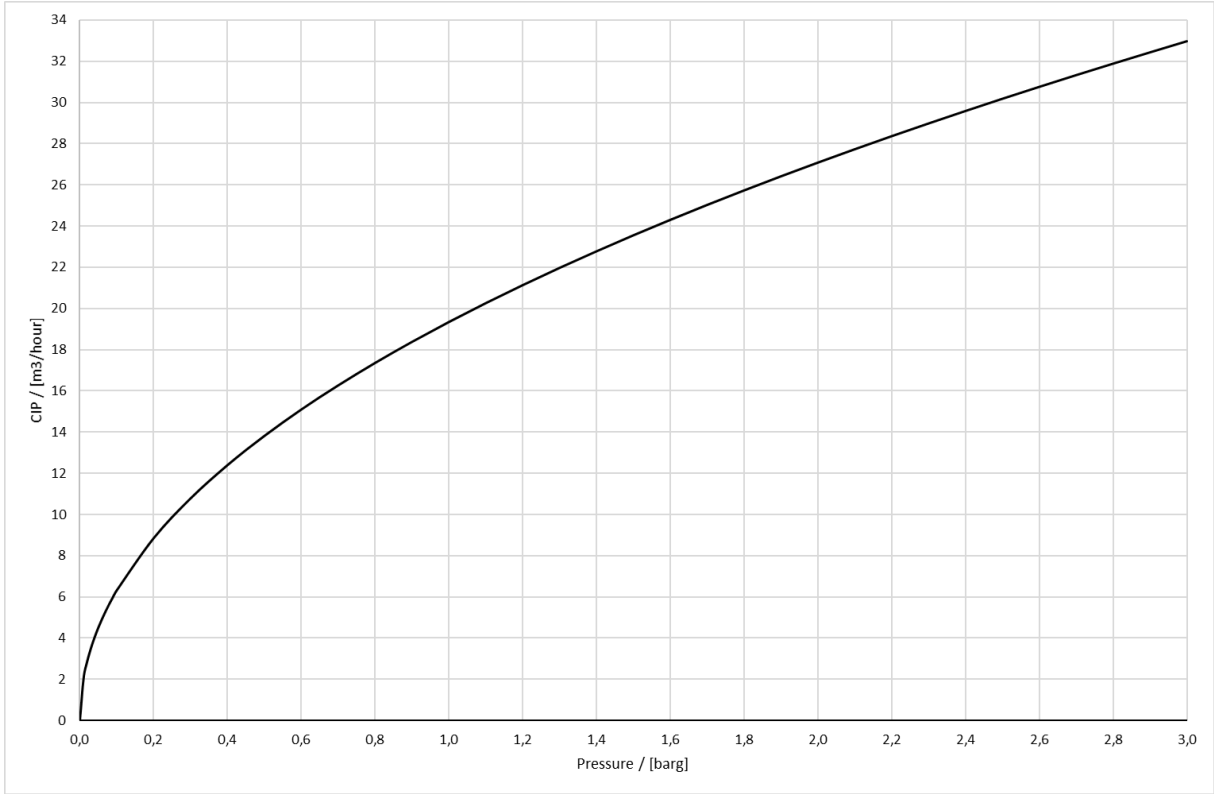


Figure 14, CIP flow versus pressure, type with Aeration

6.2 ALTB-SB-35, Without Aeration (item number 8010010024):**Environmental requirements:**

Temperature: 10°C - 40°C

Relative humidity: 20% - 80%

Size:

See order confirmation / delivery note: Dimensions to be found in chapter 7

Power supply:

See order confirmation / delivery note: Data to be found on motor name plate

CIP (through connections in pos. 9 (NW65)):Temperature, agitator running: $\leq 90^{\circ}\text{C}$, recommended about 65°C Temperature, agitator stopped: $\leq 120^{\circ}\text{C}$

Pressure: 1-3 bar above tank pressure depending on tank size

Quantity: 20-33 m³/hFlow [m³/hour]: $19,1 \times p^{0,5}$, at pressure p [barg]

Detergent: Suitable for: steel EN 1.4404, PTFE, EPDM and PEEK

Material:

See order confirmation / delivery note: Data to be found in chapter 7

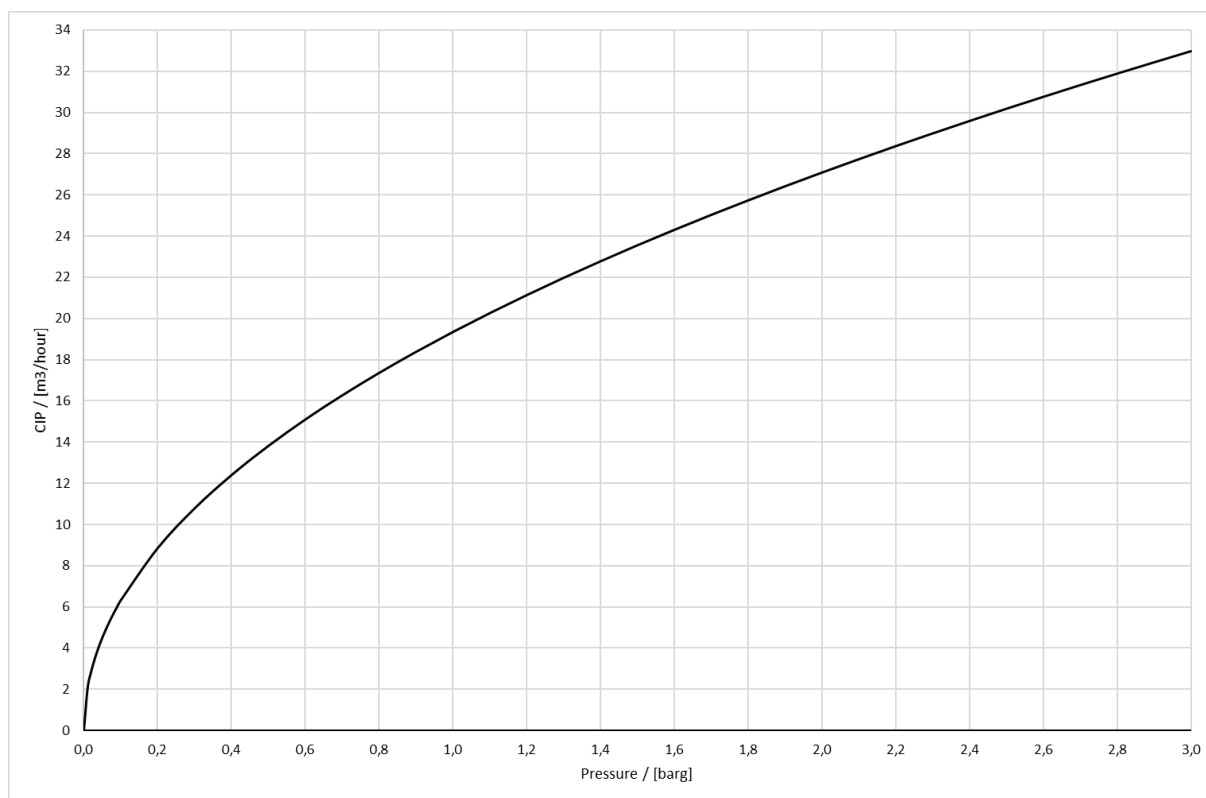


Figure 15, CIP flow versus pressure, type without Aeration

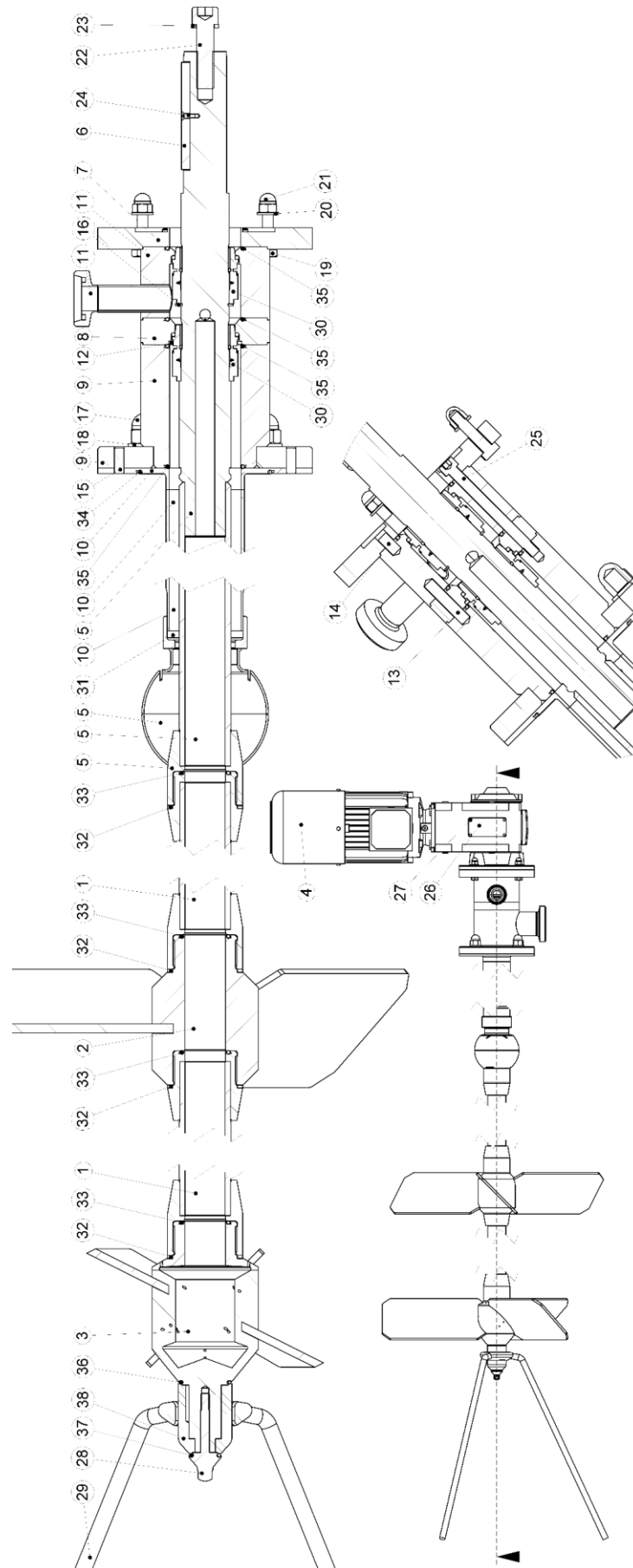
7 Parts list / Service kits

7 Parts list / Service kits

All possible configurations described below. Always use original Alfa Laval parts.

7.1 ALTB-SB-35, With Aeration (item number 8010010025)

7.1.1 Drawing



7 Parts list / Service kits

7.1.2 Part list

Item number 8010010025 includes parts pos. #5 to #38

Pos	Qty	Item #	Drawing #	Denomination	Material
1	2	See table*	96143204	Agitator shaft, Welded	
2	1	See table*	96143199	Propeller for agitator, Upper	
3	1	See table*	96143294	Propeller for agitator, Lower	
4	1	See table*	96143233	Gear motor	
5	1	8010010043	8010010043	Gear Shaft	
6	1	9614313403	96143134	Parallel key	1.4307/1.4301
7	1	9614318301	96143183	Flange, Upper for Agitator	1,4404
8	1	9614319701	96143197	Intermediate coupling	
9	1	9614317901	96143179	Console for Agitator	
10	1	9614318501	96143185	Tube, CIP for spray ball	
11	1	9614319301	96143193	Gear console with aeration	
12	1	9614319201	96143192	Gasket support	1,4404
13	2	9614313504	96143135	Pin	1,4404
14	2	9614313503	96143135	Pin	1,4404
15	2	9614313501	96143135	Pin	1,4404
16	1	TE2601000199	None	Circlip, outer	
17	4	TE2601000058	None	Cap nut	
18	4	TE2601000348	None	Washer	
19	4	TE2601000630	None	Screw	
20	4	TE2601000346	None	Washer	
21	4	TE2601000355	None	Cap nut	
22	1	TE2601000047	None	Screw	
23	1	TE2601000169	None	Washer	
24	1	TE2601000644	None	Screw	
25	4	TE2601000631	None	Screw	
26	1	TE2601041560	None	Name plate	AISI 304L
27	4	TE2601000202	None	Rivet	
28	1	9615391801	96153918	Screw	1,4404
29	1	8010011480	8010011480	Bottom bearing stand	1,4404
30	2	9614321601	96143216	Single Mechanical seal	
31	1	9614329901	96143299	Spray ball bearing	PTFE AF 1086
32	4	9614311803	96143118	Gasket	PTFE AF 1086
33	4	9614312702	96143127	O-ring	EPDM
34	1	9614312704	96143127	O-ring	EPDM
35	4	9614312703	96143127	O-ring	EPDM
36	1	9615396601	None	O-ring	EPDM
37	1	9615396001	None	O-ring	EPDM
38	1	9615391201	96153912	Bushing - BS3, size 50/55/60/65	PEEK

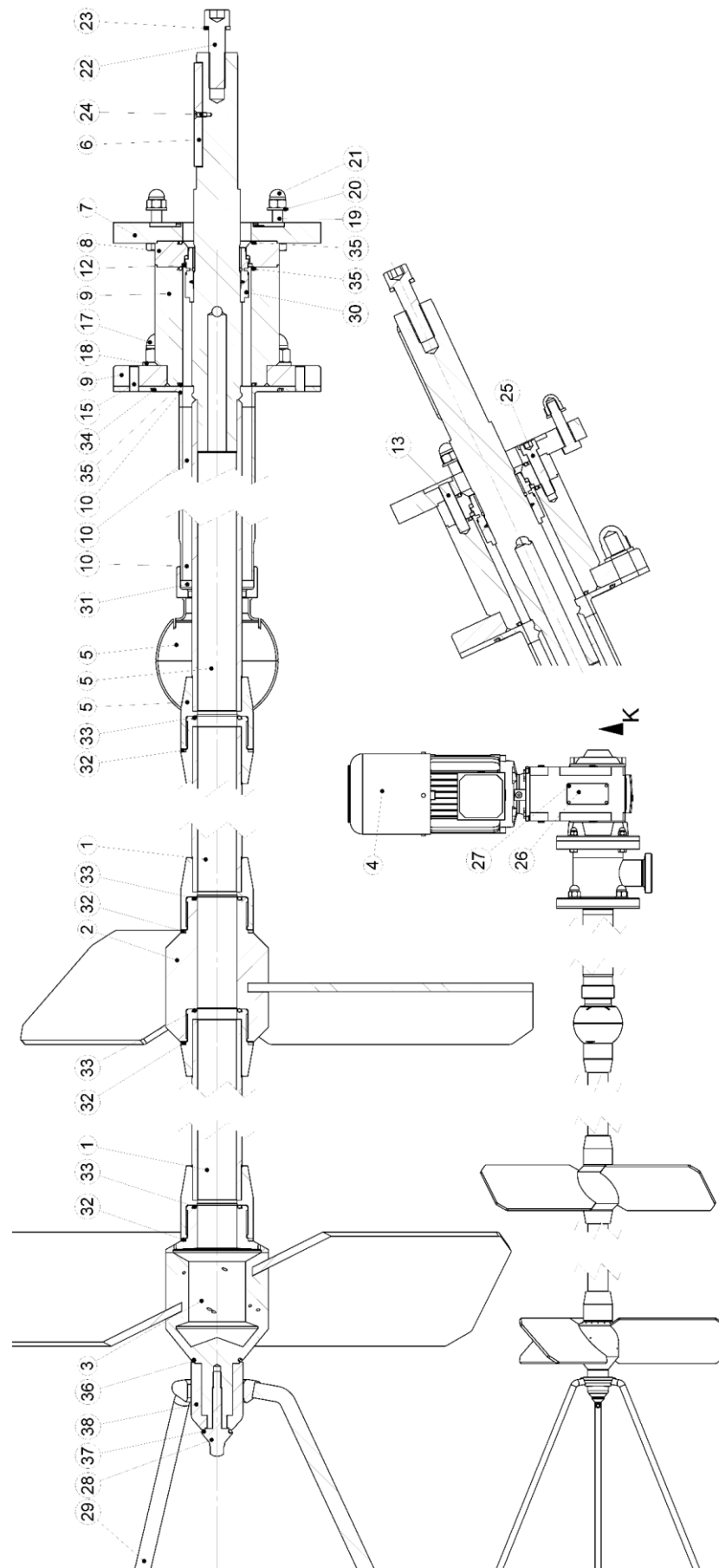
*Not part of top-level item number - item number must be selected in sales configurator or drawing.

7.1.3 Spare Part Kit:

Spare Part Kit item number 8010010036 includes parts pos. #30 to #38

7.2 ALTB-SB-35, Without Aeration (item number 8010010024)

7.2.1 Drawing



7 Parts list / Service kits

7.2.2 Part list:

Item number 8010010024 includes parts pos. #5 to #38

Pos	Qty	Item #	Drawing #	Denomination	Material
1	2	See table*	96143204	Agitator shaft, Welded	
2	1	See table*	96143199	Propeller for agitator, Upper	
3	1	See table*	96143294	Propeller for agitator, Lower	
4	1	See table*	96143233	Gear motor	
5	1	8010010042	8010010042	Gear Shaft	
6	1	9614313403	96143134	Parallel key	1.4307/1.4301
7	1	9614318301	96143183	Flange, Upper for Agitator	1,4404
8	1	9614319701	96143197	Intermediate coupling	
9	1	9614317801	96143178	Console for Agitator	
10	1	9614318501	96143185	Tube, CIP for spray ball	
12	1	9614319201	96143192	Gasket support	1,4404
13	2	9614313504	96143135	Pin	1,4404
15	2	9614313501	96143135	Pin	1,4404
17	4	TE2601000058	None	Cap nut	
18	4	TE2601000348	None	Washer	
19	4	TE2601000630	None	Screw	
20	4	TE2601000346	None	Washer	
21	4	TE2601000355	None	Cap nut	
22	1	TE2601000047	None	Screw	
23	1	TE2601000169	None	Washer	
24	1	TE2601000644	None	Screw	
25	4	TE2601000632	None	Screw	
26	1	TE2601041560	None	Name plate	AISI 304L
27	4	TE2601000202	None	Rivet	
28	1	9615391801	96153918	Screw	1,4404
29	1	8010011480	8010011480	Bottom bearing stand	1,4404
30	1	9614321601	96143216	Single Mechanical seal	
31	1	9614329901	96143299	Spray ball bearing	PTFE AF 1086
32	4	9614311803	96143118	Gasket Ø70/Ø60x3	PTFE AF 1086
33	4	9614312702	96143127	O-ring	EPDM
34	1	9614312704	96143127	O-ring	EPDM
35	3	9614312703	96143127	O-ring	EPDM
36	1	9615396601	None	O-ring	EPDM
37	1	9615396001	None	O-ring	EPDM
38	1	9615391201	96153912	Bushing - BS3, size 50/55/60/65	PEEK

*Not part of top-level item number - item number must be selected in sales configurator or drawing.

7.2.3 Spare Part Kit:

Spare Part Kit item number 8010010037 includes parts pos. #30 to #38

7.3 ALTB-SB-35, (With and Without Aeration)

7.3.1 Gear motor:

Gear motor specification:

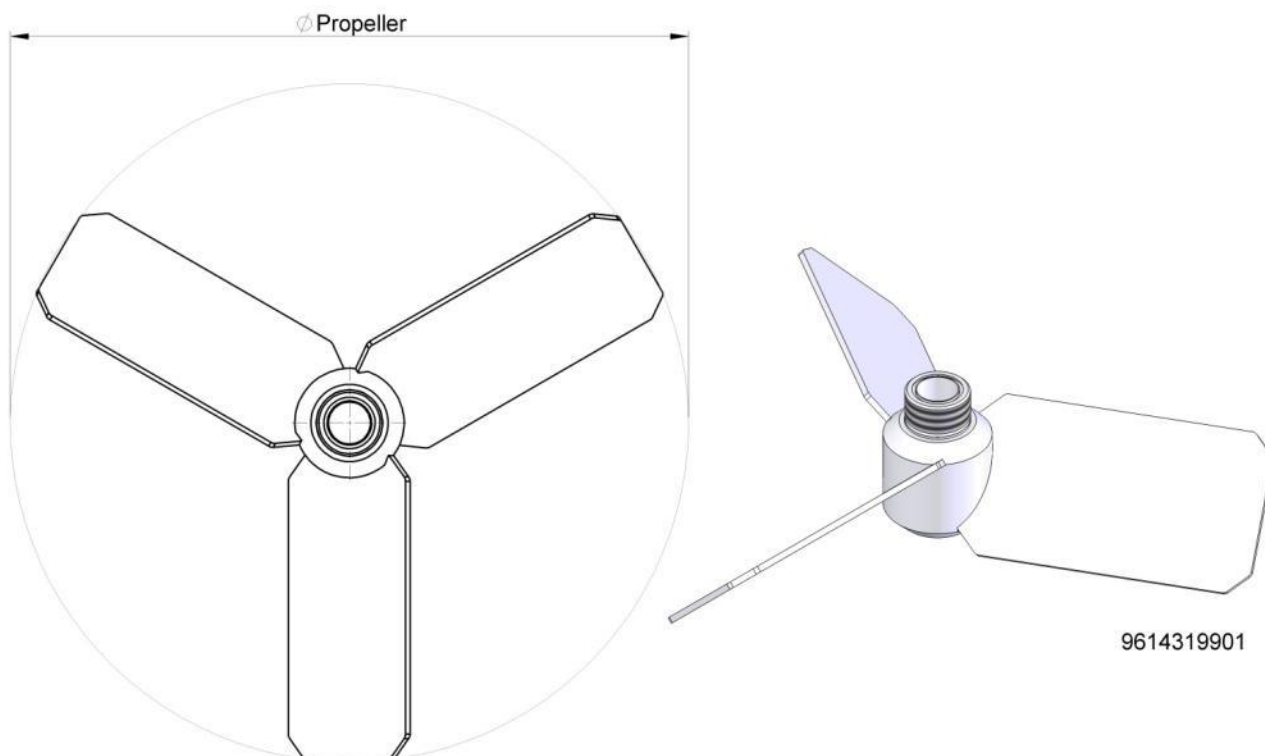
Type:	High efficiency Helical Bevel
Shaft material:	1,4057
Motor Temperature Protection:	PTC resistor, 3x155°C
Motor Backstop / Freewheel bearing:	Yes
Lubrication type*:	Food-compatible oil ISI VG 220
Lubrication supplier*:	Klüber
Lubrication classification*:	CLP PG H1 220
Lubrication quantity:	1,2 ltr
Surface color:	RAL 5010
Surface treatment:	Paint coat 3,0, 110-150 µm
Surface corrosion class:	EN 12944, C2
Labelling:	According to local legislation

*For more information and certificate see section 8.2.

Please contact Alfa Laval if a new gear motor is required. This is necessary to ensure compliance with local legislation requirements.

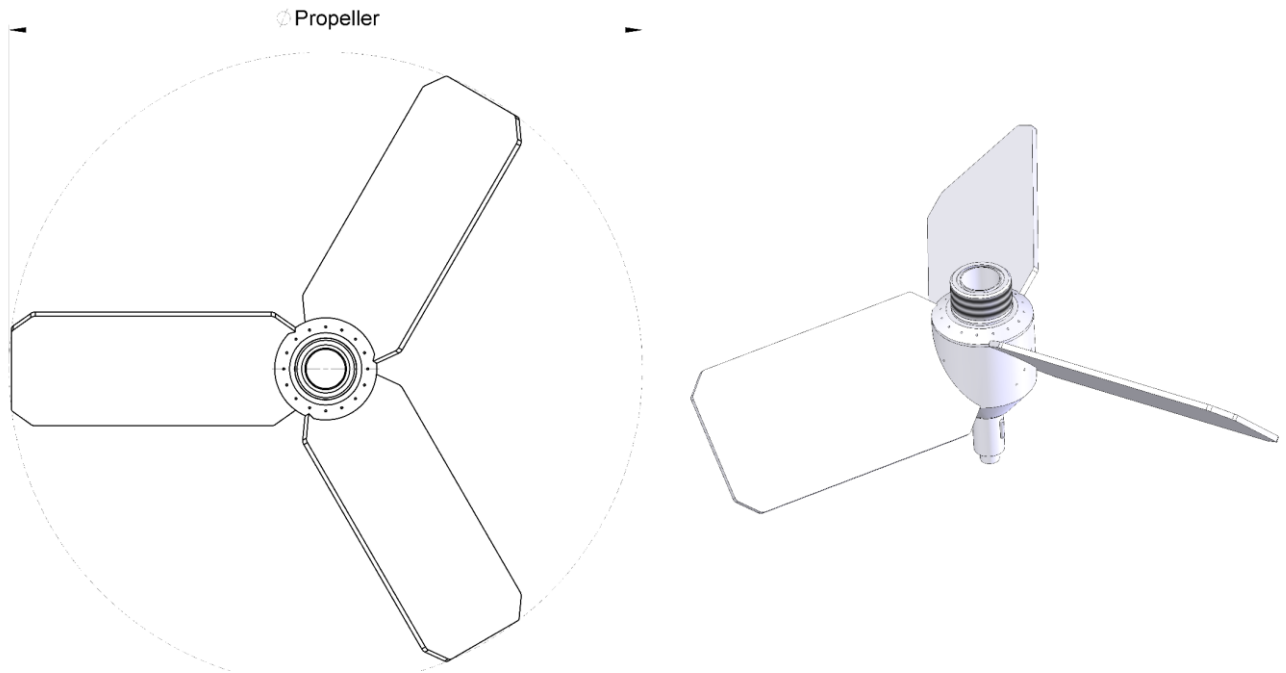
7 Parts list / Service kits

7.3.2 Propeller, Upper, Drawing (Item number 96143199xx, pos 2):



7.3.3 Propeller, Upper, Variants (item number 96143199xx, pos 2):

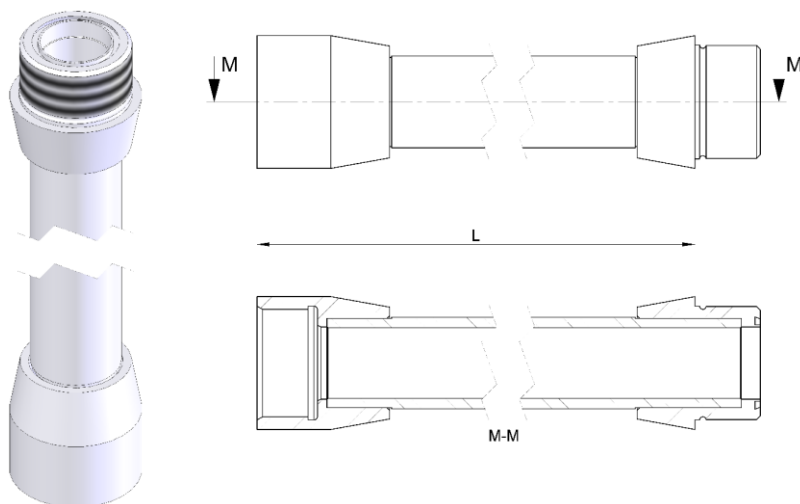
Item #	ØPropeller / [mm]
9614319901	614
9614319902	664
9614319903	713
9614319904	763
9614319905	813
9614319906	863
9614319907	912
9614319908	962
9614319909	1012
9614319910	1062
9614319911	1112
9614319912	564
9614319913	515
9614319914	466
9614319915	416
9614319916	367

7.3.4 Propeller, Lower, Drawing (item number 96143294xx, pos 3):**7.3.5 Propeller, Lower, Variants (item number 96143294xx, pos 3):**

Item #	ØPropeller / [mm]
9614329401	613
9614329402	663
9614329403	712
9614329404	762
9614329405	812
9614329406	862
9614329407	912
9614329408	962
9614329409	1011
9614329410	1061
9614329411	1111
9614329412	563
9614329413	514
9614329414	464
9614329415	415
9614329416	366

7 Parts list / Service kits

7.3.6 Agitator shaft, welded, Drawing (item number 96143204xx, pos 1):



7.3.7 Agitator shaft, welded, Variants (item number 96143204xx, pos 1):

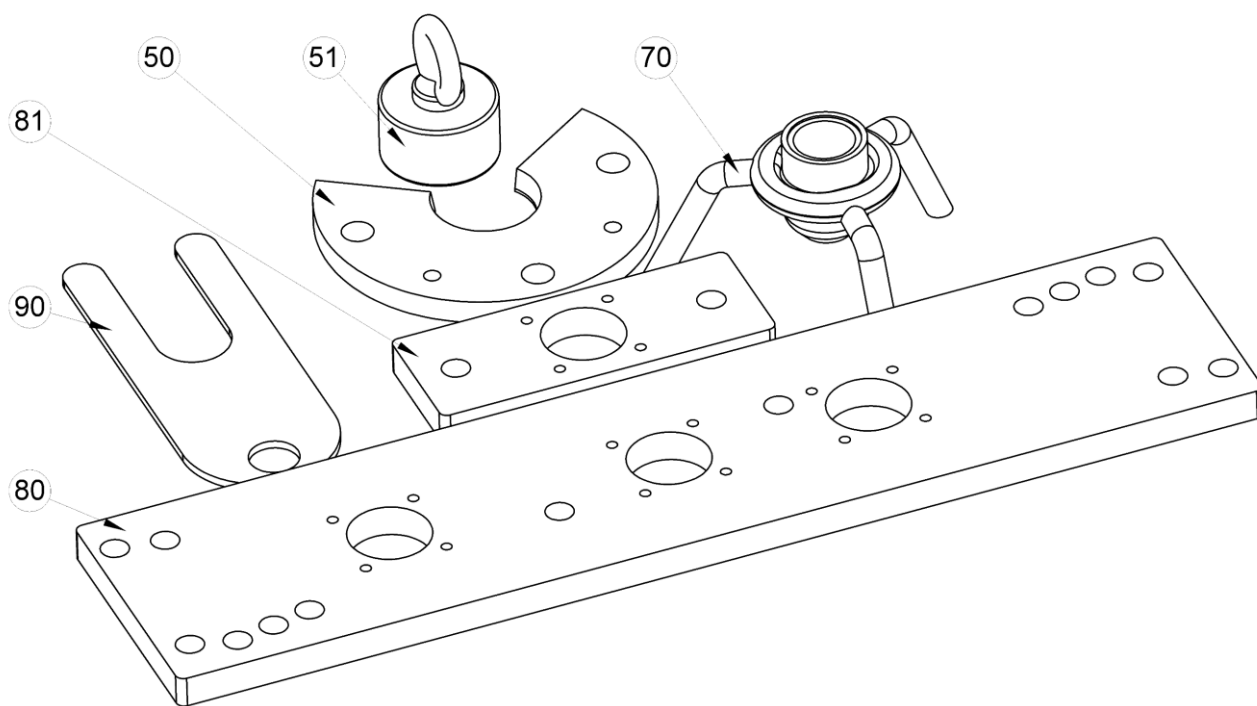
Item #	L / [mm]		Item #	L / [mm]
9614320401	800		9614320427	950
9614320402	900		9614320428	2700
9614320403	1000		9614320429	2800
9614320404	1100		9614320430	2900
9614320405	1200		9614320431	3000
9614320406	1300		9614320432	1050
9614320407	1400		9614320433	1150
9614320408	1500		9614320434	1250
9614320409	1600		9614320435	1350
9614320410	1700		9614320436	1450
9614320411	1800		9614320437	1550
9614320412	1900		9614320438	1650
9614320413	2000		9614320439	1750
9614320414	2100		9614320440	1850
9614320415	2200		9614320441	1950
9614320416	2300		9614320442	2050
9614320417	2400		9614320443	2150
9614320418	2500		9614320444	2250
9614320419	2600		9614320445	2350
9614320420	500		9614320446	2450
9614320421	550		9614320447	2550
9614320422	600		9614320448	2650
9614320423	650		9614320449	2750
9614320424	700		9614320450	2850
9614320425	750		9614320451	2950
9614320426	850		9614320452	3050

7.4 Accessories

7.4.1 Mounting Tool Kit, Drawing

The mounting tool can be used for easy installation of SB Agitator Type 35.

The tool pos. 70 has the geometry of the busing pos. 38 and the upper part of the bottom bearing stand pos. 29. It can be used to measure and determine the required length of the legs of the bottom bearing stand pos. 29 before it is installed and welded into the tank.

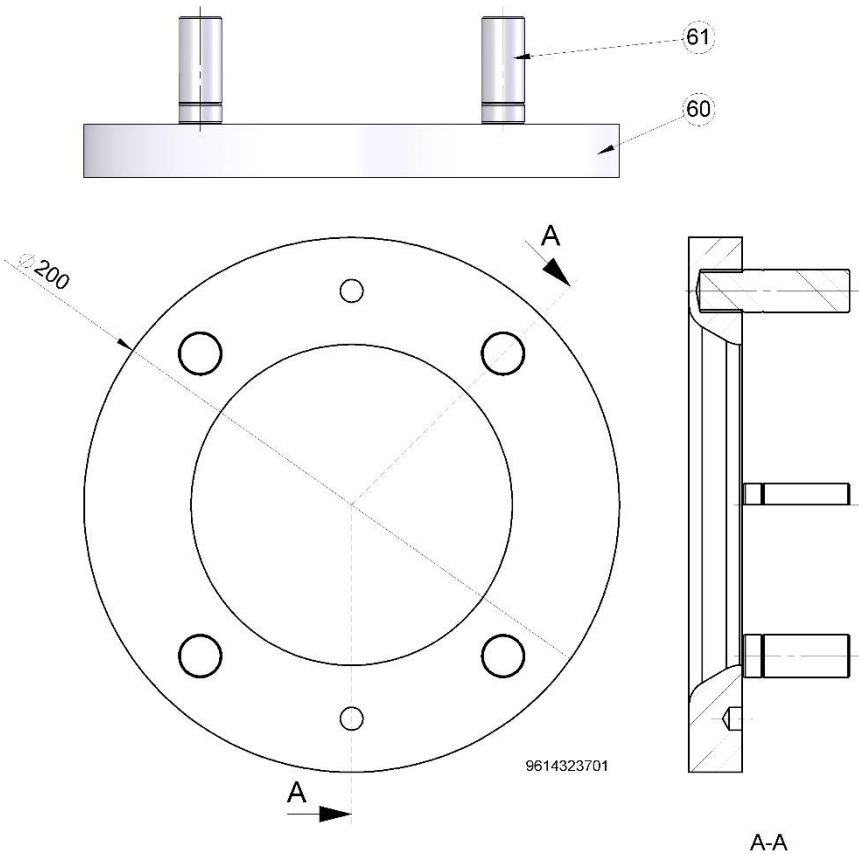


7.4.2 Mounting Tool Kit, Parts

The Mounting Tool Kit item number is 8010010030 and it include the following parts:

Pos	Qty	Item #	Denomination	Material
50	1	9614324501	Holding flange	Aluminium 6061 Alloy
51	1	9614324401	Lifting eye	1.4404 / A2
70	1	8010010035	Tool – Bottom Bearing Stand	PA12
80	1	9614312401	Guide Plate	Aluminium 6061 Alloy
81	1	9614312501	Guide Plate	Aluminium 6061 Alloy
90	1	8010010029	Holding Plate	1.4404

7.4.3
Welding Flange Kit, Drawing:



7.4.4
Welding Flange Kit, Part List:

The Welding Flange Kit item number is 9614323701 and it include the following parts:

Pos	Qty	Item #	Denomination	Material
60	1	9614323601	Welding Flange	1.4404
61	4	TE2601000672	Stud	A2

8 Appendix

8.1 Declaration of Compliance

Supplier

Alfa Laval Flow Equipment (Kunshan) Co Ltd
Baishu Road, Kunshan
Economic & Technical development Zone
Jiangsu - 215301 - P. R. China
Tel Switchboard: +86 512 577 145 04

Traceability

We as supplier hereby guarantee and certify that the materials and/or parts of equipment(s) stated in this manual have been manufactured in accordance to and comply with the Regulation (EC) No. 1935/2004 of the European Parliament and of the Council of 27 October 2004 on “Materials and articles intended to come into contact with food” regarding traceability.

Compliance for the U.S. Food & Drug Administration CFR 21 §177

We hereby confirm that the materials used in the equipment stated in this manual are suitable and licensed for FDA and can be used in food applications in accordance with FDA. Handling/assembly at Alfa Laval has not changed the material characteristics and parts have not been contaminated with unacceptable products. FDA Declarations from our suppliers can be forwarded upon request.

This Certified Mill Test Report is computer generated and is valid without signature

Michael Zhen, Quality Manager, Alfa Laval



Product information

Klübersynth UH1 6 oils

Synthetic gear and high-temperature oils for the food-processing and pharmaceutical industries

Benefits for your application

- The oils meet the requirements according to DIN 51 517 – 03, CLP
- Registered by NSF as H1 lubricants-for use in food-processing and pharmaceutical industries, complies with FDA 21 CFR Sec. 178.3570
- ISO 21469 certified – supports the compliance with the hygienic requirements in your production. You will find further information about ISO Standard 21469 on our website www.klueber.com.
- Much longer service life than mineral oils due to the excellent ageing and oxidation resistance of the base oil; thus maintenance intervals can be extended and in certain cases even lifetime lubrication is possible
- Owing to the wide service temperature range it is possible in many cases to use just one viscosity grade for both low and high temperatures
- The optimum friction behavior of the polyglycol base oil reduces power losses and improves efficiency
- The good wear protection of both gears and rolling bearings ensure that the service life calculated for the lubricated components is achieved.
- The oils' high micropitting resistance offers sufficient protection to gears that are subject to high loads and would normally be susceptible to this type of damage.
- The excellent viscosity-temperature behavior supports the formation of a sufficient lubricating film even at elevated and high temperatures.
- Seals made of 72 NBR 902, 75 FKM 585 and 75 FKM 170055 are resistant against Klübersynth UH1 6 oils.
- Approved by Flender, Siemens Geared Motors, SEW Eurodrive, Getriebbau Nord, Stöber Antriebstechnik, Lenze, ZAE Antriebstechnik Baldor, Boston Gear, Bonfiglioli, Watt Drive etc.

Description

Klübersynth UH1 6 oils are gear oils on a polyglycol basis. They have a high scuffing load capacity and micro-pitting resistance. These oils have also proved their good wear protection in rolling bearings on the FAG FE 8 test rig for gear oils.

Klübersynth UH1 6 oils stand out for their excellent ageing and oxidation resistance, good viscosity-temperature behaviour and very good thermal stability.

Application

Klübersynth UH1 6 oils are used for the lubrication of bevel and spur gears, rolling and plain bearings as well as all types of denture clutches, especially when exposed to high temperatures.

Klübersynth UH1 6 oils were especially developed for the lubrication of worm gears with steel/bronze pairings.

The polyglycol base oils and special additives reduce the friction coefficient and provide low wear values, which is a clear advantage in these applications.

Klübersynth UH1 6 100, 150, 220, 320, 460, 680, en
article number: 096094, 096050, 096059, 096063, 096060, 096064

Edition 12.09, replaces edition 07.09
MA-TMHSI



Product information



Klübersynth UH1 6 oils

Synthetic gear and high-temperature oils for the food-processing and pharmaceutical industries

Klübersynth UH1 6 oils achieve a particularly low wear intensity according to DIN 3996 (calculation of load capacity). Klübersynth UH1 6 oils can also be used for the lubrication of lifting, drive and transport chains.

Application notes

Klübersynth UH1 6 oils can be applied by immersion, immersion/circulation and injection.

Klübersynth UH1 6 oils are **not** miscible with mineral oils and synthetic hydrocarbons like polyalphaolefins.

Application notes

We recommend cleaning the lubrication points or rinsing gears with the Klübersynth UH1 6 oil which will be used after conversion.

Klübersynth UH1 6 oils are neutral towards ferrous metals and almost all nonferrous metals.

There may be increased wear when the contact surfaces of design elements made of aluminium or aluminium alloys are exposed to dynamic loads. If necessary, preliminary tests should be carried out.

For permanent temperatures up to 80°C seals made of 72 NBR 902 may be used. For higher temperatures, we recommend to use seals made of 75 FKM 585.

It should be noted that elastomers from one or several manufacturers can behave differently.

When applying Klübersynth UH1 6 oils we recommend the use of two-component paints (reaction paints) for interior coating. Oil gauge glasses should preferably be made of natural glass or polyamide materials. Other transparent plastics, e.g. Plexiglas, have a tendency to crack under stress.

The suitability of materials used in contact with Klübersynth UH1 6 oils should be tested, especially prior to series application.

Viscosity selection

When determining the oil viscosity for gears, the manufacturer's instructions take priority. Only in cases where there are no gear manufacturer's instructions, the viscosity can be selected in accordance with the enclosed worksheet "Klübersynth UH1 6 oils – selection of oil viscosity for gears".

To determine the correct oil viscosity for bearings, please observe the bearing manufacturer's instructions.

For determining the existing viscosity, please refer to the enclosed viscosity-temperature diagram indicating the differing viscosity-temperature behavior of Klübersynth UH1 6 oils as compared to mineral oils.

Minimum shelf life

The minimum shelf life is approx. 36 months if the product is stored in its unopened original container in a dry, frost-free place.

Pack sizes

20 l canister
200 l drum

Material Safety Data Sheets

Material safety data sheets can be downloaded or requested via our website www.klueber.com. You may also obtain them through your contact person at Klüber Lubrication.

Klübersynth UH1 6-100, 150, 220, 320, 460, 680, en
article number: 096094, 096058, 096059, 096063, 096060, 096064

Edition 12.09, replaces edition 07.09
MA-TM/HSI



Product information

Klübersynth UH1 6 oils

Synthetic gear and high-temperature oils for the food-processing and pharmaceutical industries

Product data

Klübersynth UH1 6- ...	100	150	220	320	460	680
Marking acc. to DIN 51502	CLP PG 100	CLP PG 150	CLP PG 220	CLP PG 320	CLP PG 460	CLP PG 680
Marking acc. to ISO 12925-1	CKC 100	CKC 150	CKC 220	CKC 320	CKC 460	CKC 680
NSF-H1 registration*, registration no.	137872	124437	124438	124439	124440	124441
ISO VG DIN 51 519	100	150	220	320	460	680
Density, DIN 51 757, at 15 °C, [kg/m³], approx.	1040	1050	1060	1065	1075	1075
Kinematic viscosity, DIN 51 562, pt. 01 at 20 °C, [mm²/s], approx.	250	390	610	840	1270	1900
at 40 °C, [mm²/s], approx.	100	150	220	320	460	680
at 100 °C, [mm²/s], approx.	19.5	28.5	41	56	78	115
Viscosity index, DIN ISO 2909, approx.	≥ 190	≥ 210	≥ 220	≥ 220	≥ 240	≥ 250
Flash point, DIN ISO 2592, [°C]	≥ 220	≥ 220	≥ 220	≥ 220	≥ 220	≥ 220
Pour point, DIN ISO 3016, [°C]	≤ -45	≤ -35	≤ -35	≤ -30	≤ -30	≤ -25
Foaming characteristics, ASTM D 892, sequence I, II, III [ml]	≤ 100/10					
Copper corrosion, DIN EN 2160, 24 h, corrosion rating	1 - 100					
Corrosion protection on steel, DIN ISO 7120	0 – A					
Ageing characteristics, ASTM D 2893, increase in viscosity, [%]	≤ 6					
FZG gear test rig, A/8.3/90 DIN 14635-1, scuffing load stage	≥ 12					
FZG gear test rig, A/16.9/90 DIN 14635-1, scuffing load stage	≥ 11	≥ 12				
Rolling bearing test rig FE 8, D 7,5/80-80, DIN 51 819-3, wear of rolling elements, [mg]	≤ 30					
Lower service temperature range**, [°C]	-35		-30			-25
Upper service temperature range**, [°C]	160					

* This lubricant is registered as H1, which means that it has been designed for incidental, technically unavoidable food contact. Experience shows that it can be used for equivalent applications in the cosmetic and pharmaceutical industry under the conditions described in the product information leaflet. Specific test results as e.g. biocompatibility, which could be an additional requirement for applications in the pharmaceutical industry, are not available for this product. Therefore, before using the lubricant adequate risk analyses should be performed and, if necessary, suitable measures be taken by the manufacturer and user of installations in order to exclude the risk of health hazards and personal injuries.

** Service temperatures are guide values which depend on the lubricant's composition, the intended use and the application method. Lubricants change their consistency, shear viscosity or viscosity depending on the mechano-dynamical loads, time, pressure and temperature. These changes in product characteristics may affect the function of a component.

Klübersynth UH1 6-100, 150, 220, 320, 460, 680, en
article number: 096094, 096058, 096059, 096063, 096060, 096064

Edition 12.09, replaces edition 07.09
MA-TM/HSI

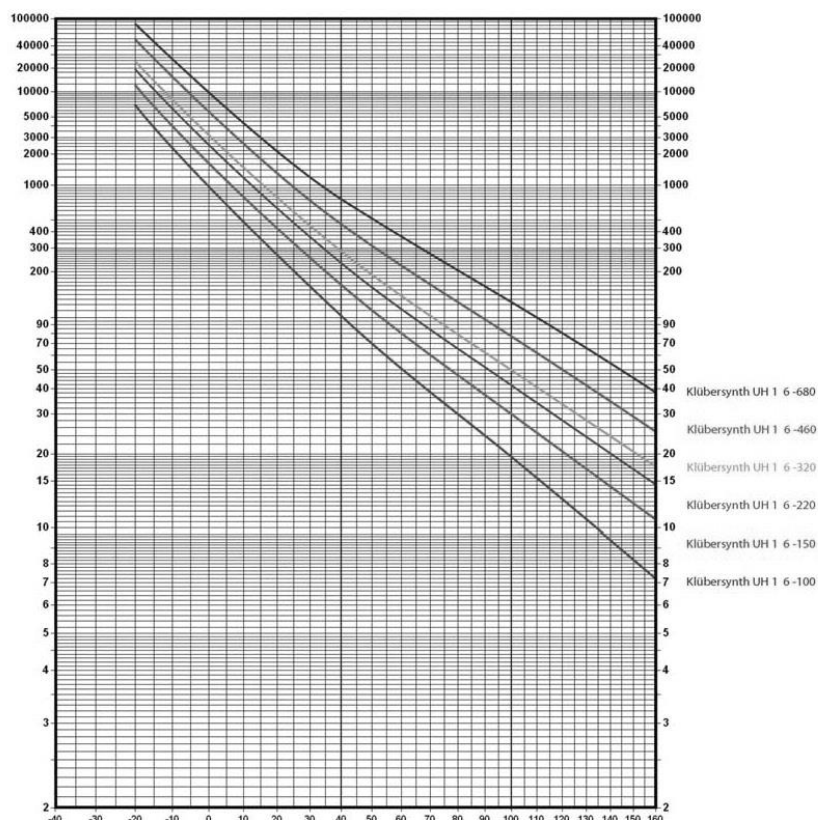


Product information

Klübersynth UH1 6 oils

Synthetic gear and high-temperature oils for the food-processing and pharmaceutical industries

Viscosity-Temperature Diagram



Lubrication is our world

With more than 2000 products available around the world, you can be sure that Klüber has the right product for your application. Please contact Klüber Lubrication specialists worldwide to assist you in all matters regarding lubrication.

www.klueber.com

Klüber Lubrication München KG, Geisenhausenerstraße 7, 81379 München, Germany, phone +49 89 7876-0, fax +49 89 7876-333.

The data in this product information is based on our general experience and knowledge at the time of printing and is intended to give information of possible applications to a reader with technical experience. It constitutes neither an assurance of product properties nor does it release the user from the obligation of performing preliminary tests with the selected product. We recommend contacting our Technical Consulting Staff to discuss your specific application. If required and possible we will be pleased to provide a sample for testing. Klüber products are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this product information at any time without notice.



Klüber Lubrication, a company of the Freudenberg Group

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NSF International / Nonfood Compounds Registration Program

Nonfood Compounds
Program Listed

July 28, 2008

Dr. Luciana Husfeld
KLUBER LUBRICATION MUNCHEN KG.
GEISENHAUSENER STR. 7
81379 MÜNCHEN
GERMANY

RE: Klübersynth UH1 6-220
Category Code: H1
NSF Registration No. 124438

Dear Dr. Luciana Husfeld:

NSF has processed the application for Registration of **Klübersynth UH1 6-220** to the NSF International Registration Guidelines for Proprietary Substances and Nonfood Compounds (2008), which are available at www.nsfwhitebook.org. The NSF Nonfood Compounds Registration Program is a continuation of the USDA product approval and listing program, which is based on meeting regulatory requirements including FDA 21 CFR for appropriate use, ingredient and labeling review.

This product is acceptable as a lubricant with incidental food contact (H1) for use in and around food processing areas. Such compounds may be used on food processing equipment as a protective anti-rust film, as a release agent on gaskets or seals of tank closures, and as a lubricant for machine parts and equipment in locations in which there is a potential exposure of the lubricated part to food. The amount used should be the minimum required to accomplish the desired technical effect on the equipment. If used as an anti-rust film, the compound must be removed from the equipment surface by washing or wiping, as required to leave the surface effectively free of any substance which could be transferred to food being processed.

NSF Registration of this product is current when the NSF Registration Number, Category Code, and Registration Mark appear on the NSF-approved product label, and the Registered product name is included in the current NSF White Book Listing of Nonfood Compounds at the NSF website (www.nsfwhitebook.org). The NSF Registration Mark can be downloaded by clicking the "Download Registration Mark" link on the NSF website (www.nsfwhitebook.org).

NSF Listing of all Registered Nonfood compounds by NSF International is not an endorsement of those compounds, or of any performance or efficacy claims made by the manufacturer.

Registration status may be verified at any time via the NSF website, at www.nsfwhitebook.org. Changes in formulation or label, without the prior written consent of NSF, will void Registration, and will supersede the on-line listing.

Sincerely,

A handwritten signature in black ink, appearing to read "Jennifer De France".

Jennifer De France
NSF Nonfood Compounds Registration Program

Company No: N04391

Intelligent Drivesystems, Worldwide Services



B1000

Operating and Assembly Instructions for
Gear Units and Geared Motors





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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. 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 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.

CAUTION! Depending on the operating conditions, the temperature of the gear unit may exceed 60°C. Danger of burns! Protection against accidental contact may need to be installed.

Tighten the drive elements or secure the parallel key before switching on.

Danger!

Only use the eyebolts attached to the gear unit for transport. 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
- 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. Description of gear units

2.1 Type designations and gear unit types

Versions / Options	
-	Foot mounting with solid shaft
A	Hollow shaft version
V	Solid shaft version
L	Solid shaft both sides
Z	Drive shaft B14
F	Output flange B5
X	Foot mounting
XZ	Base and output flange B14
AL	Base and output flange B5
XF	Reinforced axial drive bearings
5	Reinforced output shaft
	(Standard helical gear unit)
V	Reinforced drive shaft
D	Torque support
K	Torque console
S	Shrink disc
VS	Reinforced shrink disc
EA	Hollow shaft with internal spline
G	Roller buffer
VG	Reinforced rubber buffer
R	Back stop
B	Fixing element
H6	Covering cap as contact guard
H6H	Covering cap IP66
VL	Reinforced bearings
VL2	Agitator design
VL3	Drywell agitator design
IEC	Standard motor mounting
NEA	Standard motor mounting
W	With free drive shaft
VA	Viton radial seals
OI	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 contact pre-stage
/31	Warm pre-stage
/40	Warm pre-stage

Helical gear units	
SK 11E, SK 21E, SK 31E, SK 41E, SK 51E (single-stage)	
SK 002, SK 12, SK 22, SK 32, SK 42, SK 52, SK 62N (2-stage)	
SK 03, SK 13, SK 23N, 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)	

NORDLOK helical gear units	
SK 320, SK 72, SK 172, SK 372, 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)	

Standard helical gear units	
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)	

Parallel shaft gear units	
SK 0182NB, SK 0282NB, SK 7282, 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)	

Bevel gear units	
SK 90072, SK 92172, SK 92372, SK 92672, SK 92772, SK 93072, SK 93272.1, SK 93272.2, SK 92672.1, SK 93072.1, SK 93172.1, SK 93372.1, SK 93672.1, SK 93772.1 (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)	

Constrate worm gear unit	
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)	

MINILOK worm gear units	
SK 1 S32, SK 1 S40, SK 1 S50, SK 1 S63, SK 1 S80, SK 1 S100, SK 1 S150, SK 1 S200, SK 1 S250, SK 1 S315, SK 1 S400, SK 1 S500, SK 1 S630 (single-stage)	
SK 2 S32NB, SK 2 S50NB, SK 2 S63NB, SK 2 S100NB, SK 2 S150NB, SK 2 S200NB, SK 2 S250NB, SK 2 S315NB, SK 2 S400NB, SK 2 S500NB, SK 2 S630NB (2-stage)	

UNIVERSAL worm gear units	
SK 1S131, SK 1S140, SK 1S150, SK 1S163, SK 1S175, SK 1S187, SK 1S196, SK 1S208, SK 1S224, SK 1S250, SK 1S280, SK 1S315, SK 1S355, SK 1S400, SK 1S450, SK 1S500, SK 1S560, SK 1S630, SK 1S710, SK 1S750, SK 1S800, SK 1S850, SK 1S900, SK 1S950, SK 1S1000, SK 1S1060, SK 1S1120, SK 1S1180, SK 1S1250, SK 1S1315, SK 1S1380, SK 1S1450, SK 1S1515, SK 1S1580, SK 1S1645, SK 1S1710, SK 1S1775, SK 1S1840, SK 1S1905, SK 1S1970, SK 1S2035, SK 1S2100, SK 1S2165, SK 1S2230, SK 1S2295, SK 1S2360, SK 1S2425, SK 1S2490, SK 1S2555, SK 1S2620, SK 1S2685, SK 1S2750, SK 1S2815, SK 1S2880, SK 1S2945, SK 1S3010, SK 1S3075, SK 1S3140, SK 1S3205, SK 1S3270, SK 1S3335, SK 1S3400, SK 1S3465, SK 1S3530, SK 1S3595, SK 1S3660, SK 1S3725, SK 1S3790, SK 1S3855, SK 1S3920, SK 1S3985, SK 1S4050, SK 1S4115, SK 1S4180, SK 1S4245, SK 1S4310, SK 1S4375, SK 1S4440, SK 1S4505, SK 1S4570, SK 1S4635, SK 1S4700, SK 1S4765, SK 1S4830, SK 1S4895, SK 1S4960, SK 1S5025, SK 1S5090, SK 1S5155, SK 1S5220, SK 1S5285, SK 1S5350, SK 1S5415, SK 1S5480, SK 1S5545, SK 1S5610, SK 1S5675, SK 1S5740, SK 1S5805, SK 1S5870, SK 1S5935, SK 1S6000, SK 1S6065, SK 1S6130, SK 1S6195, SK 1S6260, SK 1S6325, SK 1S6390, SK 1S6455, SK 1S6520, SK 1S6585, SK 1S6650, SK 1S6715, SK 1S6780, SK 1S6845, SK 1S6910, SK 1S6975, SK 1S7040, SK 1S7105, SK 1S7170, SK 1S7235, SK 1S7300, SK 1S7365, SK 1S7430, SK 1S7495, SK 1S7560, SK 1S7625, SK 1S7690, SK 1S7755, SK 1S7820, SK 1S78	




2. Description of Gear Units

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)

2.2 Name plate





NORD DRIVESYSTEMS

Getriebelab NORD GmbH & Co. KG
D-22941 Bergshelde/Hamburg

Typ SK 9282ASH – IEC280 – 280S/4

2 2 S1 3 2010 4

No. 200537905 – 100 12596508 5

M2	12971	Nm	6	1	26,89	9	M3	10
P1	75	W	7	n2	52	11	min ⁻¹	
	12771	kg	8	CLP PG 220 / 55L	12			
			13	1:3	14			

1234567890

www.nord.com

Figure 2-1: Name plate (example)

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

3. Assembly instructions, storage, preparation, installation

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 +50 °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 °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 Getriebebau NORD and take the recommended action.

Oil expansion tanks (Option OA) must be fitted in accordance with 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 OT) must be fitted in accordance with 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.

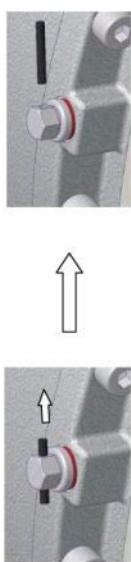


Figure 3-1: Activating the vent plug

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.

The gear unit must be installed in the correct configuration (see Section 6.1) (UNIVERSAL gear unit types SI and SMI 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:

- 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.

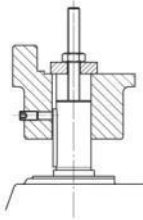



Figure 3-3: Example of a simple pulling device



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. Assembly instructions, storage, preparation, installation

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 (e.g. Nord Anti-Corrosion Art.No. 089 00099). Excess grease or anti-corrosion agent may escape after assembly and may drip off. Clean these points on the output shaft after a running-in time of approx. 24 hours. This escape of grease is not due to a leak in the gear unit.

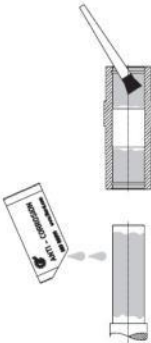


Figure 3-4: Applying lubricant to the shaft and the hub



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

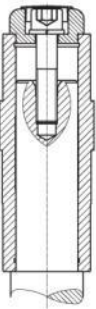


Figure 3-6: Gear unit mounted to shaft with a shoulder using the fastening element

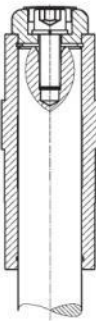


Figure 3-7: Gear unit mounted to shaft without a shoulder using the fastening element

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

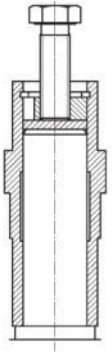


Figure 3-8: Dismantling using dismantling device

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).

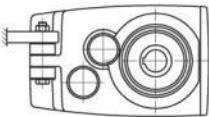


Figure 3-9: Mounting the rubber buffer (Option G and/or VG) on parallel shaft gear units

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.



3. Assembly instructions, storage, preparation, installation

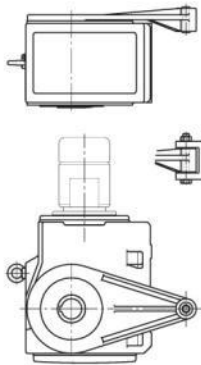


Figure 3-10: Attaching the torque support on bevel gear and worm gear units

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, Loctite 54-03).

3.8 Fitting shrink discs

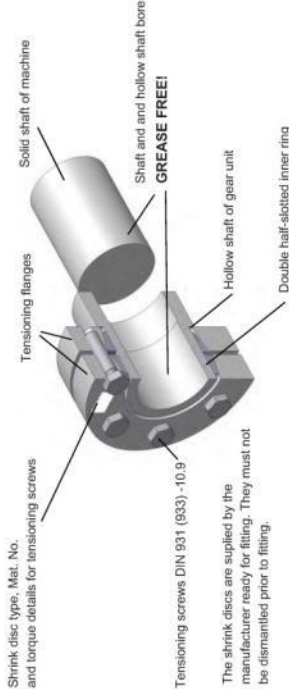


Figure 3-11: Hollow shaft with shrink disc



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. ¼ 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. ¼ 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 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) For covers with option H66, press in the new / new condition closing cap by tapping it lightly with a hammer.

3. Assembly instructions, storage, preparation, installation

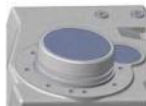


Figure 3-12: Fitting the covers, Option SH, Option H, and Option H66

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 90, 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. If the coupling half contains a threaded pin, the coupling must be secured axially on the shaft. The threaded pin must be coated prior to use with a securing lubricant e.g. Loctite 242, Loctexal 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 Loctexal 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

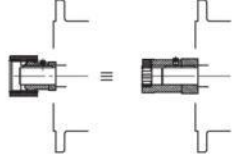
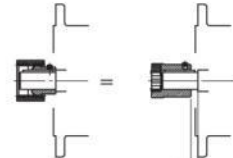
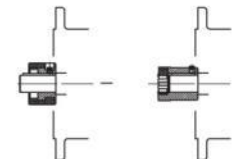


Figure 3-13: Fitting the coupling onto the motor shaft - various types of coupling

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

Standard helical gear unit:	SK0, SK01, SK20, SK25, SK30, SK33 (2-stage) SK10, SK200, SK250, SK300, SK330 (3-stage)	
	IEC size 63	IEC size 71
Dimension B (Fig. 3-13V)	B = 4,5 mm	B = 11,5 mm

3.11 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. Assembly instructions, storage, preparation, installation



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

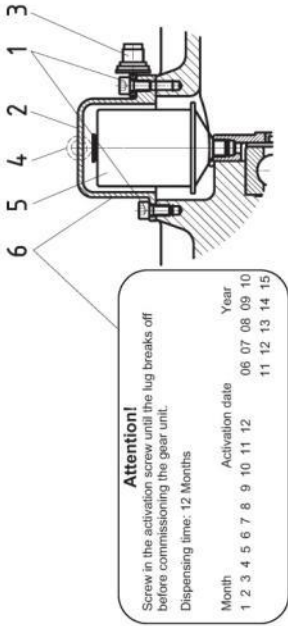


Figure 4-1: Activating the automatic lubricant dispenser with standard motor mounting



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 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:	
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
Every 25000 operating hours, at least every 5 years	<ul style="list-style-type: none"> - Replace shaft sealing rings if worn - Re-lubrication of the bearings in the gear unit 	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!

Shaft sealing rings are rubbing seals and have sealing lips made from an elastomer material. These sealing lips are lubricated with a special grease at the factory. This reduces the wear due to their function and ensures a long service life. An oil film in the region of the rubbing sealing lip is therefore normal and is not due to leakage.



5. Service and Maintenance



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)

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



5. Service and Maintenance



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: Pelamo 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, Loctite 54-03 prior to inserting. Check the sealing ring for damage. Replace with a new sealing ring in case of damage.
- 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 G1 1/4) 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.



5. Service and Maintenance



Cleaning or replacing the vent plug

Unscrew the vent screw and thoroughly clean it (e.g. with compressed air) and fit the vent screw in the same place. If necessary, use a new vent screw with a new sealing ring.

Replacing the shaft sealing ring

Shaft sealing rings are rubbing seals made from an elastomer material and according to their principle are subject to natural wear. The wearing life of shaft sealing rings depends on many factors and cannot be calculated in advance. Once the shaft sealing ring has reached the end of its service life, the oil film in the region of the sealing lip increases and a measurable leakage with dripping oil occurs. **The shaft sealing ring must then be replaced.** To reduce the risk of leaks due to worn shaft sealing rings we recommend that as a precaution, the shaft sealing rings are replaced after every 25,000 operating hours or every 5 years. The space between the sealing lip and the protective lip must be filled approximately 50% with grease on fitting (recommended grease: PETAMO GHY 133N). Take care that after fitting, the new shaft sealing ring does not run in the old wear track.

Re-lubricating bearings

For bearings which are not oil-lubricated and whose holes are completely above the oil level, replace the roller bearing grease (recommended grease: PETAMO GHY 133N). Please contact the NORD service department.

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:

- Vent
- Oil level
- Oil drain



Note!

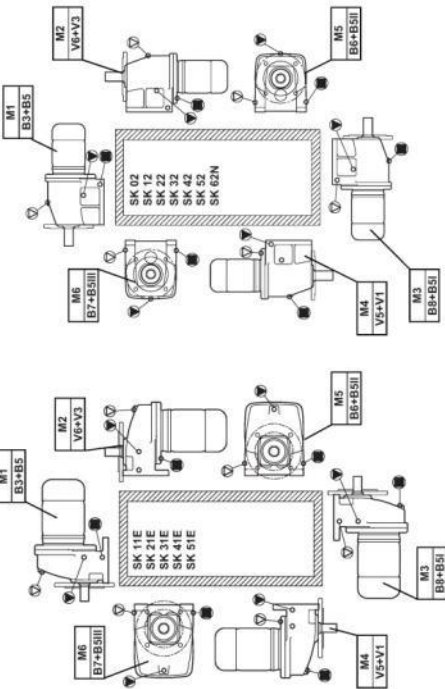
SK 320, SK 172, SK 272, SK 372K, SK 273 and SK373 as well as SK 01282 NB, SK 0282 NB, SK 1382 NB and UNIVERSAL / Minibloc gear units are lubricated for life. These gear units do not have an oil filler screw.

UNIVERSAL / MiniBloc worm gear units

NORD UNIVERSAL / MiniBloc worm gear units are suitable for all installation positions. They have an oil filler which is independent of the version.

As an option, types SI and SMI can be equipped with a vent screw. Gear units with vents must be installed in the stated position (see section 6.5)

Types SI, SMI, S, SM and SU as 2-stage gear unit types and types SI, SMI as worm gear units for direct motor mounting have an oil filler which depends on the version and must be installed in the stated position.



6. Appendix

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:

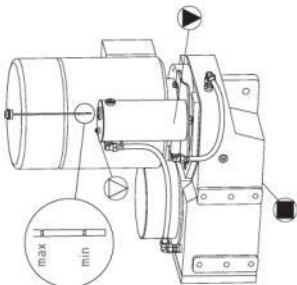
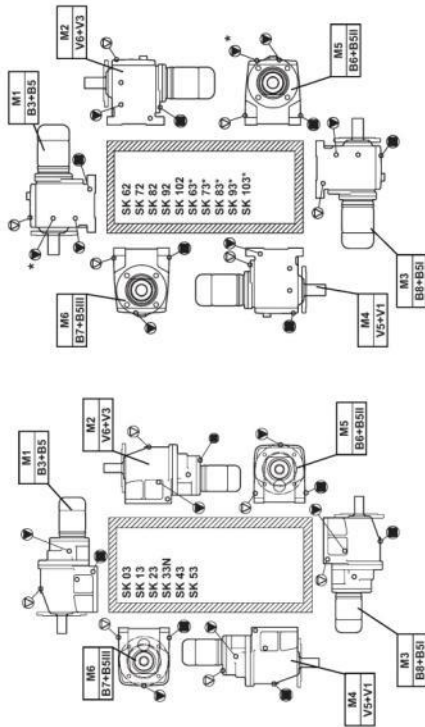
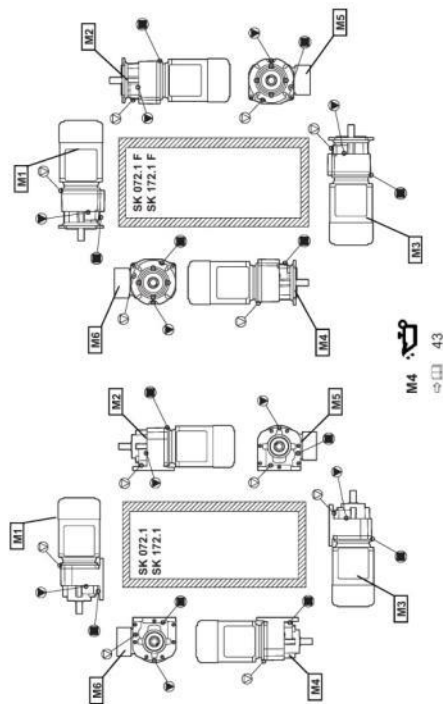
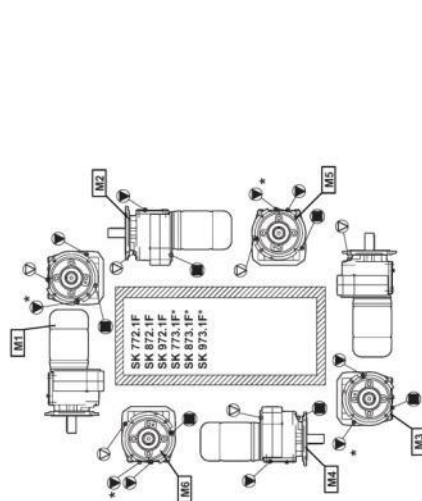
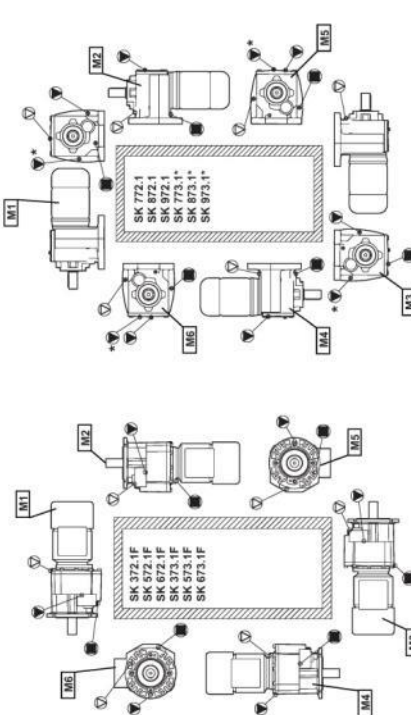
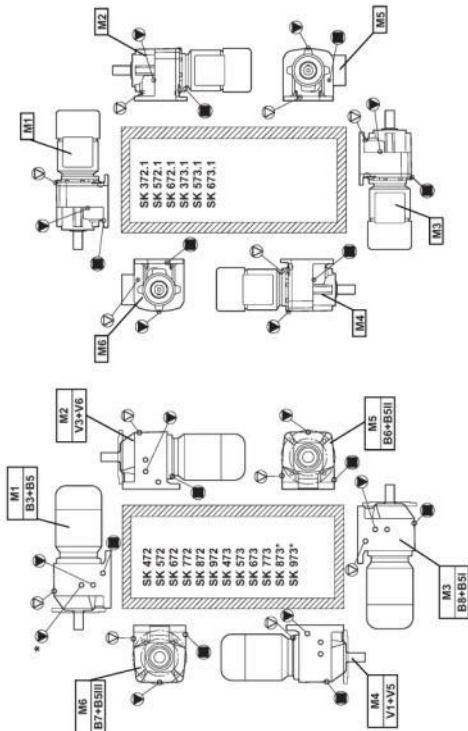


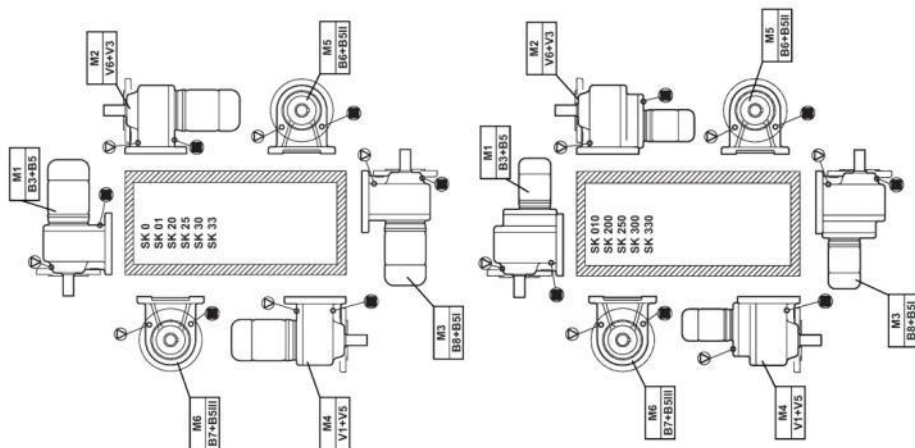
Figure 6-1: Oil level check with oil level tank



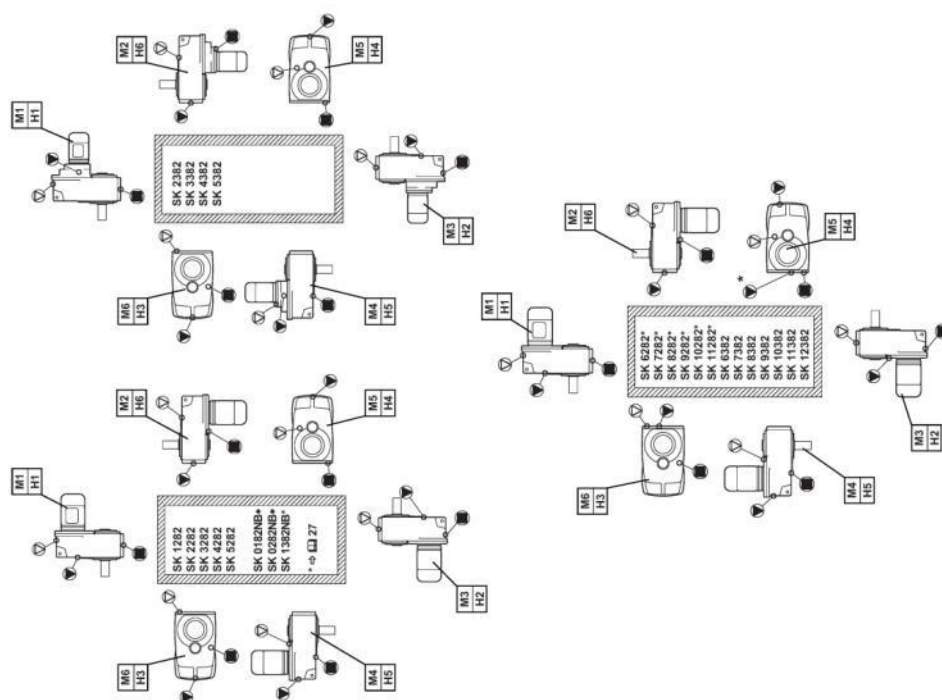


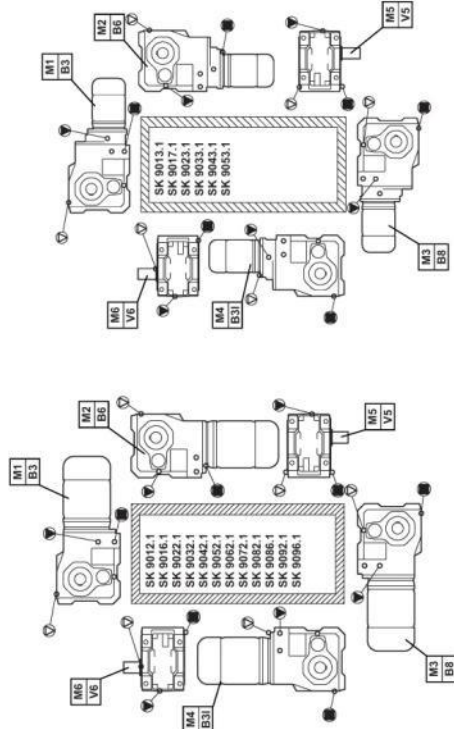
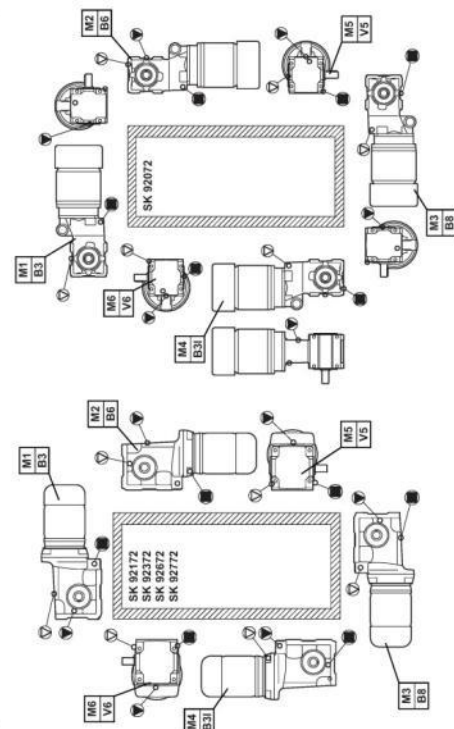
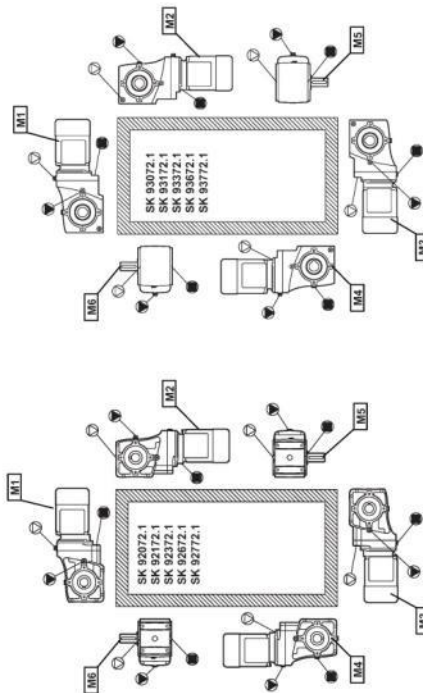
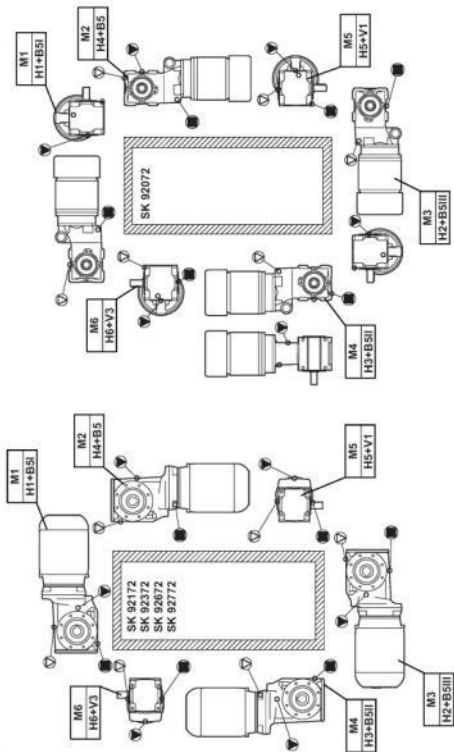
M4
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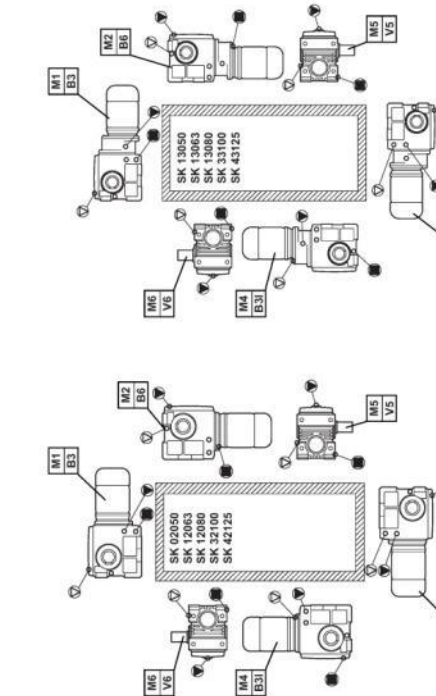
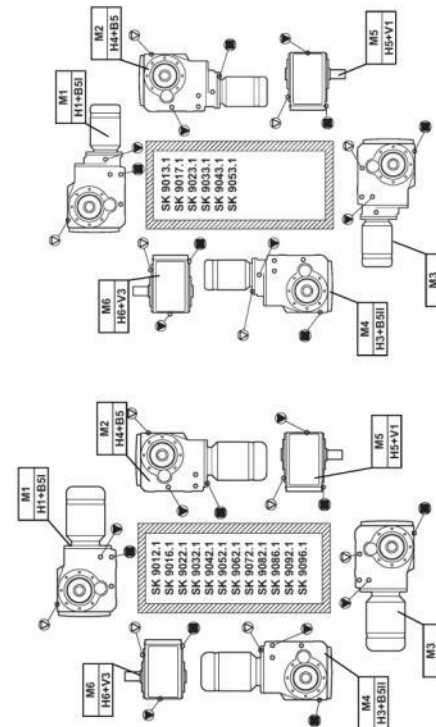
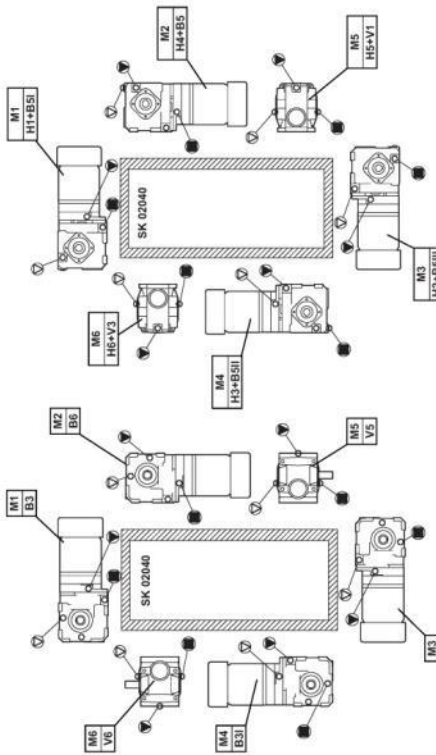
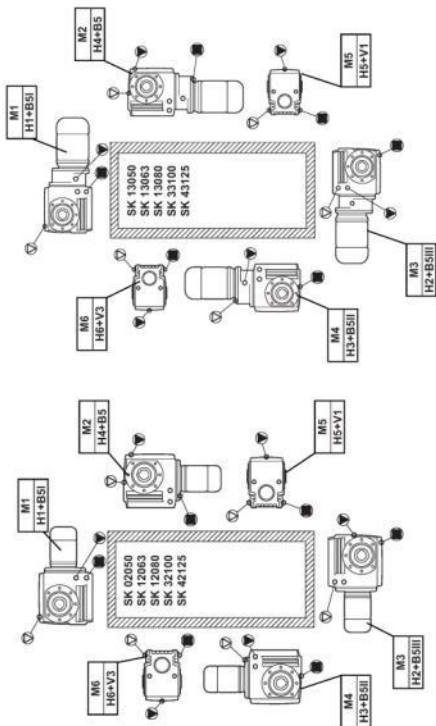




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6. Appendix

6.2 Torque values

Size	Bolt Torques [Nm]					
	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	11	10	11
M10	53	78	91	11	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	-	-	-
G1¼	-	-	-	20	-	-

6.3 Troubleshooting

Fault	Gear unit malfunctions	
	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

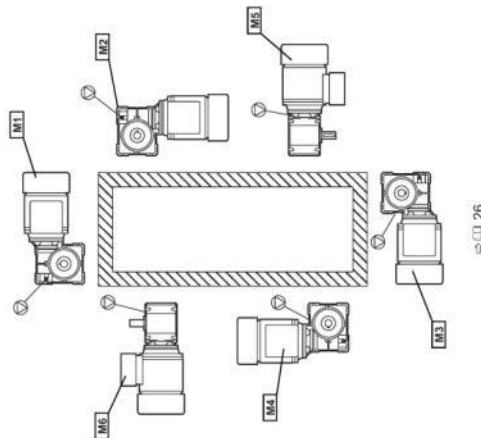


Attention!

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



SK 1S32 – SK 1S63
SK 1SU32 – SK 1SU63
SK 1SM31 – SK 1SM63
SK 1S131 – SK 1S175
SK 1SIS31 – SK 1SIS75
SK 1SMI31 – SK 1SMI75
SK 1SID31 – SK 1SID75
SK 1SIS-D31 – SK 1SIS-D63
SK 1SMID31 – SK 1SMID75
SK 2S32NB – SK 2S63NB
SK 2SU32NB – SK 2SU63NB
SK 2SM40 – SK 2SM63
SK 2SIS-D40 – SK 2SIS-D63
SK 2SMID40 – SK 2SMID63





6. Appendix

6.4 Lubricants

With the exception of type SK 11282, SK 11382, SK 12382 and SK 9096, 1 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	Castrol	Fuchs	Klubers	Mobil	Shell
Mineral oil-based grease	-30 ... 60°C	Longtime PD 2	RENOLIT GP 2	-	Mobilur EP 2	Gadus S2 V100 2
		Energygrease LS 2	RENOLIT LZR 2 H	-	-	-
	-50 ... -40°C	Energygrease LS-EP 2	Optikemp LG 2	RENOLIT JP 1619	-	-
Synthetic grease	-25 ... 80°C	Energygrease SY 2200	Triol 4747	RENOLIT PL 1 2	Mochemp SHC 32	Casida EP 32
		Energygrease LS-EP 2	-	RENOLIT LST 2	Mochemp SHC 102	Naturelle Grease EP2
Biodegradable grease	-25 ... -40°C	Biogrease EP 2	-	PLANTOGEL 2 S	Mochemp SHC 102	Naturelle Grease EP2
Foodstuff, food-grade grease	-25 ... -40°C	-	Oben UP 2	RENOLIT ST FG 1	Mochemp SHC 102	Casida RL S2



6. Appendix

Lubricant table

This table shows comparable lubricants from various manufacturers. The manufacturer can be changed within a particular viscosity or lubricant type. Getriebebau 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	Castrol	Fuchs	Klubers	Mobil	Shell
Mineral oil	CLP 680	ISO VG 680 0 ... 40°C	Alpha EP 680 GR-XF 680 Optigear BM 680	RENOLIN CLP 680 Plus	Klubersynth GEM 1-680 N	Mobilgear 680 XP 680	Omala S2 G 680
	CLP 220	ISO VG 220 -10 ... 40°C	Alpha EP 220 GR-XF 220 Optigear BM 220	RENOLIN CLP 220 Plus	Klubersynth GEM 1-220 N	Mobilgear 220 XP 220	Omala S2 G 220
	CLP 100	ISO VG 100 -15 ... 25°C	Alpha EP 100 GR-XF 100 Optigear BM 100	RENOLIN CLP 100 Plus	Klubersynth GEM 1-100 N	Mobilgear 100 XP 100	Omala S2 G 100
Synthetic oil (Polyglycol)	CLP PG 680	ISO VG 680 -20 ... 40°C	Alpha EP 680 GR-XF 680 Optigear BM 680	RENOLIN PG 680	Klubersynth GH 6-680	Mobilgear 680 WE 680	Omala S4 WE 680
	CLP PG 220	ISO VG 220 -25 ... 80°C	Alpha EP 220 GR-XF 220 Optigear BM 220	RENOLIN PG 220	Klubersynth GH 6-220	Mobilgear 220 WE 220	Omala S4 WE 220
Synthetic oil (Hydrocarbon)	CLP HC 460	ISO VG 460 -30 ... 80°C	Alpha EP 460 GR-XF 460 Optigear BM 460	RENOLIN HC 460	Klubersynth GEM 4-460 N	Mobilgear 460 SHC 460	Omala S4 GX 460
	CLP HC 220	ISO VG 220 -40 ... 80°C	Alpha EP 220 GR-XF 220 Optigear BM 220	RENOLIN HC 220	Klubersynth GEM 4-220 N	Mobilgear 220 SHC 220	Omala S4 GX 220
Bio-degradable oil	CLP E 680	ISO VG 680 -5 ... 40°C	Alpha EP 680 GR-XF 680 Optigear BM 680	PLANTOGEL 680 S	-	-	-
	CLP E 220	ISO VG 220 -5 ... 40°C	Alpha EP 220 GR-XF 220 Optigear BM 220	PLANTOGEL 220 S	-	-	-
Food grade oil	CLP PG H1 680	ISO VG 680 -5 ... 40°C	Alpha EP 680 GR-XF 680 Optigear BM 680	GERALYN SF 680	Klubersynth UH 1-680 N	Mobilgear 680 Glypsyle 680	Casida Fluid WG 680
	CLP PG H1 220	ISO VG 220 -5 ... 40°C	Alpha EP 220 GR-XF 220 Optigear BM 220	GERALYN SF 220	Klubersynth UH 1-220 N	Mobilgear 220 Glypsyle 220	Casida Fluid WG 220
	CLP HC H1 680	ISO VG 680 -5 ... 40°C	Alpha EP 680 GR-XF 680 Optigear BM 680	GERALYN SF 680	Klubersynth UH 1-680 N	Mobilgear 680 Glypsyle 680	Casida Fluid WG 680
	CLP HC H1 220	ISO VG 220 -5 ... 40°C	Alpha EP 220 GR-XF 220 Optigear BM 220	GERALYN SF 220	Klubersynth UH 1-220 N	Mobilgear 220 Glypsyle 220	Casida Fluid WG 220
Gear unit liquid grease		-25 ... 80°C	Energygrease LS-EP 00	RENOLIT DURAPLEX EP 00	Klubersynth GB 00	Mobilgear 00 Grease LBZ	Omala S4 EP 00



6. Appendix



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.

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.

* Type SK11282, SK11382, SK12382 and SK 9096.1 gear units are normally supplied without oil.

	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7	B5	V3	B51	V1	B511	B511
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	1,40	1,10	0,70	0,90	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	1,00	2,60	2,80	1,60	3,30	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
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7	B5	V3	B51	V1	B511	B511
SK12	0,15	0,60	0,70	0,60	0,40	0,40	0,25	0,60	0,60	0,60	0,50	0,50
SK22	0,25	0,75	0,85	0,75	0,50	0,50	0,35	0,85	0,90	0,90	0,60	0,60
SK32	0,50	1,60	1,80	1,60	1,35	1,35	0,70	2,00	2,00	1,60	1,55	1,55
SK42	0,90	2,50	2,50	2,90	2,00	2,00	1,30	2,90	3,30	3,10	2,40	2,40
SK52	1,30	4,50	4,50	4,30	3,20	3,20	1,80	4,40	4,50	4,00	3,70	3,70
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7	B5	V3	B51	V1	B511	B511
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	75,00	66,00	102,00	71,00	71,00	40,00	81,00	66,00	104,00	72,00	72,00
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7	B5	V3	B51	V1	B511	B511
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
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
	B3	V6	B8	V5	B6	B7	B5	V3	B51	V1	B511	B511
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	76,00	99,00	67,00	67,00

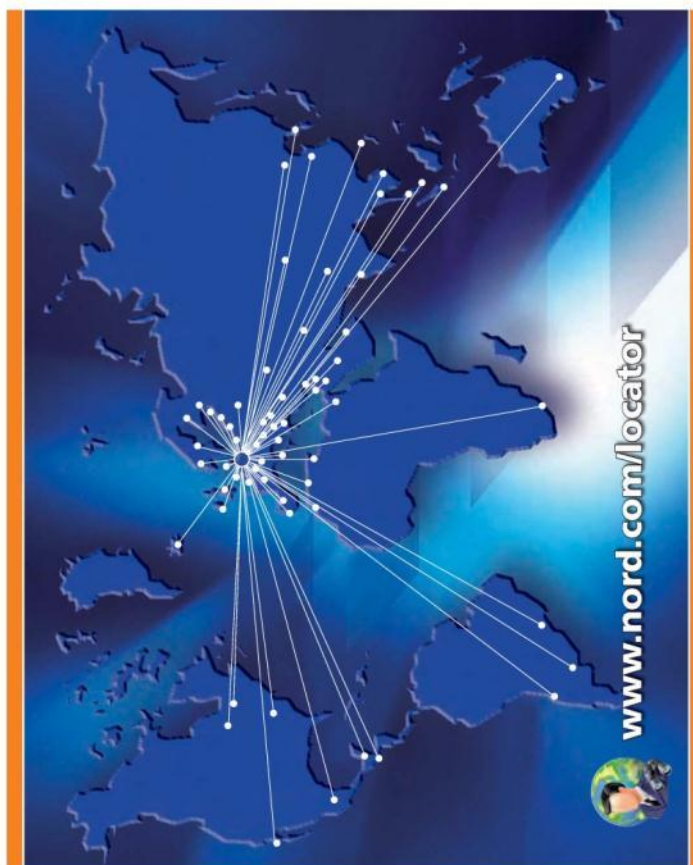


																																																
	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6																		
SK772	0,35	0,50	0,50	0,50	0,50	0,50	0,35	0,50	0,50	0,50	0,50	0,35	0,50	0,50	0,50	0,50	0,50	0,50	0,35	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50																		
SK772	0,60	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00	1,00	0,60	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00																		
SK772	1,00	1,90	1,90	2,00	1,80	1,80	1,00	1,90	1,90	2,00	1,80	1,00	1,90	1,90	2,00	1,80	1,90	1,90	1,00	1,90	1,90	2,00	1,80	1,00	1,90	1,90	2,00	1,80	1,90	1,50																		
SK772	1,40	3,40	3,10	3,15	1,45	3,15	1,15	3,40	3,10	3,15	1,45	1,15	3,40	3,10	3,15	1,45	2,70	2,80	1,15	3,40	3,10	3,15	1,45	2,70	2,80	1,15	3,40	3,10	3,15	2,70																		
SK772	2,00	3,30	3,50	4,20	2,70	3,30	1,60	3,30	3,50	4,20	2,70	1,60	3,30	3,50	4,20	2,70	3,90	3,30	1,60	3,30	3,50	4,20	2,70	1,60	3,30	3,50	4,20	2,70	3,90	3,10																		
SK772	3,70	9,60	9,10	7,30	4,70	8,00	3,50	9,60	9,10	7,30	4,70	3,50	9,60	9,10	7,30	4,70	7,90	7,70	3,50	9,60	9,10	7,30	4,70	3,50	9,60	9,10	7,30	4,70	7,90	7,20																		
SK772	6,50	16,00	15,70	14,70	8,50	14,00	6,50	15,00	13,00	13,50	6,50	12,00	10,00	10,50	10,00	13,00	13,50	6,50	12,00	10,00	10,50	10,00	13,00	13,50	6,50	12,00	10,00	10,50	10,00	12,00																		
	SK773	0,62	1,10	1,10	1,10	1,10	1,10	0,62	1,10	1,10	1,10	1,10	0,62	1,10	1,10	1,10	1,10	1,10	0,62	1,10	1,10	1,10	1,10	1,10	0,62	1,10	1,10	1,10	1,10	1,10																		
	SK773	0,55	1,10	1,10	1,10	1,10	1,10	0,55	1,10	1,10	1,10	1,10	0,55	1,10	1,10	1,10	1,10	1,10	0,55	1,10	1,10	1,10	1,10	1,10	0,55	1,10	1,10	1,10	1,10	1,10																		
	SK773	1,30	2,50	2,10	2,40	2,10	2,10	1,35	2,40	2,10	2,10	2,10	1,35	2,40	2,10	2,10	2,50	2,10	1,35	2,40	2,10	2,10	2,10	2,50	2,10	1,35	2,40	2,10	2,10	2,10																		
	SK773	1,30	2,50	2,10	2,40	2,10	2,10	1,25	2,40	2,10	2,10	2,10	1,25	2,40	2,10	2,10	2,50	2,10	1,25	2,40	2,10	2,10	2,10	2,50	2,10	1,25	2,40	2,10	2,10	2,10																		
	SK773	1,80	3,80	3,20	3,40	2,90	3,30	1,70	3,60	3,30	3,30	3,30	1,70	3,60	3,30	3,30	3,90	3,30	1,70	3,60	3,30	3,30	3,30	3,90	3,30	1,70	3,60	3,30	3,30	3,90																		
	SK773	2,50	4,50	3,70	4,60	3,30	3,30	2,30	5,00	3,90	3,90	3,90	2,30	5,00	3,90	3,90	4,50	3,90	2,30	5,00	3,90	3,90	3,90	4,50	3,90	2,30	5,00	3,90	3,90	3,90																		
SK773	6,20	8,40	7,50	9,10	7,50	7,50	5,00	8,80	7,60	7,60	7,60	5,00	8,80	7,60	7,60	8,00	8,00	5,00	8,80	7,60	7,60	7,60	8,00	8,00	5,00	8,80	7,60	7,60	7,60	8,00																		
SK773	10,00	15,40	13,00	16,00	13,00	13,00	10,30	16,50	13,00	13,00	13,00	10,30	16,50	13,00	13,00	16,00	14,00	10,30	16,50	13,00	13,00	13,00	16,00	14,00	10,30	16,50	13,00	13,00	13,00	14,00																		

[illegible]



	M1	M2	M3	M4	M5	M6	M1	M2	M3	M4	M5	M6
SK0721	0,40	0,60	0,80	0,90	0,40	0,40	0,40	0,60	0,80	0,90	0,40	0,40
SK0722	0,55	0,90	0,85	1,10	0,75	0,62	0,50	0,92	0,87	1,05	0,75	0,65
SK0723	0,90	1,30	1,45	1,60	1,20	1,20	1,15	1,50	1,20	1,75	1,15	1,15
SK0724	1,90	3,50	3,20	3,40	2,60	2,60	1,95	2,80	2,50	3,30	2,40	2,40
SK0725	2,30	4,50	4,00	5,30	4,10	4,10	2,75	4,40	4,50	5,85	3,50	3,50
SK0726	3,30	6,50	5,50	7,00	5,00	5,00	3,75	6,00	6,50	8,50	5,00	5,00
SK0727	4,30	8,50	7,00	9,00	6,00	6,00	4,75	7,50	8,00	10,50	6,50	6,50
SK0728	5,30	10,50	8,00	11,00	7,00	7,00	5,75	9,00	9,50	12,50	8,00	8,00
SK0729	6,30	12,50	9,00	13,00	8,00	8,00	6,75	10,50	11,00	14,50	9,50	9,50
SK0730	7,30	14,50	10,00	15,00	9,00	9,00	7,75	12,50	13,00	17,00	10,50	10,50
SK0731	8,30	16,50	11,00	17,00	10,00	10,00	8,75	14,50	15,00	19,00	12,50	12,50
SK0732	9,30	18,50	12,00	19,00	11,00	11,00	9,75	16,50	17,00	21,00	14,50	14,50
SK0733	10,30	20,50	13,00	21,00	12,00	12,00	10,75	18,50	19,00	23,00	16,50	16,50
SK0734	11,30	22,50	14,00	23,00	13,00	13,00	11,75	20,50	21,00	25,00	18,50	18,50
SK0735	12,30	24,50	15,00	25,00	14,00	14,00	12,75	22,50	23,00	27,00	20,50	20,50
SK0736	13,30	26,50	16,00	27,00	15,00	15,00	13,75	24,50	25,00	29,00	22,50	22,50
SK0737	14,30	28,50	17,00	29,00	16,00	16,00	14,75	26,50	27,00	31,00	24,50	24,50
SK0738	15,30	30,50	18,00	31,00	17,00	17,00	15,75	28,50	29,00	33,00	26,50	26,50
SK0739	16,30	32,50	19,00	33,00	18,00	18,00	16,75	30,50	31,00	35,00	28,50	28,50
SK0740	17,30	34,50	20,00	35,00	19,00	19,00	17,75	32,50	33,00	37,00	30,50	30,50
SK0741	18,30	36,50	21,00	37,00	20,00	20,00	18,75	34,50	35,00	39,00	32,50	32,50
SK0742	19,30	38,50	22,00	39,00	21,00	21,00	19,75	36,50	37,00	41,00	34,50	34,50
SK0743	20,30	40,50	23,00	41,00	22,00	22,00	20,75	38,50	39,00	43,00	36,50	36,50
SK0744	21,30	42,50	24,00	43,00	23,00	23,00	21,75	40,50	41,00	45,00	38,50	38,50
SK0745	22,30	44,50	25,00	45,00	24,00	24,00	22,75	42,50	43,00	47,00	40,50	40,50
SK0746	23,30	46,50	26,00	47,00	25,00	25,00	23,75	44,50	45,00	49,00	42,50	42,50
SK0747	24,30	48,50	27,00	49,00	26,00	26,00	24,75	46,50	47,00	51,00	44,50	44,50
SK0748	25,30	50,50	28,00	51,00	27,00	27,00	25,75	48,50	49,00	53,00	46,50	46,50
SK0749	26,30	52,50	29,00	53,00	28,00	28,00	26,75	50,50	51,00	55,00	48,50	48,50
SK0750	27,30	54,50	30,00	55,00	29,00	29,00	27,75	52,50	53,00	57,00	50,50	50,50
SK0751	28,30	56,50	31,00	57,00	30,00	30,00	28,75	54,50	55,00	59,00	52,50	52,50
SK0752	29,30	58,50	32,00	59,00	31,00	31,00	29,75	56,50	57,00	61,00	54,50	54,50
SK0753	30,30	60,50	33,00	61,00	32,00	32,00	30,75	58,50	59,00	63,00	56,50	56,50
SK0754	31,30	62,50	34,00	63,00	33,00	33,00	31,75	60,50	61,00	65,00	58,50	58,50
SK0755	32,30	64,50	35,00	65,00	34,00	34,00	32,75	62,50	63,00	67,00	60,50	60,50
SK0756	33,30	66,50	36,00	67,00	35,00	35,00	33,75	64,50	65,00	69,00	62,50	62,50
SK0757	34,30	68,50	37,00	69,00	36,00	36,00	34,75	66,50	67,00	71,00	64,50	64,50
SK0758	35,30	70,50	38,00	71,00	37,00	37,00	35,75	68,50	69,00	73,00	66,50	66,50
SK0759	36,30	72,50	39,00	73,00	38,00	38,00	36,75	70,50	71,00	75,00	68,50	68,50
SK0760	37,30	74,50	40,00	75,00	39,00	39,00	37,75	72,50	73,00	77,00	70,50	70,50
SK0761	38,30	76,50	41,00	77,00	40,00	40,00	38,75	74,50	75,00	79,00	72,50	72,50
SK0762	39,30	78,50	42,00	79,00	41,00	41,00	39,75	76,50	77,00	81,00	74,50	74,50
SK0763	40,30	80,50	43,00	81,00	42,00	42,00	40,75	78,50	79,00	83,00	76,50	76,50
SK0764	41,30	82,50	44,00	83,00	43,00	43,00	41,75	80,50	81,00	85,00	78,50	78,50
SK0765	42,30	84,50	45,00	85,00	44,00	44,00	42,75	82,50	83,00	87,00	80,50	80,50
SK0766	43,30	86,50	46,00	87,00	45,00	45,00	43,75	84,50	85,00	89,00	82,50	82,50
SK0767	44,30	88,50	47,00	89,00	46,00	46,00	44,75	86,50	87,00	91,00	84,50	84,50
SK0768	45,30	90,50	48,00	91,00	47,00	47,00	45,75	88,50	89,00	93,00	86,50	86,50
SK0769	46,30	92,50	49,00	93,00	48,00	48,00	46,75	90,50	91,00	95,00	88,50	88,50
SK0770	47,30	94,50	50,00	95,00	49,00	49,00	47,75	92,50	93,00	97,00	90,50	90,50
SK0771	48,30	96,50	51,00	97,00	50,00	50,00	48,75	94,50	95,00	99,00	92,50	92,50
SK0772	49,30	98,50	52,00	99,00	51,00	51,00	49,75	96,50	97,00	101,00	94,50	94,50
SK0773	50,30	100,50	53,00	101,00	52,00	52,00	50,75	98,50	99,00	103,00	96,50	96,50
SK0774	51,30	102,50	54,00	103,00	53,00	53,00	51,75	100,50	101,00	105,00	98,50	98,50
SK0775	52,30	104,50	55,00	105,00	54,00	54,00	52,75	102,50	103,00	107,00	100,50	100,50
SK0776	53,30	106,50	56,00	107,00	55,00	55,00	53,75	104,50	105,00	109,00	102,50	102,50
SK0777	54,30	108,50	57,00	109,00	56,00	56,00	54,75	106,50	107,00	111,00	104,50	104,50
SK0778	55,30	110,50	58,00	111,00	57,00	57,00	55,75	108,50	109,00	113,00	106,50	106,50
SK0779	56,30	112,50	59,00	113,00	58,00	58,00	56,75	110,50	111,00	115,00	108,50	108,50
SK0780	57,30	114,50	60,00	115,00	59,00	59,00	57,75	112,50	113,00	117,00	110,50	110,50
SK0781	58,30	116,50	61,00	117,00	60,00	60,00	58,75	114,50	115,00	119,00	112,50	112,50
SK0782	59,30	118,50	62,00	119,00	61,00	61,00	59,75	116,50	117,00	121,00	114,50	114,50
SK0783	60,30	120,50	63,00	121,00	62,00	62,00	60,75	118,50	119,00	123,00	116,50	116,50
SK0784	61,30	122,50	64,00	123,00	63,00	63,00	61,75	120,50	121,00	125,00	118,50	118,50
SK0785	62,30	124,50	65,00	125,00	64,00	64,00	62,75	122,50	123,00	127,00	120,50	120,50
SK0786	63,30	126,50	66,00	127,00	65,00	65,00	63,75	124,50	125,00	129,00	122,50	122,50
SK0787	64,30	128,50	67,00	129,00	66,00	66,00	64,75	126,50	127,00	131,00	124,50	124,50
SK0788	65,30	130,50	68,00	131,00	67,00	67,00	65,75	128,50	129,00	133,00	126,50	126,50
SK0789	66,30	132,50	69,00	133,00	68,00	68,00	66,75	130,50	131,00	135,00	128,50	128,50
SK0790	67,30	134,50	70,00	135,00	69,00	69,00	67,75	132,50	133,00	137,00	130,50	130,50
SK0791	68,30	136,50	71,00	137,00	70,00	70,00	68,75	134,50	135,00	139,00	132,50	132,50
SK0792	69,30	138,50	72,00	139,00	71,00	71,00	69,75	136,50	137,00	141,00	134,50	134,50
SK0793	70,30	140,50	73,00	141,00	72,00	72,00	70,75	138,50	139,00	143,00	136,50	136,50
SK0794	71,30	142,50	74,00	143,00	73,00	73,00	71,75	140,50	141,00	145,00	138,50	138,50
SK0795	72,30	144,50	75,00	145,00	74,00	74,00	72,75	142,50	143,00	147,00	140,50	140,50
SK0796	73,30	146,50	76,00	147,00	75,00	75,00	73,75	144,50	145,00	149,00	142,50	142,50
SK0797	74,30	148,50	77,00	149,00	76,00	76,00	74,75	146,50	147,00	151,00	144,50	144,50
SK0798	75,30	150,50	78,00	151,00	77,00	77,00	75,75	148,50	149,00	153,00	146,50	146,50
SK0799	76,30	152,50	79,00	153,00	78,00	78,00	76,75	150,50	151,00	155,00	148,50	148,50
SK0800	77,30	154,50	80,00	155,00	79,00	79,00	77,75	152,50	153,00	157,00	150,50	150,50
SK0801	78,30	156,50	81,00	157,00	80,00	80,00	78,75	154,50	155,00	159,00	152,50	152,50
SK0802	79,30	158,50	82,00	159,00	81,00	81,00	79,75	156,50	157,00	161,00	154,50	154,50
SK0803	80,30	160,50	83,00	161,00	82,00	82,00	80,75	158,50	159,00	163,00	156,50	156,50
SK0804	81,30	162,50	84,00	163,00	83,00	83,00	81,75	160,50	161,00	165,00	158,50	158,50
SK0805	82,30	164,50	85,00	165,00	84,00	84,00	82,75	162,50	163,00	167,00	160,50	160,50
SK0806	83,30	166,50	86,00	167,00	85,00	85,00	83,75	164,50	165,00	169,00	162,50	162,50
SK0807	84,30	168,50	87,00	169,00	86,00	86,00	84,75	166,50	167,00	171,00	164,50	164,50
SK0808	85,30	170,50	88,00	171,00	87,00	87,00	85,75	168,50	169,00	173,00	166,50	166,50
SK0809	86,30	172,50	89,00	173,00	88,00	88,00	86,75	170,50	171,00	175,00	168,50	168,50
SK0810	87,30	174,50	90,00	175,00	89,00	89,00	87,75	172,50	173			

[illegible]

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Mat.-Nr. 6052802/0713