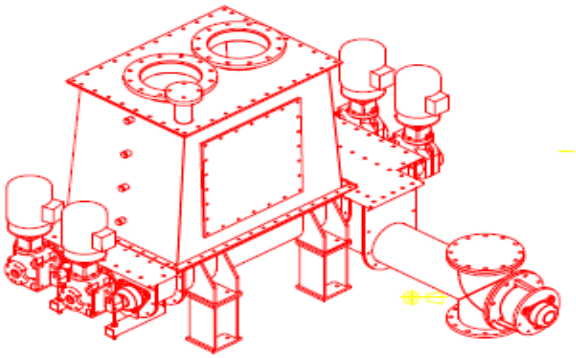
# SECTION 03

## Surge Hopper



# Installation, Operating and Maintenance Instructions

## Surge Hopper

Project Name: Rentech ClearFuels Integrated Biorefinery Project
Andritz Project : C-03-810628-104

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Mill Location: Commerce City, CO
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# 1. Introduction

This manual is part of the technical documentation of ANDRITZ. It is intended as a supplement to the training provided, to supply the basic knowledge required for the proper, safe and economical use of the equipment delivered by ANDRITZ. Observance of these instructions helps avoid hazards and reduce repair and downtime costs, and increases the reliability and useful life of the machines.

## 1.1 Use

**Target group** This operating manual is intended for users with knowledge of mechanical engineering and is for the exclusive use of the mill operators and all personnel.

Personnel entrusted with work on the machine must have read and understood these operating instructions and comply with them. This refers in particular to the following tasks:

- Handling, starting and stopping
- Troubleshooting
- Maintenance and upkeep
- Haulage
- Handling process materials, cleaning of machine and area around the machine

The following sections are especially important:

- the chapter on **SAFETY**
- the safety instructions contained in various other chapters

**Supplementary instructions** The mill operator shall complete this manual by adding national regulations on safety at work, health protection and environmental protection.

Instructions on any special operational conditions concerning work organization, sequence of work/operations and the personnel assigned to the job shall also be added. This also includes instructions on supervising and reporting obligations.

**Safe keeping** Keep the entire operating manual near the place where the machine is installed and within easy reach.

## 1.2 Standards and guidelines

The machine/plant has been built in accordance with state-of-the-art standards and the recognized safety rules. The equipment conforms to equivalent appropriate standards.

## 1.3 How to use the manual

**Pictograms**

The following pictograms are used in the manual:

Warning signs
Warning signs are shown with an explanation of the type of the hazard. The meaning of the different graduations of hazards is described in the chapter on SAFETY.

Marks an instruction on handling of the machine or system.

Marks useful information.

► Marks a cross-reference to other sections, figures and tables in brackets.

**Work steps (operations)**

Work steps are presented in tables. Work steps are numbered and must be carried out in the order specified.

**Listings**

Lists without numbering do not require operations to be carried out in a certain order.

**Numbering of pages, tables and figures**

| | | |
|---|---|---|
| Pages | Consecutive numbering of chapters | 2-1 |
| Tables | Tab. + Consecutive numbering of chapters | Tab. 2-1 |
| Figures | Fig. + Consecutive numbering of chapters | Fig. 2-1 |

**Abbreviations**

| | |
|---|---|
| Dwg. | Drawing |
| Fig. | Figure |
| Sec. | Section |
| Tab. | Table |

**Illustrations and graphic charts**

The illustrations and graphic charts show the basic design of the machine. This may not necessarily exactly correspond to the design supplied.

## 1.4 Warranty and guarantee

ANDRITZ's general terms of delivery and sale shall apply. Guarantee and liability claims on ANDRITZ shall become void, if personal injury or material damage is caused by one or several of the following reasons:

- Use of the machine/system for any purpose other than its designated use
- Non-conformity of erection work, start-up and handling of the machine/system
- Non-observance of the safety instructions in the manual
- Non-authorized structural changes to the machine/system
- Non-observance of the maintenance and upkeep instructions

In the event of a claim for repair under Warrantee, ANDRITZ reserves the right to assess the damage to the machine/system.

## 1.5 Copyright

The maintenance manual is protected by copyright. All usual rights are reserved. This manual must not be wholly or partly reproduced without authorization by ANDRITZ. Contraventions shall entail damage claims and may have penal consequences. All rights shall also be reserved for any patents granted, registration of trademarks and technical modifications without prior notification.

# 2. Safety

## 2.1 General safety regulations

This chapter on safety contains general safety regulations which must be observed when working on the machine/plant.
In addition, the chapters in the operating manual contain further safety regulations. These are marked by warning signs.
Safety instructions on components not supplied by ANDRITZ are contained in the descriptions of the components provided by sub-suppliers. The safety instructions supplement ANDRITZ's operating instructions.
All safety instructions must be observed. Disregarding the safety instructions may cause a risk to life and limb, environmental pollution hazards and damage to property.

## 2.2 Danger and warning signs

The entire SAFETY chapter is of extreme importance and relevant to safety. The information in this chapter, therefore, is not marked with special danger symbols.
In the following chapters of this manual, warnings are marked by a pictogram. The following warning signs are used:

| | |
|---|---|
|  **DANGER** | **This symbol indicates there may be a risk to life and limb.** Non-compliance with the warning signs may lead to serious health problems or even fatal injuries, and can cause extensive damage to property. |
|  **WARNING** | **This symbol points to an imminent health risk, as well as a risk of environmental pollution and of damage to property.** Non-compliance with the warning signs may cause moderate health problems and/or extensive environmental pollution and damage to property. |
|  **CAUTION** | **This symbol points to a dangerous situation.** Non-observance of these signs may cause environmental pollution and damage to property. |

## 2.3 Designated use

The equipment shall only be used according to the specifications forming part of the purchase order.
Using the machine/plant for other purposes is considered contrary to its designated use.

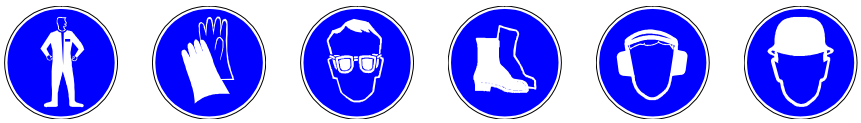
Any modifications to the scope of supply made without the agreement of ANDRITZ are considered contrary to the designated use.
The term designated use shall also include adherence to the operating instructions, observance of the operating, inspection and maintenance conditions and of the regulations on cleaning and upkeep.

## 2.4 General remarks on machine/plant safety

The machine/plant has been built in accordance with state of the art standards and recognized safety rules. Nevertheless, its use may constitute a risk to life and limb of the user or of third parties, or cause damage to the machine/plant and to other material property.
The machine/plant may only be operated when in perfect condition and with due consideration to safety and the risks involved. All protective devices and the emergency cut-out devices must be in place and fully functional.
Malfunctions and unforeseen changes to the machine/plant must be remedied immediately.

## 2.5 Personal protective apparel

**General protective apparel**



The following must always be worn when performing work on the machine/plant:

- Protective clothing to prevent the fiber pulp from coming into contact with the skin
- Protective gloves to prevent hand injuries
- Protective goggles to prevent eye injuries
- Safety shoes as protection against foot injuries
- The required personal ear protection to avoid hearing defects
- Standard hard hat as protection against head injuries

## 2.6 Safety at the machine installation site

- Adequate lighting must be provided (industrial lighting)
- Area around the machine and marked escapes must be kept free. Area around machine must be marked as danger zone
- Make sure the machine and surrounding area are kept clean. In particular, oil and grease on the floor and on machine elements may cause slipping. This is therefore a considerable source of injuries, as are tools
- The floor around the machine must be provided with a non-slip finish

- In order to prevent any falls from or damage to the machine, it is forbidden to climb onto machine elements or on the machine (except for the treading areas provided). Use ladders or similar equipment in accordance with recognized standards
- Proper lifting tackle must be used to avoid injury or excessive physical effort

## 2.7 Safety during erection

- When lifting parts, pay attention to their weight, particularly the screw. Do not go under a part being hoisted.
- Make sure that all lifting equipment is in good working order and is safe to use.
- Make sure that the lifting hoists are adequately sized for the load that is to be lifted.

## 2.8 Safety during operation

- Prior to start-up, check that no one is working at the machine and that drive and guards are properly fixed.
- If there is a sudden increase in the power consumption of the electric motor, immediately check to ensure that the screw is not contacting any other metal.
- It is NOT ALLOWED to clean the LBB during operation! There is danger of injured personnel.

## 2.9 Safety during maintenance

- Before opening the Inspection Door, make sure that the LBB is cool and that all gases have been vented from the machine.
- Do not repack the shaft pack box unless LBB is empty, isolated, and locked out.
- When lifting parts, pay attention to their weight, particularly the screws. Do not go under a part being hoisted.
- The surfaces of the LBB may be hot. To avoid burns, wear proper personal protection when working in the vicinity of hot surfaces.
- Before disassembling, check the condition of hoisting points and repair them if necessary.
- Follow all industrial safety regulations concerning lifting, auxiliary equipment and work in general during repair, component replacing, assembly and disassembly.

Follow all industrial safety regulations concerning lifting, auxiliary equipment and work in general during repair, component replacing, assembly and disassembly.

Make sure that all drive guards are re-installed before operating the Metering Screw.

## 2.10 Safety signs affixed to the equipment

The following warnings and informative signs are permanently fixed on the equipment. Keep signs always clean and check that symbols are understood by all user groups before putting the equipment into service.

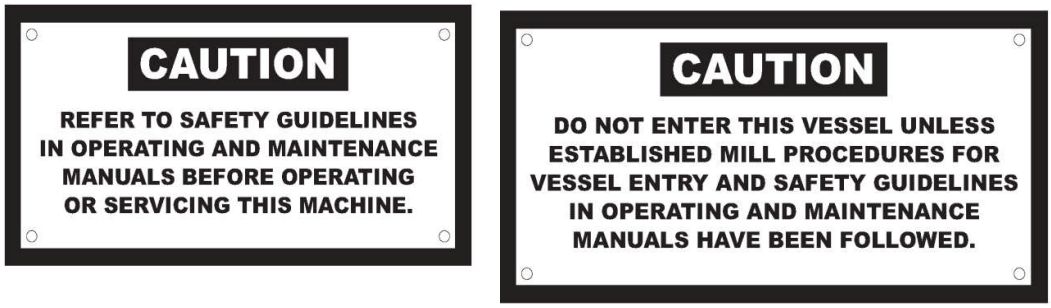



**Fig. 2-1 Safety signs affixed to the equipment**

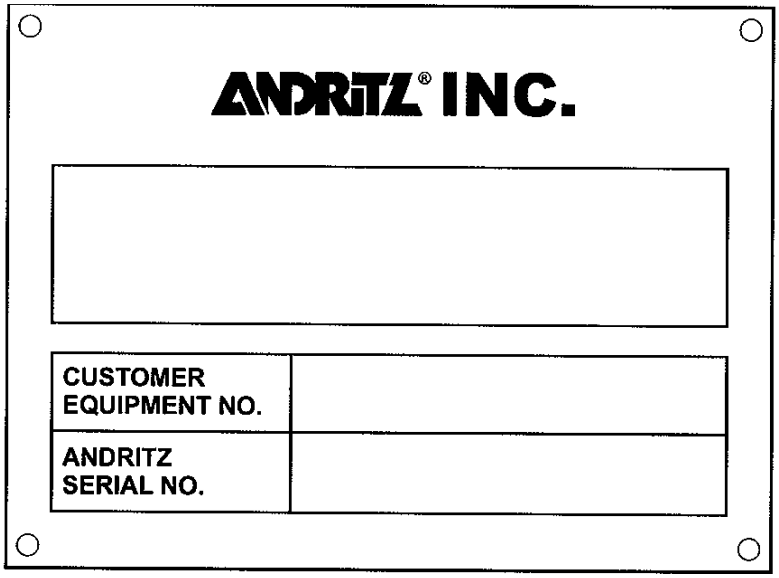


**Fig. 2-2 Name plate**

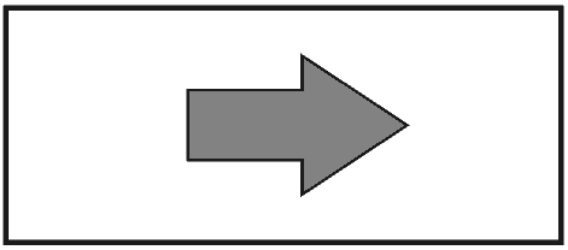


**Fig. 2-3 Direction arrow**

## 2.11 Chemical safety

Hazardous chemicals may be used in certain process stages. Please read the safety data sheets related to each chemical and take necessary precautions to avoid contact.

# 3. Delivery

## 3.1 Mode of delivery

The LBB comes completely assembled. Before the erection, the gear reducers and motors must be mounted and aligned according the gear reducer and motor manufacturer specifications, if these were not installed at the factory.

## 3.2 Packaging

Carefully remove all packaging from the LBB. Make sure that any loose parts are secured in a safe place where they can be found easily when needed.

## 3.3 Receiving inspection

Check to see that any loose pieces noted on the packing list have been received. Check to make sure that there is no damage to any parts of the machine. If any damage is noted, contact ANDRITZ immediately. Also check to be sure that the loose pieces were shipped as well and that all pieces have been received.

## 3.4 Storage

If the LBB will not be installed immediately, leave it on the shipping skid. Replace the wrappings to protect the machine from the weather. Make sure any loose pieces are stored with their respective parts or someplace where they will not get lost. Store the machine in a protected area, out of the weather as much as possible and in a location where it will not get hit by any construction equipment.

# 4. Erection

## 4.1 Erection site

Make sure that the site is clear and free of any obstructions when lifting the LBB.

## 4.2 Lifting

See Section 4.3 for details on how to lift the LBB.

## 4.3 Installation

The LBB comes completely assembled, so there are no special installation instructions. The LBB should be installed in the position and orientation shown on the drawings supplied with the project.
The inlet and discharge nozzles should be properly aligned and connected using the hardware and gaskets supplied with the project.

In field erection, the mounting surfaces for supporting the LBB must be level and true so that there is no distortion transmitted to the assembly. Shims and grout should be used as required. Anchor bolts that are out of line should be moved.

Do not force alignment of components and sub-assemblies. Any misalignment of components may cause operational problems, so the cause of misalignment **MUST** be found and corrected. Tighten all fasteners when the structures are properly aligned.

Attach any loose pipes or other external attachments according to the drawings supplied with this project.

General comments regarding the installation of the LBB:

DANGER

- The LBB Screw should never be lifted by the conveyor housing only.
- Sometimes the layout of the platforms and the LBB already being installed will prevent the use of the spreader bar. In this case, the Lifting Straps can be positioned as needed.
- Any pipelines attached to the LBB should be positioned and hangers designed so as not to put excessive loads on the housing nozzles.
- The gear reducer and drive components should be installed per the manufacturer's recommendations contained elsewhere in this manual. Couplings, if used, should be aligned to the manufacturer's specifications.

- Couplings, if used, should be aligned to the manufacturer's specifications.
- The packing glands are supplied loosely tightened. Do not tighten the bolts until startup.

After installation, all bearings should have the lubrication checked and all oil reservoirs should be topped off.

Before putting the LBB into general operation, the machine should be test run empty and all interlocks tested to be sure that they are functioning correctly.

Check that the conveyor is turning at the same speed and that the rotational speed matches the input number. It is very important that the conveyors are turning at the same speed and the speed is measured exactly. This is a key measurement. Verify that the speed indicators are reading properly.

# 5. Piping installation

## 5.1 General instructions for installation

All pipelines should be run and supported so as not to put undue loads on the machine nozzles. The attachment flanges should not be forced into alignment – if the pipes no not line up, modify the piping spools or the pipe hangers to move the pipes into alignment.

## 5.2 Final Steps

- Once all the elements have been loosely positioned and the LBB Inlet has been welded to the Bin and the outlet is welded to the transfer conveyor, all the hardware can be securely fastened. The bolts should be tightened to the torque specification shown in Table 4.5

| Bolt Size | Bolt Torque | |
|---|---|---|
| | N-M | FT-LB |
| M16 | 75 | 55 |
| M20 | 115 | 85 |
| M24 | 200 | 150 |
| M30 | 400 | 300 |
| M33 | 500 | 375 |
| M36 | 700 | 515 |
| M42 | 1115 | 825 |
| | | |
| 7/8" | 160 | 115 |
| 1" | 235 | 175 |
| 1-1/4" | 490 | 360 |
| 1-3/8" | 665 | 490 |

TABLE 5.1 RECOMMENDED BOLT TORQUES

- All field welds used for connecting the flexible joint of the inlet or outlet of the LBB must be ground flush with the base material and smoothened wherever chips will in contact.

# 6. Operation

**NOTE:** This project is supplied with a separate Operations Manual. Please refer to this manual for specific operating instructions.

## 6.1 Inspection before operation

- Before start-up of LBB, make sure that system is empty of product and free of obstructions and debris.
- Check that the screw(s) turn freely, and without any noise or binding.
- Check that the gearbox is securely bolted into place.
- Make sure the gearbox is filled with the correct lubricant.
- DO NOT tighten the packing glands! Check that the nuts are finger tight only.
- Lubricate all drives and bearings per service instructions. The bearings should be over lubricated. This means some grease should be showing coming out of the bearings.
- Check screw rotation after electrical connections have been made but **BEFORE** any material is fed to the system. Incorrect screw rotation can cause serious damage to the system and to related equipment. If required, reconnect motor leads to change the direction of rotation and achieve proper material flow.
- Check the interlock diagram. If possible, run a simulation to test the interlocks.
- The instrumentation readout for the screw speed must be field verified.
- Operate the LBB empty for several hours as a break-in period. Observe for any problems such as unusual noises or vibrations, apparent misalignments or bearing temperature rise. Check for proper initial lubrication of all components.
- Problems must be corrected before the LBB is put under load.

## 6.2 Start-up

- Check the dry motor loads and record the value.
- Packing should be leaking during the first start. Tighten the packing bolts after the first 10 minutes to slow the leakage, but do not stop the leakage.
- Monitor the motor load to determine the average nominal amperage after achieving full production.
- The flow rate per RPM must be measured after the installation and every time the screw is changed.

## 6.3 Operational control and adjustment

- The LBB is normally controlled by desired production rate input into the DCS. As such, the operator will not need to directly adjust the operation of the LBB.
- Monitor the motor load that it stays close to the nominal average.
- Check that liquids are not leaking from the packing gland. Tighten the packing gland in small amounts only enough to compress the wave spring to provide a compressive force. See Section 7.3

# 7. Inspection and maintenance

The maintenance and inspection instructions of the LBB have been prepared to ensure that normal repair and service procedures can be easily carried out, provided that the instructions for installation and operation have also been studied. Following these instructions will guarantee reliable operation and minimize down-time.

## 7.1 General Maintenance

There should be little extra maintenance associated with the LBB. Normal preventative maintenance measures should be employed to insure reliable operation. These measures include such items as:

- Frequent inspection of the machine in operation to check for any unusual noises coming from the machine or other indications that problems are happening. Any such noise or indication of trouble should be investigated at the earliest opportunity.
- Follow the gear reducer manufacturer's recommendations for the maintenance requirements on the gear reducer. These instructions are located in Section 10 in this maintenance manual.
- Follow the bearing manufacturer's recommendations for lubrication on the bearings. Normally the grease will be a lithium based, multi service, extreme pressure grease. The bearing manufacturer's instructions in Section 8 will give the re-lubrication interval and the replenishment quantity for the bearings used on this machine.

## 7.2 Disassembly, Repair and Assembly

The LBB should give long and continuous service free from the need for extensive maintenance. However, the machine should be inspected periodically to insure that all elements are in good condition and free from corrosion or other conditions, which would affect the reliability of the LBB.

**Disassembly:**

Reference Drawing: See Section 11 of this manual for the drawings showing the LBB for this project.

The LBB Conveyor should be removed from service and prepared for maintenance following the mill's general safety guidelines. The unit should be removed entirely from its operating location and moved to a workshop for rebuild and repair. It is possible to repair the unit in place, but it is much more difficult to do so because of its location.

## *SCREW REPLACEMENT*

**LOCK OUT POWER** before starting any maintenance work.

1. Empty Load Hopper of product.
2. Open or remove any top covers.
3. Remove discharge end plate with bearing pedestal mounts, disconnecting any instrumentation and conduit as required.
4. Remove discharge end coupling bolts and pull shafts from screws. Inspect and replace worn or damaged bolts and shafts.
5. Remove drive end coupling bolts. Inspect and replace as required.
6. Independently support one end cover, and remove the hardware connecting the end cover to the housing.
7. Remove the hardware holding the bearing housings to the bearing housing support on each end cover.
8. Support each of the lower bearing housing halves so that they don't fall to the floor and injure someone.
9. Pick up the end cover and both conveyors slightly and move them axially until the bottom bearing housing halves are no longer on the support pedestals. Be careful not to damage the bearing seals or the stability ring when doing this.
10. Lower the conveyors until they are resting on the inside of the housing shell. At this point, for each bearing assembly, the bearing, the adapter assembly, the stability ring(s), if this is the drive side and the bearing seals can be removed.
11. Remove the end cover. Both packing glands, both pack boxes, and the Waterless Packing Systems will come with the end cover.
12. Repeat the same process to remove the other end cover.
13. At this point, the conveyor assemblies are ready to be removed. Each conveyor assembly is removed by carefully sliding it to the most accessible end, being careful not to damage the flights, or by sliding it far enough to be tilted and removed through the open top.
14. The Waterless Packing System should be serviced following the separate instructions located Section 7.3.

**Inspection:**

All components should be carefully inspected for damage and weld deterioration. In addition to a general visual inspection, certain items should always be reviewed.

Housing:

- Look for nozzle weld defects, both on the inside and outside of the vessel.
- Check for shell thinning.

Conveyor:

- Look for weld defects in the flight to pipe body welds and the welds sealing the lining of the pipe body.
- Check the packing sleeves for damage. Replace them if necessary.
- Any time the packing sleeves are removed, the journal-to-head welds should be inspected.

End covers:

- The gusset welds should be inspected for defects.
- The condition of the pack box bore should be reviewed and repaired as necessary.

**Assembly:**

Assembly is the reverse of disassembly with a few special precautions.

As with disassembly, care should be taken not to damage the flights while inserting the conveyor assembly into the housing. Check for any debris left over from the inspection and remove it before installing the conveyor.

The drive side should be assembled first. Before installing the end bearing, position the conveyor assembly so that the edge of the conveyor pipe body has the correct clearance to the edge of the housing.

Place all the bearing elements on the shaft, but do not position or tighten the bearings until the bearing housing has been positioned on the end cover and the bolts tightened.

Leave the Waterless Packing System components out when installing the end covers. If the packing gland and packing box are not split, don't forget to install them before the bearing is installed. The machine should be packed after final assembly. Follow the separate packing procedures contained elsewhere in this manual for installing the Waterless Packing System.

Install the Pillow Block Bearings per the manufacturer's mounting procedures contained in their literature. The conveyor should be supported until the bearing is positioned and seated so as not to damage the equipment.

When the machine is completely assembled, but before the top cover assembly is installed, rotate the conveyor one complete revolution to insure that the conveyor turns freely and does not hit anything in the housing.

Make sure that the bearings are lubricated per the instructions listed in the bearing mounting procedure. Because ambient temperatures and bearing cooling rates will vary from mill to mill, the exact bearing operating temperature should be confirmed after the machine has been operated for a period of time. The mill's lubrication supplier should then be contacted for a more exact recommendation of lubricant and re-lubrication interval than the general recommendations given elsewhere.

Follow the manufacturer's instructions for installing the gear reducers. Careful attention should be paid to the torque requirements of the bolts that tighten the shrink disc connectors (if used) and the tightening sequence for these bolts.

The belt tension should be checked after installation of the gear reducer and motor, whether or not the motor was removed from the motor mounting assembly on the gear reducer.

## 7.3 Seal Maintenance

The LBB system is fitted with shaft seal assembly chosen to provide the best protection for the specific application. Packing System used on this machine is designed to seal the shafts without the use of any cooling or sealing water. The individual pieces of the system are designed to dissipate the heat generated by the process and the shaft friction and to protect the sealing elements from damage from the material in the machine.

### 7.4 INITIAL PREPARATION

Be sure that the new packing system parts exist and are in the proper condition. The system will come in a single container and should be stacked in the container in the order in which the elements will be used. Do not disturb the order of the elements in order to be sure that they are installed correctly.

1. Follow mill safety procedures to lockout the machine and make sure that it is safe to work on. The machine should be empty of all process contents and be completely de-pressurized before beginning to remove the packing system.

2. Remove the packing gland and slide it back as far as possible to get it out of the way.

3. The nuts securing the packing gland are live loaded with wave springs, so be careful when removing the nuts. Also be careful not to lose the wave springs, as new ones are not supplied with the new packing system.

4. Once the packing gland is out of the way, remove each ring of packing using packing hooks or other suitable tools. Refer to the Spare Parts drawing issued for this machine to see how many rings of packing are used for each pack box.

5. Once all the packing rings are removed, the throat bearing at the bottom of the pack box can be removed. The bearing is equipped with tapped holes to allow for easier removal. The bearing is split and pinned, so that once it is out of the pack box, it can be removed from the shaft.

6. All the elements of the old packing system should be discarded, as they are not reusable.

7. Once all the packing elements are out, the surfaces of the pack box and the packing sleeve should be carefully inspected for any damage or wear. Any grooving or other damage should be repaired, or if severe, the part should be replaced. It cannot be overemphasized that **the Waterless Packing System will not work properly if the sealing surfaces on packing sleeve or in packing box are damaged**.

8. The shaft should be checked to make sure that it is still running centered in the pack box. If not, then the shaft should be re-centered before installing the new packing system.

9. The pack box should be thoroughly cleaned and be free of any process contaminates or any other foreign material.

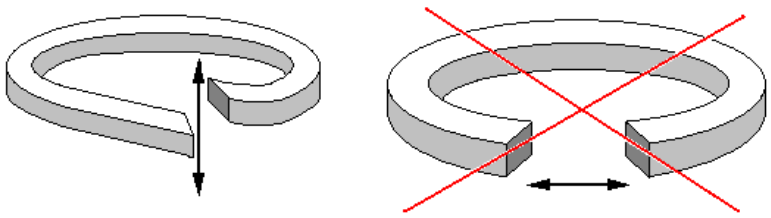
## 7.5 PACKING SYSTEM INSTALLATION

1. The throat bearing is installed first. This piece is split so that it can be put on the shaft without disassembling the machine. It is pinned so that the concentricity of the piece is maintained. Be sure to install this piece with the removal holes facing out, so that it can be removed later.

2. When installing the bearing, it is important to be sure that it is seated fully and firmly against the shoulder of the pack box. If the bearing is not completely seated against the shoulder, small particulates from the process will get into the space between the bearing and the shoulder and cause rapid wear on the bearing and premature failure of the packing system.

3. Next put the initial rings of packing in. These are colored a mottled black with white areas. Each ring should be installed individually and properly seated.

4. Again, it is important to be sure that each ring of packing is seated fully and firmly against the preceding element. Stagger the splits in the packing rings 90 degrees so that no two splits are in line. When opening the splits to put them on the shaft, the split should be moved axially just enough to allow the ring to fit over the shaft (Figure 7.5.1). Excessive opening of the split could damage the fiber in the packing ring and cause premature ring failure.



**CORRECT** **INCORRECT**

Figure 7.5.1

5. The outside rings of packing are installed next. These are colored silver. Follow the same procedure as above to be sure that the rings are fully and firmly seated and that the splits are staggered.

6. The packing gland is the last element to be installed. The wave springs are installed between the nuts and the gland flange face to provide a live load to the system. The nuts should be tightened evenly and uniformly enough to compress the wave spring and thus provide a positive compressive force against the packing. Do not over-tighten the nuts.

**OPERATION**

The Waterless Packing System is designed to be relatively maintenance free. The packing should only be adjusted when the wave spring no longer provides a compressive force on the packing system and there is leakage through the system. At this point, the nuts should only be tightened enough to again compress the wave spring and thus give a positive force on the packing. Excessive tightening of the nuts will cause short lifetime for the packing system.

**TROUBLESHOOTING**

**1. EXTENSSIVE NOISE OR VIBRATION: Possible Causes:**

a. Improper alignment of rotating components
b. Debris or obstruction in feed hopper.
c. Blockage of downstream equipment.

**What to do:**

a. Locate and correct misalignment components
b. Remove obstruction.
c. Clear blockage.

**2. MATERIAL DOES NOT FLOW TO BIN BOTTOM SCREWS: Possible Causes:**

a. Handling characteristics of design material changed.
b. Material “bridges” above screws.
c. Obstruction in hopper.

**What to do:**

a. Research source of material and correct raw material problems.
b. Install flow-aid devices on hopper sidewalls or re-design feed hopper.
c. Remove obstruction.

**3. MATERIAL DOES NOT DISCHARGE FROM LBB: Possible Causes:**

a. All screws not turning.
b. One or more screws not turning.
c. Material “logging” on rotating screws.
d. Obstruction in discharge spout or downstream equipment.

What to do:

a. Confirm incoming power; confirm position of Start-Stop or HOA switch; confirm operation of motor starter; confirm primary drive shaft rotation.
b. Check integrity of coupling bolts; check screw failure; check spur pinion failure; check shaft failure.
c. Remove hopper material load manually; prepare in feed material to combat ‘sticky’ nature.
d. Clear obstruction.

# 8 Lubrication

The bearings of the LBB are supplied already lubricated.

The recommended grease is a lithium-based, extreme pressure, multi-service grease with EP additives. The specification is ISO 6743-9, grade ISO-L-XCCFB-2 or DIN 51502 with the grade per DIN 81825-KP2K-30. Recommended suppliers are shown in Figure 8.0.1.

| Lubricants |
|---|
| |
| Mobilux EP 2 |
| Esso Beacon EP 2 |
| Shell Alvania R 3 |
| Tebo Multi-Purpose Extra |
| SKF LGMT 3 |

Figure 8.0.1

Note that this specification is good for bearing operating temperatures from -30° C (-20° F) to 110° C (230° F). If the bearings operate outside this temperature range contact your lubrication supplier for the proper grease for the specific temperature range that the bearings are operating in.

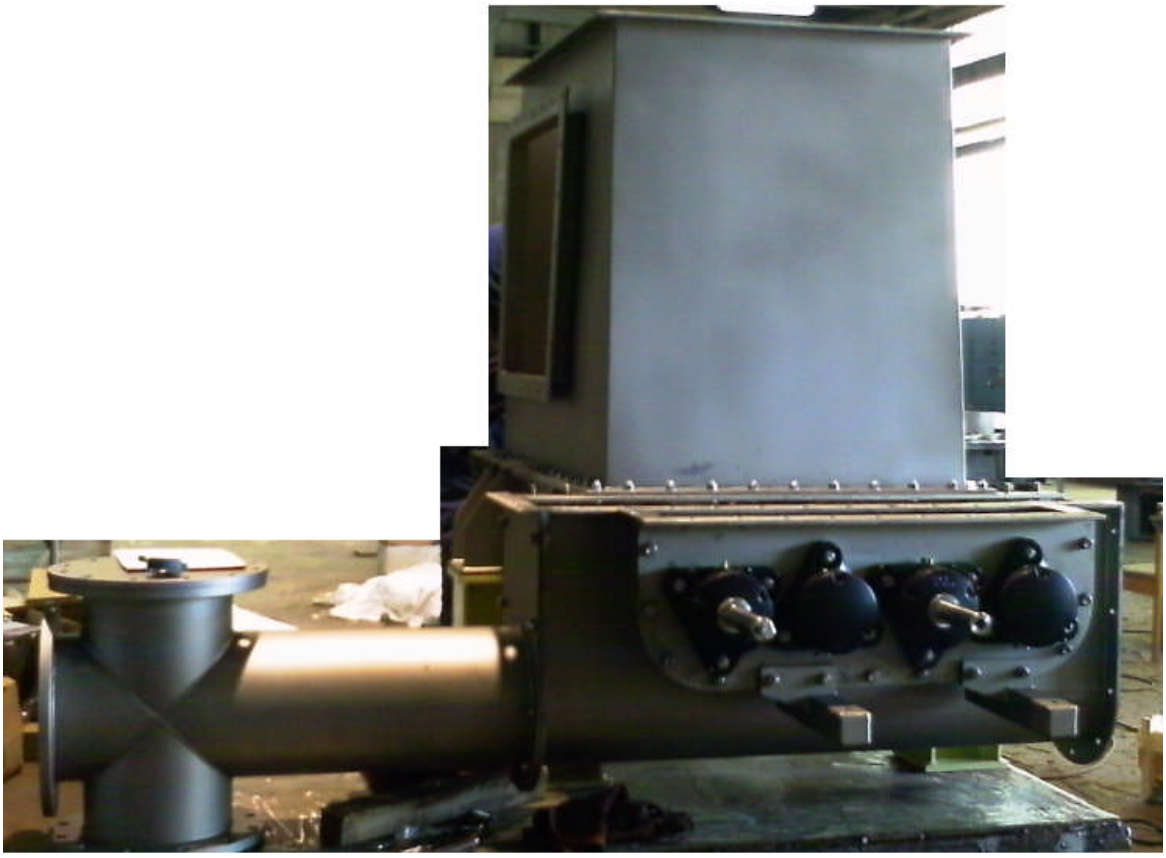
**Re-lubrication:**

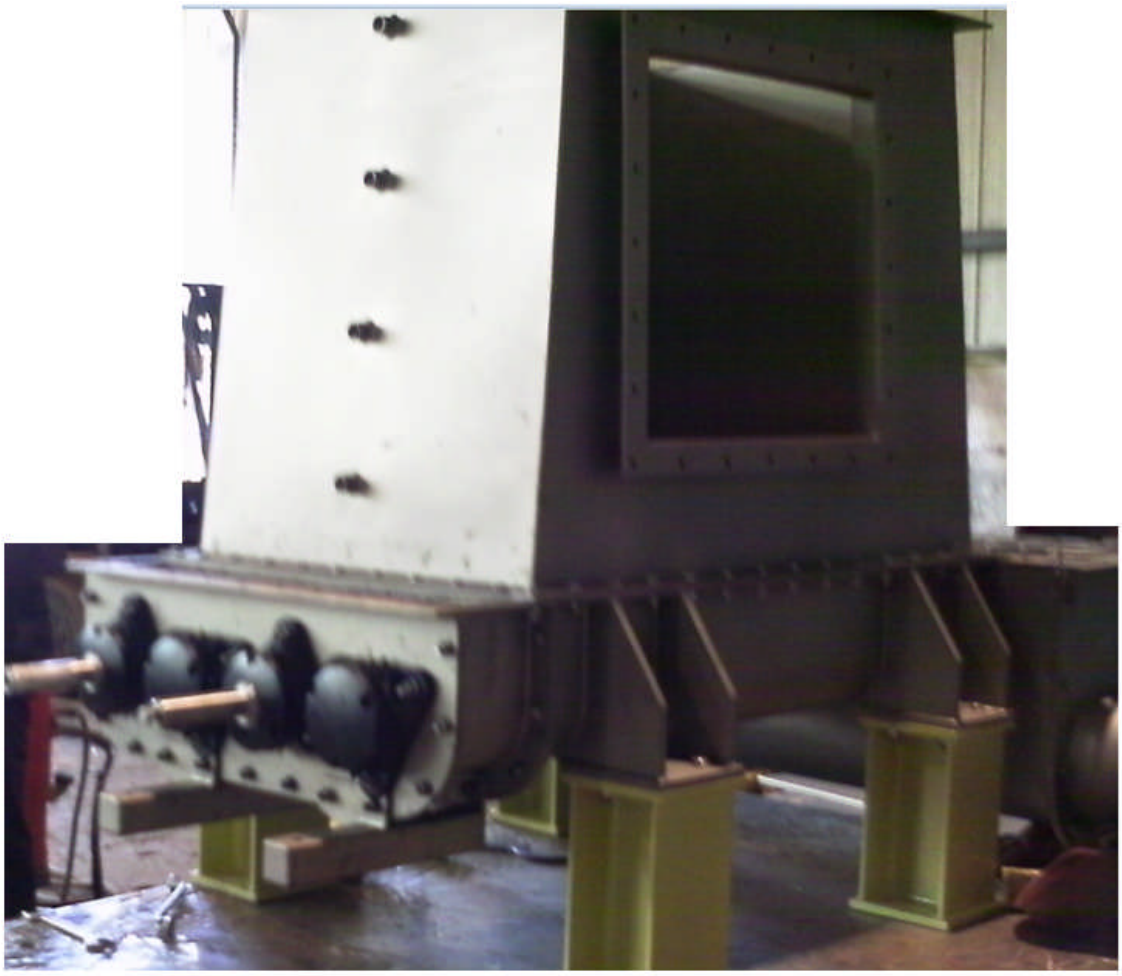
Re-lubrication should be per the chart listed below. The lubricating interval in operating hours is valid for bearing operating temperatures up to +70°C (160° F). If a bearing is in use at a higher temperature, the lubricating intervals must be shortened. An increase in temperature of +15°C (30° F) cuts the lubricating interval in half.

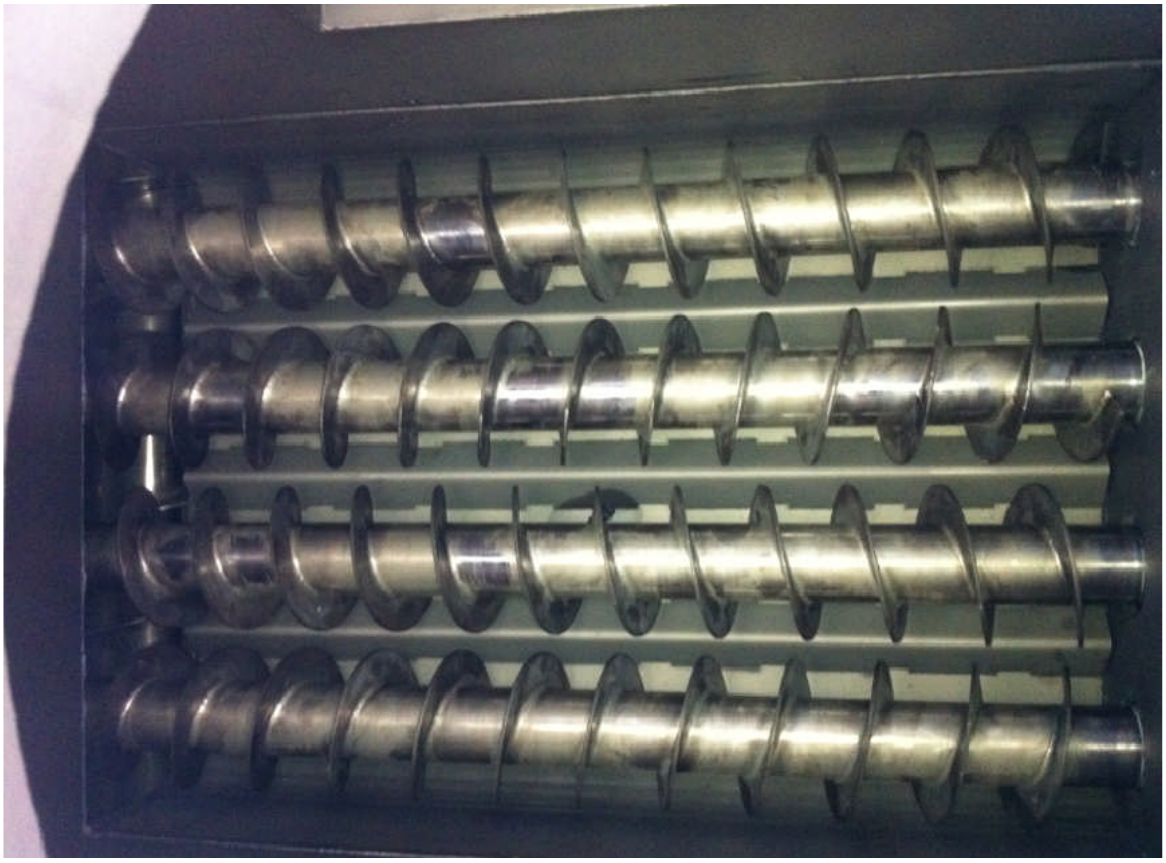
Also, be careful using greases with a thickener of a different metallic soap than lithium or synthetic greases for re-lubrication. These greases do not always mix well with the supplied grease and could cause a loss of lubrication properties and premature failure of the bearings. Contact your lubrication supplier to be sure that the re-lubrication grease is compatible with the lithium-based grease supplied with the Airlock Screw Feeder.

The gear reducer should be lubricated per the manufacturer's instructions listed in the information shown in Section 9.

# 9 Drive Documents and Information

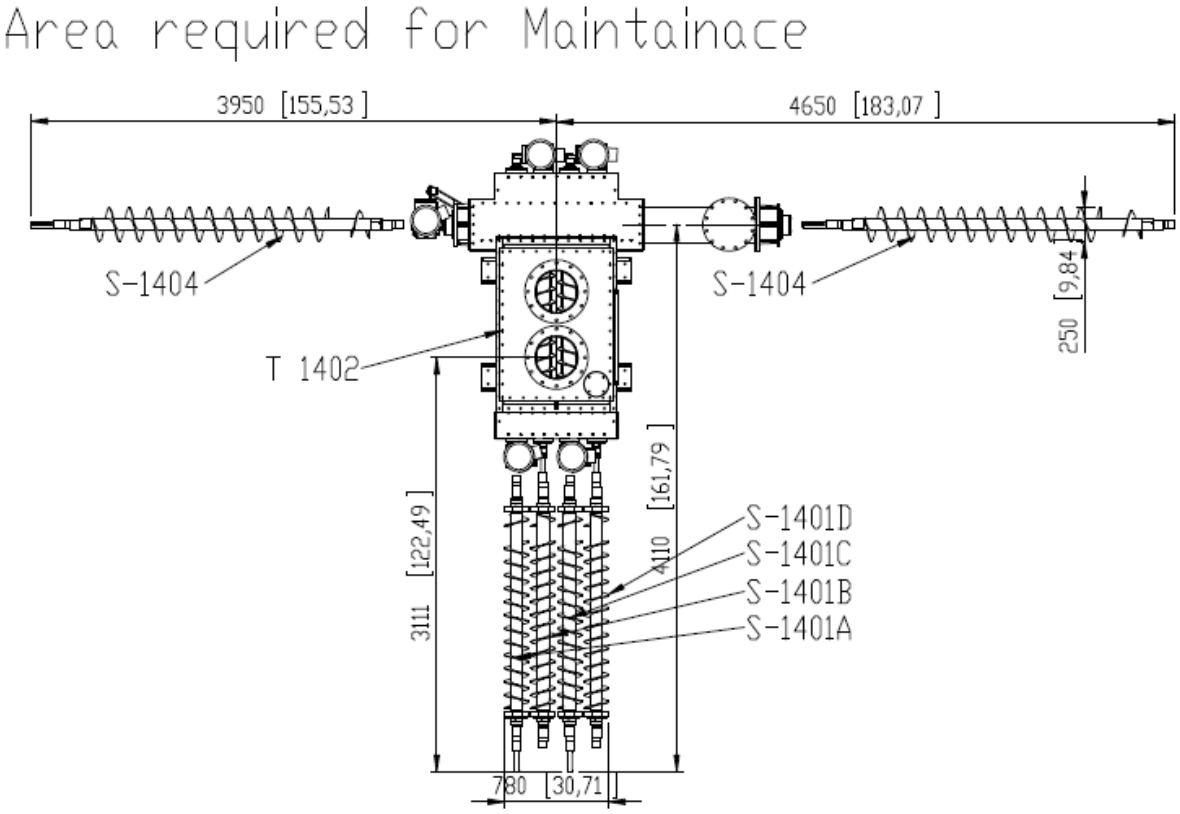


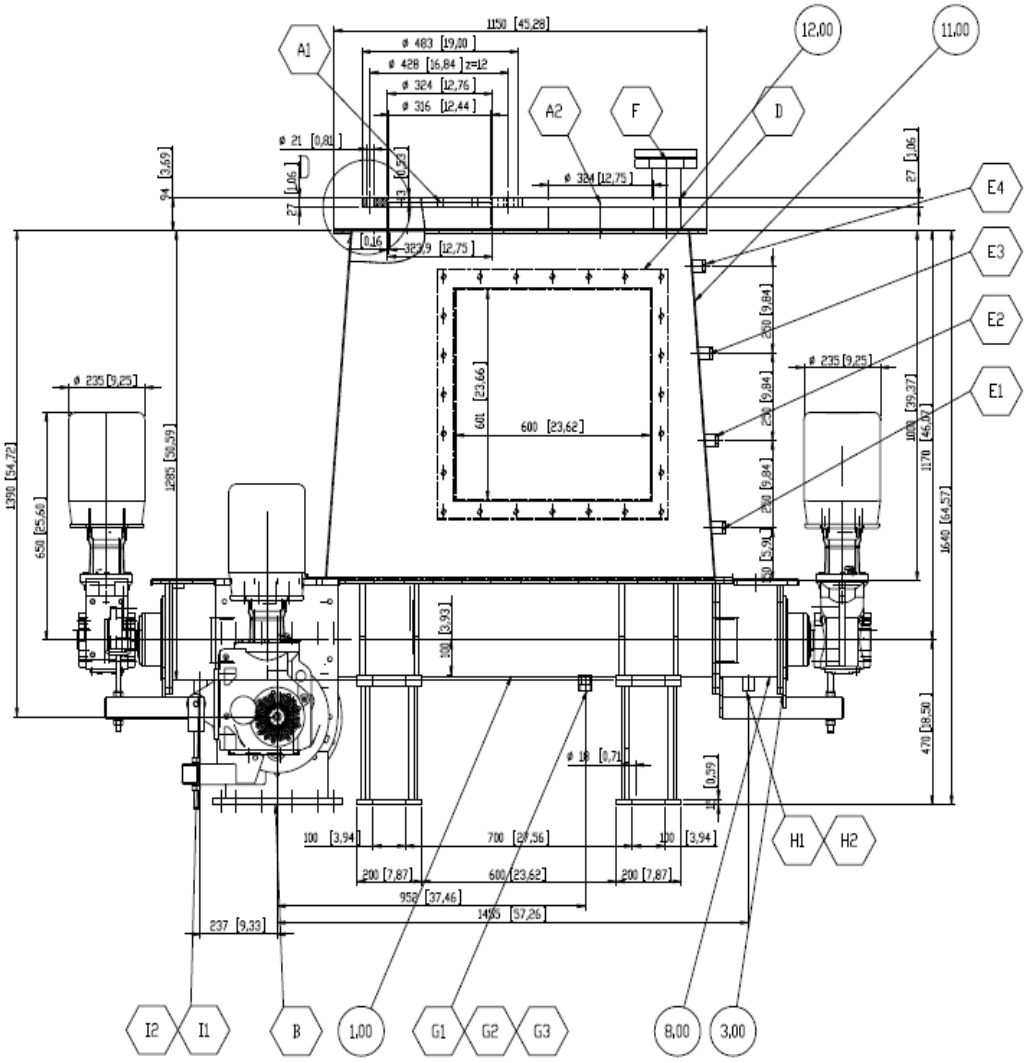


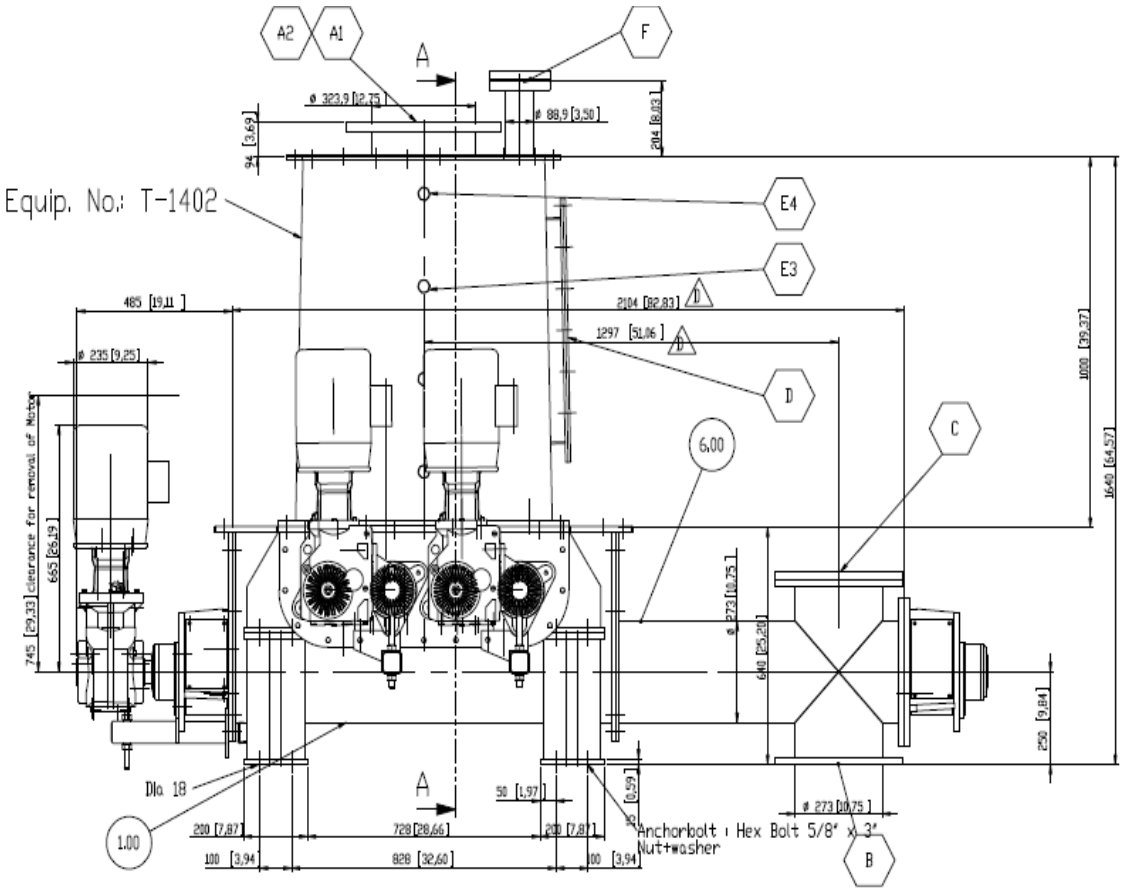


# 10 Machine Drawings

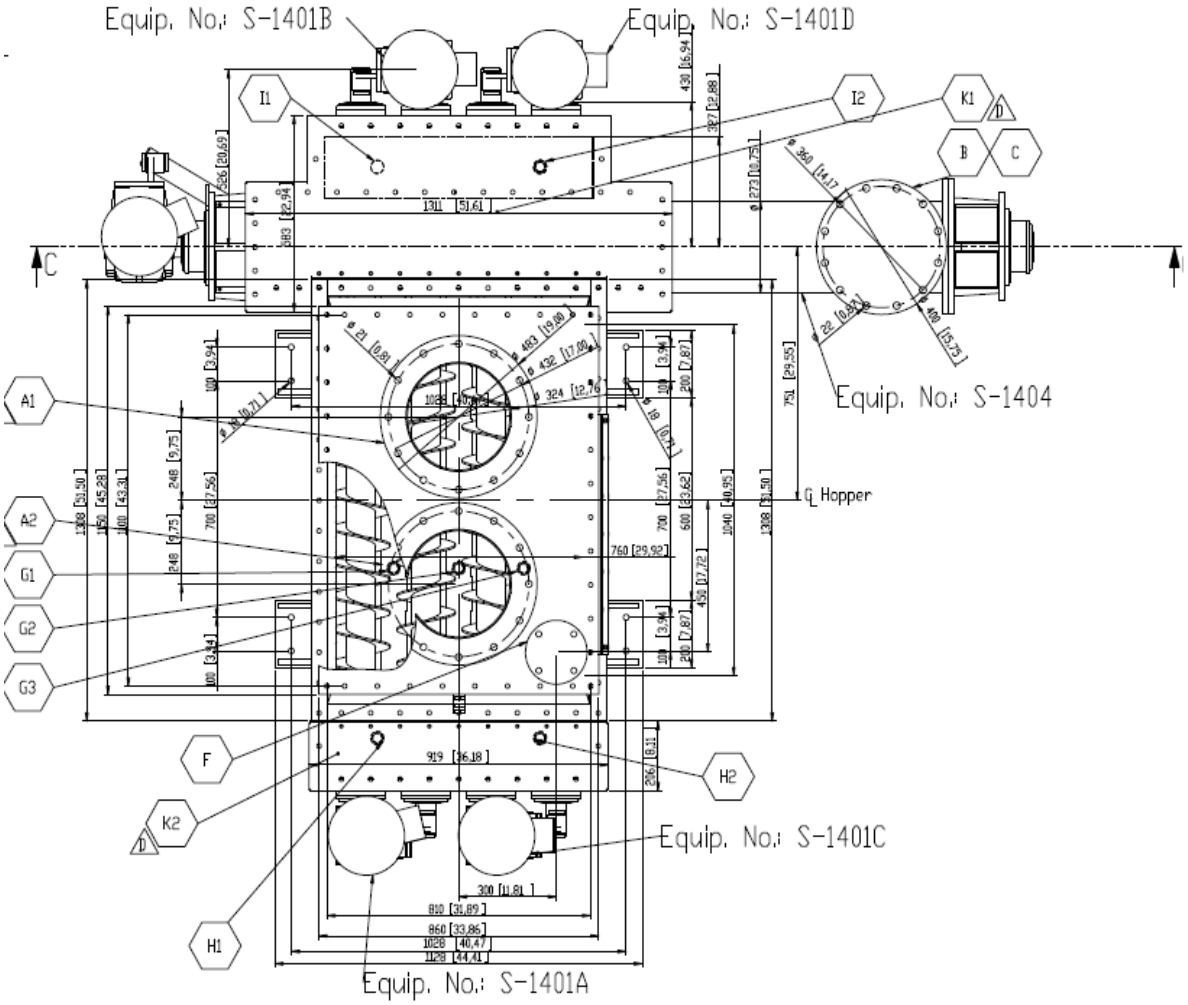
General Arrangement Drawing








| Item No | Material | Lenght mm | Widht mm | Helght mm | Motor HP | Weight kg |
|---|---|---|---|---|---|---|
| T 1402 | SA 240 304 | 2000 | 2955 | 1640 | - | 1283 kg |
| S1401 A-D | SA 240 304 | 2225 | 180 | 180 | 1 HP | 176 kg/pc |
| S 1404 | SA 240 304 | 2892 | 250 | 250 | 5 HP | 260 kg |
| - | - | - | - | - | Total | 2248 kg |


Equip. No.: S-1401B
Equip. No.: S-1401D
Equip. No.: S-1404
Equip. No.: S-1401C
Equip. No.: S-1401A
Hopper
I1
I2
K1
K2
A1
A2
G1
G2
G3
F
H1
H2
B
C
D

# 11 Spare Parts Information

Spare parts requirements are split up into three groups – **Emergency (E)**, **Consumable (C)** and **Extended (X)**. The definitions of each of these are:

**Emergency:** These parts are those that are critical to the operation of the machine, difficult or impossible to repair, take a long time to have made and may be damaged under unusual or upset conditions. It is recommended that these parts be kept in the mill's inventory at all times in the quantities listed. ANDRITZ does not stock these parts for emergency conditions. These parts should always be purchased from ANDRITZ to insure that they are the proper part and are correctly fabricated.

**Consumable:** These parts are those that wear as part of the normal operation of the machine or those parts that are needed every time the machine is disassembled. These parts are normally changed every time the machine is overhauled. While it is not absolutely necessary that the customer keep these parts in inventory, it is important that the customer knows where they can be found on short notice. ANDRITZ can supply these items on a normal delivery schedule either individually or as part of a repair kit. ANDRITZ does not stock these parts for emergency conditions.

**Extended:** These parts are those that eventually wear out over the operating time of the machine and need to be replaced. These are normally relatively expensive parts that take considerable time to fabricate. It is not necessary to keep these parts in inventory, but as the inspection records indicate that they are wearing out, the replacement costs should be budgeted and the part purchased. ANDRITZ does not stock these parts for emergency conditions. These parts should always be purchased from ANDRITZ to insure that they are the proper part and are correctly fabricated.

## SPARE PARTS RECOMMENDATIONS:

**Emergency:**

- Packing System

**Consumable:**

- All bearings and bearing adapters, seals, locknuts lock washers and stability rings.
- All gaskets
- The tachometer.
- Sight Glass lens.

**Extended:**

- Conveyor Assemblies

# Spare Parts Recommendations

Customer: Rentech ClearFuels

Material Number: 132054892

Description: BIN SURGE HOPPER /LIVE BOTTOM

**SPARE PART LIST**

Attached – Per Spare Parts Drawing 702080073 (also attached)

Customer: URS ENERGY & CONSTRUCTION INC
Material Number: 132054892
Description: BIN SURGE HOPPER /LIVE BOTTOM C-03-810628 URS CLEAR FUELS SURGE HOPPER S URS ENERGY & CONSTRUCTION INC
Project WBS Number: C-03-810628-104

**SPARE PART LIST**

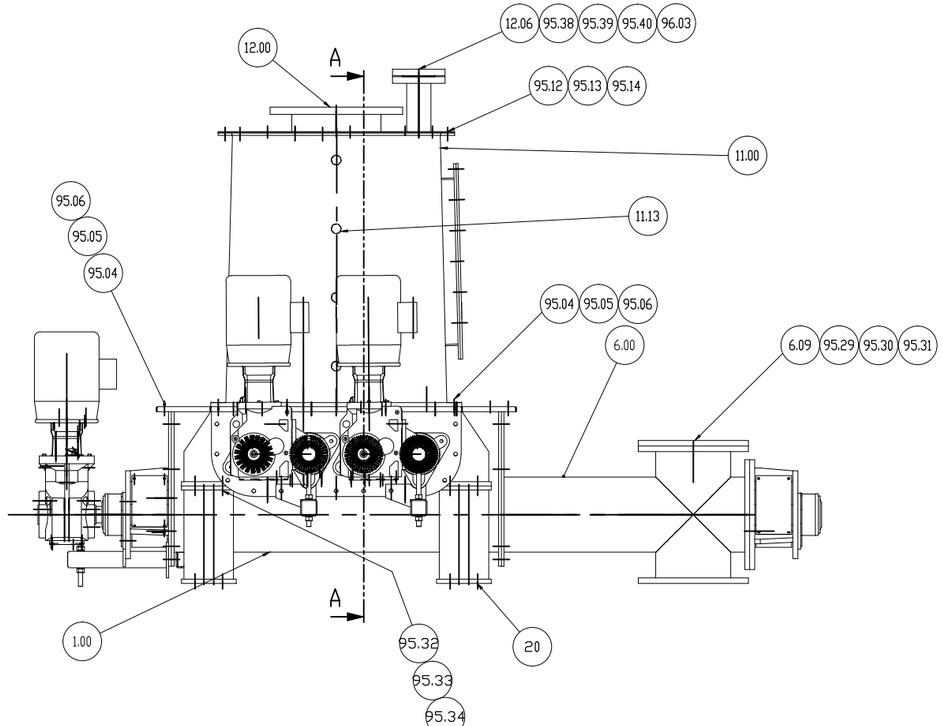
| | |
|---|---|
| Spare Parts Drawing: | 702080073 |

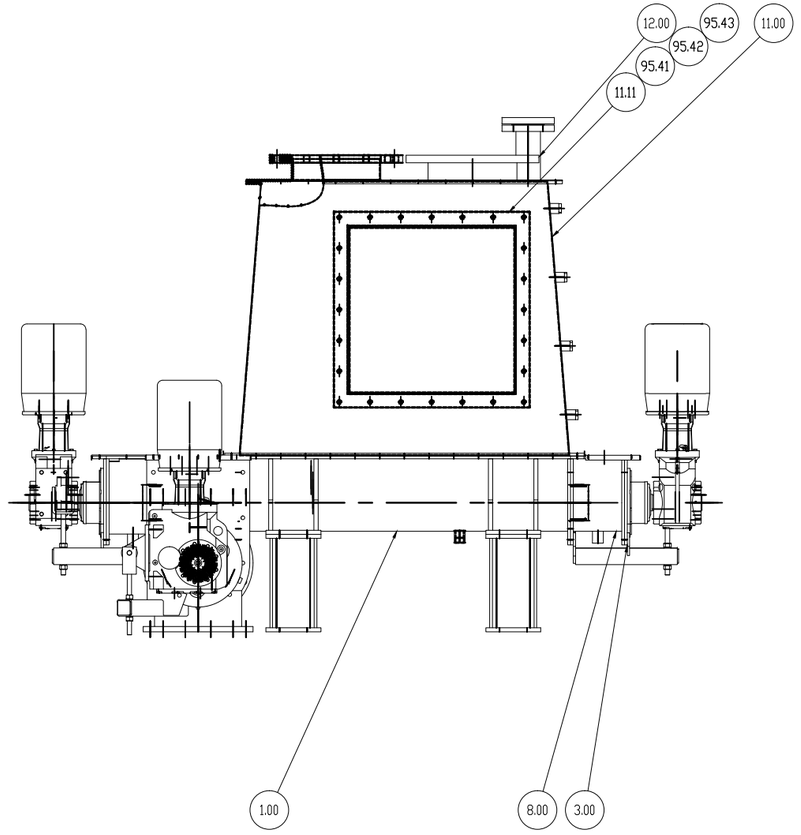
| F/N | Name | Description | Spare Part | Qty |
|---|---|---|---|---|
| | 132054892 | BIN SURGE HOPPER /LIVE BOTTOM C-03-810628 URS CLEAR FUELS SURGE HOPPER S URS ENERGY & CONSTRUCTION INC | | |
| 1 | 202578434 | ASSEMBLY -0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 1.00 | 202578729 | HOUSING -BOTTOM 0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 1.08 | 131969952 | HEX SOCKET PIPE PLUG DIN906 - R1 A1 ISO3506-1 AMC 1990 01 00 000 | | 3.0 |
| 2.00 | 202578730 | HOUSING - TRANSFER, 0.6M3 LIVE BOTTOM | | 1.0 |
| 2.11 | 131178184 | STUD ,THREADED 1/2 - 13 UNC, FULL THREAD X 2-1/4 A193-B8 | | 16.0 |
| 2.12 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 AMC A194- GRADE 8 | | 16.0 |
| 2.13 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 16.0 |
| 2.15 | 131969952 | HEX SOCKET PIPE PLUG DIN906 - R1 STAINLESS STEEL | | 2.0 |
| 5.00 | 202578734 | HOUSING -END, 0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 5.05 | 131178184 | STUD ,THREADED 1/2 - 13 UNC, FULL THREAD X 2-1/4 A193-B8 | | 4.0 |
| 5.06 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194- GRADE 8 | | 4.0 |
| 5.07 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 ½: STANDARD STAINLESS STEEL | | 4.0 |
| 6.00 | 202579481 | HOUSING -DISCHARGE, 0.6M3 LIVE BOTTOM | | 1.0 |
| 6.09 | 202585732 | COVER PLATE -DISCHARGE SCREW, 0.6M3 LBB | | 1.0 |
| 7.00 | 202579487 | HOUSING -END DISHARGE, 0.6M3 LIVE BOTT | | 1.0 |
| 7.04 | 131178184 | STUD ,THREADED 1/2 - 13 UNC, FULL THREAD X 2-1/4 A193-B8 | | 4.0 |
| 7.05 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 AMC A194 GRADE 8 | | 4.0 |
| 7.06 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 ½: STANDARD STAINLESS STEEL | | 4.0 |
| 8.00 | 202579490 | HOUSING -BOTTOM END, 0.6M3 LIVE BOTTOM | | 1.0 |
| 8.07 | 131178184 | STUD ,THREADED 1/2 - 13 UNC, FULL THREAD X 2-1/4 A193-B8 | | 16.0 |
| 8.08 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 16.0 |
| 8.09 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 16.0 |
| 8.10 | 131456898 | HEX HEAD PLUG ASMEB16.3 NPS 1" - NPT CARBON STEEL | | 2.0 |
| 9.00 | 202579949 | SCREW CONVEYOR ASSEMBLY LIVE BOTTOM BIN 0.6M3 | EXTENDED | 2.0 |
| 9.10 | 132092340 | AC-MOTOR 1 HP 1765 1/MIN 460 V 3 PH 60 HZ 143TC | | 2.0 |
| 9.11 | | ADAPTER | | 2.0 |
| 9.12 | | GEAR REDUCER | EXTENDED | 2.0 |
| 10.00 | 202579968 | SCREW CONVEYOR ASSEMBLY LIVE BOTTOM BIN 0.6M3 | EXTENDED | 2.0 |
| 10.10 | 132092340 | AC-MOTOR 1 HP 1765 1/MIN 460 V 3 PH 60 HZ 143TC | | 2.0 |
| 10.11 | | ADAPTER | | 2.0 |
| 10.12 | | GEAR REDUCER | EXTENDED | 2.0 |

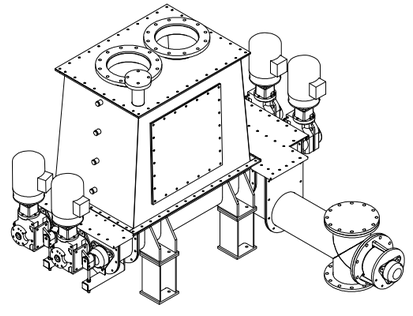
| F/N | Name | Description | Spare Part | Qty |
|---|---|---|---|---|
| 11.00 | 202580108 | BIN -0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 11.11 | 202580153 | SIDE COVER -0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 11.13 | 131456927 | HEX HEAD PLUG ASMEB16.3 NPS 3/4" - NPT STAINLESS STEEL | | 4.0 |
| 12.00 | 202580127 | TOP COVER -0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 12.06 | 131418128 | BLIND FLANGE ASMEB16.5 NPS 3 CLASS 150 A105 | | 1.0 |
| 95.38 | 132114697 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 5/8" - 11 X 3-1/4" PART THD B8 CLASS 1 ASTMA193 | | 4.0 |
| 95.39 | 131865256 | HEX NUT ANSI/ASMEB18.2.2 5/8" - 11 UNC A194- GRADE 8 | | 4.0 |
| 95.40 | 131337529 | FLAT WASHER ANSI/ASMEB18.22.1 5/8 STANDARD STAINLESS STEEL | | 4.0 |
| 96.03 | 202580151 | FLAT GASKET 3" BLIND FLANGE, LBB 0.6M3 | CONSUMABLE | 1.0 |
| 13.01 | 202580181 | SAFETY GUARD -UPPER, 0.6M3 LIVE BOTTOM BIN | | 4.0 |
| 13.02 | 202580186 | SAFETY GUARD -LOWER, 0.6M3 LIVE BOTTOM BIN | | 4.0 |
| 14.00 | 202580623 | PACK BOX -0.6M3 LIVE BOTTOM BIN | | 10.0 |
| 15.01 | 202580720 | COVER PLATE 0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 15.02 | 202580721 | COVER PLATE -DISCHARGE SIDE, 0.6M3 LIVE BOTTOM BIN | | 1.0 |
| 16.00 | 202580629 | PACKING SLEEVE - 0.6M3 LIVE BOTTOM BIN | CONSUMABLE | 10.0 |
| 18.00 | 202580626 | PACKING GLAND -0.6M3 LIVE BOTTOM BIN | | 10.0 |
| 19.00 | 202579974 | SCREW CONVEYOR ASSEMBLY LIVE BOTTOM BIN 0.6M3 | EXTENDED | 1.0 |
| 19.10 | 131304458 | AC-MOTOR 5 HP 1800 1/MIN TEFC 184TC | | 1.0 |
| 19.11 | | ADAPTER | | 1.0 |
| 19.12 | | GEAR REDUCER | EXTENDED | 1.0 |
| 19.50 | 202580687 | TORQUE ARM SUPPORT -DISCHARGE SCREW, 0.6M3 LBB | | 1.0 |
| 19.09 | 202580659 | RETAINER DISC -FEED SCREW, 0.6M3 LIVE BOTTOM | | 1.0 |
| 19.15 | 132114690 | STUD BOLT DIN976-1 - M16X230 - B A2-50 ISO3506-1 | | 1.0 |
| 19.16 | 100002205 | HEX NUT ISO4032 - M16 A2-50 ISO3506-2 | | 2.0 |
| 19.17 | 131045106 | PLAIN WASHER (ISO7089) - 18 - 200HV A2 STAINLESS STEEL | | 2.0 |
| 95.24 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 AMC A194 GRADE 8 | | 3.0 |
| 95.25 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 3.0 |
| 95.57 | 131866216 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 2 PART THD A193-B7 | | 3.0 |
| 95.58 | 131976883 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-3/4 PART THD A193-B8 | | 2.0 |
| 95.59 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 2.0 |
| 95.60 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 2.0 |
| 20.00 | 202580639 | FOOT -0.6M3 LIVE BOTTOM BIN | | 4.0 |
| 21.00 | 202580653 | TORQUE ARM SUPPORT -0.6M3 LIVE BOTTOM BIN | | 2.0 |
| 21.06 | 132114690 | STUD BOLT DIN976-1 - M16X230 - B A2-50 ISO3506-1 | | 1.0 |
| 21.07 | 100002205 | HEX NUT ISO4032 - M16 A2-50 ISO3506-2 | | 2.0 |
| 21.08 | 131045106 | PLAIN WASHER (ISO7089) - 18 - 200HV A2 ISO3506-1 | | 2.0 |
| 21.09 | 202580659 | RETAINER DISC -FEED SCREW, 0.6M3 LIVE BOTTOM | | 1.0 |
| 22.00 | 202580675 | TORQUE ARM SUPPORT FEED SCREW, DISCHARGE END, 0.6 | | 2.0 |
| 22.06 | 132114690 | STUD BOLT DIN976-1 - M16X230 - B A2-50 ISO3506-1 | | 1.0 |
| 22.07 | 100002205 | HEX NUT ISO4032 - M16 A2-50 ISO3506-2 | | 2.0 |
| 22.08 | 131045106 | PLAIN WASHER (ISO7089) - 18 - 200HV A2 ISO3506-1 | | 2.0 |
| 22.09 | 202580659 | RETAINER DISC -FEED SCREW, 0.6M3 LIVE BOTTOM | | 1.0 |

| F/N | Name | Description | Spare Part | Qty |
|---|---|---|---|---|
| 95.61 | 132114694 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2" - 13 X 3/4" FULL THD B8 CLASS 1 ASTMA193 | | 4.0 |
| 95.62 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 4.0 |
| 90.01 | 132114700 | BEARING HOUSING SKF FNL 513B | | 5.0 |
| 90.02 | 132114699 | BEARING HOUSING SKF FNL 513A | | 5.0 |
| 90.03 | 131669563 | SPHERICAL ROLLER BEARING DIN635-2 22213 EK | CONSUMABLE | 10.0 |
| 90.04 | 131243061 | ADAPTER SLEEVE DIN5415 H 313 | CONSUMABLE | 10.0 |
| 90.05 | 131460464 | ROTARY SHAFT SEAL DIN3760 AS - 60X75X8 NBR | CONSUMABLE | 5.0 |
| 90.06 | 131460470 | ROTARY SHAFT SEAL DIN3760 AS - 65X85X10 NBR | COMSUMABLE | 10.0 |
| 90.07 | 131619597 | LOCATING RING SKF FRB 2/120 | | 5.0 |
| 95.01 | 132043496 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/4 FULL THREAD B8 CLASS 1 ASTMA193 | | 40.0 |
| 95.02 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 40.0 |
| 95.03 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 40.0 |
| 95.04 | 131827536 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/2 PART THD A193-B8 | | 38.0 |
| 95.05 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 38.0 |
| 95.06 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 38.0 |
| 95.07 | 132043496 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/4 FULL THREAD B8 CLASS 1 ASTMA193 | | 11.0 |
| 95.08 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 11.0 |
| 95.09 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 11.0 |
| 95.10 | 132043496 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/4 FULL THREAD B8 CLASS 1 ASTMA193 | | 20.0 |
| 95.11 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 20.0 |
| 95.12 | 132043496 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/4 FULL THREAD B8 CLASS 1 ASTMA193 | | 38.0 |
| 95.13 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 38.0 |
| 95.14 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 38.0 |
| 95.15 | 131827536 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/2 PART THD A193-B8 | | 27.0 |
| 95.16 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 39.0 |
| 95.17 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 39.0 |
| 95.18 | 132114694 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2" - 13 X 3/4" FULL THD B8 CLASS 1 ASTMA193 | | 13.0 |
| 95.19 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 13.0 |
| 95.23 | 131827536 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/2 PART THD A193-B8 | | 6.0 |
| 95.24 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 6.0 |
| 95.25 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 6.0 |
| 95.26 | 131833721 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 3/4 - 10 X 2-3/4 PART THD A193-B8 | | 8.0 |
| 95.27 | 132114698 | HEX NUT ANSI/ASMEB18.2.2 3/4" - 10 8 ASTMA194 | | 8.0 |
| 95.28 | 131325774 | FLAT WASHER ANSI/ASMEB18.22.1 3/4 STANDARD STAINLESS STEEL | | 8.0 |
| 95.29 | 131833721 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 3/4 - 10 X 2-3/4 PART THD A193-B8 | | 12.0 |
| 95.30 | 132114698 | HEX NUT ANSI/ASMEB18.2.2 3/4" - 10 8 ASTMA194 | | 12.0 |

| F/N | Name | Description | Spare Part | Qty |
|---|---|---|---|---|
| 95.31 | 131325774 | FLAT WASHER ANSI/ASMEB18.22.1 3/4 STANDARD STAINLESS STEEL | | 12.0 |
| 95.32 | 132114695 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 5/8" - 11 X 2-1/2" PART THD B8 CLASS 1 ASTMA193 | | 16.0 |
| 95.33 | 131865256 | HEX NUT ANSI/ASMEB18.2.2 5/8" - 11 UNC A194 GRADE 8 | | 16.0 |
| 95.34 | 131866917 | FLAT WASHER ANSI/ASMEB18.22.1 5/8" STANDARD STAINLESS STEEL | | 16.0 |
| 95.35 | 132114696 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 5/8" - 11 X 2-3/4" PART THD B8 CLASS 1 ASTMA193 | | 16.0 |
| 95.36 | 131865256 | HEX NUT ANSI/ASMEB18.2.2 5/8" - 11 UNC A194 GRADE 8 | | 16.0 |
| 95.37 | 131866917 | FLAT WASHER ANSI/ASMEB18.22.1 5/8" STANDARD STAINLESS STEEL | | 16.0 |
| 95.41 | 132043496 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 1-1/4 FULL THREAD B8 CLASS 1 ASTMA193 | | 24.0 |
| 95.42 | 131457121 | HEX NUT ANSI/ASMEB18.2.2 1/2" - 13 A194 GRADE 8 | | 24.0 |
| 95.43 | 131325735 | FLAT WASHER ANSI/ASMEB18.22.1 1/2 STANDARD STAINLESS STEEL | | 24.0 |
| 95.44 | 131976466 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 3/8 - 16 X 2 PART THD A193-B8 | | 24.0 |
| 95.45 | 131420903 | HEX NUT ANSI/ASMEB18.2.2 3/8" - 16 UNC A194 GRADE 8 | | 24.0 |
| 95.46 | 131337540 | FLAT WASHER ANSI/ASMEB18.22.1 3/8 STANDARD STAINLESS STEEL | | 24.0 |
| 95.47 | 131976466 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 3/8 - 16 X 2 PART THD A193-B8 | | 6.0 |
| 95.48 | 131420903 | HEX NUT ANSI/ASMEB18.2.2 3/8" - 16 UNC A194 GRADE 8 | | 6.0 |
| 95.49 | 131337540 | FLAT WASHER ANSI/ASMEB18.22.1 3/8 STANDARD STAINLESS STEEL | | 6.0 |
| 95.50 | 132039738 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 3/8 - 16 X 3/4 FULL THREAD A193-B8 | | 40.0 |
| 95.51 | 131337540 | FLAT WASHER ANSI/ASMEB18.22.1 3/8 STANDARD STAINLESS STEEL | | 40.0 |
| 95.52 | 132114693 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 5/16" - 18 X 1-1/2" PART THD B8 CLASS 1 ASTMA193 | | 24.0 |
| 95.53 | 131337532 | FLAT WASHER ANSI/ASMEB18.22.1 5/16 STANDARD STAINLESS STEEL | | 24.0 |
| 95.56 | 132114692 | SET SCREW ~ISO4026 - M8X10 - A2-70 ISO3506-1 | | 40.0 |
| 95.63 | 131866216 | HEX HEAD CAP SCREW ANSI/ASMEB18.2.1 1/2 - 13 X 2 PART THD A193-B8 | | 12.0 |
| 95.64 | 131325078 | SOCKET HEAD CAP SCREW DIN6912 - M16X70 - A4-70 ISO3506-1 | | 5.0 |
| 96.01 | 132115824 | SHAFT PACKING RING 110 X 90 X 12 | CONSUMAB;LE | 20.0 |
| 96.04 | 132114686 | O-RING ISO3601-1 - B0800A - 80X2.65 - N VITON | CONSUMABLE | 10.0 |





| | | | | | |
|---|---|---|---|---|---|
| Customer: ---- | | AMC: ---- | Basic Material Name: ---- | Basic Material Standard: ---- | Net weight: ---- |
| Pos. No.: ---- | Customer Drawing No.: ---- | | | Designed: JB | Date: 06/10/2011 |
| Product Type: ---- | Product Code: ---- | | | Drawn: JB | Date: 06/10/2011 |
| Size: A1 | Scale: 1:1 | Description Line 1 (EN): ---- | | Checked: JFB | Date: 19/10/2011 |
| Division: KF | Prod. Home: 1221 | System: AUTOCAD_05 | Description Line 2 (EN): SPARE PARTS DRAWING | Approved: GIFJOH04 | Date: 21/10/2011 |
| | | Replacement for Drawing: ---- | Rev. / Replaced by Drawing: ---- | Rev. / Copy from Drawing: ---- | Rev.: ---- Sheet: ---- |
| ANDRITZ FIBER AND CHEMICAL DIVISION | | SAP Mat. No./Variant: ---- | Reference Drawing: ---- | Old Drawing No.: ---- | Rev.: ---- M-Film: ---- |
| | | SAP Main WBS Element: ---- | | Drawing No.: 702080073 – 1 | Rev.: ---- Sheet: 1 / 2 |

CHESTERTON
Global Solutions, Local Service.

## How to Install

# CHESTERTON® 1740 Packings

The best performance from 1740 is obtained when the following installation procedures are used.

1. Before installing, check shaft alignment and surface finish. Shaft or sleeve should be in “as-new” condition.
2. Cut packing on a mandrel the same size as the shaft or sleeve, and form into rings. Packing joints may be butt, diagonal, or bias cuts.
3. Seat each ring firmly in the stuffing box, staggering joints 90° for each successive ring. It is not necessary to drive or tamp them into position.
4. Tighten follower gland nuts finger tight. Start pump. If there is no leakage, lossen gland nuts, until leakage occurs. Wear protective equipment as required by fluid being packed.
5. Reduce leakage to desired level by tightening gland nuts one flat at a time, waiting at least five minutes between adjustments. (Remember: Packing lasts longer when it is adjusted to minimize leakage, not to stop it completely).
6. If the gland overheats, back off follower gland nuts and repeat run-in procedure.

*Chesterton ISO certificates available at www.chesterton.com/corporate/iso*

CHESTERTON

860 Salem Street
Groveland, MA 01834 USA
Telephone: 781-438-7000 Fax: 978-469-6528
www.chesterton.com

# CHESTERTON® 1740 PRODUCT DATA SHEET

## 1.0 SCOPE

1.1 This specification describes 1740 Packing which is a multi-service, non-asbestos packing.

1.2 It is applicable for use to seal shafts, rods and expansion joints against water, steam, solvents, mild acids and alkalies, oil and abrasives to 500˚F (260˚C). This packing will not stain in pulp and paper mill applications.

## 2.0 CONTENT AND CONSTRUCTION

2.1 Content

2.1.1 Yarn

- 2.1.1.1 1740 shall be made of single ply, continuous, multi-filament aramid yarn.

2.1.2 Lubricants

- 2.1.2.1 The yarn shall be impregnated with tetrafluoroethylene (TFE) dispersion and silicone based lubricants.

2.2 Construction

2.2.1 Packing of 1/8" through 6mm shall be square braided.

2.2.2 Packing of 1/4" through 1" shall be interbraided.

## 3.0 TYPICAL PHYSICAL, THERMAL, AND CHEMICAL CHARACTERISTICS

3.1 Physical Characteristics

3.1.1 Pressure Rating - 300 PSI (21 Bar)

3.1.2 Maximum Shaft Speed - 2000 FPM (10 MPS)

3.2 Thermal Characteristics

3.2.1 Maximum Service Temperature - 500˚F (260˚C)

3.3 Chemical Characteristics

3.3.1 Compatible pH Range - 4 to 11

3.3.2 Chemical Incompatibility - strong mineral acids and alkalies.

**A.W. CHESTERTON CO.**
225 FALLON ROAD, MIDDLESEX INDUSTRIAL PARK
STONEHAM, MASSACHUSETTS 02180-9101 USA
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TEL: (617) 438-7000
CABLE: Chesterton Stoneham, Mass.



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SKF

# SKF spherical roller bearings – setting a new standard for performance and reliability

# Contents

**Made by SKF®** stands for excellence. It symbolises our consistent endeavour to achieve total quality in everything we do. For those who use our products. “Made by SKF” implies three main benefits.

**Reliability** – thanks to modern, efficient products, based on our worldwide application know-how, optimised materials, forward-looking designs and the most advanced production techniques.

**Cost effectiveness** – resulting from the favourable ratio between our product quality plus service facilities, and the purchase price of the product.

**Market lead** – which you can achieve by taking advantage of our products and services. Increased operating time and reduced down-time, as well as improved output and product quality are the key to a successful partnership.

# Economical and robust



## Why spherical roller bearings?

Spherical roller bearings offer an attractive combination of design features, which are making them irreplaceable in many demanding applications.

- **Self-aligning**
  Spherical roller bearings allow misalignment between shaft and housing without increase of friction and without reduction of bearing life.
- **Very high load carrying capacity**
  Optimum layout inside available cross-section provides maximum radial and axial load carrying capacity.
- **Robust**
  Insensitive to misalignment caused by shaft or housing deflection due to heavy load.
- **Easily fitted for loads in all directions**
  The bearings are non-separable and ready to install using a number of mounting methods.
- **Easy bearing application**
  The favourable design characteristics and mounting enable for a more efficient and compact machine design.

Spherical roller bearings with integral seals offer additional benefits.

- **Protection against contamination**
  Sealed spherical roller bearings are especially suited for bearing positions where, because of limited space or for cost reasons, effective external seals cannot be provided.
- **Grease retention**
  Contact seals on both sides of the bearing retain the factory filled grease where it is required: inside the bearing.
- **Minimum maintenance requirements**
  Under normal operating conditions, sealed spherical roller bearings are maintenance free, keeping service costs and grease consumption low.

# Why SKF spherical roller bearings?

SKF bearings are developed for customer satisfaction. The best confirmation of the total quality of SKF spherical roller bearings is their success on the market. There are twice as many SKF spherical roller bearings in service as those of any other bearing manufacturer.

This is not just by chance: SKF spherical roller bearings are well-proven in the field and undergo continuous development to provide improved performance. The most recent example has been the introduction of the Explorer bearings, which opened up new application horizons, and the sealed bearings in standard and Explorer versions.

The use of SKF spherical roller bearings implies several benefits.

**Application efficiencies**
SKF spherical roller bearings have a very high load carrying capacity in the radial and axial directions. Bearing applications become increasingly cost effective due to

- long service life and
- compact arrangements.

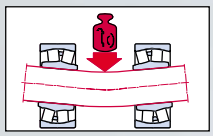
**Reduced operating costs**
The optimised and robust internal design of the SKF spherical roller bearings minimises friction and heat, and by this, lubricant consumption. In service, this reduces costs due to

- less machine downtime,
- minimised maintenance requirements and
- high reliability.

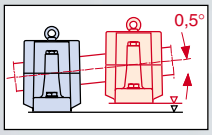
**Seals integration**
Under normal operating conditions, sealed SKF spherical roller bearings are greased for life and make external seals unnecessary, creating additional benefits:

- simplified bearing arrangements;
- no relubrication.

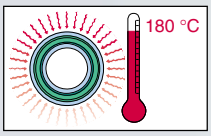
**Standard solution**
Many bearing applications previously fitted with expensive special bearings can now be equipped with SKF spherical roller bearings. Because of the global availability of SKF spherical roller bearings, spare parts are much easier to get.



***Rugged***



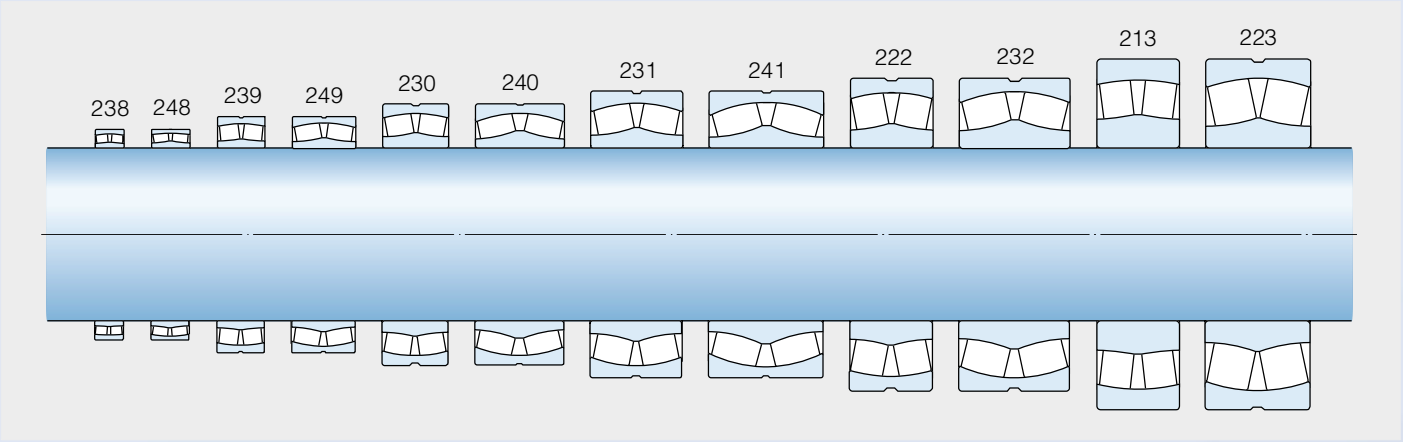

***Tolerant to alignment errors***




***Resistant to elevated temperatures***

**Customer satisfaction**
Equipment owners will be impressed by the low operating costs in combination with high reliability contributed by SKF spherical roller bearings. Not only are costs reduced, but with sealed versions environmental resources are spared.

***SKF bearings:***
***always the best choice, when robustness and reliability matter***

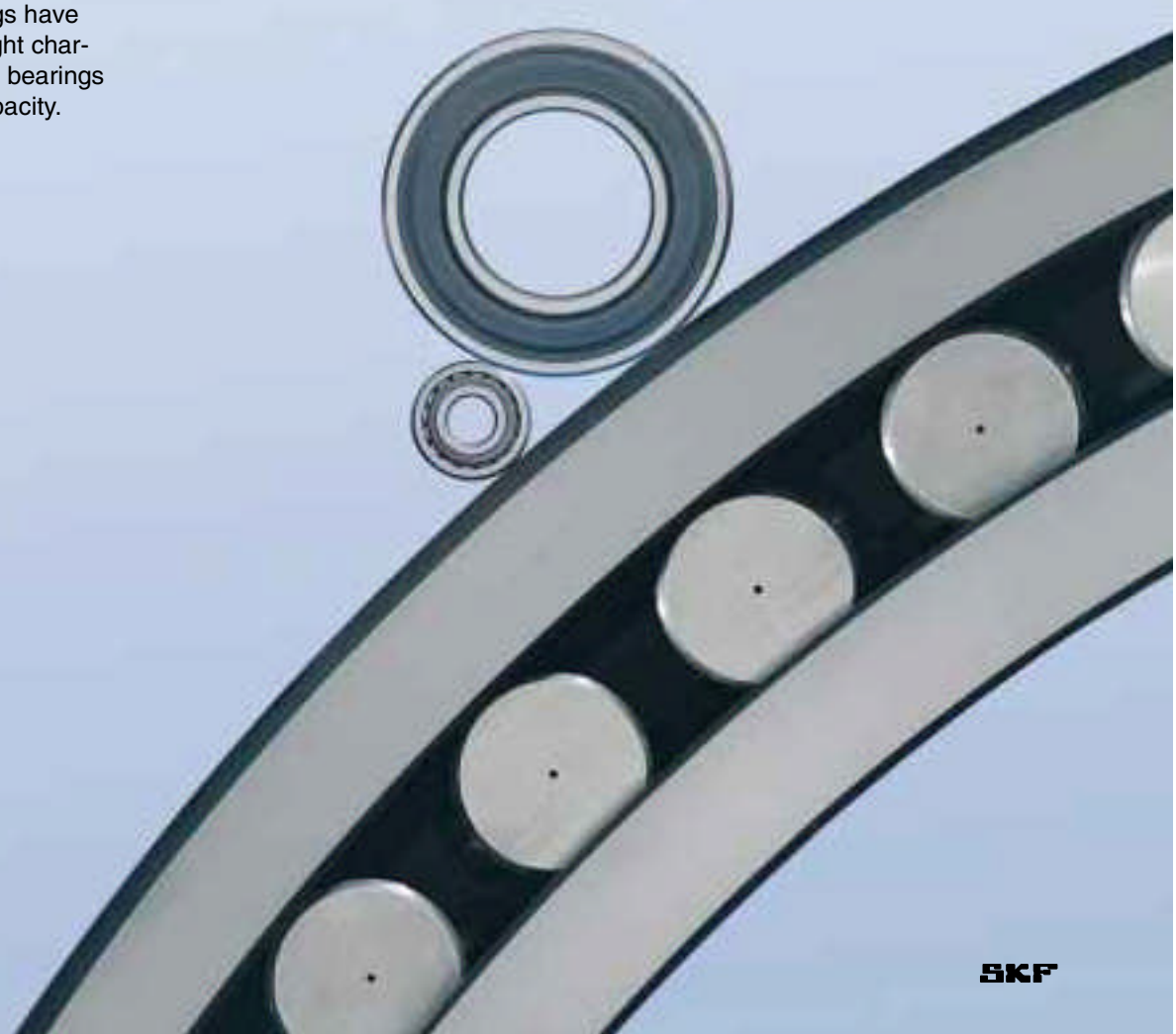



***Bearing series***

# A complete bearing range

The range of open and sealed SKF spherical roller bearings covers all series currently in demand. Taking availability into account, this constitutes the most complete range on the market.

Narrow low-section bearings have better speed, space and weight characteristics. Wide high-section bearings have higher load carrying capacity.



**Product range**

Page ..... 18

Page ..... 32



### SKF spherical roller bearings without seals

The open bearings are available in sizes from 20 to 1 800 mm bore diameter and with cylindrical or tapered bore to suit all types of mounting methods. To facilitate efficient lubrication, most bearings are provided with an annular groove and three lubrication holes in the outer ring.

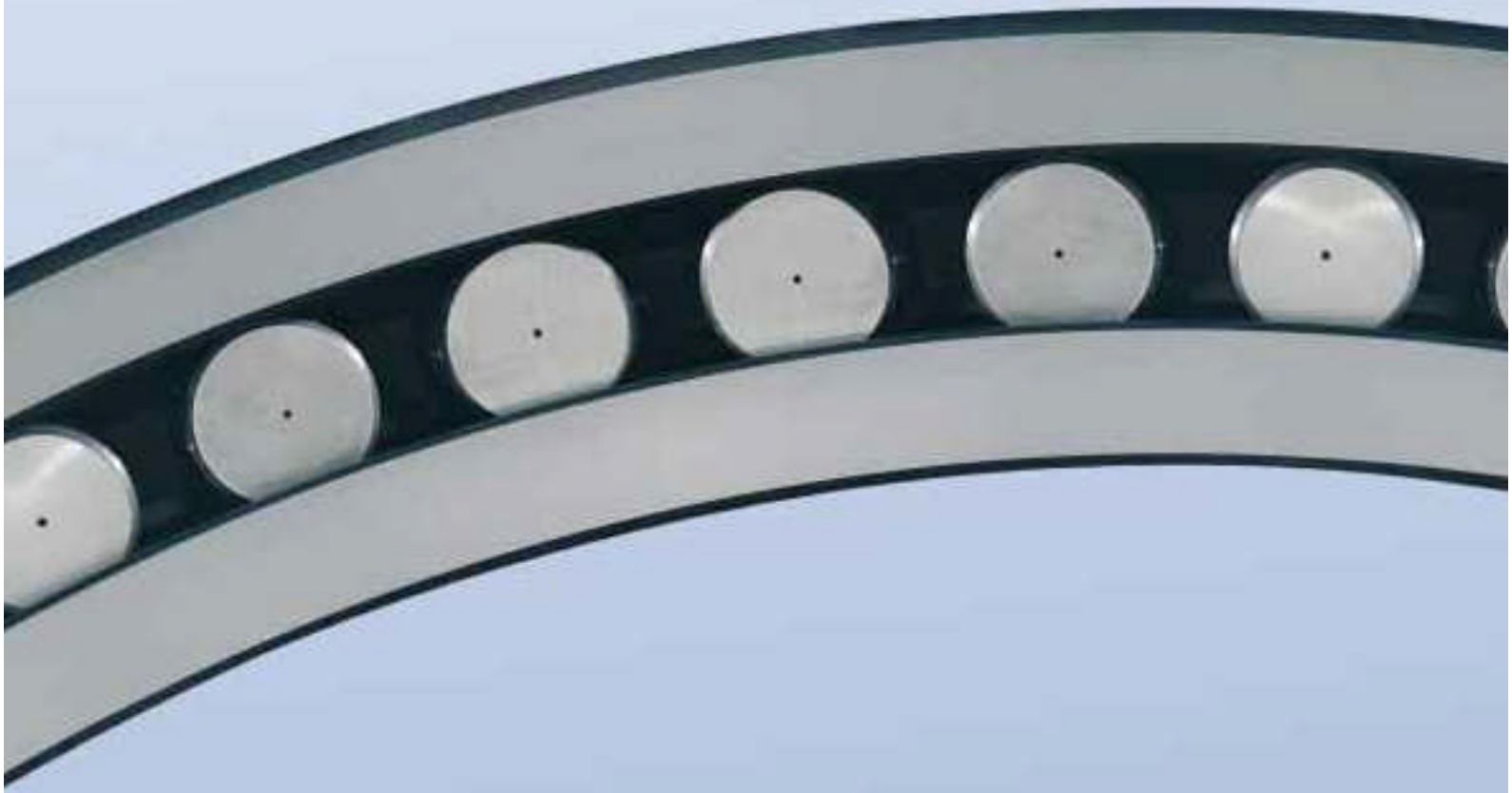
The bearings are available in a wide range of series designed to satisfy the following selection criteria:

- load carrying capacity;
- combination of radial and axial loads;
- rotational speed;
- space in the application.

### Sealed SKF spherical roller bearings

The SKF range of sealed spherical roller bearings comprises bearings with cylindrical bore for shaft diameters of 35 to 220 mm and bearings with tapered bore for shaft diameters of 40 to 90 mm in the seven most frequently used bearing series. Further sizes can be produced to special order.

The seals have been specially developed for spherical roller bearings and effectively prevent contamination from entering the rolling contact area. This is not only true in operation, but also during bearing installation, resulting in long service life.



# SKF spherical roller bearings – leading in design

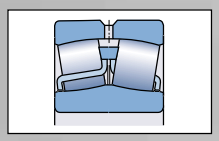
## Standard bearings: a unique combination of design features

All SKF spherical roller bearings have features in common which are unique in the market:

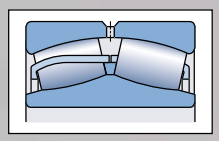
- symmetrical rollers
- special roller profile
- self-guiding rollers – an SKF patent
- floating guide ring between the two rows of rollers
- bearing components dimensionally stabilised for high temperatures
- metallic cages

To facilitate efficient bearing lubrication SKF standard spherical roller bearings are provided with three lubrication holes in the outer ring, mostly in combination with an annular groove. Depending on size and series, standard SKF spherical roller bearings are basically made in three different designs:

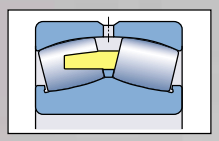
- E design
- CC design
- CA design



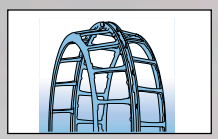
***E design***
*The bearings of this design have symmetrical rollers, two hardened window-type steel cages centred on the inner ring, a flangeless inner ring and a floating guide ring between the two roller rows.*



***CC design***
*With symmetrical rollers, two window-type steel cages which are inner ring centred via a floating guide ring between the two roller rows.*



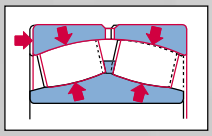
***CA design***
*With symmetrical rollers. The inner ring centred guide ring centres the one piece, double pronged machined cage of brass or steel. The inner ring has retaining flanges.*



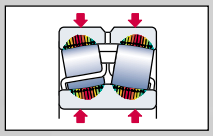
***Durable cage design***
*Steel and brass cages are strong as well as tolerant to high temperatures and all lubricants. Small and medium size bearings have window-type steel cages, larger sizes have machined double pronged brass or steel cages.*

***E design***

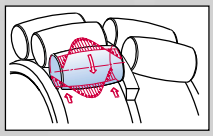
***CC design***



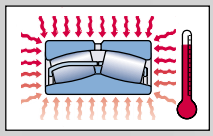
***Very high load carrying capacity***
*The symmetrical rollers self-adjust, providing an even load distribution along the roller length. This gives very high load carrying capacity under all load combinations.*



***No edge stresses***
*The special roller profile minimises the risk of edge stresses.*



***Reduced friction and minimum heat generation***
*Self-guiding rollers – an SKF patent – mean reduced friction and minimum heat generation.*



***Excellent performance at high temperatures***
*High-strength, dimensionally stable bearing rings minimise the risk of ring breakage and also allow good performance at high temperatures.*

# Setting new standards: the SKF Explorer

The unique SKF spherical roller bearing designs were the starting points for further development of materials and manufacturing processes. The Explorer spherical roller bearings are the result of very skilled and intensive fine tuning processes, which, taken all together constitute a new performance level for spherical roller bearings.

- **Steel**
  New, ultra-clean for longer life at higher loads.
- **Heat treatment**
  New procedures significantly improve wear resistance.
- **Manufacturing**
  Refined processes allow the production of smoother running bearings with improved lubrication.
- **Internal geometry**
  A fine-tuned micro-geometry of the rolling contacts gives better stress distribution.

Explorer bearings give more performance for the same size as explained in more detail from **page 12** onwards.

***CA design***

# Sealed SKF spherical roller bearings – for demanding environments

Sealed SKF spherical roller bearings are designed to fulfil high demands on sealing efficiency and operational reliability under difficult environmental conditions. The seals were developed using computer simulation, making full usage of the vast expertise within the SKF Group. They have been extensively tested both in the laboratory and in the field and have proved their reliable performance and efficiency.

SKF sealed spherical roller bearings include double-lip, sheet steel reinforced seals made of

– nitrile rubber (NBR)
– hydrogenated nitrile rubber (HNBR)
– fluoro rubber (FPM)

and a grease fill which is appropriate to the operating conditions.

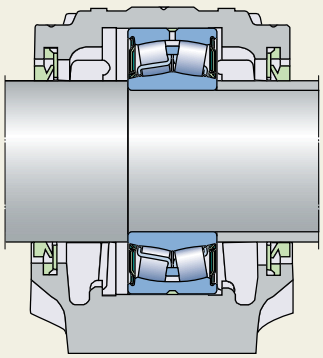
This forms a ready-to-mount and lubricated-for-life bearing with long service life and normally the same space requirements as a standard open bearing. The advantages include a simplification of the bearing arrangement, as well as the option of downsizing. Facilities for relubrication are normally not required, and there are no more costs for purchasing, applying and disposing of bearing greases.

**Temperature limits**
Sealed SKF spherical roller bearings are suitable for normal operating temperatures up to 110 °C (230 °F). Bearings for higher operating temperatures can be produced upon request. In these cases, the grease and seal material must be chosen accordingly. Other operating conditions such as the speed may need to be considered as well. Please contact the SKF application engineering service for further advice.

### Contamination resistance

Due to the efficiency of the integral seals, additional external seals are normally not required. Generally compact bearing arrangements can be produced in most cases. However, if the environmental conditions are harsh, external seals should be employed (→ **fig 1**).

**Fig 1**



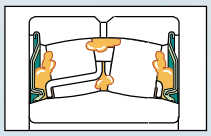
***A sealed spherical roller bearing in an SNL plummer block housing***

### Warning for fluoro rubber (FPM) seals

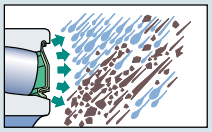
FPM is very stable and harmless in normal operating conditions – up to 200 °C (392 °F). However, if exposed to extreme temperatures above 300 °C (572 °F), e.g. fire or the flame of a cutting torch, fluoro rubber emits dangerous toxic vapours. Once overheated the fluoro rubber will remain dangerous to handle even when cooled. Please contact SKF for complete safety instructions. See also SKF catalog 4006 “CR seals” for further information.

### Rule of thumb

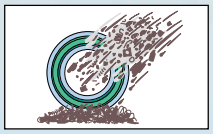
Sealed bearings do not need relubrication when the temperatures do not exceed 70 °C (158 °F) and speed are not more than 50 % of the speed rating listed in the product tables. More precise information is given in the section “Lubrication and maintenance” on **page 28**.



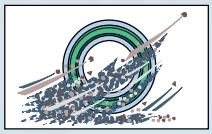
***Well lubricated***
*Bearings for normal operating temperatures and speeds are lubricated with the SKF lithium base grease LGEP 2 with excellent rust inhibiting properties.*



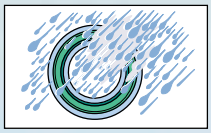
***Well protected***
*The bearings have a sheet steel reinforced double-lip seal at each side. Seals can be made of nitrile rubber (NBR), hydrogenated nitrile rubber (HNBR) or fluoro rubber (FPM).*



***Solid contaminants excluded***
*Eliminate dirt in the bearing, which creates indentations in both raceways and rollers and causes early failure due to flaking. The best and simplest method to do this is to use SKF sealed spherical roller bearings. The seals offer protection for the bearing interior during handling and mounting.*



***Always reliable***
*The bearings are filled with a high-quality grease, which is particularly suitable for SKF spherical roller bearings. Integral seals contribute to the efficient lubrication by keeping the lubricant in position inside the bearing.*



***Moisture cannot enter***
*Adequate seals keep water out of the bearing, which otherwise would cause corrosion and considerable damage to the raceways, leading to noise and early failure. The improved seals are endorsed by the rust inhibiting properties of the lubricant.*

# SKF Explorer – the new performance class for spherical roller bearings

Having invented the spherical roller bearing some eighty years ago, SKF has been the leading manufacturer of these bearings ever since.

Now our specialists in all different disciplines have combined their experience and know-how into one large step forward in bearing technology. And we are proud of having made tomorrow's bearing technology available for our customers today. The Explorer bearings represents a significant breakthrough in performance. By studying the interrelationsship between each bearing component, SKF scientists were able to maximize the effects of lubrication and minimize the effects of friction, wear, and contamination.

The Explorer design is the result of years of intensive research by an international team of SKF scientists and engineers. It incorporates a number of improvements including:

**The new material**
The new steel used in SKF Explorer bearings is extraordinarily clean and homogeneous. It forms a perfect structure which does not generate stress peaks under load.

**The new heat treatment**
Together with a refined heat treatment process, the new steel significantly improves the SKF Explorer bearings wear resistance. It does this while retaining the temperature resistance and toughness of the bearings.

**The new manufacturing processes**
Improved manufacturing processes has enabled the tightening of the tolerances for all essential bearing features. To achieve good bearing performance, the surface texture has been refined to maintain an optimum oil film between the contacting surfaces.

**The new bearing knowledge**
Sophisticated in-house software has enabled SKF design engineers to study internal bearing dynamics to an extent not possible previously. This led the way to design refinements, which, implemented in the Explorer bearings, allowed further optimisation of the rolling element/raceway contacts.

**New performance class** Page ..... 18 Page ..... 32



**The result: longer bearing life**
All these improvements contribute to a significant increase in bearing service life and reliability. This can best be shown through calculation using the SKF Life Method. The properties of SKF Explorer spherical roller bearings are taken into consideration by

- increased basic dynamic load ratings and
- an increased life adjustment factor $a_{SKF}$.

**Availability**
The popular small and medium size spherical roller bearings in the series 213, 222, 223, 230, 231, 240 and 241 are available as Explorer bearings. The range is being extended in these bearings series as well as in other series.

In the product table, the Explorer bearing designations are printed in blue.

**Product designations**
The Explorer bearings retain the designations of the earlier standard bearings, e.g. 22218 E or BS2-2210 C-2CS. However, each bearing and its box is marked with the name EXPLORER, so that there can be no confusion.

## Existing machine

Switching to Explorer bearings give

- several times the service life previously achieved,
- more machine uptime,
- higher safety factor,
- an appreciable reduction of machine cycle cost

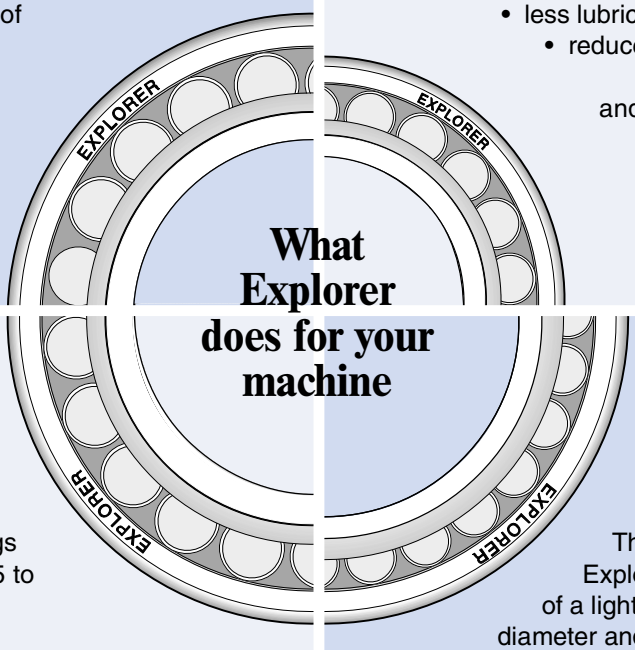
and, therefore, added value.

## New machine with same power

Explorer makes it possible to use a smaller bearing size which allows

- more compact machines,
- higher speeds,
- smoother and quieter running,
- less lubricant usage,
- reduced friction,

and will create added value.




## What Explorer does for your machine

## Existing machine with increased power

Same size Explorer bearings allow power increases of 15 to 25 % with

- same service life,
- same machine uptime,
- same machine design,

and higher added value.

## New machine with same or increased power

The higher carrying capacity of Explorer bearings allows the use of a lighter series with same outside diameter and increased bore diameter, so that

- a stronger, or even hollow shaft can be used,
- the total design can be stiffer and also cheaper,
- system life is increased due to higher stiffness,

and machine cycle cost is significantly reduced.

# Efficient in all industrial segments

**Industrial segments**

- Metallurgical
- Mining & construction
- Pulp & paper
- Fluid machinery
- Materials handling
- Industrial gearboxes
- Textile industry
- Railways

**Requirements**

- Long service life
- High load carrying capacity
- Compact arrangements
- Tolerant of misalignment
- Minimum maintenance
- Reduced operation costs
- No unplanned stoppages
- Environmental welfare
- High availability
- Technical support

**Solution**

Long service life, high reliability, limited maintenance and the ability to design compact arrangements have made SKF spherical roller bearings indispensable in many industries. In addition to the industries listed above SKF spherical roller bearings are also used in bridges, dam gates, electric motors, generators, plastic calenders, extruders, printing machines, robots and many other applications.

Because end users are recognizing that high quality bearings deliver an excellent return on investment, SKF spherical roller bearings are becoming the preferred choice in new applications.

## Where maintenance can be a nightmare

To get to the top is always a challenge, particularly if the goal is the top of ski-lift masts in mid winter when it is 30 degrees below zero and the bearings have to be relubricated. If operational reliability is to be achieved, then it has to be done. Regular relubrication is a must if the bearings are to be kept from rusting because of condensation. In addition safety considerations call for regular inspections – a dangerous job high up in mountainous terrain and under difficult weather conditions.

The introduction of SKF sealed spherical roller bearings has made all the difference. It is now only necessary to perform maintenance once a season – before starting operation. The highly efficient seals reliably exclude condensation so that corrosion is no longer a problem. It has also been possible to simplify the arrangement, saving space and costs – as well as making handling and installation easier.

# Downsizing – more than just size

A typical application for spherical roller bearings is the winch of a traversing industrial lift. In this application the load, bending and deformation all call for rugged bearings that can function properly even under misalignment.

Open spherical bearing arrangements provided good service, but were too bulky and complicated to be considered completely satisfactory.

As a result, the open bearings were replaced with SKF sealed spherical roller bearings eliminating the need for the external seals and covers.

This obviously saved space and also meant that the bearings could be positioned 40 % closer to the drum, thus reducing the stress on the journals. In fact, it was possible to reduce the journal diameter by 20 % and use smaller bearings.

The new compact bearing arrangement requires much less maintenance and there is no loss of load lifting capacity. The result has been a 50 % savings of the total cost of the original bearing arrangement.





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# Trouble-Free Operation – the SKF concept for cost saving

The bearings in a machine can be compared to the heart of a human being. If the bearing comes to a standstill, so does the machine.

Just as a doctor listens to the heart of a patient, so it is possible to listen to the bearings in order to judge the condition of the machine. It is possible to determine whether the bearing is in danger of failing prematurely because of faulty mounting, poor lubrication or other causes.

If the bearings are neglected the result will be higher costs, unnecessary stoppages and, in the worst case, damage to other components of the machine. However, if the bearings are given the attention they deserve, not only will productivity be increased, but costs for maintenance, purchasing and storage will be reduced.

Why is SKF so certain of this? Because, SKF bearings, given ideal operating conditions, can live almost for ever.

The background photo is published by kind permission of British Steel – Sections, Plates & Commercial Steels.

## Trouble-Free Operation

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All that is needed is a partnership with SKF for Trouble-Free Operation (TFO™). This includes everything you need to eliminate downtime from one reliable source:

- plant maintenance assessment
- reliability systems – local and via satellite
- predictive and preventive maintenance programs
- root cause failure analysis
- lubrication and filtration management
- equipment maintenance and monitoring – fans, pumps, gear boxes and spindles
- precision balancing
- precision alignment
- productivity management process
- applications-specific training
- technology upgrades
- repair services

There is no single TFO program from SKF, because it is defined in terms of a company's own particular needs and application challenges. Whatever the choice, it will be a win-win situation.

More information can be obtained from the nearest SKF office or authorised dealer.


***SKF service engineer on site***

***Expert advice from the SKF application engineering service***

***SKF mounting and dismounting tools***

***Practical SKF seminars cover all there is to know about mounting and maintaining rolling bearings***

# Selection of bearing size

## Bearing life

The life-extending improvements embodied in SKF Explorer spherical roller bearings can best be understood using the SKF Life Method. This calculation method constitutes an extension of the fatigue life theory developed by Lundberg and Palmgren and is better able to predict bearing life. The Life Method was first presented as the SKF New Life Theory in the SKF General Catalogue 4000 in 1989. For roller bearings

$$L_{naa} = a_1 \, a_{SKF} \, L_{10}$$

or

$$L_{naa} = a_1 \, a_{SKF} \left(\frac{C}{P}\right)^{10/3}$$

If the speed is constant, it is often preferable to calculate the life expressed in operating hours using

$$L_{naah} = a_1 \, a_{SKF} \, \frac{1\,000\,000}{60\,n} \left(\frac{C}{P}\right)^{10/3}$$

where

$L_{naa}$ = the adjusted rating life according to the SKF Life Method, million revolutions
$L_{naah}$ = the adjusted rating life according to the SKF Life Method, operating hours
$L_{10}$ = basic rating life, million revolutions
$a_1$ = life adjustment factor for reliability (➔ **Table 1**)
$a_{SKF}$ = life adjustment factor based on SKF Life Method (➔ **Diagram 1**)
$C$ = basic dynamic load rating, kN
$P$ = equivalent dynamic bearing load, kN
$n$ = rotational speed, r/min

### $a_{SKF}$ factor

The $a_{SKF}$ factor represents a very complex relationship between various influencing factors including contamination and lubrication. Lubrication conditions are expressed by the viscosity ratio $\kappa$. Values of $a_{SKF}$ can be obtained from **Diagram 1** for different values of $\eta_c$ ($P_u/P$) and $\kappa$.

For standard spherical roller bearings, the values in black on the x axis should be used and for Explorer bearings the values in blue on the x axis. In fact, for Explorer spherical roller bearings it has been found appropriate to multiply $\eta_c$ ($P_u/P$) by 1,4 as an expression of the life extending refinements of these bearings, and the blue values correspond to this.

**Diagram 1** has been drawn up for a safety factor commonly used in fatigue life considerations and is valid for lubricants without EP additives. If a lubricant containing such additives is used, reference should be made to the SKF General Catalogue or the SKF Interactive Engineering Catalogue on CD-ROM or the Internet (www.skf.com).

### Equivalent dynamic bearing load

The equivalent dynamic bearing load for spherical roller bearings can be obtained from

$P = F_r + Y_1 F_a$ when $F_a/F_r \leq e$
$P = 0{,}67\, F_r + Y_2 F_a$ when $F_a/F_r > e$

where

$P$ = equivalent dynamic bearing load, kN
$F_r$ = actual radial bearing load, kN
$F_a$ = actual axial bearing load, kN
$Y_1$, $Y_2$ = axial load factors for the bearings
$e$ = calculation factor

Appropriate values of the factors e, $Y_1$ and $Y_2$ will be found in the bearing tables for each individual bearing.

***Life adjustment factor $a_1$***

**Table 1**

| Reliability % | Factor $a_1$ |
|---|---|
| 90 | 1 |
| 95 | 0,62 |
| 96 | 0,53 |
| 97 | 0,44 |
| 98 | 0,33 |
| 99 | 0,21 |

# Standard and Explorer – a comparison

The performance enhancements incorporated into the SKF Explorer spherical roller bearings can best be demonstrated by a life calculation comparison for the bearing 22218 E in its earlier standard and its new Explorer version.

For the same operating conditions the life of

- the previous standard 22218 E with
  - a basic dynamic load rating C = 282 kN, and
  - a fatigue load limit $P_u$ = 39 kN, and
- the Explorer bearing 22218 E with
  - a basic dynamic load rating C = 325 kN, and
  - a fatigue load limit $P_u$ = 39 kN

are calculated.

The operating conditions are:

- equivalent dynamic bearing load P = 28,2 kN
- viscosity ratio $\kappa = 2$
- contamination factor $\eta_c = 0,4$.

The lives of the two bearings are then calculated.

**Earlier standard bearing**

For $\eta_c (P_u/P) = 0,4 \times 39/28,2 = 0,55$ using the black values on the x axis in **Diagram 1** and $\kappa = 2$

$a_{SKF} = 3,7$

so that the life becomes

$L_{10aa} = a_{SKF} (C/P)^{10/3} = 3,7 \times (282/28,2)^{10/3}$

$L_{10aa}$ = 7 970 million revolutions.

**Explorer bearing**

For $\eta_c (P_u/P) = 0,4 \times 39/28,2 = 0,55$ using the blue values on the x axis in **Diagram 1** and $\kappa = 2$

$a_{SKF} = 7,1$

so that the life becomes

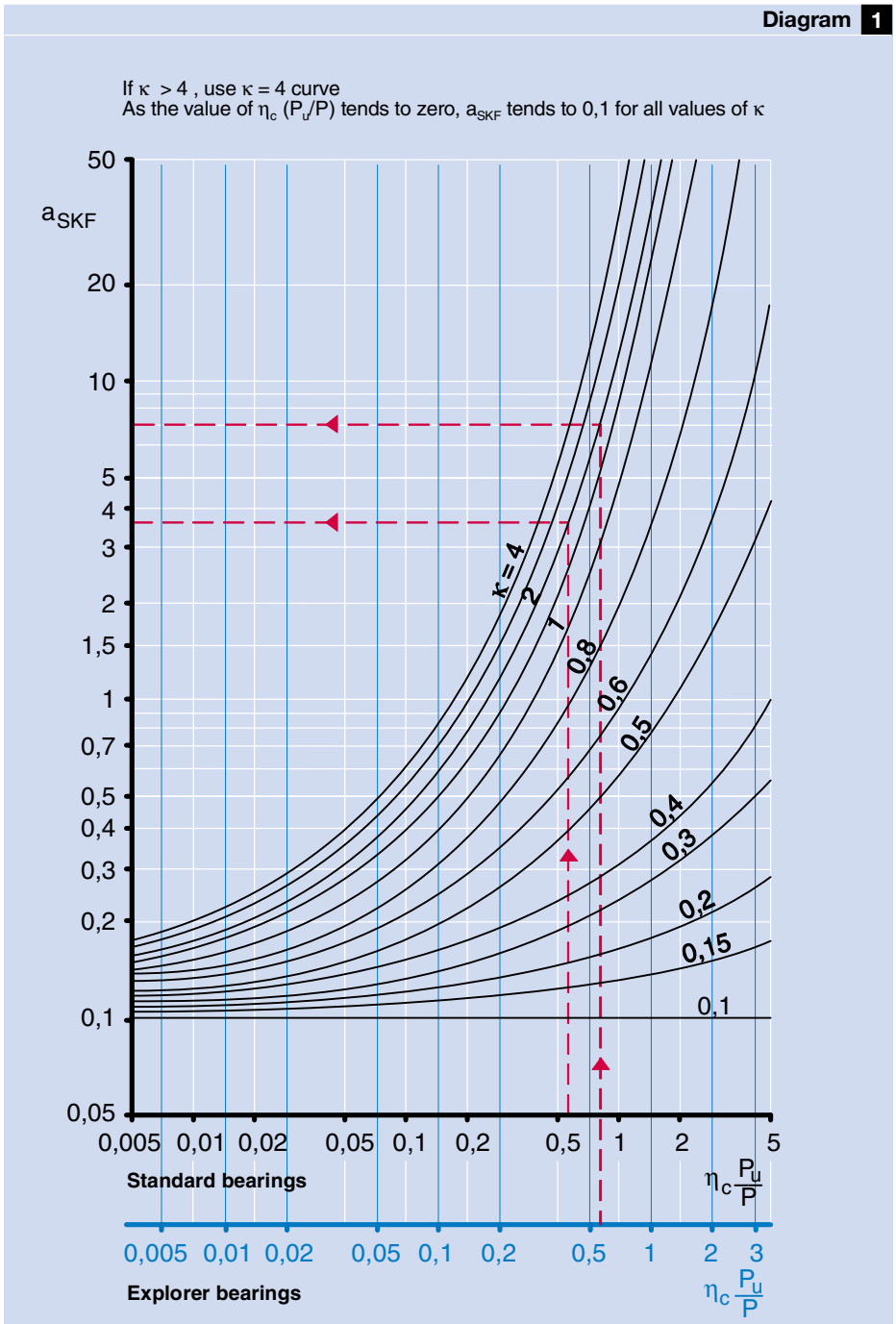
$L_{10aa} = a_{SKF} (C/P)^{10/3} = 7,1 \times (325/28,2)^{10/3}$

$L_{10aa}$ = 24 500 million revolutions.

In this case, the Explorer bearing has a life compared with that of the previous standard bearing, which is 24 500/7 970 = 3,07 or just over three times longer.

***Factor $a_{SKF}$ for spherical roller bearings***

**Diagram 1**



# Minimum load

In order to provide optimum performance, spherical roller bearings must always be subjected to a given minimum load, especially if they operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on rolling conditions in the bearing and may cause damage due to sliding movements between the rollers and raceways.

The requisite minimum load to be applied to SKF Explorer spherical roller bearings can be estimated from

$$F_{rm} = 0{,}017\ C - Y_0 F_a$$

and for standard spherical roller bearings from

$$F_{rm} = 0{,}02\ C - Y_0 F_a$$

where
$F_{rm}$ = minimum radial load, kN
$C$ = basic dynamic load rating, kN
$F_a$ = actual axial bearing load, kN
$Y_0$ = axial load factor of the bearing

The values for C and $Y_0$ will be found in the bearing tables for each individual bearing.

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, often exceed the requisite minimum load. If this is not the case, the bearing must be subjected to an additional radial load. It is advisable to contact SKF when problems with minimum load occur.

# Required static load rating

The requisite basic load rating $C_0$ can be determined from

$$C_0 = s_0 P_0$$

where
$C_0$ = static load rating, kN
$s_0$ = static safety factor
$P_0$ = equivalent static bearing load, kN

Guideline values based on experience are given in **Table 2** for the static safety factor $s_0$ for various types of operation and requirements regarding smooth running.

The equivalent static bearing load for spherical roller bearings can be obtained from

$$P_0 = F_r + Y_0 F_a$$

where
$P_0$ = equivalent static bearing load, kN
$F_r$ = actual radial bearing load, kN
$F_a$ = actual axial bearing load, kN
$Y_0$ = axial load factor of the bearing

The appropriate value of the factor $Y_0$ will be found in the bearing tables for each individual bearing.

**Are you still doing these calculations by hand?**
The CD-ROM “SKF Interactive Engineering Catalogue” includes all the equations mentioned in this brochure and the underlying software enables them to be calculated at the click of a mouse. Visit our site on the Internet “www.skf.com”

***Guideline values for the static safety factor $s_0$***

**Table 2**

| Type of operation | Rotating bearings<br>Requirements regarding quiet running<br>Unimportant | Normal | High | Non rotating bearings |
|---|---|---|---|---|
| Smooth, vibration-free | 1 | 1,5 | 3 | 0,8 |
| Normal | 1 | 1,5 | 3,5 | 1 |
| Pronounced shock loads | ≥ 2,5 | ≥ 3 | ≥ 4 | ≥ 2 |

# Application of bearings



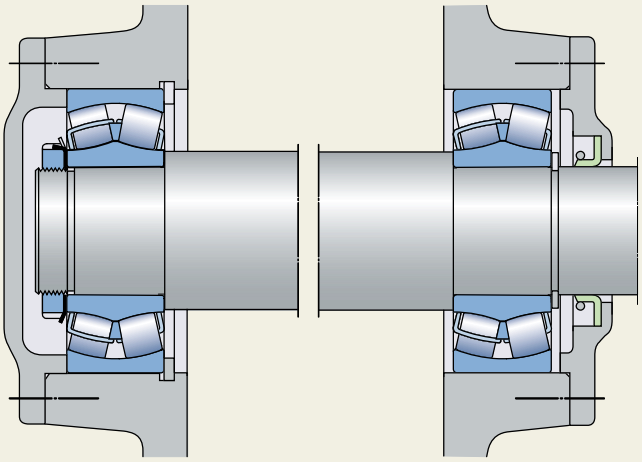
## Conventional bearing arrangements

Conventional self-aligning bearing arrangements using two spherical roller bearings (➔ **fig** 1) – one applied as a locating, the other as a non-locating bearing – are the basis of many industrial bearing arrangements. This is a simple robust arrangement capable of withstanding high radial as well as thrust loads, whilst easily accommodating misalignments.

The non-locating bearing must be able to slide axially, usually inside the housing, to accommodate shaft expansion or contraction. To achieve this movement, one of the bearing rings must be mounted with a loose fit and axial space provided for movement.

Under certain loading conditions, however, this bearing arrangement may not be suitable. The ring with a loose fit can creep and damage the housing. It can also result in accelerated wear and increased vibration, additional maintenance and repair costs. It also means that the shaft is supported less rigidly in the radial direction. In these situations, SKF recommends a new self-aligning system.

Fig 1



*Conventional spherical roller bearing arrangement with locating (left) and non-locating bearing (right)*

# The new self-aligning bearing system

The new self-aligning bearing system consists of a spherical roller bearing as the locating and a CARB® toroidal roller bearing as the non-locating bearing (➔ **fig** 2).

This bearing system accommodates misalignment as well as axial movement without generating additional axial forces caused by the friction between the outer ring and housing. Due to the ideal co-operation of both bearings the real load situation is always as predicted.

The advantages of spherical roller bearings and CARB bearings are fully utilised in this bearing system, allowing the performance expected and needed by designers today.

The new self-aligning system enhances reliability and performance. Producers as well as users of machines have clearly reduced costs due to simpler design and increased productivity.

More information will be found in the SKF brochure 4417 “Self-aligning bearing systems” .

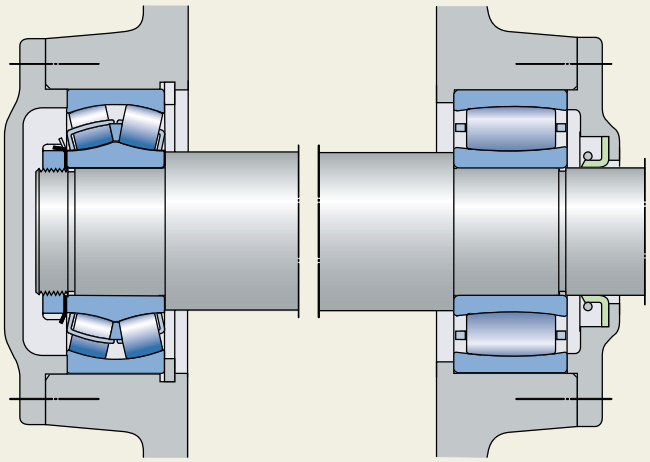
# Radial location of bearings

If the load carrying ability of a bearing is to be fully utilised, its rings must be evenly supported around the circumference and across the whole width of the raceway. This support must be firm and even and can be provided by a cylindrical or tapered seating.

Sufficient support, as well as good radial location of the bearing, generally requires a tight fit between the bearing rings and the surrounding components. However, if easy mounting and dismounting is required, or for the one ring of non-locating bearings, a tight fit cannot be applied.

Further information on selection of fits and accuracy of the bearings seatings will be found in the SKF General Catalogue or CD-ROM “SKF Interactive Engineering Catalogue”.

**Fig 2**



***Self-aligning bearing system using a CARB bearing as the non-locating bearing***

## Axial location of bearings

An interference fit alone is generally inadequate for the axial location of a spherical roller bearing ring. As a rule, some suitable means of axially securing the ring is needed. Both rings of a locating bearing should be axially secured at both sides. For non-locating bearings, on the other hand, it is sufficient if the ring having the tighter fit – usually the inner ring – is axially secured; the other ring must be free to move axially with respect to its seating (➔ **fig** 1 on **page 21**).

Bearing rings having an interference fit are generally mounted so that the ring abuts a shoulder on the shaft or in the housing at one side. At the opposite side, inner rings are normally secured by a snap ring, shaft nut or an end plate attached to the shaft end. Outer rings are usually retained by the housing end cover (➔ **fig** 1 on **page 21**).

The dimensions of the shaft and housing shoulders adjacent to the bearing must provide sufficient support for the bearing rings, without contact between the rotating parts of the bearing and a stationary component. To ensure this, appropriate abutment dimensions are quoted for each individual bearing listed in the product tables.

When using a shaft nut to locate a sealed bearing, insert an intermediate ring between the bearing and the locking washer and, probably, to extend the threaded portion of the shaft accordingly (➔ **fig** 3).

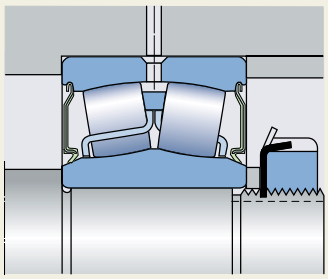
## Design of associated components

For arrangements with large spherical roller bearings it is often necessary to make design provisions to enable the bearings to be mounted or dismounted easily. For example, withdrawal tools can be applied to dismount bearings, if appropriate slots are machined in the shaft and housing shoulders, or if threaded holes are provided in the housing shoulders.

If the oil injection method is to be used to mount and dismount bearings on tapered journals (➔ **fig** 4) or to dismount bearings from cylindrical seatings (➔ **fig** 5), it is necessary to provide oil supply ducts in the journal and grooves in the seating. Recommendations are given in the SKF publication 4100 “SKF Bearing Maintenance Handbook” or CD-ROM “SKF Interactive Engineering Catalogue”.

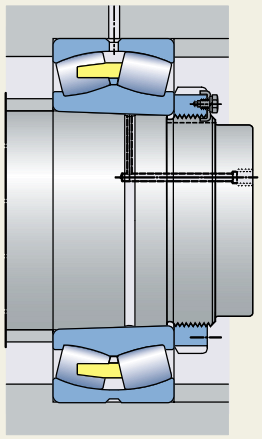
***An intermediate ring between the bearing and lock washer (of the nut) protects the seal***

Fig 3



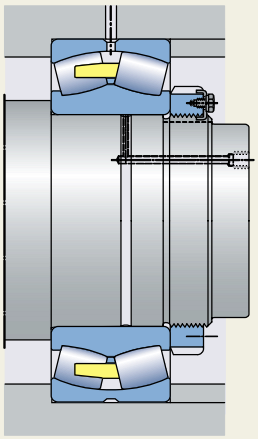
***Spherical roller bearing of CAK design on a tapered journal with oil supply ducts and grooves***

Fig 4



***Spherical roller bearing of CA design on a cylindrical seating with oil supply ducts and grooves***

Fig 5



# Mounting and dismounting

## Bearing storage

Before leaving the factory, SKF spherical roller bearings are treated with a corrosion inhibitor. They can be stored in their unopened original packages for up to five years (three years for sealed bearings), provided the relative humidity in the store does not exceed 60 % (➔ **fig** 1).

To avoid the risk of contamination and corrosion, the original packages should not be opened until immediately before mounting the bearing.

## Mounting

Skill and cleanliness are essential when mounting bearings, to make sure that they perform satisfactorily and attain their full potential. Above all, the correct method of mounting should be chosen and suitable tools used. This is particularly important, where sealed SKF spherical roller bearings are concerned, since misalignments of the inner ring relative to the outer ring in excess of 0,5° may damage the seals. For optimum results in mounting and dismounting bearings, SKF offers a full range of tools and equipment. Please refer to the “Related SKF products” section on **page 58**.

**Bearings with cylindrical bore**

When mounting bearings with cylindrical bore, the ring with the tighter fit is normally mounted first.

The force required to mount a bearing increases according to the bearing size. Therefore, it is not always possible to press large bearings onto a cylindrical shaft or into a housing in the cold state. In this case, either the inner ring or the housing should be expanded by heating before mounting.

To mount with an interference fit on a shaft the bearing should be heated to some 80 to 90 °C (180 to 200 °F) above the temperature of the shaft. Please remember that sealed bearings should never be heated to more than 110 °C (230 °F).

The use of an SKF induction heater has been found very advantageous (➔ **fig** 2). It heats the bearing rapidly, and a bult-in thermostat prevents bearing damage caused by overheating. Non-metallic components such as seals remain cold, as does the heater itself.

Mounting bearings by cooling the shaft or the bearing is not recommended, as the very low temperatures required inevitably cause condensation, thus creating a risk of corrosion.

***Correct storage of bearings***

Fig 1

***SKF induction heater***

Fig 2

**Bearings with tapered bore**

Bearings with tapered bore are always mounted with an interference on the shaft. They can be mounted on adapter or withdrawal sleeves or directly on to tapered journals.

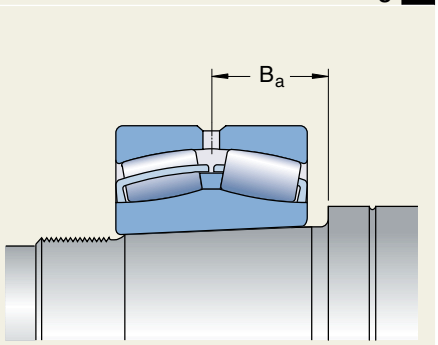
When dimensioning a tapered journal, the distance between the centre of the bearing in its final mounted position and a reference face on the shaft should be used as a basis (➔ **fig** 3). When the dimension $B_a$ has been established, the dimensioning of the journal should be continued as described in SKF catalogue 4003 “Large bearings”.

Spherical roller bearings up to 200 mm bore diameter may be driven up on to a tapered journal or a withdrawal sleeve using a shaft nut and on to an adapter sleeve using the sleeve nut and a spanner (➔ **fig** 4).

The application of the high drive-up forces required by larger bearings can be facilitated using the oil injection method (➔ **fig** 5). This necessitates the provision of oil supply ducts in the journals and oil distribution grooves in the seating. Further reduction of the mounting effort can be achieved by using the oil injection method in combination with an SKF hydraulic nut.

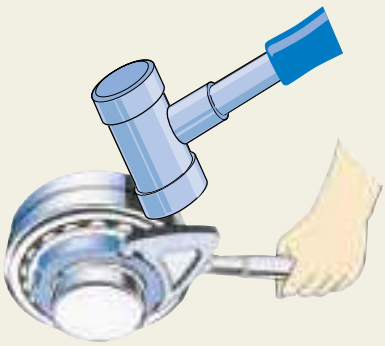
For bearings which are to be hot mounted, the final axial position on the seating has to be predetermined by means of, for instance, a tailor-made spacer ring (➔ **fig** 6). When cold, the bearing will obtain its correct interference fit.

Fig 3




*Dimensioning of tapered journals*

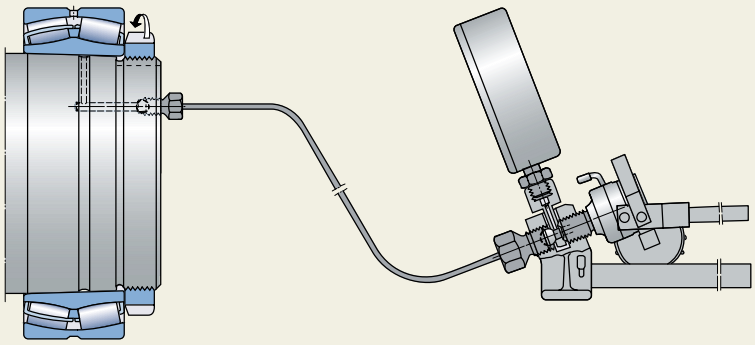
Fig 4



*Drive-up of medium size bearing*

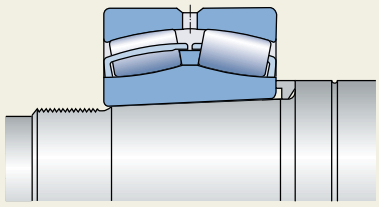
*Drive-up of large size bearing*

Fig 5



*Tailor-made spacer ring used to position the bearing axially*

Fig 6

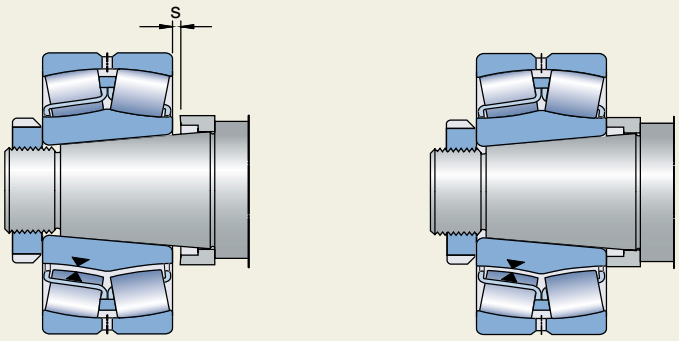


The reduction in radial internal clearance of open bearings or the axial displacement of the inner ring on its tapered seating is used as a measure of the degree of interference (➔ **fig 7**).

To effectively mount sealed bearings with a tapered bore, it is only possible to use the drive-up distance as a measure, and the “SKF drive-up method” is recommended. It allows the starting position of the bearing to be easily and accurately determined by applying a well-defined oil pressure in the hydraulic nut. The correct fit is then achieved by controlling the axial drive-up from this position.

The SKF drive-up method incorporates the use of a new type of hydraulic nut fitted with a dial indicator to control the drive-up and a specially calibrated pressure gauge, mounted on the selected pump (➔ **fig 8**).

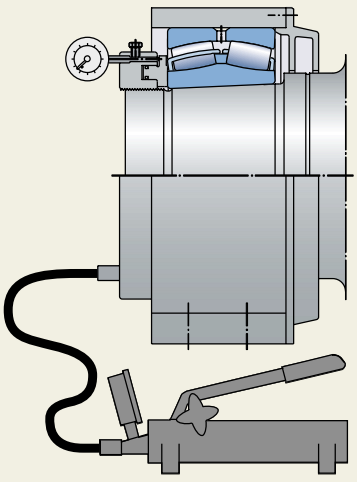
Fig 7




***Desired interference obtained by measuring clearance reduction or axial drive-up***

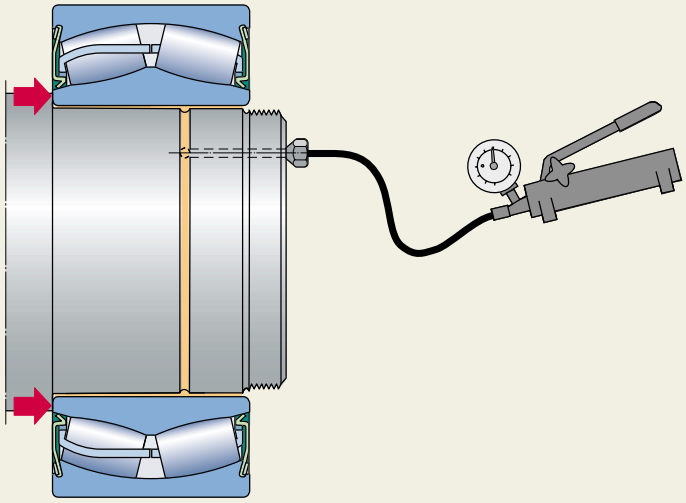
***Mounting a bearing using the SKF drive-up method***

Fig 8



***Dismounting a bearing from a cylindrical seat using the oil injection method***

Fig 9



# Dismounting

The force required to remove a bearing is generally greater than the mounting force, particularly if, after a long period of service, fretting corrosion is present. If bearings or other associated components are to be reused after inspection, they must be dismounted as carefully as they were mounted, and the dismounting force should never be applied through the rolling elements.

**Bearings with cylindrical bore**
Small bearings can generally be removed using a mechanical puller. These withdrawal tools should grip over the rings from the inside or outside and contact the side faces.

Dismounting larger bearings with bore diameters of 80 mm and above with an interference fit on the shaft is considerably eased, if the SKF oil injection method is used (➔ **fig** 9).

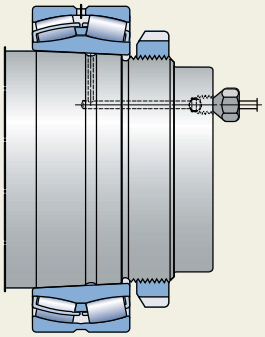
**Bearings with tapered bore**
To remove spherical roller bearings from tapered journals, the oil injection method is recommended (➔ **fig** 10). The film of pressurised oil separates the two mating surfaces and makes the bearing slide off easily.

Bearings mounted on adapter or withdrawal sleeves are most easily removed using a hydraulic nut (➔ **fig** 11). By using sleeves with oil ducts and oil distribution grooves, the oil injection method easily facilitates the removal of large bearings (➔ **fig** 12).

**Safety note**
To avoid damage or accidents when dismounting bearings from tapered seatings using the oil injection method, always make sure that the bearing is blocked at the shaft end, e.g. by a lock nut, to prevent it from falling off.

**See also SKF publication 4100 “SKF Bearing Maintenance Handbook”.**

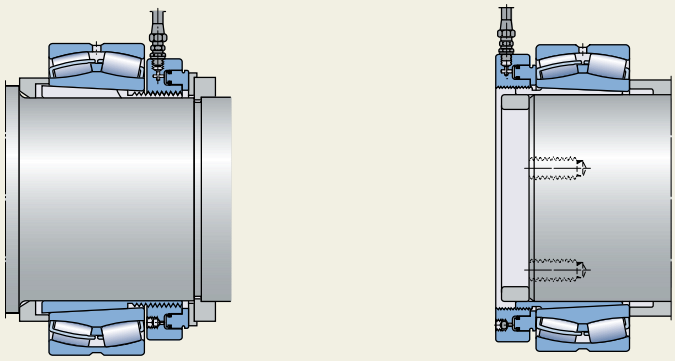
Fig 10



***Dismounting a bearing from a tapered journal using the SKF oil injection method***

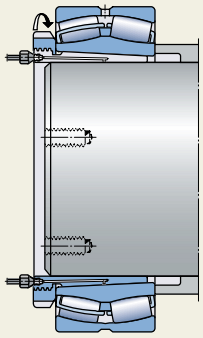
***Dismounting bearings on adapter and withdrawal sleeves with hydraulic nuts***

Fig 11



***Dismounting a large size bearing on withdrawal sleeve with oil ducts and grooves***

Fig 12



# Lubrication and maintenance

## Oil lubrication

For oil lubrication of spherical roller bearings, oil bath and circulating oil lubrication are the two main options.

### Oil bath

This is the most simple method of oil lubrication (➔ **fig** 1). The oil, which is picked up by the rotating components of the bearing, is distributed within the bearing and then flows back to the oil bath.

The oil level should be such that it almost reaches the centre of the lowest roller when the bearing is stationary. The speed ratings for oil lubrication given in the product tables apply to this method of lubrication. Even under optimum operating conditions, the oil must be changed at least once a year.

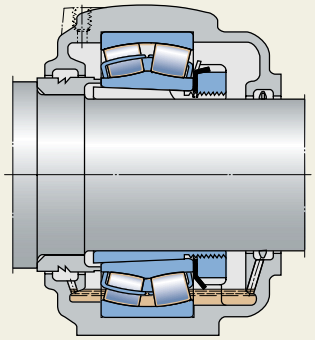
### Circulating oil

In the circulating system, the oil can be continuously filtered and/or cooled (➔ **fig** 2). This significantly increases the service life of the oil, helping to avoid frequent oil changes.

The circulation can be produced by a pump. Adequately dimensioned ducts must allow the oil to leave the arrangement after passing through the bearing.

An intermediate form of oil lubrication is one where the oil is splashed up from the oil bath by other components, e.g. gears in a gearbox.

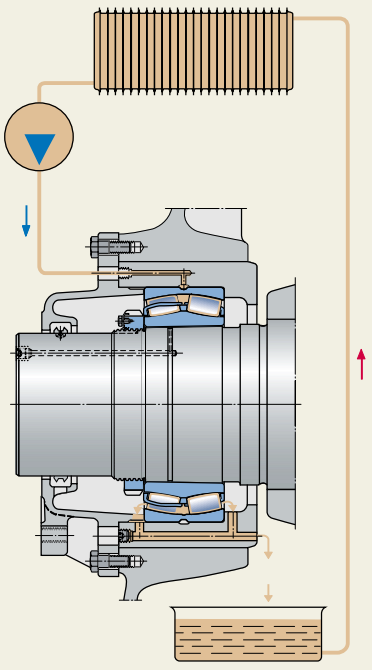
Fig 1



***Spherical roller bearing application lubricated by oil bath***

***Spherical roller bearing application lubricated by circulating oil***

Fig 2



## Grease lubrication

Today's modern greases allow an increasing number of maintenance-free bearing applications which are lubricated for life. Here, the selection of sealed SKF spherical roller bearings is the optimum choice, both technically and economically. These bearings are filled with the SKF lithium base grease LGEP 2 before leaving the factory (➔ **Table** 1) and are ready to mount and operate.

In cases where the operating conditions are so harsh that very frequent relubrication is needed or where sealed SKF spherical roller bearings are not available, SKF offers a full range of greases and tools to enable proper lubrication of the bearing (➔ section "Lubricants and lubrication equipment" on **page 60**).

### Relubrication

It is only possible to determine the time at which relubrication is required based on statistics. The definition used by SKF for the recommendations regarding relubrication intervals relates to a time at which 99 % of the bearings are still reliably lubricated, i.e. they correspond to an $L_1$ grease life which is the relubrication interval $t_f$. The $L_{10}$ grease life is approximately twice the $L_1$ life.

If the $L_{10}$ grease life corresponds to, or exceeds, the $L_{10}$ life of the bearing, the bearing may be considered as being lubricated for life, and relubrication will not be required.

The following recommendations are based on the results of long-term tests in various applications. They do not apply where water and/or particulate contaminants can penetrate the bearing arrangement. In such cases it is advisable to replenish or renew the grease fill in the arrangement more frequently to remove moisture or other contaminants.

### Relubrication intervals

Under normal conditions the relubrication interval $t_f$ can be determined from **Diagram** 1 based on

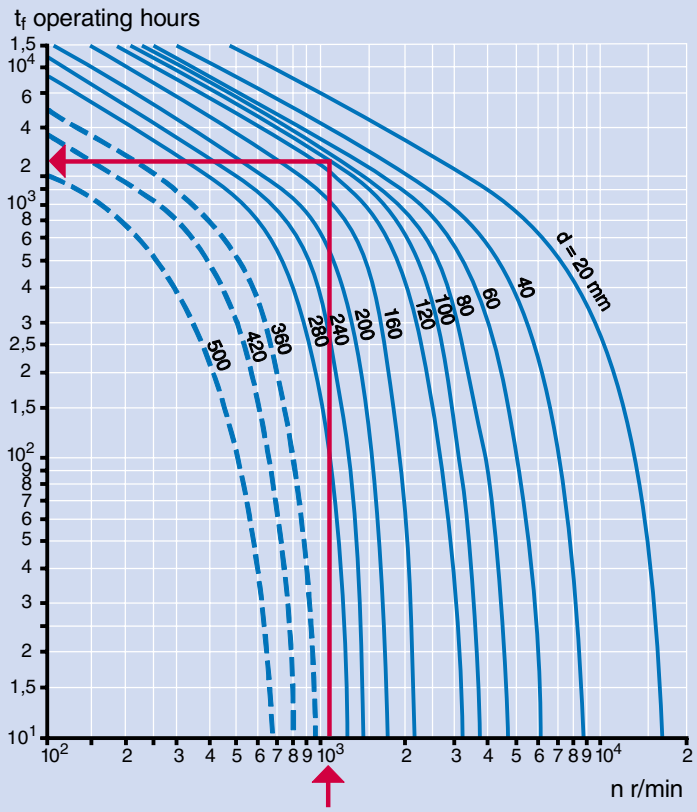
- the rotational speed n and
- the bearing bore diameter d.

The diagram is valid for bearings, which are lubricated with a quality lithium base grease, on horizontal shafts in stationary machines where loads are normal and the operating temperature does not exceed the "reference temperature" for the grease; this is usually 70 °C (158 °F).

Lubricating greases age with time and this process is accelerated at elevated temperatures. Therefore, the relubrication interval obtained from the diagram should be halved for every 15 °C (27 °F) above the reference temperature. At temperatures below 70 °C (158 °F), the relubrication interval may be extended.

Where bearings having bore diameters larger than some 300 mm are concerned, the high specific loads mean that adequate lubricant supply to the rolling contacts can only be secured if relubrication is more frequent than suggested by the diagram. For this reason the relevant curves are shown as dashed lines. In such cases continuous relubrication is recommended.

**Diagram 1**




**Example**
A spherical roller bearing with a bore diameter (d) of 100 mm rotates at 1 000 r/min. The operating temperature varies between 60 and 70 °C (140 to 158 °F). What is the correct relubrication interval?
Follow the line from $10^3$ on the speed (x) axis to the intersection of the curve for d = 100 mm.
Then follow a line from this intersection horizontally across to the value of $t_f$ which is approximately 2 000. The relubrication interval is therefore 2 000 operating hours.

***Relubrication intervals for grease lubricated spherical roller bearings***

***Technical data for SKF grease LGEP 2***

**Table 1**

| Property | SKF grease LGEP 2 |
|---|---|
| Consistency (NLGI Scale) | 2 |
| Soap base | lithium |
| Colour | light brown |
| Base oil | mineral |
| Operating temperature range, °C (°F) | –20 to +110 (–4 to +230) |
| Reference temperature, °C (°F) | 60 (140) |
| Dropping point to ISO 2176, °C (°F) | min. 180 (356) |
| Kinematic viscosity of base oil<br>at 40 °C, $mm^2/s$<br>at 100 °C, $mm^2/s$ | <br>200<br>16 |

**See also "SKF Interactive Engineering Catalogue" or SKF "General Catalogue".**

### Grease quantity for periodic relubrication

If the relubrication interval is less than 6 months, it is recommended to replenish the grease fill in the bearing arrangement at intervals corresponding to 0,5 $t_f$. The complete grease fill should be replaced after three replenishments.

Suitable quantities to be added for open bearings can be obtained from

$$G_p = 0{,}005\ D\ B$$

and for sealed bearings from

$$G_p = 0{,}0015\ D\ B$$

where
$G_p$ = grease quantity to be added when replenishing, g
D = bearing outside diameter, mm
B = total bearing width, mm

The bearing must rotate during relubrication to achieve proper distribution of the grease.

### Grease quantity for continuous relubrication

The grease quantity to be continuously supplied can be obtained from

$$G_k = (0{,}3 \ldots 0{,}5)\ D\ B \times 10^{-4}$$

where
$G_k$ = grease quantity to be continuously supplied, g/h
D = bearing outside diameter, mm
B = total bearing width, mm

Continuous relubrication can be efficiently achieved using the SKF SYSTEM 24 lubricator.

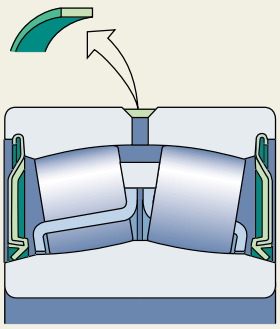
### Relubrication of sealed SKF spherical roller bearings

The sealed spherical roller bearings shown in the product tables (**page 54** onwards) have an annular groove and three lubrication holes as standard. To prevent moisture from penetrating and to retain the grease in the bearing a polymer band in the groove covers the lubrication holes (➔ **fig 3**).

If it is anticipated that bearing relubrication will be necessary during operation, the band should be removed before the bearing is mounted. When relubricating, grease should be slowly pressed into the bearing as it rotates until fresh grease emerges from the sealing lips. Excess pressure should be avoided to prevent seal damage.

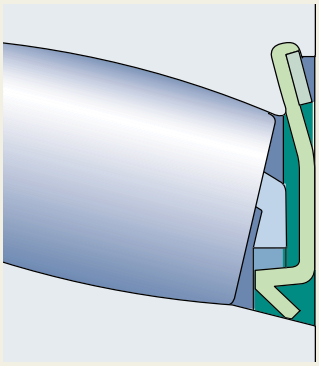
***A polymer band in the annular groove covers the lubrication holes in the outer ring of sealed bearings***

**Fig 3**



***Retaining rings hold the seals in the outer ring***

**Fig 4**



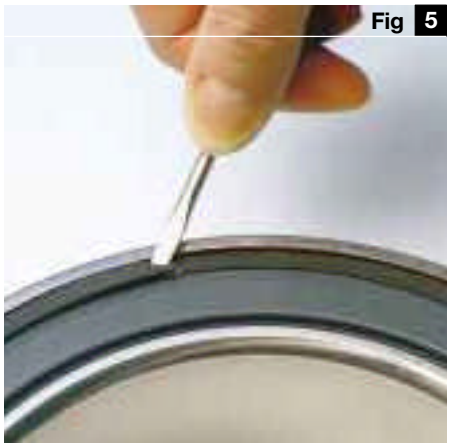
# Maintenance

The seals of SKF spherical roller bearings with a bore diameter of 110 mm and above are secured by retaining rings inserted in the outer ring (➔ **fig** 4). The seals can be removed from the bearing so that the bearing can be inspected, washed and regreased, after which the seals can be reinserted and secured. To avoid damage to the seals, this work has to be done with care, using suitable, well rounded tools with no sharp edges.

1. Remove the retaining ring by inserting a tool under the recessed end of the retaining ring (➔ **fig** 5) and pushing it out of the groove.
2. Remove the second retaining ring as above.
3. Swivel out the inner ring, so that the seals are pushed out by the rollers.
4. The bearing, seals and retaining rings can now be washed
5. Inspect the parts for further usability.
6. Regrease the bearing with inner ring swivelled out.
7. Align the bearing and put it on a clean surface for remounting the seals.
8. Insert the seal as far as possible into its groove in the outer ring. Hold down the already inserted part of the seal with one hand, and press in the remainder, stepwise with the thumb of the other hand (➔ **fig** 6).
9. Mount the retaining ring by inserting the rectangular end first. Holding this part down, press in the remainder stepwise with a tool, until the whole retaining ring properly contacts the seal as shown in **fig** 4.
10. Mount the second seal according to steps 7 to 9.
11. If the bearing is not immediately re-used, preserve the bearing surfaces with oil and make sure that the bearing is well packed.

***Removing a retaining ring***

Fig 5



***Inserting the seal in the outer ring***

Fig 6

# Bearing data – general

**Designs**
Depending on the size and the series, SKF spherical roller bearings incorporate one of the internal designs shown below. Common features of all designs include symmetrical rollers and a floating guide ring between the roller rows. The arrangement of the guide ring as well as the cage execution are different for the various designs.

E design
$d \leq 65$ mm

Guide ring centred on the inner ring, two window-type steel cages.

E design
$d > 65$ mm

Guide ring centred on the cages, two window-type steel cages.

C, CC, EC and ECC designs

Guide ring centred on the inner ring, two window-type steel cages.

CA, CAC, CAF, ECA and ECAF designs

Guide ring centred on the inner ring, retaining flanges on the inner ring, one-piece machined cage of brass or steel (suffix F).

CAFA and CAMA designs

Guide ring centred on the inner ring, retaining flanges on the inner ring, one-piece machined cage of steel (CAFA) or brass (CAMA).

**Explorer**
The designations of Explorer bearings are printed in blue in the product tables.

**Cylindrical or tapered bore**
SKF spherical roller bearings are available with cylindrical bore and tapered bore. The tapered bore of bearings of series 240, 241, 248 and 249 has a taper of 1:30, whereas the bore of the other bearing series have a taper of 1:12.

**Annular groove and lubrication holes**
Efficient lubrication of the SKF spherical roller bearings is facilitated by either

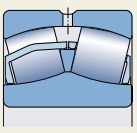
- three lubrication holes and an annular groove (E design or suffix W33) or
- three lubrication holes without annular groove (suffix W20).

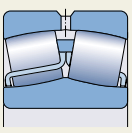
**Dimensions**
The boundary dimensions of SKF spherical roller bearings with and without seals are in accordance with ISO 15:1998, except for the width of the sealed bearings of series BS2-22. These are basically series 222 E or 222 CC bearings, but are slightly wider to integrate the seals.

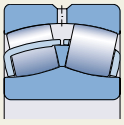
**Tolerances**
SKF spherical roller bearings with cylindrical and tapered bore are produced as standard with normal tolerances corresponding to ISO 492:1994.

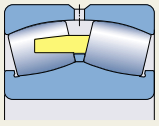
**Running accuracy**
In high-speed bearing arrangements the demands on running accuracy are often higher than usual. For such bearing arrangements, the C08 execution is recommended which has running accuracy to ISO tolerance class 5 specifications. The values for the running accuracy are in accordance with ISO 492:1994. Check availability of the C08 specification bearing before ordering.

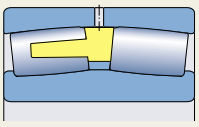
**Internal clearance**
SKF spherical roller bearings are manufactured as standard with Normal radial internal clearance. Nearly all the bearings are also available with a larger C3 internal clearance and some can be supplied with a even larger C4 clearance. Some sizes can be delivered with C2 internal clearance which is smaller than Normal. Check the availability of bearings with radial

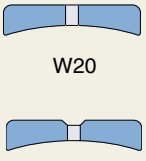

E design
$d \leq 65$ mm


E design
$d > 65$ mm


C, CC, EC and ECC designs


CA, CAC, CAF, ECA and ECAF designs


CAFA and CAMA designs



internal clearances other than Normal before ordering. The various radial internal clearances are in accordance with ISO 5753:1991 and shown in **Tables** 1 and 2. They are valid for zero measuring load and before mounting.

***Radial internal clearance of spherical roller bearings with cylindrical bore***

**Table 1**

| Bore diameter d | | Radial internal clearance C2 | | Normal | | C3 | | C4 | | C5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | min | max | min | max | min | max | min | max | min | max |
| mm | | µm | | | | | | | | | |
| **18** | **24** | 10 | 20 | 20 | 35 | 35 | 45 | 45 | 60 | 60 | 75 |
| **24** | **30** | 15 | 25 | 25 | 40 | 40 | 55 | 55 | 75 | 75 | 95 |
| **30** | **40** | 15 | 30 | 30 | 45 | 45 | 60 | 60 | 80 | 80 | 100 |
| **40** | **50** | 20 | 35 | 35 | 55 | 55 | 75 | 75 | 100 | 100 | 125 |
| **50** | **65** | 20 | 40 | 40 | 65 | 65 | 90 | 90 | 120 | 120 | 150 |
| **65** | **80** | 30 | 50 | 50 | 80 | 80 | 110 | 110 | 145 | 145 | 185 |
| **80** | **100** | 35 | 60 | 60 | 100 | 100 | 135 | 135 | 180 | 180 | 225 |
| **100** | **120** | 40 | 75 | 75 | 120 | 120 | 160 | 160 | 210 | 210 | 260 |
| **120** | **140** | 50 | 95 | 95 | 145 | 145 | 190 | 190 | 240 | 240 | 300 |
| **140** | **160** | 60 | 110 | 110 | 170 | 170 | 220 | 220 | 280 | 280 | 350 |
| **160** | **180** | 65 | 120 | 120 | 180 | 180 | 240 | 240 | 310 | 310 | 390 |
| **180** | **200** | 70 | 130 | 130 | 200 | 200 | 260 | 260 | 340 | 340 | 430 |
| **200** | **225** | 80 | 140 | 140 | 220 | 220 | 290 | 290 | 380 | 380 | 470 |
| **225** | **250** | 90 | 150 | 150 | 240 | 240 | 320 | 320 | 420 | 420 | 520 |
| **250** | **280** | 100 | 170 | 170 | 260 | 260 | 350 | 350 | 460 | 460 | 570 |
| **280** | **315** | 110 | 190 | 190 | 280 | 280 | 370 | 370 | 500 | 500 | 630 |
| **315** | **355** | 120 | 200 | 200 | 310 | 310 | 410 | 410 | 550 | 550 | 690 |
| **355** | **400** | 130 | 220 | 220 | 340 | 340 | 450 | 450 | 600 | 600 | 750 |
| **400** | **450** | 140 | 240 | 240 | 370 | 370 | 500 | 500 | 660 | 660 | 820 |
| **450** | **500** | 140 | 260 | 260 | 410 | 410 | 550 | 550 | 720 | 720 | 900 |
| **500** | **560** | 150 | 280 | 280 | 440 | 440 | 600 | 600 | 780 | 780 | 1 000 |
| **560** | **630** | 170 | 310 | 310 | 480 | 480 | 650 | 650 | 850 | 850 | 1 100 |
| **630** | **710** | 190 | 350 | 350 | 530 | 530 | 700 | 700 | 920 | 920 | 1 190 |
| **710** | **800** | 210 | 390 | 390 | 580 | 580 | 770 | 770 | 1 010 | 1 010 | 1 300 |
| **800** | **900** | 230 | 430 | 430 | 650 | 650 | 860 | 860 | 1 120 | 1 120 | 1 440 |
| **900** | **1 000** | 260 | 480 | 480 | 710 | 710 | 930 | 930 | 1 220 | 1 220 | 1 570 |
| **1 000** | **1 120** | 290 | 530 | 530 | 780 | 780 | 1 020 | 1 020 | 1 330 | 1 330 | 1 720 |
| **1 120** | **1 250** | 320 | 580 | 580 | 860 | 860 | 1 120 | 1 120 | 1 460 | 1 460 | 1 870 |
| **1 250** | **1 400** | 350 | 640 | 640 | 950 | 950 | 1 240 | 1 240 | 1 620 | 1 620 | 2 060 |
| **1 400** | **1 600** | 400 | 720 | 720 | 1 060 | 1 060 | 1 380 | 1 380 | 1 800 | 1 800 | 2 300 |
| **1 600** | **1 800** | 450 | 810 | 810 | 1 180 | 1 180 | 1 550 | 1 550 | 2 000 | 2 000 | 2 550 |

***Radial internal clearance of spherical roller bearings with tapered bore***

**Table 2**

| Bore diameter d | | Radial internal clearance C2 | | Normal | | C3 | | C4 | | C5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| over | incl. | min | max | min | max | min | max | min | max | min | max |
| mm | | µm | | | | | | | | | |
| **24** | **30** | 20 | 30 | 30 | 40 | 40 | 55 | 55 | 75 | – | – |
| **30** | **40** | 25 | 35 | 35 | 50 | 50 | 65 | 65 | 85 | 85 | 105 |
| **40** | **50** | 30 | 45 | 45 | 60 | 60 | 80 | 80 | 100 | 100 | 130 |
| **50** | **65** | 40 | 55 | 55 | 75 | 75 | 95 | 95 | 120 | 120 | 160 |
| **65** | **80** | 50 | 70 | 70 | 95 | 95 | 120 | 120 | 150 | 150 | 200 |
| **80** | **100** | 55 | 80 | 80 | 110 | 110 | 140 | 140 | 180 | 180 | 230 |
| **100** | **120** | 65 | 100 | 100 | 135 | 135 | 170 | 170 | 220 | 220 | 280 |
| **120** | **140** | 80 | 120 | 120 | 160 | 160 | 200 | 200 | 260 | 260 | 330 |
| **140** | **160** | 90 | 130 | 130 | 180 | 180 | 230 | 230 | 300 | 300 | 380 |
| **160** | **180** | 100 | 140 | 140 | 200 | 200 | 260 | 260 | 340 | 340 | 430 |
| **180** | **200** | 110 | 160 | 160 | 220 | 220 | 290 | 290 | 370 | 370 | 470 |
| **200** | **225** | 120 | 180 | 180 | 250 | 250 | 320 | 320 | 410 | 410 | 520 |
| **225** | **250** | 140 | 200 | 200 | 270 | 270 | 350 | 350 | 450 | 450 | 570 |
| **250** | **280** | 150 | 220 | 220 | 300 | 300 | 390 | 390 | 490 | 490 | 620 |
| **280** | **315** | 170 | 240 | 240 | 330 | 330 | 430 | 430 | 540 | 540 | 680 |
| **315** | **355** | 190 | 270 | 270 | 360 | 360 | 470 | 470 | 590 | 590 | 740 |
| **355** | **400** | 210 | 300 | 300 | 400 | 400 | 520 | 520 | 650 | 650 | 820 |
| **400** | **450** | 230 | 330 | 330 | 440 | 440 | 570 | 570 | 720 | 720 | 910 |
| **450** | **500** | 260 | 370 | 370 | 490 | 490 | 630 | 630 | 790 | 790 | 1 000 |
| **500** | **560** | 290 | 410 | 410 | 540 | 540 | 680 | 680 | 870 | 870 | 1 100 |
| **560** | **630** | 320 | 460 | 460 | 600 | 600 | 760 | 760 | 980 | 980 | 1 230 |
| **630** | **710** | 350 | 510 | 510 | 670 | 670 | 850 | 850 | 1 090 | 1 090 | 1 360 |
| **710** | **800** | 390 | 570 | 570 | 750 | 750 | 960 | 960 | 1 220 | 1 220 | 1 500 |
| **800** | **900** | 440 | 640 | 640 | 840 | 840 | 1 070 | 1 070 | 1 370 | 1 370 | 1 690 |
| **900** | **1 000** | 490 | 710 | 710 | 930 | 930 | 1 190 | 1 190 | 1 520 | 1 520 | 1 860 |
| **1 000** | **1 120** | 530 | 770 | 770 | 1 030 | 1 030 | 1 300 | 1 300 | 1 670 | 1 670 | 2 050 |
| **1 120** | **1 250** | 570 | 830 | 830 | 1 120 | 1 120 | 1 420 | 1 420 | 1 830 | 1 830 | 2 250 |
| **1 250** | **1 400** | 620 | 910 | 910 | 1 230 | 1 230 | 1 560 | 1 560 | 2 000 | 2 000 | 2 450 |
| **1 400** | **1 600** | 680 | 1 000 | 1 000 | 1 350 | 1 350 | 1 720 | 1 720 | 2 200 | 2 200 | 2 700 |
| **1 600** | **1 800** | 750 | 1 110 | 1 110 | 1 500 | 1 500 | 1 920 | 1 920 | 2 400 | 2 400 | 2 950 |

### Misalignment

Spherical roller bearings can accommodate misalignment between the outer and inner rings without affecting the bearing. The guideline values of permissible misalignment given in **Table** 3 refer to open bearings and are valid for normal loads (C/P > 10) and operating conditions, and when the inner ring rotates under constant misalignment.

Whether the stated values of misalignment between the outer ring and inner ring can be fully exploited or not depends on the design of the bearing arrangement, the type of seals used etc.

Under the same conditions, sealed SKF spherical roller bearings can accommodate angular misalignments of the shaft with respect to the housing of up to approximately 0,5°.

### Influence of operating temperature on the bearing materials

SKF spherical roller bearings rings and rollers are special heat treated so that they can be used at temperatures up to +200 °C (390 °F) for up to 2 500 hours or for brief periods at even higher temperatures without any inadmissible dimensional changes occurring. If provision is made to accommodate slight changes of fits and clearance, even higher temperatures or longer periods can be accommodated.

Sealed SKF spherical roller bearings should not be used at operating temperatures above +110 °C (230 °F) as this would be detrimental to the seals and grease.

### Axial load carrying capacity

Because of their special internal design, SKF spherical roller bearings not only have lower friction than other spherical roller bearings, they are also able to accommodate appreciably heavier axial loads. However, if $F_a/F_r > e$ (➔ **product tables**), a more frequent relubrication than usual is recommended.

### Speed ratings

Due to the friction generated by contact seals, the speed ratings for sealed bearings for normal temperatures are approximately 40 % of those for the corresponding open bearings.

**Table 3**

| Bearing series | Permissible angular misalignment |
|---|---|
| – | degrees |
| 213 | 1 |
| 222 | 1,5 |
| 223 | 2 |
| 230 | 1,5 |
| 231 | 1,5 |
| 232 | 2,5 |
| 238 | 1 |
| 239 | 1,5 |
| 240 | 2 |
| 241 | 2,5 |
| 248 | 1,5 |
| 249 | 1,5 |

***Guideline values for permissible angular misalignment***

# Supplementary designations

The designation suffixes used to identify certain features of SKF spherical roller bearings are explained below. The suffixes used to identify bearing (and cage) design, e.g. CC or E, are not included here as they are explained under “Designs”.

**C2** Radial internal clearance smaller than Normal

**C3** Radial internal clearance greater than Normal

**C4** Radial internal clearance greater than C3

**C08** Increased running accuracy to ISO tolerance class 5

**C083** C08 + C3

**C084** C08 + C4

**2CS** Sheet steel reinforced rubbing seals of nitrile rubber (NBR) at both sides of bearing. Grease fill 25 to 35 % with SKF grease LGEP 2. Annular groove and three lubrication holes in outer ring.

**2CSW** 2CS + W

**2CS2** Sheet steel reinforced rubbing seals of fluoro rubber (FPM) at both sides of bearing. Grease fill 70 to 100 % with a polyurea high temperature grease. Annular groove and three lubrication holes in the outer ring.

**2CS2W** 2CS2 + W

**2CS5** Sheet steel reinforced rubbing seals of hydrogenated nitrile rubber (HNBR) at both sides of bearing. Grease fill 70 to 100 % with a polyurea high temperature grease. Annular groove and three lubrication holes in the outer ring.

**2CS5W** 2CS5 + W

**HA3** Case hardened inner ring

**K** Tapered bore, taper 1:12

**K30** Tapered bore, taper 1:30

**VA405** Bearing for vibrating applications

**VA406** Bearing for vibrating applications with PTFE-coated bore

**VE552(E)** Outer ring with three equally spaced threaded holes in one side face to take hoisting tackle; the E indicates that appropriate eye bolts are supplied with the bearings

**VE553(E)** Outer ring with three equally spaced threaded holes in both side faces to take hoisting tackle; the E indicates that appropriate eye bolts are supplied with the bearings

**VG186** Hardened cages

**VQ424** Running accuracy better than C08

**VT143** Grease fill 25 to 35 % with SKF grease LGEP 2

**W** No relubrication facility in outer ring

**W20** Three lubrication holes in outer ring

**W26** Six lubrication holes in inner ring

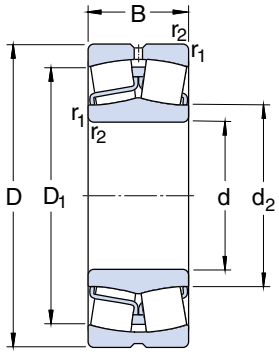
**W33** Annular groove and three lubrication holes in outer ring

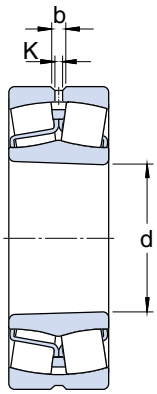
**W77** Plugged W33 lubrication holes

**W509** W26 + W33

**235220** Case hardened inner ring with helical groove in bore

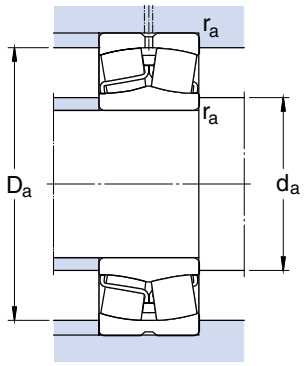
**Spherical roller bearings**
d **20 – 80** mm

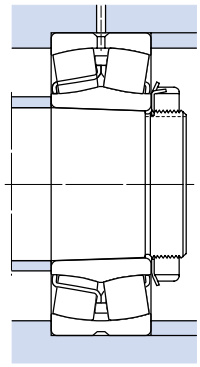



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **20** | 52 | 18 | 49 | 44 | 4,75 | 8 500 | 11 000 | 0,28 | **22205/20 E** | – |
| **25** | 52 | 18 | 49 | 44 | 4,75 | 8 500 | 11 000 | 0,19 | **22205 E** | **22205 EK** |
| | 62 | 17 | 41,4 | 41,5 | 4,55 | 6 700 | 8 500 | 0,28 | **21305 CC** | – |
| **30** | 62 | 20 | 56 | 52 | 5,5 | 7 500 | 9 500 | 0,30 | **22206 CC/W33** | **22206 CCK/W33** |
| | 72 | 19 | 55,2 | 61 | 6,8 | 6 000 | 7 500 | 0,41 | **21306 CC** | – |
| **35** | 72 | 23 | 76,5 | 73,5 | 8 | 6 300 | 8 000 | 0,46 | **22207 CC/W33** | **22207 CCK/W33** |
| | 80 | 21 | 65,6 | 72 | 8,15 | 5 300 | 6 700 | 0,55 | **21307 CC** | – |
| **40** | 80 | 23 | 96,5 | 90 | 9,8 | 6 000 | 7 500 | 0,53 | **22208 E** | **22208 EK** |
| | 90 | 23 | 82,8 | 98 | 11 | 4 500 | 5 600 | 0,76 | **21308 CC** | **21308 CCK** |
| | 90 | 33 | 150 | 140 | 15 | 4 500 | 5 600 | 1,05 | **22308 E** | **22308 EK** |
| **45** | 85 | 23 | 90 | 88 | 9,5 | 5 300 | 6 700 | 0,60 | **22209 CC/W33** | **22209 CCK/W33** |
| | 100 | 25 | 125 | 127 | 13,7 | 4 500 | 5 600 | 0,99 | **21309 E** | **21309 EK** |
| | 100 | 36 | 183 | 183 | 19,6 | 3 800 | 4 800 | 1,40 | **22309 E** | **22309 EK** |
| **50** | 90 | 23 | 96,5 | 100 | 11 | 5 000 | 6 300 | 0,65 | **22210 CC/W33** | **22210 CCK/W33** |
| | 110 | 27 | 156 | 166 | 18,6 | 4 000 | 5 000 | 1,35 | **21310 E** | **21310 EK** |
| | 110 | 40 | 220 | 224 | 24 | 3 400 | 4 300 | 1,90 | **22310 E** | **22310 EK** |
| **55** | 100 | 25 | 125 | 127 | 13,7 | 4 500 | 5 600 | 0,84 | **22211 E** | **22211 EK** |
| | 120 | 29 | 156 | 166 | 18,6 | 4 000 | 5 000 | 1,70 | **21311 E** | **21311 EK** |
| | 120 | 43 | 270 | 280 | 30 | 3 200 | 4 000 | 2,45 | **22311 E** | **22311 EK** |
| **60** | 110 | 28 | 156 | 166 | 18,6 | 4 000 | 5 000 | 1,15 | **22212 E** | **22212 EK** |
| | 130 | 31 | 212 | 240 | 26,5 | 3 400 | 4 300 | 2,10 | **21312 E** | **21312 EK** |
| | 130 | 46 | 310 | 335 | 36,5 | 2 800 | 3 600 | 3,10 | **22312 E** | **22312 EK** |
| **65** | 120 | 31 | 193 | 216 | 24 | 3 800 | 4 800 | 1,55 | **22213 E** | **22213 EK** |
| | 140 | 33 | 236 | 270 | 29 | 3 200 | 4 000 | 2,55 | **21313 E** | **21313 EK** |
| | 140 | 48 | 340 | 360 | 38 | 2 600 | 3 400 | 3,75 | **22313 E** | **22313 EK** |
| **70** | 125 | 31 | 208 | 228 | 25,5 | 3 600 | 4 500 | 1,55 | **22214 E** | **22214 EK** |
| | 150 | 35 | 285 | 325 | 34,5 | 2 800 | 3 600 | 3,10 | **21314 E** | **21314 EK** |
| | 150 | 51 | 400 | 430 | 45 | 2 200 | 3 000 | 4,55 | **22314 E** | **22314 EK** |
| **75** | 115 | 40 | 152 | 232 | 28,5 | 2 600 | 3 400 | 1,55 | **24015 CC/W33** | – |
| | 130 | 31 | 212 | 240 | 26,5 | 3 400 | 4 300 | 1,70 | **22215 E** | **22215 EK** |
| | 160 | 37 | 285 | 325 | 34,5 | 2 800 | 3 600 | 3,75 | **21315 E** | **21315 EK** |
| | 160 | 55 | 440 | 475 | 48 | 2 200 | 3 000 | 5,55 | **22315 E** | **22315 EK** |
| **80** | 140 | 33 | 236 | 270 | 29 | 3 200 | 4 000 | 2,10 | **22216 E** | **22216 EK** |
| | 170 | 39 | 325 | 375 | 39 | 2 600 | 3 400 | 4,45 | **21316 E** | **21316 EK** |
| | 170 | 58 | 490 | 540 | 54 | 2 000 | 2 800 | 6,60 | **22316 E** | **22316 EK** |

The designations of Explorer bearings are printed in blue

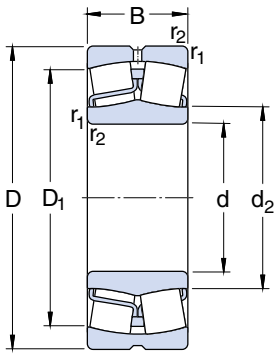


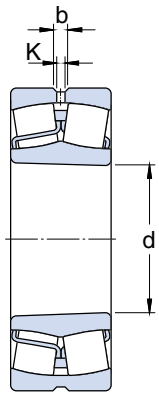





| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **20** | 31,2 | 44,2 | 3,7 | 2 | 1 | 26 | 46 | 1 | 0,35 | 1,9 | 2,9 | 1,8 |
| **25** | 31,2 | 44,2 | 3,7 | 2 | 1 | 31 | 46 | 1 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 35,7 | 50,7 | – | – | 1,1 | 32 | 55 | 1 | 0,30 | 2,3 | 3,4 | 2,2 |
| **30** | 37,7 | 52,4 | 3,7 | 2 | 1 | 36 | 56 | 1 | 0,33 | 2 | 3 | 2 |
| | 43,3 | 58,82 | – | – | 1,1 | 37 | 65 | 1 | 0,27 | 2,5 | 3,7 | 2,5 |
| **35** | 44,5 | 60,9 | 3,7 | 2 | 1,1 | 42 | 65 | 1 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 47,2 | 65,6 | – | – | 1,5 | 44 | 71 | 1,5 | 0,28 | 2,4 | 3,6 | 2,5 |
| **40** | 49,6 | 69,4 | 5,5 | 3 | 1,1 | 47 | 73 | 1 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 55,6 | 74,3 | – | – | 1,5 | 49 | 81 | 1,5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 49,9 | 74,3 | 5,5 | 3 | 1,5 | 49 | 81 | 1,5 | 0,37 | 1,8 | 2,7 | 1,8 |
| **45** | 54,9 | 73,6 | 5,5 | 3 | 1,1 | 52 | 78 | 1 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 65,3 | 87,9 | 5,5 | 3 | 1,5 | 54 | 91 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 57,6 | 83,1 | 5,5 | 3 | 1,5 | 54 | 91 | 1,5 | 0,37 | 1,8 | 2,7 | 1,8 |
| **50** | 60,1 | 78,8 | 5,5 | 3 | 1,1 | 57 | 83 | 1 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 72,6 | 96,5 | 5,5 | 3 | 2 | 60 | 100 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 63,9 | 91,9 | 5,5 | 3 | 2 | 60 | 100 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| **55** | 65,3 | 87,9 | 5,5 | 3 | 1,5 | 64 | 91 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 72,6 | 96 | 5,5 | 3 | 2 | 65 | 110 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 70,1 | 102 | 5,5 | 3 | 2 | 66 | 109 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| **60** | 72,6 | 96,3 | 5,5 | 3 | 1,5 | 69 | 101 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 87,8 | 115 | 5,5 | 3 | 2,1 | 72 | 118 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 77,9 | 110 | 5,5 | 3 | 2,1 | 72 | 118 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| **65** | 80 | 106 | 5,5 | 3 | 1,5 | 74 | 111 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 94,7 | 124 | 5,5 | 3 | 2,1 | 77 | 128 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 81,6 | 118 | 8,3 | 4,5 | 2,1 | 77 | 128 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| **70** | 83 | 111 | 5,5 | 3 | 1,5 | 79 | 116 | 1,5 | 0,22 | 3 | 4,6 | 2,8 |
| | 101 | 133 | 5,5 | 3 | 2,1 | 82 | 138 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 90,3 | 128 | 8,3 | 4,5 | 2,1 | 82 | 138 | 2 | 0,33 | 2 | 3 | 2 |
| **75** | 84,1 | 100 | 5,5 | 3 | 1,1 | 81 | 109 | 1 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 87,8 | 115 | 5,5 | 3 | 1,5 | 84 | 121 | 1,5 | 0,22 | 3 | 4,6 | 2,8 |
| | 101 | 133 | 5,5 | 3 | 2,1 | 87 | 148 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 92,8 | 135 | 8,3 | 4,5 | 2,1 | 87 | 148 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| **80** | 94,7 | 127 | 5,5 | 3 | 2 | 91 | 129 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 106 | 141 | 5,5 | 3 | 2,1 | 92 | 158 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 98,3 | 143 | 8,3 | 4,5 | 2,1 | 92 | 158 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |

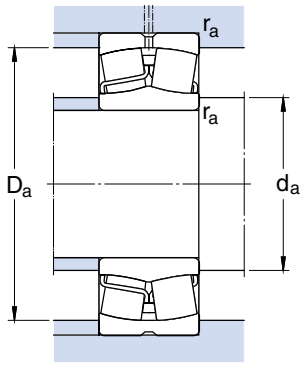
**Spherical roller bearings**
d **85 – 130** mm

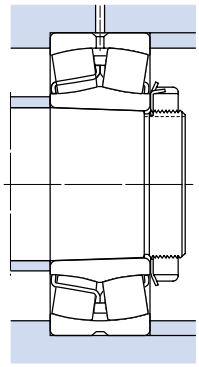



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **85** | 150 | 36 | 285 | 325 | 34,5 | 2 800 | 3 600 | 2,65 | **22217 E** | **22217 EK** |
| | 180 | 41 | 325 | 375 | 39 | 2 600 | 3 400 | 5,20 | **21317 E** | **21317 EK** |
| | 180 | 60 | 550 | 620 | 61 | 1 900 | 2 600 | 7,65 | **22317 E** | **22317 EK** |
| **90** | 160 | 40 | 325 | 375 | 39 | 2 600 | 3 400 | 3,40 | **22218 E** | **22218 EK** |
| | 160 | 52,4 | 311 | 440 | 48 | 1 900 | 2 600 | 4,65 | **23218 CC/W33** | **23218 CCK/W33** |
| | 190 | 43 | 380 | 450 | 46,5 | 2 400 | 3 200 | 6,10 | **21318 E** | **21318 EK** |
| | 190 | 64 | 610 | 695 | 67 | 1 800 | 2 400 | 9,05 | **22318 E** | **22318 EK** |
| **95** | 170 | 43 | 380 | 450 | 46,5 | 2 400 | 3 200 | 4,15 | **22219 E** | **22219 EK** |
| | 200 | 45 | 425 | 490 | 49 | 2 200 | 3 000 | 7,05 | **21319 E** | **21319 EK** |
| | 200 | 67 | 670 | 765 | 73,5 | 1 800 | 2 400 | 10,5 | **22319 E** | **22319 EK** |
| **100** | 150 | 50 | 248 | 415 | 45,5 | 1 900 | 2 600 | 3,15 | **24020 CDC/W33** | – |
| | 165 | 52 | 322 | 490 | 53 | 2 000 | 2 800 | 4,55 | **23120 CC/W33** | **23120 CCK/W33** |
| | 165 | 65 | 455 | 640 | 68 | 1 700 | 2 200 | 5,65 | **24120 CC/W33** | – |
| | 180 | 46 | 425 | 490 | 49 | 2 200 | 3 000 | 4,90 | **22220 E** | **22220 EK** |
| | 180 | 60,3 | 414 | 600 | 63 | 1 700 | 2 200 | 6,85 | **23220 CC/W33** | **23220 CCK/W33** |
| | 215 | 47 | 425 | 490 | 49 | 2 200 | 3 000 | 8,60 | **21320 E** | **21320 EK** |
| | 215 | 73 | 815 | 950 | 88 | 1 700 | 2 200 | 13,5 | **22320 E** | **22320 EK** |
| **110** | 170 | 45 | 267 | 440 | 46,5 | 2 200 | 3 000 | 3,80 | **23022 CC/W33** | **23022 CCK/W33** |
| | 180 | 56 | 430 | 585 | 61 | 1 900 | 2 600 | 5,75 | **23122 CC/W33** | **23122 CCK/W33** |
| | 180 | 69 | 460 | 750 | 78 | 1 600 | 2 000 | 7,10 | **24122 CC/W33** | **24122 CCK30/W33** |
| | 200 | 53 | 560 | 640 | 63 | 2 000 | 2 800 | 7,00 | **22222 E** | **22222 EK** |
| | 200 | 69,8 | 518 | 765 | 76,5 | 1 600 | 2 000 | 9,85 | **23222 CC/W33** | **23222 CCK/W33** |
| | 240 | 80 | 950 | 1 120 | 100 | 1 500 | 1 900 | 18,4 | **22322 E** | **22322 EK** |
| **120** | 180 | 46 | 355 | 500 | 52 | 2 000 | 2 800 | 4,20 | **23024 CC/W33** | **23024 CCK/W33** |
| | 180 | 60 | 430 | 670 | 68 | 1 600 | 2 000 | 5,45 | **24024 CC/W33** | **24024 CCK30/W33** |
| | 200 | 62 | 510 | 695 | 71 | 1 800 | 2 400 | 8,00 | **23124 CC/W33** | **23124 CCK/W33** |
| | 200 | 80 | 575 | 950 | 95 | 1 400 | 1 800 | 10,3 | **24124 CC/W33** | **24124 CCK30/W33** |
| | 215 | 58 | 630 | 765 | 73,5 | 1 900 | 2 600 | 8,70 | **22224 E** | **22224 EK** |
| | 215 | 76 | 610 | 930 | 93 | 1 500 | 1 900 | 12,0 | **23224 CC/W33** | **23224 CCK/W33** |
| | 260 | 86 | 965 | 1 120 | 100 | 1 400 | 1 800 | 23,0 | **22324 CC/W33** | **22324 CCK/W33** |
| **130** | 200 | 52 | 430 | 610 | 62 | 1 900 | 2 600 | 6,00 | **23026 CC/W33** | **23026 CCK/W33** |
| | 200 | 69 | 540 | 815 | 81,5 | 1 500 | 1 900 | 8,05 | **24026 CC/W33** | **24026 CCK30/W33** |
| | 210 | 64 | 489 | 780 | 78 | 1 700 | 2 200 | 8,80 | **23126 CC/W33** | **23126 CCK/W33** |
| | 210 | 80 | 587 | 1 000 | 100 | 1 300 | 1 700 | 11,0 | **24126 CC/W33** | **24126 CCK30/W33** |
| | 230 | 64 | 735 | 930 | 88 | 1 800 | 2 400 | 11,0 | **22226 E** | **22226 EK** |
| | 230 | 80 | 690 | 1 060 | 104 | 1 300 | 1 700 | 14,5 | **23226 CC/W33** | **23226 CCK/W33** |
| | 280 | 93 | 1 120 | 1 320 | 114 | 1 300 | 1 700 | 29,0 | **22326 CC/W33** | **22326 CCK/W33** |

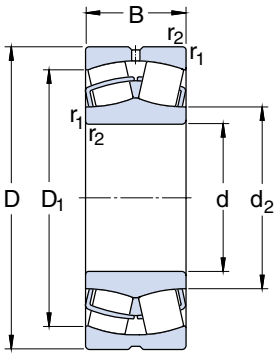
The designations of Explorer bearings are printed in blue

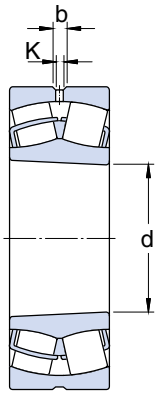




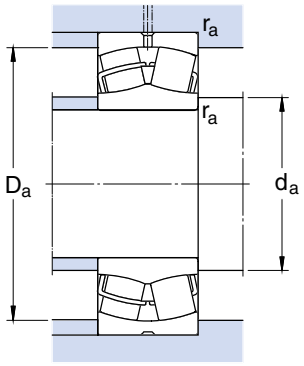
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **85** | 101 | 133 | 5,5 | 3 | 2 | 96 | 139 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 106 | 141 | 5,5 | 3 | 3 | 99 | 166 | 2,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 108 | 154 | 8,3 | 4,5 | 3 | 99 | 166 | 2,5 | 0,33 | 2 | 3 | 2 |
| **90** | 106 | 141 | 5,5 | 3 | 2 | 101 | 149 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 106 | 137 | 5,5 | 3 | 2 | 101 | 149 | 2 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 112 | 150 | 8,3 | 4,5 | 3 | 104 | 176 | 2,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 113 | 161 | 11,1 | 6 | 3 | 104 | 176 | 2,5 | 0,33 | 2 | 3 | 2 |
| **95** | 112 | 150 | 8,3 | 4,5 | 2,1 | 107 | 158 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 118 | 159 | 8,3 | 4,5 | 3 | 109 | 186 | 2,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 118 | 168 | 11,1 | 6 | 3 | 109 | 186 | 2,5 | 0,33 | 2 | 3 | 2 |
| **100** | 111 | 132 | 5,5 | 3 | 1,5 | 107 | 143 | 1,5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 115 | 144 | 5,5 | 3 | 2 | 111 | 154 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 113 | 141 | 5,5 | 3 | 2 | 111 | 154 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 118 | 159 | 8,3 | 4,5 | 2,1 | 112 | 168 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 117 | 153 | 8,3 | 4,5 | 2,1 | 112 | 168 | 2 | 0,33 | 2 | 3 | 2 |
| | 118 | 159 | 8,3 | 4,5 | 3 | 114 | 201 | 2,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 130 | 184 | 11,1 | 6 | 3 | 114 | 201 | 2,5 | 0,33 | 2 | 3 | 2 |
| **110** | 125 | 151 | 5,5 | 3 | 2 | 120 | 160 | 2 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 126 | 157 | 8,3 | 4,5 | 2 | 121 | 169 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 123 | 153 | 5,5 | 3 | 2 | 121 | 169 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 130 | 178 | 8,3 | 4,5 | 2,1 | 122 | 188 | 2 | 0,25 | 2,7 | 4 | 2,5 |
| | 130 | 169 | 8,3 | 4,5 | 2,1 | 122 | 188 | 2 | 0,33 | 2 | 3 | 2 |
| | 143 | 204 | 13,9 | 7,5 | 3 | 124 | 226 | 2,5 | 0,33 | 2 | 3 | 2 |
| **120** | 135 | 163 | 5,5 | 3 | 2 | 130 | 170 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 132 | 159 | 5,5 | 3 | 2 | 130 | 170 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 139 | 174 | 8,3 | 4,5 | 2 | 131 | 189 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 135 | 168 | 5,5 | 3 | 2 | 131 | 189 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 141 | 189 | 11,1 | 6 | 2,1 | 132 | 203 | 2 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 141 | 182 | 8,3 | 4,5 | 2,1 | 132 | 203 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 152 | 216 | 13,9 | 7,5 | 3 | 134 | 246 | 2,5 | 0,35 | 1,9 | 2,9 | 1,8 |
| **130** | 148 | 180 | 8,3 | 4,5 | 2 | 140 | 190 | 2 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 145 | 175 | 5,5 | 3 | 2 | 140 | 190 | 2 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 148 | 184 | 8,3 | 4,5 | 2 | 141 | 199 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 146 | 180 | 5,5 | 3 | 2 | 141 | 199 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 152 | 201 | 11,1 | 6 | 3 | 144 | 216 | 2,5 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 151 | 196 | 8,3 | 4,5 | 3 | 144 | 216 | 2,5 | 0,33 | 2 | 3 | 2 |
| | 164 | 233 | 16,7 | 9 | 4 | 148 | 262 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |

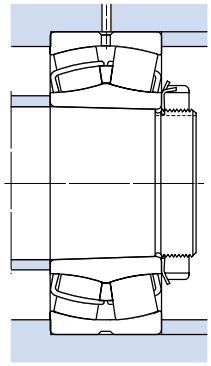



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **140** | 210 | 53 | 465 | 680 | 68 | 1 800 | 2 400 | 6,55 | 23028 CC/W33 | 23028 CCK/W33 |
| | 210 | 69 | 570 | 900 | 88 | 1 400 | 1 800 | 8,55 | 24028 CC/W33 | 24028 CCK30/W33 |
| | 225 | 68 | 546 | 900 | 88 | 1 600 | 2 000 | 10,5 | **23128 CC/W33** | **23128 CCK/W33** |
| | 225 | 85 | 673 | 1 160 | 112 | 1 100 | 1 500 | 13,5 | **24128 CC/W33** | **24128 CCK30/W33** |
| | 250 | 68 | 710 | 900 | 86,5 | 1 700 | 2 200 | 14,0 | 22228 CC/W33 | 22228 CCK/W33 |
| | 250 | 88 | 915 | 1 250 | 120 | 1 200 | 1 600 | 19,0 | 23228 CC/W33 | 23228 CCK/W33 |
| | 300 | 102 | 1 290 | 1 560 | 132 | 1 100 | 1 500 | 36,5 | 22328 CC/W33 | 22328 CCK/W33 |
| **150** | 225 | 56 | 510 | 750 | 73,5 | 1 700 | 2 200 | 7,95 | 23030 CC/W33 | 23030 CCK/W33 |
| | 225 | 75 | 655 | 1 040 | 100 | 1 300 | 1 700 | 10,5 | 24030 CC/W33 | 24030 CCK30/W33 |
| | 250 | 80 | 725 | 1 200 | 114 | 1 400 | 1 800 | 16,0 | **23130 CC/W33** | **23130 CCK/W33** |
| | 250 | 100 | 1 020 | 1 530 | 146 | 1 000 | 1 400 | 20,0 | 24130 CC/W33 | 24130 CCK30/W33 |
| | 270 | 73 | 850 | 1 080 | 102 | 1 600 | 2 000 | 18,0 | 22230 CC/W33 | 22230 CCK/W33 |
| | 270 | 96 | 1 080 | 1 460 | 137 | 1 100 | 1 500 | 24,5 | 23230 CC/W33 | 23230 CCK/W33 |
| | 320 | 108 | 1 460 | 1 760 | 146 | 1 000 | 1 400 | 43,5 | 22330 CC/W33 | 22330 CCK/W33 |
| **160** | 240 | 60 | 585 | 880 | 83 | 1 700 | 2 200 | 9,70 | 23032 CC/W33 | 23032 CCK/W33 |
| | 240 | 80 | 750 | 1 200 | 114 | 1 100 | 1 500 | 13,0 | 24032 CC/W33 | 24032 CCK30/W33 |
| | 270 | 86 | 980 | 1 370 | 129 | 1 300 | 1 700 | 20,5 | 23132 CC/W33 | 23132 CCK/W33 |
| | 270 | 109 | 1 040 | 1 760 | 163 | 950 | 1 300 | 25,0 | **24132 CC/W33** | **24132 CCK30/W33** |
| | 290 | 80 | 1 000 | 1 290 | 118 | 1 500 | 1 900 | 22,5 | 22232 CC/W33 | 22232 CCK/W33 |
| | 290 | 104 | 1 220 | 1 660 | 153 | 1 000 | 1 400 | 31,0 | 23232 CC/W33 | 23232 CCK/W33 |
| | 340 | 114 | 1 600 | 1 960 | 160 | 950 | 1 300 | 52,0 | 22332 CC/W33 | 22332 CCK/W33 |
| **170** | 260 | 67 | 710 | 1 060 | 100 | 1 600 | 2 000 | 13,0 | 23034 CC/W33 | 23034 CCK/W33 |
| | 260 | 90 | 930 | 1 460 | 137 | 1 000 | 1 400 | 17,5 | 24034 CC/W33 | 24034 CCK30/W33 |
| | 280 | 88 | 1 040 | 1 500 | 137 | 1 200 | 1 600 | 22,0 | 23134 CC/W33 | 23134 CCK/W33 |
| | 280 | 109 | 1 220 | 1 860 | 170 | 900 | 1 200 | 27,5 | 24134 CC/W33 | 24134 CCK30/W33 |
| | 310 | 86 | 1 120 | 1 460 | 132 | 1 300 | 1 700 | 28,5 | 22234 CC/W33 | 22234 CCK/W33 |
| | 310 | 110 | 1 400 | 1 930 | 173 | 950 | 1 300 | 37,5 | 23234 CC/W33 | 23234 CCK/W33 |
| | 360 | 120 | 1 760 | 2 160 | 176 | 950 | 1 300 | 61,0 | 22334 CC/W33 | 22334 CCK/W33 |
| **180** | 250 | 52 | 490 | 830 | 76,5 | 1 700 | 2 200 | 7,90 | 23936 CC/W33 | – |
| | 280 | 74 | 830 | 1 250 | 114 | 1 400 | 1 800 | 17,0 | 23036 CC/W33 | 23036 CCK/W33 |
| | 280 | 100 | 937 | 1 730 | 156 | 950 | 1 300 | 23,0 | **24036 CC/W33** | **24036 CCK30/W33** |
| | 300 | 96 | 1 200 | 1 760 | 160 | 1 100 | 1 500 | 28,0 | 23136 CC/W33 | 23136 CCK/W33 |
| | 300 | 118 | 1 400 | 2 160 | 196 | 900 | 1 200 | 34,5 | 24136 CC/W33 | 24136 CCK30/W33 |
| | 320 | 86 | 1 180 | 1 560 | 140 | 1 300 | 1 700 | 29,5 | 22236 CC/W33 | 22236 CCK/W33 |
| | 320 | 112 | 1 290 | 2 120 | 186 | 900 | 1 200 | 39,5 | **23236 CC/W33** | **23236 CCK/W33** |
| | 380 | 126 | 2 000 | 2 450 | 193 | 900 | 1 200 | 71,5 | 22336 CC/W33 | 22336 CCK/W33 |

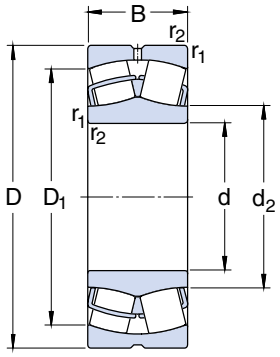
The designations of Explorer bearings are printed in blue

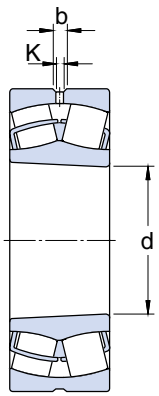




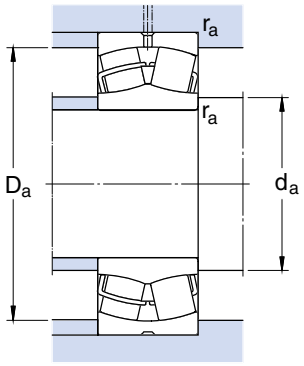
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **140** | 158 | 190 | 8,3 | 4,5 | 2 | 150 | 200 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 155 | 185 | 5,5 | 3 | 2 | 150 | 200 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 159 | 197 | 8,3 | 4,5 | 2,1 | 152 | 213 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 156 | 193 | 8,3 | 4,5 | 2,1 | 152 | 213 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 166 | 216 | 11,1 | 6 | 3 | 154 | 236 | 2,5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 165 | 212 | 11,1 | 6 | 3 | 154 | 236 | 2,5 | 0,33 | 2 | 3 | 2 |
| | 175 | 247 | 16,7 | 9 | 4 | 157 | 283 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| **150** | 169 | 203 | 8,3 | 4,5 | 2,1 | 161 | 214 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 165 | 197 | 5,5 | 3 | 2,1 | 161 | 214 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 172 | 216 | 11,1 | 6 | 2,1 | 162 | 238 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 169 | 211 | 8,3 | 4,5 | 2,1 | 162 | 238 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 178 | 234 | 13,9 | 7,5 | 3 | 164 | 256 | 2,5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 175 | 228 | 11,1 | 6 | 3 | 164 | 256 | 2,5 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 188 | 266 | 16,7 | 9 | 4 | 167 | 303 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| **160** | 180 | 217 | 11,1 | 6 | 2,1 | 171 | 229 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 176 | 211 | 8,3 | 4,5 | 2,1 | 171 | 229 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 184 | 234 | 13,9 | 7,5 | 2,1 | 172 | 258 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 181 | 228 | 8,3 | 4,5 | 2,1 | 172 | 258 | 2 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 191 | 250 | 13,9 | 7,5 | 3 | 174 | 276 | 2,5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 188 | 244 | 13,9 | 7,5 | 3 | 174 | 276 | 2,5 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 200 | 282 | 16,7 | 9 | 4 | 177 | 323 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| **170** | 191 | 232 | 11,1 | 6 | 2,1 | 181 | 249 | 2 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 188 | 226 | 8,3 | 4,5 | 2,1 | 181 | 249 | 2 | 0,33 | 2 | 3 | 2 |
| | 195 | 244 | 13,9 | 7,5 | 2,1 | 182 | 268 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 190 | 237 | 8,3 | 4,5 | 2,1 | 182 | 268 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 203 | 267 | 16,7 | 9 | 4 | 187 | 293 | 3 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 200 | 261 | 13,9 | 7,5 | 4 | 187 | 293 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 213 | 300 | 16,7 | 9 | 4 | 187 | 343 | 3 | 0,33 | 2 | 3 | 2 |
| **180** | 199 | 231 | 5,5 | 3 | 2 | 190 | 240 | 2 | 0,18 | 3,8 | 5,6 | 3,6 |
| | 204 | 249 | 13,9 | 7,5 | 2,1 | 191 | 269 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 201 | 243 | 8,3 | 4,5 | 2,1 | 191 | 269 | 2 | 0,33 | 2 | 3 | 2 |
| | 207 | 259 | 13,9 | 7,5 | 3 | 194 | 286 | 2,5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 203 | 253 | 11,1 | 6 | 3 | 194 | 286 | 2,5 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 213 | 278 | 16,7 | 9 | 4 | 197 | 303 | 3 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 211 | 271 | 13,9 | 7,5 | 4 | 197 | 303 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 224 | 317 | 22,3 | 12 | 4 | 197 | 363 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |

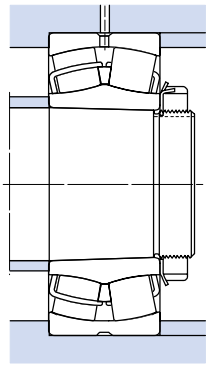



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **190** | 260 | 52 | 475 | 800 | 76,5 | 1 700 | 2 200 | 8,30 | 23938 CC/W33 | – |
| | 290 | 75 | 865 | 1 340 | 122 | 1 300 | 1 700 | 18,0 | 23038 CC/W33 | 23038 CCK/W33 |
| | 290 | 100 | 978 | 1 800 | 163 | 950 | 1 300 | 24,5 | **24038 CC/W33** | **24038 CCK30/W33** |
| | 320 | 104 | 1 370 | 2 080 | 183 | 1 000 | 1 400 | 35,0 | 23138 CC/W33 | 23138 CCK/W33 |
| | 320 | 128 | 1 600 | 2 500 | 212 | 850 | 1 100 | 43,0 | 24138 CC/W33 | 24138 CCK30/W33 |
| | 340 | 92 | 1 270 | 1 700 | 150 | 1 200 | 1 600 | 36,5 | 22238 CC/W33 | 22238 CCK/W33 |
| | 340 | 120 | 1 660 | 2 400 | 208 | 850 | 1 100 | 48,0 | 23238 CC/W33 | 23238 CCK/W33 |
| | 400 | 132 | 2 120 | 2 650 | 208 | 850 | 1 100 | 82,5 | 22338 CC/W33 | 22338 CCK/W33 |
| **200** | 280 | 60 | 620 | 1 040 | 93 | 1 600 | 2 000 | 11,5 | 23940 CC/W33 | – |
| | 310 | 82 | 1 000 | 1 530 | 137 | 1 200 | 1 600 | 23,3 | 23040 CC/W33 | 23040 CCK/W33 |
| | 310 | 109 | 1 130 | 2 120 | 186 | 900 | 1 200 | 31,0 | **24040 CC/W33** | **24040 CCK30/W33** |
| | 340 | 112 | 1 600 | 2 360 | 204 | 950 | 1 300 | 43,0 | 23140 CC/W33 | 23140 CCK/W33 |
| | 340 | 140 | 1 800 | 2 800 | 232 | 800 | 1 000 | 53,5 | 24140 CC/W33 | 24140 CCK30/W33 |
| | 360 | 98 | 1 460 | 1 930 | 166 | 1 100 | 1 500 | 43,5 | 22240 CC/W33 | 22240 CCK/W33 |
| | 360 | 128 | 1 860 | 2 700 | 228 | 850 | 1 100 | 58,0 | 23240 CC/W33 | 23240 CCK/W33 |
| | 420 | 138 | 2 320 | 2 900 | 224 | 850 | 1 100 | 95,0 | 22340 CC/W33 | 22340 CCK/W33 |
| **220** | 300 | 60 | 630 | 1 080 | 93 | 1 500 | 1 900 | 12,5 | 23944 CC/W33 | – |
| | 340 | 90 | 1 220 | 1 860 | 163 | 1 100 | 1 500 | 30,5 | 23044 CC/W33 | 23044 CCK/W33 |
| | 340 | 118 | 1 360 | 2 600 | 212 | 850 | 1 100 | 40,0 | **24044 CC/W33** | **24044 CCK30/W33** |
| | 370 | 120 | 1 800 | 2 750 | 232 | 900 | 1 200 | 53,5 | 23144 CC/W33 | 23144 CCK/W33 |
| | 370 | 150 | 2 120 | 3 350 | 285 | 750 | 950 | 67,0 | 24144 CC/W33 | 24144 CCK30/W33 |
| | 400 | 108 | 1 760 | 2 360 | 196 | 950 | 1 300 | 60,5 | 22244 CC/W33 | 22244 CCK/W33 |
| | 400 | 144 | 2 360 | 3 450 | 285 | 750 | 950 | 81,5 | 23244 CC/W33 | 23244 CCK/W33 |
| | 460 | 145 | 2 700 | 3 450 | 260 | 750 | 950 | 120 | 22344 CC/W33 | 22344 CCK/W33 |
| **240** | 320 | 60 | 655 | 1 160 | 98 | 1 300 | 1 700 | 13,5 | 23948 CC/W33 | – |
| | 360 | 92 | 1 290 | 2 080 | 176 | 1 000 | 1 400 | 33,5 | 23048 CC/W33 | 23048 CCK/W33 |
| | 360 | 118 | 1 380 | 2 700 | 228 | 800 | 1 000 | 43,0 | **24048 CC/W33** | **24048 CCK30/W33** |
| | 400 | 128 | 2 080 | 3 200 | 255 | 850 | 1 100 | 66,5 | 23148 CC/W33 | 23148 CCK/W33 |
| | 400 | 160 | 2 400 | 3 900 | 320 | 670 | 850 | 83,0 | 24148 CC/W33 | 24148 CCK30/W33 |
| | 440 | 120 | 2 200 | 3 000 | 245 | 900 | 1 200 | 83,0 | 22248 CC/W33 | 22248 CCK/W33 |
| | 440 | 160 | 2 900 | 4 300 | 345 | 670 | 850 | 110 | 23248 CC/W33 | 23248 CCK/W33 |
| | 500 | 155 | 2 670 | 4 000 | 290 | 670 | 850 | 155 | **22348 CC/W33** | **22348 CCK/W33** |
| **260** | 360 | 75 | 880 | 1 800 | 156 | 1 100 | 1 500 | 23,5 | **23952 CC/W33** | – |
| | 400 | 104 | 1 600 | 2 550 | 212 | 900 | 1 200 | 48,5 | 23052 CC/W33 | 23052 CCK/W33 |
| | 400 | 140 | 2 040 | 3 450 | 285 | 700 | 900 | 65,5 | 24052 CC/W33 | 24052 CCK30/W33 |
| | 440 | 144 | 2 550 | 3 900 | 290 | 800 | 1 000 | 90,5 | 23152 CC/W33 | 23152 CCK/W33 |
| | 440 | 180 | 3 000 | 4 800 | 380 | 600 | 750 | 110 | 24152 CC/W33 | 24152 CCK30/W33 |
| | 480 | 130 | 2 650 | 3 550 | 285 | 850 | 1 100 | 110 | 22252 CC/W33 | 22252 CCK/W33 |
| | 480 | 174 | 3 250 | 4 750 | 360 | 630 | 800 | 140 | 23252 CC/W33 | 23252 CCK/W33 |
| | 540 | 165 | 3 050 | 4 550 | 325 | 630 | 800 | 190 | **22352 CC/W33** | **22352 CCK/W33** |

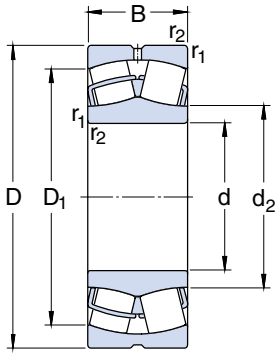
The designations of Explorer bearings are printed in blue

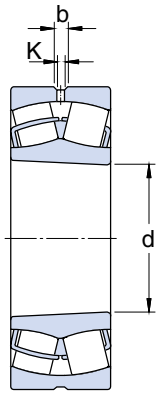




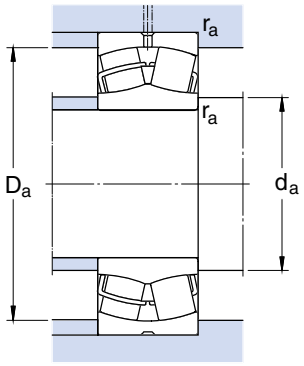
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **190** | 209 | 240 | 5,5 | 3 | 2 | 200 | 250 | 2 | 0,16 | 4,2 | 6,3 | 4 |
| | 216 | 261 | 13,9 | 7,5 | 2,1 | 201 | 279 | 2 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 210 | 253 | 8,3 | 4,5 | 2,1 | 201 | 279 | 2 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 220 | 276 | 13,9 | 7,5 | 3 | 204 | 306 | 2,5 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 215 | 268 | 11,1 | 6 | 3 | 204 | 306 | 2,5 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 225 | 294 | 16,7 | 9 | 4 | 207 | 323 | 3 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 222 | 287 | 16,7 | 9 | 4 | 207 | 323 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 236 | 333 | 22,3 | 12 | 5 | 210 | 380 | 4 | 0,35 | 1,9 | 2,9 | 1,8 |
| **200** | 222 | 258 | 8,3 | 4,5 | 2,1 | 211 | 269 | 2 | 0,19 | 3,6 | 5,3 | 3,6 |
| | 228 | 278 | 13,9 | 7,5 | 2,1 | 211 | 299 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 223 | 268 | 11,1 | 6 | 2,1 | 211 | 299 | 2 | 0,33 | 2 | 3 | 2 |
| | 231 | 293 | 16,7 | 9 | 3 | 214 | 326 | 2,5 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 226 | 284 | 11,1 | 6 | 3 | 214 | 326 | 2,5 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 238 | 313 | 16,7 | 9 | 4 | 217 | 343 | 3 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 235 | 304 | 16,7 | 9 | 4 | 217 | 343 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 249 | 351 | 22,3 | 12 | 5 | 220 | 400 | 4 | 0,33 | 2 | 3 | 2 |
| **220** | 241 | 278 | 8,3 | 4,5 | 2,1 | 231 | 289 | 2 | 0,16 | 4,2 | 6,3 | 4 |
| | 250 | 306 | 13,9 | 7,5 | 3 | 233 | 327 | 2,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 244 | 295 | 11,1 | 6 | 3 | 233 | 327 | 2,5 | 0,33 | 2 | 3 | 2 |
| | 255 | 320 | 16,7 | 9 | 4 | 237 | 353 | 3 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 248 | 310 | 11,1 | 6 | 4 | 237 | 353 | 3 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 263 | 346 | 16,7 | 9 | 4 | 237 | 383 | 3 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 259 | 338 | 16,7 | 9 | 4 | 237 | 383 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 279 | 389 | 22,3 | 12 | 5 | 240 | 440 | 4 | 0,31 | 2,2 | 3,3 | 2,2 |
| **240** | 261 | 298 | 8,3 | 4,5 | 2,1 | 251 | 309 | 2 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 271 | 326 | 13,9 | 7,5 | 3 | 253 | 347 | 2,5 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 265 | 316 | 11,1 | 6 | 3 | 253 | 347 | 2,5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 277 | 348 | 16,7 | 9 | 4 | 257 | 383 | 3 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 271 | 336 | 11,1 | 6 | 4 | 257 | 383 | 3 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 290 | 683 | 22,3 | 12 | 4 | 257 | 423 | 3 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 287 | 374 | 22,3 | 12 | 4 | 257 | 423 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 304 | 422 | 22,3 | 12 | 5 | 260 | 480 | 4 | 0,31 | 2,2 | 3,3 | 2,2 |
| **260** | 287 | 331 | 8,3 | 4,5 | 2,1 | 271 | 348 | 2 | 0,18 | 3,8 | 5,6 | 3,6 |
| | 295 | 360 | 16,7 | 9 | 4 | 275 | 385 | 3 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 289 | 347 | 11,1 | 6 | 4 | 275 | 385 | 3 | 0,33 | 2 | 3 | 2 |
| | 301 | 380 | 16,7 | 9 | 4 | 277 | 423 | 3 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 294 | 368 | 13,9 | 7,5 | 4 | 277 | 423 | 3 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 311 | 421 | 22,3 | 12 | 5 | 280 | 460 | 4 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 312 | 408 | 22,3 | 12 | 5 | 280 | 460 | 4 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 329 | 457 | 22,3 | 12 | 6 | 286 | 514 | 5 | 0,31 | 2,2 | 3,3 | 2,2 |

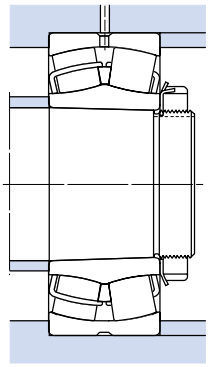



| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed ratings Lubrication grease | oil | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **280** | 380 | 75 | 845 | 1 760 | 143 | 1 000 | 1 400 | 25,0 | **23956 CC/W33** | **–** |
| | 420 | 106 | 1 730 | 2 850 | 224 | 850 | 1 100 | 52,5 | **23056 CC/W33** | **23056 CCK/W33** |
| | 420 | 140 | 2 160 | 3 800 | 285 | 670 | 850 | 69,5 | **24056 CC/W33** | **24056 CCK30/W33** |
| | 460 | 146 | 2 650 | 4 250 | 335 | 750 | 950 | 97,0 | **23156 CC/W33** | **23156 CCK/W33** |
| | 460 | 180 | 3 100 | 5 100 | 415 | 560 | 700 | 120 | **24156 CC/W33** | **24156 CCK30/W33** |
| | 500 | 130 | 2 700 | 3 750 | 300 | 800 | 1 000 | 115 | **22256 CC/W33** | **22256 CCK/W33** |
| | 500 | 176 | 3 250 | 4 900 | 365 | 600 | 750 | 150 | **23256 CC/W33** | **23256 CCK/W33** |
| | 580 | 175 | 3 450 | 5 200 | 365 | 600 | 750 | 235 | **22356 CC/W33** | **22356 CCK/W33** |
| **300** | 380 | 60 | 656 | 1 600 | 137 | 1 000 | 1 400 | 16,5 | **23860 CAMA** | **23860 CAKMA** |
| | 420 | 90 | 1 200 | 2 500 | 200 | 950 | 1 300 | 39,5 | **23960 CC/W33** | **23960 CCK/W33** |
| | 460 | 118 | 2 120 | 3 450 | 265 | 800 | 1 000 | 71,5 | **23060 CC/W33** | **23060 CCK/W33** |
| | 460 | 160 | 2 700 | 4 750 | 355 | 600 | 750 | 97,0 | **24060 CC/W33** | **24060 CCK30/W33** |
| | 500 | 160 | 3 200 | 5 100 | 380 | 670 | 850 | 125 | **23160 CC/W33** | **23160 CCK/W33** |
| | 500 | 200 | 3 750 | 6 300 | 465 | 530 | 670 | 160 | **24160 CC/W33** | **24160 CCK30/W33** |
| | 540 | 140 | 2 760 | 4 250 | 325 | 750 | 950 | 145 | **22260 CC/W33** | **22260 CCK/W33** |
| | 540 | 192 | 3 900 | 5 850 | 425 | 530 | 670 | 190 | **23260 CC/W33** | **23260 CCK/W33** |
| **320** | 440 | 90 | 1 430 | 2 700 | 212 | 900 | 1 200 | 42,0 | **23964 CC/W33** | **23964 CCK/W33** |
| | 480 | 121 | 2 240 | 3 800 | 285 | 800 | 1 000 | 78,0 | **23064 CC/W33** | **23064 CCK/W33** |
| | 480 | 160 | 2 850 | 5 100 | 400 | 560 | 700 | 100 | **24064 CC/W33** | **24064 CCK30/W33** |
| | 540 | 176 | 3 750 | 6 000 | 440 | 630 | 800 | 165 | **23164 CC/W33** | **23164 CCK/W33** |
| | 540 | 218 | 3 740 | 7 100 | 510 | 480 | 600 | 210 | **24164 CC/W33** | **24164 CCK30/W33** |
| | 580 | 150 | 3 160 | 4 900 | 375 | 670 | 850 | 175 | **22264 CC/W33** | **22264 CCK/W33** |
| | 580 | 208 | 3 850 | 6 700 | 480 | 500 | 630 | 240 | **23264 CC/W33** | **23264 CCK/W33** |
| **340** | 460 | 90 | 1 460 | 2 800 | 216 | 900 | 1 200 | 45,5 | **23968 CC/W33** | **23968 CCK/W33** |
| | 520 | 133 | 2 700 | 4 550 | 335 | 700 | 900 | 105 | **23068 CC/W33** | **23068 CCK/W33** |
| | 520 | 180 | 3 450 | 6 200 | 475 | 530 | 670 | 140 | **24068 CC/W33** | **24068 CCK30/W33** |
| | 580 | 190 | 4 250 | 6 800 | 480 | 600 | 750 | 210 | **23168 CC/W33** | **23168 CCK/W33** |
| | 580 | 243 | 4 660 | 8 650 | 630 | 450 | 560 | 280 | **24168 ECCJ/W33** | **24168 ECCK30J/W33** |
| | 620 | 224 | 4 490 | 7 800 | 550 | 430 | 530 | 295 | **23268 CA/W33** | **23268 CAK/W33** |
| **360** | 480 | 90 | 1 400 | 2 750 | 220 | 850 | 1 100 | 43,0 | **23972 CC/W33** | **23972 CCK/W33** |
| | 540 | 134 | 2 750 | 4 800 | 345 | 670 | 850 | 110 | **23072 CC/W33** | **23072 CCK/W33** |
| | 540 | 180 | 3 550 | 6 550 | 490 | 500 | 630 | 145 | **24072 CC/W33** | **24072 CCK30/W33** |
| | 600 | 192 | 4 300 | 6 950 | 490 | 560 | 700 | 220 | **23172 CC/W33** | **23172 CCK/W33** |
| | 600 | 243 | 4 890 | 9 300 | 670 | 430 | 530 | 270 | **24172 ECCJ/W33** | **24172 ECCK30J/W33** |
| | 650 | 170 | 3 740 | 6 200 | 440 | 480 | 600 | 255 | **22272 CA/W33** | **22272 CAK/W33** |
| | 650 | 232 | 4 660 | 8 300 | 570 | 400 | 500 | 335 | **23272 CA/W33** | **23272 CAK/W33** |

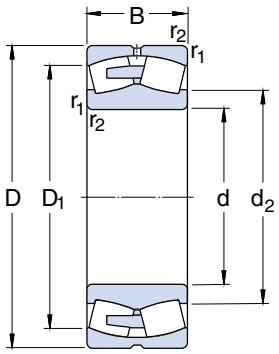
The designations of Explorer bearings are printed in blue

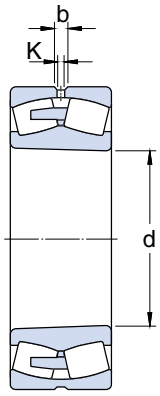




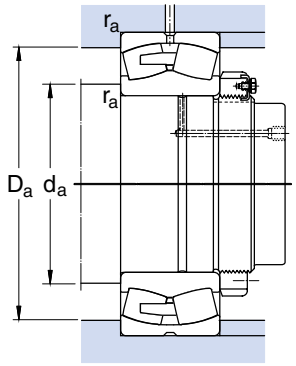
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **280** | 308 | 352 | 11,1 | 6 | 2,1 | 291 | 369 | 2 | 0,16 | 4,2 | 6,3 | 4 |
| | 315 | 380 | 16,7 | 9 | 4 | 295 | 405 | 3 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 309 | 368 | 11,1 | 6 | 4 | 295 | 405 | 3 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 321 | 400 | 16,7 | 9 | 5 | 300 | 440 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 315 | 390 | 13,9 | 7,5 | 5 | 300 | 440 | 4 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 333 | 441 | 22,3 | 12 | 5 | 300 | 480 | 4 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 332 | 429 | 22,3 | 12 | 5 | 300 | 480 | 4 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 354 | 492 | 22,3 | 12 | 6 | 306 | 554 | 5 | 0,30 | 2,3 | 3,4 | 2,2 |
| **300** | 329 | 358 | – | – | 2,1 | 311 | 369 | 2 | 0,13 | 5,2 | 7,7 | 5 |
| | 333 | 385 | 11,1 | 6 | 3 | 313 | 407 | 2,5 | 0,19 | 3,6 | 5,3 | 3,6 |
| | 340 | 413 | 16,7 | 9 | 4 | 315 | 445 | 3 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 331 | 400 | 13,9 | 7,5 | 4 | 315 | 445 | 3 | 0,33 | 2 | 3 | 2 |
| | 345 | 434 | 16,7 | 9 | 5 | 320 | 480 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 339 | 422 | 13,9 | 7,5 | 5 | 320 | 480 | 4 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 354 | 477 | 22,3 | 12 | 5 | 320 | 520 | 4 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 356 | 461 | 22,3 | 12 | 5 | 320 | 520 | 4 | 0,35 | 1,9 | 2,9 | 1,8 |
| **320** | 353 | 405 | 11,1 | 6 | 3 | 333 | 427 | 2,5 | 0,18 | 3,8 | 5,6 | 3,6 |
| | 360 | 433 | 16,7 | 9 | 4 | 335 | 465 | 3 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 354 | 423 | 13,9 | 7,5 | 4 | 335 | 465 | 3 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 370 | 465 | 22,3 | 12 | 5 | 340 | 520 | 4 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 364 | 455 | 16,7 | 9 | 5 | 340 | 520 | 4 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 379 | 512 | 22,3 | 12 | 5 | 340 | 560 | 4 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 382 | 493 | 22,3 | 12 | 5 | 340 | 560 | 4 | 0,35 | 1,9 | 2,9 | 1,8 |
| **340** | 374 | 426 | 11,1 | 6 | 3 | 353 | 447 | 2,5 | 0,17 | 4 | 5,9 | 4 |
| | 385 | 467 | 22,3 | 12 | 5 | 358 | 502 | 4 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 377 | 453 | 16,7 | 9 | 5 | 358 | 502 | 4 | 0,33 | 2 | 3 | 2 |
| | 394 | 498 | 22,3 | 12 | 5 | 360 | 560 | 4 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 383 | 488 | 16,7 | 9 | 5 | 360 | 560 | 4 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 426 | 528 | 22,3 | 12 | 6 | 366 | 594 | 5 | 0,35 | 1,9 | 2,9 | 1,8 |
| **360** | 394 | 447 | 11,1 | 6 | 3 | 373 | 467 | 2,5 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 404 | 482 | 22,3 | 12 | 5 | 378 | 522 | 4 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 398 | 474 | 16,7 | 9 | 5 | 378 | 522 | 4 | 0,31 | 2,2 | 3,3 | 2,2 |
| | 418 | 524 | 22,3 | 12 | 5 | 380 | 580 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 406 | 506 | 16,7 | 9 | 5 | 380 | 580 | 4 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 453 | 566 | 22,3 | 12 | 6 | 386 | 624 | 5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 447 | 552 | 22,3 | 12 | 6 | 386 | 624 | 5 | 0,35 | 1,9 | 2,9 | 1,8 |

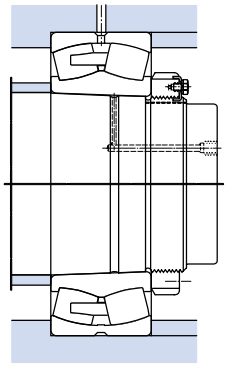



| Principal dimensions | | | Basic load ratings | | Fatigue load limit | Speed ratings Lubrication | | Mass | Designations Bearings with | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | dynamic | static | | grease | oil | | cylindrical bore | tapered bore |
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **380** | 520 | 106 | 1 960 | 3 800 | 285 | 800 | 1 000 | 69,0 | **23976 CC/W33** | **23976 CCK/W33** |
| | 560 | 135 | 2 900 | 5 000 | 360 | 630 | 800 | 115 | **23076 CC/W33** | **23076 CCK/W33** |
| | 560 | 180 | 3 600 | 6 800 | 480 | 480 | 600 | 150 | **24076 CC/W33** | **24076 CCK30/W33** |
| | 620 | 194 | 3 740 | 7 100 | 500 | 400 | 500 | 230 | **23176 CA/W33** | **23176 CAK/W33** |
| | 620 | 243 | 5 060 | 9 800 | 710 | 340 | 430 | 300 | **24176 ECA/W33** | **24176 ECAK30/W33** |
| | 680 | 240 | 5 060 | 9 150 | 620 | 380 | 480 | 375 | **23276 CA/W33** | **23276 CAK/W33** |
| **400** | 540 | 106 | 2 000 | 3 900 | 290 | 750 | 950 | 71,0 | **23980 CC/W33** | **23980 CCK/W33** |
| | 600 | 148 | 3 250 | 5 700 | 400 | 600 | 750 | 150 | **23080 CC/W33** | **23080 CCK/W33** |
| | 600 | 200 | 4 300 | 8 000 | 560 | 450 | 560 | 205 | **24080 ECCJ/W33** | **24080 ECCK30J/W33** |
| | 650 | 200 | 4 080 | 7 650 | 530 | 380 | 480 | 265 | **23180 CA/W33** | **23180 CAK/W33** |
| | 650 | 250 | 5 350 | 10 600 | 735 | 320 | 400 | 340 | **24180 ECA/W33** | **24180 ECAK30/W33** |
| | 720 | 256 | 5 750 | 10 400 | 680 | 340 | 430 | 450 | **23280 CA/W33** | **23280 CAK/W33** |
| | 820 | 243 | 6 560 | 10 400 | 670 | 360 | 450 | 650 | **22380 CA/W33** | **22380 CAK/W33** |
| **420** | 560 | 106 | 2 040 | 4 150 | 300 | 700 | 900 | 74,5 | **23984 CC/W33** | **23984 CCK/W33** |
| | 620 | 150 | 2 990 | 6 000 | 415 | 450 | 560 | 155 | **23084 CA/W33** | **23084 CAK/W33** |
| | 620 | 200 | 3 850 | 8 300 | 585 | 380 | 480 | 210 | **24084 ECA/W33** | **24084 ECAK30/W33** |
| | 700 | 224 | 4 890 | 9 300 | 620 | 360 | 450 | 350 | **23184 CJ/W33** | **23184 CKJ/W33** |
| | 700 | 280 | 6 330 | 12 600 | 850 | 300 | 380 | 445 | **24184 ECA/W33** | **24184 ECAK30/W33** |
| | 760 | 272 | 6 330 | 11 600 | 765 | 320 | 400 | 535 | **23284 CA/W33** | **23284 CAK/W33** |
| **440** | 600 | 118 | 2 450 | 4 900 | 345 | 670 | 850 | 99,5 | **23988 CC/W33** | **23988 CCK/W33** |
| | 650 | 157 | 3 220 | 6 550 | 450 | 430 | 530 | 180 | **23088 CA/W33** | **23088 CAK/W33** |
| | 650 | 212 | 4 140 | 9 150 | 630 | 360 | 450 | 245 | **24088 ECA/W33** | **24088 ECAK30/W33** |
| | 720 | 226 | 5 180 | 10 000 | 670 | 340 | 430 | 360 | **23188 CA/W33** | **23188 CAK/W33** |
| | 720 | 280 | 6 560 | 13 200 | 900 | 280 | 360 | 460 | **24188 ECA/W33** | **24188 ECAK30/W33** |
| | 790 | 280 | 6 730 | 12 500 | 800 | 320 | 400 | 590 | **23288 CA/W33** | **23288 CAK/W33** |
| **460** | 580 | 118 | 1 790 | 4 900 | 345 | 450 | 560 | 75,5 | **24892 CAMA/W20** | **24892 CAK30MA/W20** |
| | 620 | 118 | 2 190 | 5 000 | 355 | 430 | 530 | 105 | **23992 CA/W33** | **23992 CAK/W33** |
| | 680 | 163 | 3 450 | 6 950 | 465 | 400 | 500 | 205 | **23092 CA/W33** | **23092 CAK/W33** |
| | 680 | 218 | 4 490 | 10 000 | 670 | 340 | 430 | 275 | **24092 ECA/W33** | **24092 ECAK30/W33** |
| | 760 | 240 | 5 640 | 10 800 | 680 | 320 | 400 | 440 | **23192 CA/W33** | **23192 CAK/W33** |
| | 760 | 300 | 7 250 | 14 600 | 1 000 | 260 | 340 | 560 | **24192 ECA/W33** | **24192 ECAK30/W33** |
| | 830 | 296 | 7 360 | 13 700 | 880 | 300 | 380 | 695 | **23292 CA/W33** | **23292 CAK/W33** |
| **480** | 600 | 90 | 1 440 | 3 750 | 280 | 430 | 530 | 61,0 | **23896 CAMA/W20** | **23896 CAKMA/W20** |
| | 650 | 128 | 2 530 | 5 700 | 405 | 400 | 500 | 125 | **23996 CA/W33** | **23996 CAK/W33** |
| | 700 | 165 | 3 340 | 6 800 | 450 | 380 | 480 | 215 | **23096 CA/W33** | **23096 CAK/W33** |
| | 700 | 218 | 4 600 | 10 400 | 695 | 340 | 430 | 285 | **24096 ECA/W33** | **24096 ECAK30/W33** |
| | 790 | 248 | 6 100 | 12 000 | 780 | 300 | 380 | 485 | **23196 CA/W33** | **23196 CAK/W33** |
| | 790 | 308 | 7 710 | 15 600 | 1 040 | 240 | 320 | 605 | **24196 ECA/W33** | **24196 ECAK30/W33** |
| | 870 | 310 | 8 170 | 15 000 | 950 | 260 | 340 | 800 | **23296 CA/W33** | **23296 CAK/W33** |

The designations of Explorer bearings are printed in blue

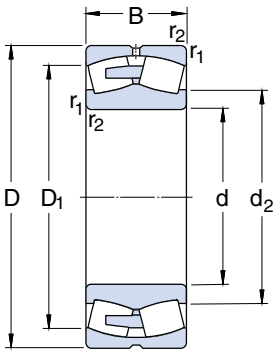


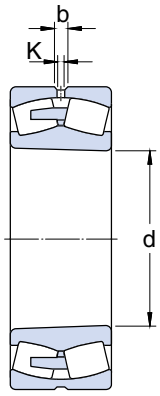





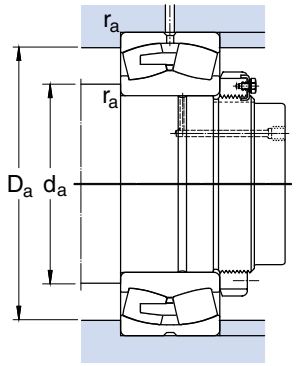
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **380** | 420 | 481 | 13,9 | 7,5 | 4 | 395 | 505 | 3 | 0,17 | 4 | 5,9 | 4 |
| | 425 | 508 | 22,3 | 12 | 5 | 398 | 542 | 4 | 0,22 | 3 | 4,6 | 2,8 |
| | 420 | 496 | 16,7 | 9 | 5 | 398 | 542 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 452 | 541 | 22,3 | 12 | 5 | 400 | 600 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 446 | 529 | 16,7 | 9 | 5 | 400 | 600 | 4 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 471 | 581 | 22,3 | 12 | 6 | 406 | 654 | 5 | 0,35 | 1,9 | 2,9 | 1,8 |
| **400** | 438 | 500 | 13,9 | 7,5 | 4 | 415 | 525 | 3 | 0,17 | 4 | 5,9 | 4 |
| | 450 | 543 | 22,3 | 12 | 5 | 418 | 582 | 4 | 0,23 | 2,9 | 4,4 | 2,8 |
| | 442 | 527 | 22,3 | 12 | 5 | 418 | 582 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 474 | 566 | 22,3 | 12 | 6 | 426 | 624 | 5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 468 | 554 | 22,3 | 12 | 6 | 426 | 624 | 5 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 499 | 615 | 22,3 | 12 | 6 | 426 | 694 | 5 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 534 | 697 | 22,3 | 12 | 7,5 | 432 | 788 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| **420** | 459 | 519 | 16,7 | 9 | 4 | 435 | 545 | 3 | 0,16 | 4,2 | 6,3 | 4 |
| | 485 | 562 | 22,3 | 12 | 5 | 438 | 602 | 4 | 0,22 | 3 | 4,6 | 2,8 |
| | 476 | 547 | 22,3 | 12 | 5 | 438 | 602 | 4 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 483 | 607 | 22,3 | 12 | 6 | 446 | 674 | 5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 496 | 590 | 22,3 | 12 | 6 | 446 | 674 | 5 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 525 | 649 | 22,3 | 12 | 7,5 | 452 | 728 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |
| **440** | 484 | 552 | 16,7 | 9 | 4 | 455 | 585 | 3 | 0,17 | 4 | 5,9 | 4 |
| | 509 | 589 | 22,3 | 12 | 6 | 463 | 627 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 498 | 572 | 22,3 | 12 | 6 | 463 | 627 | 5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 528 | 632 | 22,3 | 12 | 6 | 466 | 694 | 5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 516 | 610 | 22,3 | 12 | 6 | 466 | 694 | 5 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 547 | 676 | 22,3 | 12 | 7,5 | 472 | 758 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |
| **460** | 505 | 541 | – | 6 | 3 | 473 | 567 | 2,5 | 0,17 | 4 | 5,9 | 3,7 |
| | 512 | 573 | 16,7 | 9 | 4 | 475 | 605 | 3 | 0,16 | 4,2 | 6,3 | 4 |
| | 531 | 616 | 22,3 | 12 | 6 | 483 | 657 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 523 | 601 | 22,3 | 12 | 6 | 483 | 657 | 5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 553 | 665 | 22,3 | 12 | 7,5 | 492 | 728 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 544 | 649 | 22,3 | 12 | 7,5 | 492 | 728 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 572 | 706 | 22,3 | 12 | 7,5 | 492 | 798 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |
| **480** | 521 | 566 | – | 7,5 | 3 | 493 | 587 | 2,5 | 0,13 | 5,2 | 7,7 | 5 |
| | 532 | 601 | 16,7 | 9 | 5 | 498 | 632 | 4 | 0,18 | 3,8 | 5,6 | 3,6 |
| | 547 | 632 | 22,3 | 12 | 6 | 503 | 677 | 5 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 541 | 619 | 22,3 | 12 | 6 | 503 | 677 | 5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 577 | 692 | 22,3 | 12 | 7,5 | 512 | 758 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 564 | 678 | 22,3 | 12 | 7,5 | 512 | 758 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 600 | 741 | 22,3 | 12 | 7,5 | 512 | 838 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |

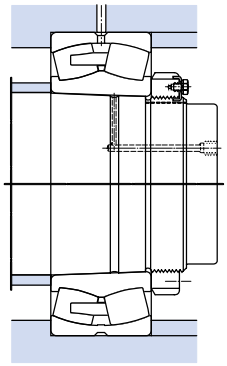
**Spherical roller bearings**
d **500 – 670** mm




| Principal dimensions | | | Basic load ratings | | Fatigue load limit | Speed ratings Lubrication | | Mass | Designations Bearings with | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | dynamic | static | | grease | oil | | cylindrical bore | tapered bore |
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **500** | 620 | 90 | 1 480 | 4 000 | 290 | 430 | 530 | 62,0 | **238/500 CAMA/W20** | **238/500 CAKMA/W20** |
| | 670 | 128 | 2 530 | 6 000 | 415 | 400 | 500 | 130 | **239/500 CA/W33** | **239/500 CAK/W33** |
| | 720 | 167 | 3 680 | 7 800 | 510 | 380 | 480 | 225 | **230/500 CA/W33** | **230/500 CAK/W33** |
| | 720 | 218 | 4 770 | 11 000 | 735 | 320 | 400 | 295 | **240/500 ECA/W33** | **240/500 ECAK30/W33** |
| | 830 | 264 | 6 730 | 12 900 | 830 | 280 | 360 | 580 | **231/500 CA/W33** | **231/500 CAK/W33** |
| | 830 | 325 | 8 630 | 17 000 | 1 120 | 220 | 300 | 745 | **241/500 ECA/W33** | **241/500 ECAK30/W33** |
| | 920 | 336 | 9 370 | 17 300 | 1 120 | 240 | 320 | 985 | **232/500 CA/W33** | **232/500 CAK/W33** |
| **530** | 650 | 118 | 1 840 | 5 300 | 380 | 380 | 480 | 86,0 | **248/530 CAMA/W20** | **248/530 CAK30MA/W20** |
| | 710 | 136 | 2 820 | 6 700 | 480 | 360 | 450 | 155 | **239/530 CA/W33** | **239/530 CAK/W33** |
| | 780 | 185 | 4 370 | 9 300 | 630 | 340 | 430 | 310 | **230/530 CA/W33** | **230/530 CAK/W33** |
| | 780 | 250 | 5 750 | 13 200 | 830 | 280 | 360 | 410 | **240/530 ECA/W33** | **240/530 ECAK30/W33** |
| | 870 | 272 | 7 130 | 14 000 | 915 | 260 | 340 | 645 | **231/530 CA/W33** | **231/530 CAK/W33** |
| | 870 | 335 | 9 200 | 19 000 | 1 220 | 200 | 280 | 830 | **241/530 ECA/W33** | **241/530 ECAK30/W33** |
| | 980 | 355 | 11 100 | 20 400 | 1 220 | 220 | 300 | 1 200 | **232/530 CA/W33** | **232/530 CAK/W33** |
| **560** | 750 | 140 | 3 050 | 7 200 | 510 | 340 | 430 | 175 | **239/560 CA/W33** | **239/560 CAK/W33** |
| | 820 | 195 | 4 890 | 10 200 | 680 | 320 | 400 | 355 | **230/560 CA/W33** | **230/560 CAK/W33** |
| | 820 | 258 | 6 330 | 14 600 | 960 | 260 | 340 | 465 | **240/560 ECA/W33** | **240/560 ECAK30/W33** |
| | 920 | 280 | 7 990 | 16 000 | 980 | 240 | 320 | 740 | **231/560 CA/W33** | **231/560 CAK/W33** |
| | 920 | 355 | 10 500 | 21 600 | 1 340 | 190 | 260 | 985 | **241/560 ECJ/W33** | **241/560 ECK30J/W33** |
| | 1 030 | 365 | 11 500 | 22 000 | 1 400 | 200 | 280 | 1 350 | **232/560 CA/W33** | **232/560 CAK/W33** |
| **600** | 800 | 150 | 3 450 | 8 300 | 585 | 320 | 400 | 220 | **239/600 CA/W33** | **239/600 CAK/W33** |
| | 870 | 200 | 5 230 | 11 400 | 750 | 300 | 380 | 405 | **230/600 CA/W33** | **230/600 CAK/W33** |
| | 870 | 272 | 7 130 | 17 000 | 1 100 | 240 | 320 | 520 | **240/600 ECAF/W33** | **240/600 ECAK30F/W33** |
| | 980 | 300 | 8 970 | 18 000 | 1 140 | 200 | 280 | 895 | **231/600 CA/W33** | **231/600 CAK/W33** |
| | 980 | 375 | 11 500 | 23 600 | 1 460 | 180 | 240 | 1 200 | **241/600 ECA/W33** | **241/600 ECAK30/W33** |
| | 1 090 | 388 | 13 100 | 25 500 | 1 560 | 190 | 260 | 1 600 | **232/600 CA/W33** | **232/600 CAK/W33** |
| **630** | 780 | 112 | 2 190 | 6 100 | 415 | 320 | 400 | 120 | **238/630 CAMA/W20** | **238/630 CAKMA/W20** |
| | 850 | 165 | 3 970 | 9 800 | 640 | 280 | 360 | 280 | **239/630 CA/W33** | **239/630 CAK/W33** |
| | 920 | 212 | 5 750 | 12 500 | 800 | 260 | 340 | 485 | **230/630 CA/W33** | **230/630 CAK/W33** |
| | 920 | 290 | 7 710 | 18 000 | 1 140 | 220 | 300 | 645 | **240/630 ECJ/W33** | **240/630 ECK30J/W33** |
| | 1 030 | 315 | 10 500 | 20 800 | 1 220 | 190 | 260 | 1 050 | **231/630 CA/W33** | **231/630 CAK/W33** |
| | 1 030 | 400 | 12 700 | 27 000 | 1 630 | 170 | 220 | 1 400 | **241/630 ECA/W33** | **241/630 ECAK30/W33** |
| **670** | 820 | 112 | 2 250 | 6 400 | 440 | 280 | 360 | 130 | **238/670 CAMA/W20** | **238/670/ CAKMA/W20** |
| | 820 | 150 | 3 110 | 9 500 | 655 | 280 | 360 | 172 | **248/670 CAMA/W20** | **–** |
| | 900 | 170 | 4 370 | 10 800 | 695 | 260 | 340 | 315 | **239/670 CA/W33** | **239/670 CAK/W33** |
| | 980 | 230 | 6 560 | 14 600 | 915 | 240 | 320 | 600 | **230/670 CA/W33** | **230/670 CAK/W33** |
| | 980 | 308 | 8 630 | 20 400 | 1 320 | 200 | 280 | 790 | **240/670 ECA/W33** | **240/670 ECAK30/W33** |
| | 1 090 | 336 | 10 900 | 22 400 | 1 370 | 180 | 240 | 1 250 | **231/670 CA/W33** | **231/670 CAK/W33** |
| | 1 090 | 412 | 13 800 | 29 000 | 1 760 | 160 | 200 | 1 600 | **241/670 ECA/W33** | **241/670 ECAK30/W33** |
| | 1 220 | 438 | 15 400 | 30 500 | 1 700 | 170 | 220 | 2 270 | **232/670 CA/W33** | **232/670 CAK/W33** |

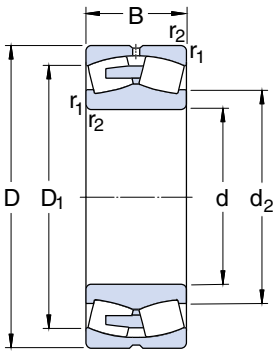


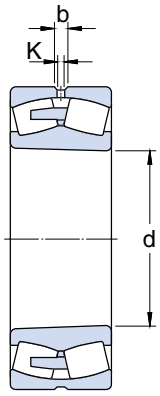





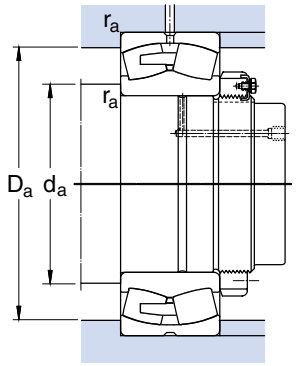
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **500** | 543 | 587 | – | 7,5 | 3 | 513 | 607 | 2,5 | 0,12 | 5,6 | 8,4 | 5,6 |
| | 557 | 621 | 22,3 | 12 | 5 | 518 | 652 | 4 | 0,17 | 4 | 5,9 | 4 |
| | 571 | 656 | 22,3 | 12 | 6 | 523 | 697 | 5 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 565 | 643 | 22,3 | 12 | 6 | 523 | 697 | 5 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 603 | 726 | 22,3 | 12 | 7,5 | 532 | 798 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 589 | 713 | 22,3 | 12 | 7,5 | 532 | 798 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 631 | 779 | 22,3 | 12 | 7,5 | 532 | 888 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |
| **530** | 573 | 612 | – | 7,5 | 3 | 543 | 637 | 2,5 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 589 | 659 | 22,3 | 12 | 5 | 548 | 692 | 4 | 0,17 | 4 | 5,9 | 4 |
| | 611 | 708 | 22,3 | 12 | 6 | 553 | 757 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 600 | 687 | 22,3 | 12 | 6 | 553 | 757 | 5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 636 | 763 | 22,3 | 12 | 7,5 | 562 | 838 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 623 | 748 | 22,3 | 12 | 7,5 | 562 | 838 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 668 | 836 | 22,3 | 12 | 9,5 | 570 | 940 | 8 | 0,35 | 1,9 | 2,9 | 1,8 |
| **560** | 625 | 695 | 22,3 | 12 | 5 | 578 | 732 | 4 | 0,16 | 4,2 | 6,3 | 4 |
| | 644 | 745 | 22,3 | 12 | 6 | 583 | 797 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 635 | 728 | 22,3 | 12 | 6 | 583 | 797 | 5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 673 | 808 | 22,3 | 12 | 7,5 | 592 | 888 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 634 | 796 | 22,3 | 12 | 7,5 | 592 | 888 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 704 | 877 | 22,3 | 12 | 9,5 | 600 | 990 | 8 | 0,35 | 1,9 | 2,9 | 1,8 |
| **600** | 668 | 742 | 22,3 | 12 | 5 | 618 | 782 | 4 | 0,17 | 4 | 5,9 | 4 |
| | 683 | 786 | 22,3 | 12 | 6 | 623 | 847 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 675 | 774 | 22,3 | 12 | 6 | 623 | 847 | 5 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 720 | 862 | 22,3 | 12 | 7,5 | 632 | 948 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 702 | 845 | 22,3 | 12 | 7,5 | 632 | 948 | 6 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 752 | 928 | 22,3 | 12 | 9,5 | 640 | 1 050 | 8 | 0,37 | 1,8 | 2,7 | 1,8 |
| **630** | 681 | 738 | – | 9 | 4 | 645 | 765 | 3 | 0,12 | 5,6 | 8,4 | 5,6 |
| | 705 | 786 | 22,3 | 12 | 6 | 653 | 827 | 5 | 0,17 | 4 | 5,9 | 4 |
| | 725 | 837 | 22,3 | 12 | 7,5 | 658 | 892 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 697 | 823 | 22,3 | 12 | 7,5 | 658 | 892 | 6 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 757 | 908 | 22,3 | 12 | 7,5 | 662 | 998 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 738 | 885 | 22,3 | 12 | 7,5 | 662 | 998 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| **670** | 720 | 778 | – | 9 | 4 | 685 | 805 | 3 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 718 | 786 | – | 9 | 4 | 685 | 805 | 3 | 0,16 | 4,2 | 6,3 | 4 |
| | 749 | 834 | 22,3 | 12 | 6 | 693 | 877 | 5 | 0,17 | 4 | 5,9 | 4 |
| | 770 | 890 | 22,3 | 12 | 7,5 | 698 | 952 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 756 | 866 | 22,3 | 12 | 7,5 | 698 | 952 | 6 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 802 | 958 | 22,3 | 12 | 7,5 | 702 | 1 058 | 6 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 782 | 942 | 22,3 | 12 | 7,5 | 702 | 1 058 | 6 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 830 | 1 027 | 22,3 | 12 | 12 | 718 | 1 172 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |

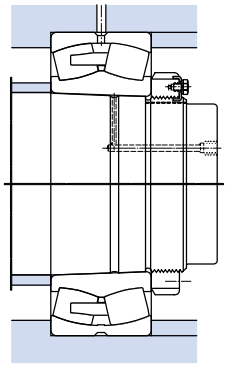
**Spherical roller bearings**
d **710 – 950** mm



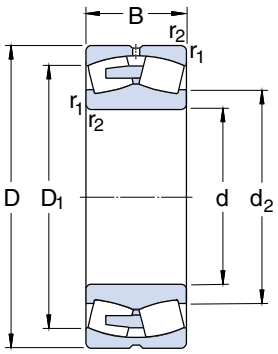

| Principal dimensions | | | Basic load ratings | | Fatigue load limit | Speed ratings Lubrication | | Mass | Designations Bearings with | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | dynamic | static | | grease | oil | | cylindrical bore | tapered bore |
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **710** | 870 | 118 | 2 580 | 7 500 | 500 | 260 | 340 | 153 | **238/710 CAMA/W20** | **–** |
| | 950 | 180 | 4 770 | 12 000 | 765 | 240 | 320 | 365 | **239/710 CA/W33** | **239/710 CAK/W33** |
| | 950 | 243 | 5 870 | 15 600 | 930 | 200 | 280 | 495 | **249/710 CA/W33** | **249/710 CAK30/W33** |
| | 1 030 | 236 | 7 250 | 16 300 | 1 000 | 220 | 300 | 670 | **230/710 CA/W33** | **230/710 CAK/W33** |
| | 1 030 | 315 | 9 370 | 22 800 | 1 370 | 190 | 260 | 895 | **240/710 ECA/W33** | **240/710 ECAK30/W33** |
| | 1 150 | 345 | 12 200 | 26 000 | 1 530 | 180 | 240 | 1 450 | **231/710 CA/W33** | **231/710 CAK/W33** |
| | 1 150 | 438 | 15 200 | 32 500 | 1 900 | 150 | 190 | 1 900 | **241/710 ECA/W33** | **241/710 ECAK30/W33** |
| | 1 280 | 450 | 17 600 | 34 500 | 2 000 | 160 | 200 | 1 450 | **232/710 CA/W33** | **232/710 CAK/W33** |
| **750** | 920 | 128 | 2 930 | 8 500 | 550 | 240 | 320 | 135 | **238/750 CAMA/W20** | **238/750 CAKMA/W20** |
| | 1 000 | 185 | 5 180 | 13 200 | 815 | 220 | 300 | 420 | **239/750 CA/W33** | **239/750 CAK/W33** |
| | 1 000 | 250 | 6 560 | 18 000 | 1 100 | 190 | 260 | 560 | **249/750 CA/W33** | **249/750 CAK30/W33** |
| | 1 090 | 250 | 8 450 | 18 600 | 1 100 | 200 | 280 | 795 | **230/750 CA/W33** | **230/750 CAK/W33** |
| | 1 090 | 335 | 10 100 | 25 000 | 1 460 | 180 | 240 | 1 065 | **240/750 ECA/W33** | **240/750 ECAK30/W33** |
| | 1 220 | 365 | 13 800 | 29 000 | 1 700 | 170 | 220 | 1 700 | **231/750 CA/W33** | **231/750 CAK/W33** |
| | 1 220 | 475 | 17 300 | 37 500 | 2 160 | 140 | 180 | 2 100 | **241/750 ECA/W33** | **241/750 ECAK30/W33** |
| | 1 360 | 475 | 18 700 | 36 500 | 2 120 | 150 | 190 | 3 050 | **232/750 CAF/W33** | **232/750 CAKF/W33** |
| **800** | 980 | 180 | 4 140 | 12 900 | 830 | 180 | 240 | 300 | **248/800 CAMA/W20** | **248/800 CAK30MA/W20** |
| | 1 060 | 195 | 5 640 | 14 300 | 880 | 200 | 280 | 470 | **239/800 CA/W33** | **239/800 CAK/W33** |
| | 1 060 | 258 | 7 020 | 19 300 | 1 060 | 180 | 240 | 640 | **249/800 CA/W33** | **249/800 CAK30/W33** |
| | 1 150 | 258 | 8 630 | 20 000 | 1 160 | 190 | 260 | 895 | **230/800 CA/W33** | **230/800 CAK/W33** |
| | 1 150 | 345 | 11 100 | 28 500 | 1 730 | 170 | 220 | 1 200 | **240/800 ECA/W33** | **240/800 ECAK30/W33** |
| | 1 280 | 375 | 14 800 | 31 500 | 1 800 | 160 | 200 | 1 920 | **231/800 CA/W33** | **231/800 CAK/W33** |
| | 1 280 | 475 | 18 400 | 40 500 | 2 320 | 130 | 170 | 2 300 | **241/800 ECA/W33** | **241/800 ECAK30/W33** |
| **850** | 1 030 | 136 | 3 340 | 10 000 | 640 | 190 | 260 | 240 | **238/850 CAMA/W20** | **238/850 CAKMA/W20** |
| | 1 120 | 200 | 5 980 | 15 600 | 930 | 190 | 260 | 560 | **239/850 CA/W33** | **239/850 CAK/W33** |
| | 1 120 | 272 | 8 170 | 22 800 | 1 370 | 170 | 220 | 740 | **249/850 CA/W33** | **249/850 CAK30/W33** |
| | 1 220 | 272 | 9 370 | 21 600 | 1 270 | 180 | 240 | 1 050 | **230/850 CA/W33** | **230/850 CAK/W33** |
| | 1 220 | 365 | 12 700 | 31 500 | 1 900 | 160 | 200 | 1 410 | **240/850 ECA/W33** | **240/850 ECAK30/W33** |
| | 1 360 | 400 | 16 100 | 34 500 | 2 000 | 140 | 180 | 2 200 | **231/850 CA/W33** | **231/850 CAK/W33** |
| | 1 360 | 500 | 20 200 | 45 000 | 2 550 | 110 | 150 | 2 710 | **241/850 ECAF/W33** | **241/850 ECAK30F/W33** |
| **900** | 1 090 | 190 | 4 660 | 15 300 | 950 | 170 | 220 | 370 | **248/900 CAMA/W20** | **248/900 CAK30MA/W20** |
| | 1 180 | 206 | 6 440 | 17 000 | 1 020 | 180 | 240 | 605 | **239/900 CA/W33** | **239/900 CAK/W33** |
| | 1 280 | 280 | 10 100 | 23 200 | 1 340 | 170 | 220 | 1 200 | **230/900 CA/W33** | **230/900 CAK/W33** |
| | 1 280 | 375 | 13 600 | 34 500 | 2 040 | 150 | 190 | 1 570 | **240/900 ECA/W33** | **240/900 ECAK30/W33** |
| | 1 420 | 515 | 21 400 | 49 000 | 2 700 | 100 | 140 | 3 350 | **241/900 ECAF/W33** | **241/900 ECAK30F/W33** |
| **950** | 1 250 | 224 | 7 250 | 19 600 | 1 120 | 170 | 220 | 755 | **239/950 CA/W33** | **239/950 CAK/W33** |
| | 1 250 | 300 | 9 200 | 26 000 | 1 500 | 140 | 180 | 1 015 | **249/950 CA/W33** | **249/950 CAK30/W33** |
| | 1 360 | 300 | 12 000 | 28 500 | 1 600 | 160 | 200 | 1 450 | **230/950 CA/W33** | **230/950 CAK/W33** |
| | 1 360 | 412 | 14 800 | 39 000 | 2 320 | 130 | 170 | 1 990 | **240/950 CAF/W33** | **240/950 CAK30F/W33** |
| | 1 500 | 545 | 23 900 | 55 000 | 3 000 | 95 | 130 | 3 535 | **241/950 ECAF/W33** | **241/950 ECAK30F/W33** |

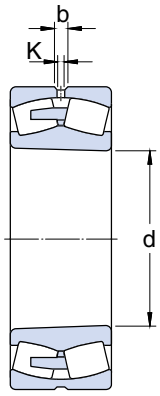


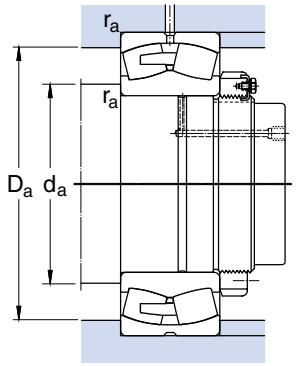


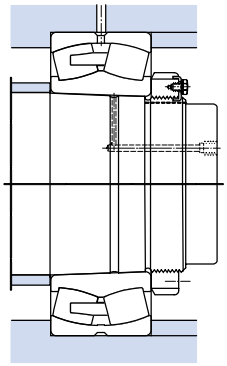
| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **710** | 762 | 834 | – | 12 | 4 | 725 | 855 | 3 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 788 | 881 | 22,3 | 12 | 6 | 732 | 927 | 5 | 0,17 | 4 | 5,9 | 4 |
| | 792 | 868 | 22,3 | 12 | 6 | 732 | 927 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 814 | 939 | 22,3 | 12 | 7,5 | 738 | 1 002 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 807 | 917 | 22,3 | 12 | 7,5 | 738 | 1 002 | 6 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 850 | 1 017 | 22,3 | 12 | 9,5 | 750 | 1 110 | 8 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 838 | 982 | 22,3 | 12 | 9,5 | 750 | 1 110 | 8 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 851 | 1 017 | 22,3 | 12 | 12 | 758 | 1 232 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |
| **750** | 807 | 873 | – | 12 | 5 | 768 | 902 | 4 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 832 | 929 | 22,3 | 12 | 6 | 773 | 977 | 5 | 0,16 | 4,2 | 6,3 | 4 |
| | 830 | 916 | 22,3 | 12 | 6 | 773 | 977 | 5 | 0,22 | 3 | 4,6 | 3,2 |
| | 860 | 996 | 22,3 | 12 | 7,5 | 778 | 1 062 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 853 | 969 | 22,3 | 12 | 7,5 | 778 | 1 062 | 6 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 900 | 1 080 | 22,3 | 12 | 9,5 | 790 | 1 180 | 8 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 875 | 1 050 | 22,3 | 12 | 9,5 | 790 | 1 180 | 8 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 938 | 1 163 | 22,3 | 12 | 15 | 808 | 1 302 | 12 | 0,35 | 1,9 | 2,9 | 1,8 |
| **800** | 865 | 921 | – | 12 | 5 | 818 | 962 | 4 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 885 | 984 | 22,3 | 12 | 6 | 823 | 1 037 | 5 | 0,16 | 4,2 | 6,3 | 4 |
| | 883 | 973 | 22,3 | 12 | 6 | 823 | 1 037 | 5 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 915 | 1 051 | 22,3 | 12 | 7,5 | 828 | 1 122 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| | 908 | 1 027 | 22,3 | 12 | 7,5 | 828 | 1 122 | 6 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 950 | 1 141 | 22,3 | 12 | 9,5 | 840 | 1 240 | 8 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 930 | 1 111 | 22,3 | 12 | 9,5 | 840 | 1 240 | 8 | 0,35 | 1,9 | 2,9 | 1,8 |
| **850** | 910 | 981 | – | 12 | 5 | 868 | 1 012 | 4 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 940 | 1 043 | 22,3 | 12 | 6 | 873 | 1 097 | 5 | 0,16 | 4,2 | 6,3 | 4 |
| | 948 | 1 028 | 22,3 | 12 | 6 | 873 | 1 097 | 5 | 0,22 | 3 | 4,6 | 2,8 |
| | 969 | 1 114 | 22,3 | 12 | 7,5 | 878 | 1 192 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| | 954 | 1 087 | 22,3 | 12 | 7,5 | 878 | 1 192 | 6 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 1 010 | 1 203 | 22,3 | 12 | 12 | 898 | 1 312 | 10 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 988 | 1 182 | 22,3 | 12 | 12 | 898 | 1 312 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |
| **900** | 969 | 1 029 | – | 12 | 5 | 918 | 1 072 | 4 | 0,14 | 4,8 | 7,2 | 4,5 |
| | 989 | 1 100 | 22,3 | 12 | 6 | 923 | 1 157 | 5 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 1 023 | 1 177 | 22,3 | 12 | 7,5 | 928 | 1 252 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| | 1 012 | 1 147 | 22,3 | 12 | 7,5 | 928 | 1 252 | 6 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 1 043 | 1 235 | 22,3 | 12 | 12 | 948 | 1 372 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |
| **950** | 1 049 | 1 161 | 22,3 | 12 | 7,5 | 978 | 1 222 | 6 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 1 051 | 1 150 | 22,3 | 12 | 7,5 | 978 | 1 222 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 1 083 | 1 242 | 22,3 | 12 | 7,5 | 978 | 1 332 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| | 1 074 | 1 212 | 22,3 | 12 | 7,5 | 978 | 1 332 | 6 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 1 102 | 1 305 | 22,3 | 12 | 12 | 998 | 1 452 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |



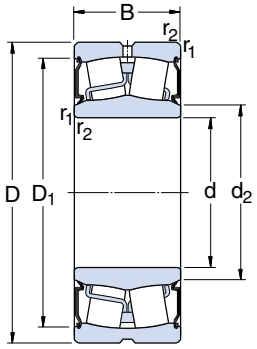

| **Principal dimensions** | | | **Basic load ratings** dynamic | static | **Fatigue load limit** | **Speed ratings** Lubrication grease | oil | **Mass** | **Designations** Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | | |
| mm | | | kN | | kN | r/min | | kg | – | |
| **1 000** | 1 220 | 165 | 4 660 | 14 300 | 865 | 170 | 220 | 410 | **238/1000 CAMA/W20** | **238/1000 CAKMA/W20** |
| | 1 320 | 315 | 10 400 | 29 000 | 1 500 | 130 | 170 | 1 200 | **249/1000 CA/W33** | **249/1000 CAK30/W33** |
| | 1 420 | 308 | 12 700 | 30 500 | 1 700 | 140 | 180 | 1 600 | **230/1000 CAF/W33** | **230/1000 CAKF/W33** |
| | 1 420 | 412 | 15 400 | 40 500 | 2 240 | 120 | 160 | 2 140 | **240/1000 CAF/W33** | **240/1000 CAK30F/W33** |
| | 1 580 | 462 | 21 400 | 48 000 | 2 550 | 100 | 140 | 3 500 | **231/1000 CAF/W33** | **231/1000 CAKF/W33** |
| | 1 580 | 580 | 26 700 | 62 000 | 3 350 | 90 | 120 | 4 300 | **241/1000 ECAF/W33** | **241/1000 ECAK30F/W33** |
| **1 060** | 1 280 | 165 | 4 770 | 15 000 | 800 | 160 | 200 | 435 | **238/1060 CAMA/W20** | **238/1060 CAKMA/W20** |
| | 1 280 | 218 | 6 100 | 20 000 | 1 200 | 130 | 170 | 570 | **248/1060 CAMA/W20** | **248/1060 CAK30MA/W20** |
| | 1 400 | 250 | 9 550 | 26 000 | 1 460 | 140 | 180 | 1 100 | **239/1060 CAF/W33** | **239/1060 CAKF/W33** |
| | 1 400 | 335 | 11 500 | 32 500 | 1 860 | 120 | 160 | 1 400 | **249/1060 CAF/W33** | **249/1060 CAK30F/W33** |
| | 1 500 | 325 | 13 800 | 34 000 | 1 830 | 130 | 170 | 2 250 | **230/1060 CAF/W33** | **230/1060 CAKF/W33** |
| | 1 500 | 438 | 17 300 | 45 500 | 2 500 | 110 | 150 | 2 515 | **240/1060 CAF/W33** | **240/1060 CAK30F/W33** |
| **1 120** | 1 360 | 243 | 7 250 | 24 000 | 1 400 | 110 | 150 | 735 | **248/1120 CAFA/W20** | **248/1120 CAK30FA/W20** |
| | 1 460 | 335 | 11 700 | 34 500 | 1 830 | 100 | 140 | 1 500 | **249/1120 CAF/W33** | **249/1120 CAK30F/W33** |
| | 1 580 | 462 | 18 700 | 50 000 | 2 850 | 95 | 130 | 2 925 | **240/1120 CAF/W33** | **240/1120 CAK30F/W33** |
| **1 180** | 1 420 | 180 | 5 870 | 18 600 | 1 080 | 130 | 170 | 575 | **238/1180 CAFA/W20** | **238/1180 CAKFA/W20** |
| | 1 420 | 243 | 7 710 | 27 000 | 1 560 | 130 | 170 | 770 | **248/1180 CAFA/W20** | **248/1180 CAK30FA/W20** |
| | 1 540 | 272 | 11 100 | 31 000 | 1 660 | 110 | 150 | 1 400 | **239/1180 CAF/W33** | **239/1180 CAKF/W33** |
| | 1 540 | 355 | 13 600 | 40 500 | 2 160 | 95 | 130 | 1 800 | **249/1180 CAF/W33** | **249/1180 CAK30F/W33** |
| **1 250** | 1 750 | 375 | 17 900 | 45 000 | 2 400 | 95 | 130 | 2 840 | **230/1250 CAF/W33** | **230/1250 CAKF/W33** |
| **1 320** | 1 600 | 280 | 9 780 | 33 500 | 1 860 | 90 | 120 | 1 160 | **248/1320 CAFA/W20** | **248/1320 CAK30FA/W20** |
| | 1 720 | 400 | 16 100 | 49 000 | 2 550 | 85 | 110 | 2 500 | **249/1320 CAF/W33** | **249/1320 CAK30F/W33** |
| **1 500** | 1 820 | 315 | 12 700 | 45 000 | 2 400 | 85 | 110 | 1 710 | **248/1500 CAFA/W20** | **248/1500 CAK30FA/W20** |
| | 1 950 | 450 | 20 700 | 63 000 | 3 150 | 67 | 85 | 3 550 | **249/1500 CAFB/W33** | **249/1500 CAK30FB/W33** |
| **1 800** | 2 180 | 375 | 17 600 | 63 000 | 3 050 | 60 | 75 | 2 900 | **248/1800 CAFA/W20** | **248/1800 CAK30FA/W20** |



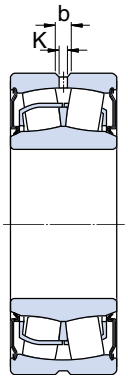





| Dimensions | | | | | | Abutment and fillet dimensions | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ | $D_1$ | b | K | $r_{1,2}$ min | $d_a$ min | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | – | | | |
| **1 000** | 1 077 | 1 161 | – | 12 | 6 | 1 023 | 1 197 | 5 | 0,12 | 5,6 | 8,4 | 5,6 |
| | 1 106 | 1 209 | 22,3 | 12 | 7,5 | 1 028 | 1 292 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 1 139 | 1 305 | 22,3 | 12 | 7,5 | 1 028 | 1 392 | 6 | 0,19 | 3,6 | 5,3 | 3,6 |
| | 1 133 | 1 275 | 22,3 | 12 | 7,5 | 1 028 | 1 392 | 6 | 0,26 | 2,6 | 3,9 | 2,5 |
| | 1 182 | 1 399 | 22,3 | 12 | 12 | 1 048 | 1 532 | 10 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 1 159 | 1 373 | 22,3 | 12 | 12 | 1 048 | 1 532 | 10 | 0,35 | 1,9 | 2,9 | 1,8 |
| **1 060** | 1 135 | 1 219 | – | 12 | 6 | 1 083 | 1 257 | 5 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 1 159 | 1 210 | – | 12 | 6 | 1 083 | 1 257 | 5 | 0,14 | 4,8 | 7,2 | 4,5 |
| | 1 171 | 1 303 | 22,3 | 12 | 7,5 | 1 088 | 1 392 | 6 | 0,16 | 4,2 | 6,3 | 4 |
| | 1 165 | 1 282 | 22,3 | 12 | 7,5 | 1 088 | 1 392 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 1 202 | 1 373 | 22,3 | 12 | 9,5 | 1 094 | 1 466 | 8 | 0,19 | 3,6 | 5,3 | 3,6 |
| | 1 196 | 1 347 | 22,3 | 12 | 9,5 | 1 094 | 1 466 | 8 | 0,26 | 2,6 | 3,9 | 2,5 |
| **1 120** | 1 207 | 1 282 | – | 12 | 6 | 1 143 | 1 337 | 5 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 1 230 | 1 349 | 22,3 | 12 | 7,5 | 1 148 | 1 432 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| | 1 266 | 1 422 | 22,3 | 12 | 9,5 | 1 154 | 1 546 | 8 | 0,26 | 2,6 | 3,9 | 2,5 |
| **1 180** | 1 261 | 1 355 | – | 12 | 6 | 1 203 | 1 397 | 5 | 0,11 | 6,1 | 9,1 | 6,3 |
| | 1 280 | 1 343 | – | 12 | 6 | 1 203 | 1 397 | 5 | 0,14 | 4,8 | 7,2 | 4,5 |
| | 1 298 | 1 435 | 22,3 | 12 | 7,5 | 1 208 | 1 512 | 6 | 0,16 | 4,2 | 6,3 | 4 |
| | 1 293 | 1 417 | 22,3 | 12 | 7,5 | 1 208 | 1 512 | 6 | 0,20 | 3,4 | 5 | 3,2 |
| **1 250** | 1 411 | 1 607 | 22,3 | 12 | 9,5 | 1 284 | 1 716 | 8 | 0,19 | 3,6 | 5,3 | 3,6 |
| **1 320** | 1 422 | 1 511 | – | 12 | 6 | 1 343 | 1 577 | 5 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 1 445 | 1 584 | 22,3 | 12 | 7,5 | 1 348 | 1 692 | 6 | 0,21 | 3,2 | 4,8 | 3,2 |
| **1 500** | 1 612 | 1 719 | – | 12 | 7,5 | 1 528 | 1 792 | 6 | 0,15 | 4,5 | 6,7 | 4,5 |
| | 1 644 | 1 794 | 22,3 | 12 | 9,5 | 1 534 | 1 916 | 8 | 0,20 | 3,4 | 5 | 3,2 |
| **1 800** | 1 932 | 2 060 | – | 12 | 9,5 | 1 834 | 2 146 | 8 | 0,15 | 4,5 | 6,7 | 4,5 |



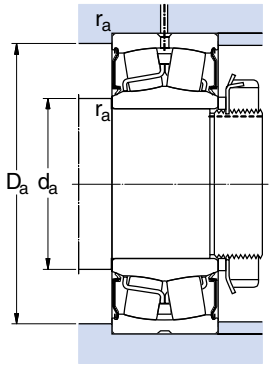

BS2-22-2CS(2)




BS2-22 C-2CS(2)

| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed rating | Mass | Designations Bearings with cylindrical bore | tapered bore |
|---|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | | |
| mm | | | kN | | kN | r/min | kg | – | |
| **30** | 62 | 25 | 56 | 52 | 5,5 | 2 800 | 0,34 | BS2-2206 C-2CS | – |
| **35** | 72 | 28 | 76,5 | 73,5 | 8 | 2 400 | 0,52 | BS2-2207 C-2CS | – |
| **40** | 80 | 28 | 96,5 | 90 | 9,8 | 2 200 | 0,57 | BS2-2208-2CS | BS2-2208-2CSK |
| **45** | 85 | 28 | 90 | 88 | 9,5 | 2 000 | 0,63 | BS2-2209 C-2CS | BS2-2209 C-2CSK |
| **50** | 90 | 28 | 96,5 | 100 | 11 | 1 900 | 0,68 | BS2-2210 C-2CS | BS2-2210 C-2CSK |
| **55** | 100 | 31 | 125 | 127 | 13,7 | 1 700 | 1,00 | BS2-2211-2CS | BS2-2211-2CSK |
| **60** | 110 | 34 | 156 | 166 | 18,6 | 1 600 | 1,30 | BS2-2212-2CS | BS2-2212-2CSK |
| **65** | 100 | 35 | 115 | 173 | 20,4 | 1000 | 0,95 | **24013-2CS5/VT143** | – |
| | 120 | 38 | 170 | 183 | 21,2 | 1 500 | 1,60 | BS2-2213 C-2CS | BS2-2213 C-2CSK |
| **70** | 125 | 38 | 208 | 228 | 25,5 | 1 400 | 1,80 | BS2-2214-2CS | BS2-2214-2CSK |
| **75** | 115 | 40 | 152 | 232 | 28,5 | 950 | 1,55 | **24015-2CS2/VT143** | – |
| | 130 | 38 | 212 | 240 | 26,5 | 1 300 | 2,10 | BS2-2215-2CS | BS2-2215-2CSK |
| **80** | 140 | 40 | 236 | 270 | 29 | 1 200 | 2,40 | BS2-2216-2CS | BS2-2216-2CSK |
| **85** | 150 | 44 | 285 | 325 | 34,5 | 1 100 | 3,00 | BS2-2217-2CS | BS2-2217-2CSK |
| **90** | 160 | 48 | 325 | 375 | 39 | 1 000 | 3,70 | BS2-2218-2CS | BS2-2218-2CSK |
| **100** | 150 | 50 | 248 | 415 | 45,5 | 800 | 3,20 | **24020-2CS2/VT143** | – |
| | 165 | 52 | 322 | 490 | 53 | 850 | 4,40 | **23120-2CS2/VT143** | – |
| | 180 | 55 | 425 | 490 | 49 | 900 | 5,50 | BS2-2220-2CS | – |
| | 180 | 60,3 | 414 | 600 | 63 | 700 | 6,70 | **23220-2CS** | – |
| **110** | 170 | 45 | 267 | 440 | 46,5 | 900 | 3,75 | **23022-2CS** | – |
| | 180 | 56 | 430 | 585 | 61 | 800 | 5,55 | 23122-2CS2/VT143 | – |
| | 180 | 69 | 460 | 750 | 78 | 630 | 6,85 | **24122-2CS2/VT143** | – |
| | 200 | 63 | 560 | 640 | 63 | 800 | 7,60 | BS2-2222-2CS5/VT143 | – |
| **120** | 180 | 46 | 355 | 500 | 52 | 850 | 4,20 | **23024-2CS2/VT143** | – |
| | 180 | 60 | 430 | 670 | 68 | 670 | 5,40 | 24024-2CS2/VT143 | – |
| | 200 | 80 | 575 | 950 | 95 | 560 | 10,0 | **24124-2CS2/VT143** | – |
| | 215 | 69 | 630 | 765 | 73,5 | 750 | 9,75 | BS2-2224-2CS | – |
| **130** | 200 | 52 | 430 | 610 | 61 | 800 | 6,10 | 23026-2CS2/VT143 | – |
| | 200 | 69 | 540 | 815 | 81,5 | 600 | 7,95 | 24026-2CS2/VT143 | – |
| | 210 | 80 | 587 | 1 000 | 100 | 530 | 11,0 | **24126-2CS2/VT143** | – |

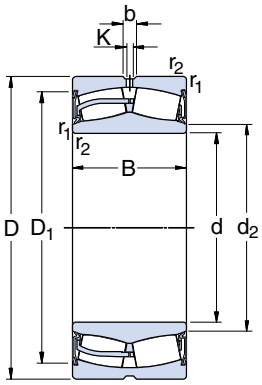
The designations of Explorer bearings are printed in blue





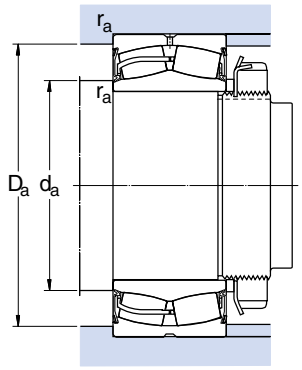

| Dimensions | | | | | | Abutment and fillet dimensions | | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ ≈ | $D_1$ ≈ | b | K | $r_{1,2}$ min | $d_a$ min | $d_a$ max | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | | – | | | |
| **30** | 36 | 55,7 | 3,7 | 2 | 1 | 36 | 36 | 56 | 1 | 0,33 | 2 | 3 | 2 |
| **35** | 43 | 63,7 | 3,7 | 2 | 1,1 | 42 | 43 | 65 | 1 | 0,31 | 2,2 | 3,3 | 3,2 |
| **40** | 47 | 73 | 5,5 | 3 | 1,1 | 47 | 47 | 73 | 1 | 0,28 | 2,4 | 3,6 | 2,5 |
| **45** | 53 | 77,1 | 5,5 | 3 | 1,1 | 52 | 53 | 78 | 1 | 0,26 | 2,6 | 3,9 | 2,5 |
| **50** | 58,1 | 82,1 | 5,5 | 3 | 1,1 | 57 | 58 | 83 | 1 | 0,24 | 2,8 | 4,2 | 2,8 |
| **55** | 64 | 91,9 | 5,5 | 3 | 1,5 | 64 | 64 | 91 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| **60** | 69,3 | 100 | 5,5 | 3 | 1,5 | 69 | 69,3 | 101 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| **65** | 71,9 | 92,8 | 5,5 | 3 | 1,1 | 71,6 | 71,6 | 93 | 1 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 74 | 111 | 5,5 | 3 | 1,5 | 74 | 74 | 111 | 1,5 | 0,24 | 2,8 | 4,2 | 2,8 |
| **70** | 80,1 | 115 | 5,5 | 3 | 1,5 | 79 | 79 | 116 | 1,5 | 0,23 | 2,9 | 4,4 | 2,8 |
| **75** | 81,8 | 105 | 5,5 | 3 | 1,1 | 81 | 81,8 | 109 | 1 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 84,5 | 119 | 5,5 | 3 | 1,5 | 84 | 84,5 | 121 | 1,5 | 0,22 | 3 | 4,6 | 2,8 |
| **80** | 92 | 128 | 5,5 | 3 | 2 | 91 | 92 | 129 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| **85** | 98,2 | 138 | 5,5 | 3 | 2 | 96 | 98 | 139 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| **90** | 103 | 148 | 5,5 | 3 | 2 | 101 | 103 | 149 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| **100** | 108 | 139 | 5,5 | 3 | 1,5 | 107 | 108 | 143 | 1,5 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 113 | 152 | 5,5 | 3 | 2 | 111 | 113 | 154 | 2 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 114 | 160 | 8,3 | 4,5 | 2,1 | 112 | 114 | 168 | 2 | 0,24 | 2,8 | 4,2 | 2,8 |
| | 114 | 160 | 8,3 | 4,5 | 2,1 | 112 | 114 | 169 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| **110** | 122 | 157 | 8,3 | 4,5 | 2 | 120 | 122 | 160 | 2 | 0,22 | 3 | 4,6 | 2,8 |
| | 123 | 166 | 8,3 | 4,5 | 2 | 121 | 123 | 169 | 2 | 0,27 | 2,5 | 3,7 | 2,5 |
| | 121 | 163 | 5,5 | 3 | 2 | 121 | 121 | 169 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| | 126 | 182 | 8,3 | 4,5 | 2,1 | 122 | 126 | 188 | 2 | 0,25 | 2,7 | 4 | 2,5 |
| **120** | 133 | 168 | 5,5 | 3 | 2 | 130 | 133 | 170 | 2 | 0,20 | 3,4 | 5 | 3,2 |
| | 130 | 166 | 5,5 | 3 | 2 | 130 | 130 | 170 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 132 | 179 | 5,5 | 3 | 2 | 131 | 132 | 189 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| | 136 | 193 | 11,1 | 6 | 2,1 | 132 | 136 | 203 | 2 | 0,26 | 2,6 | 3,9 | 2,5 |
| **130** | 145 | 186 | 8,3 | 4,5 | 2 | 140 | 145 | 190 | 2 | 0,21 | 3,2 | 4,8 | 3,2 |
| | 141 | 183 | 5,5 | 3 | 2 | 140 | 141 | 190 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 142 | 190 | 5,5 | 3 | 2 | 141 | 142 | 199 | 2 | 0,33 | 2 | 3 | 2 |

**Sealed spherical roller bearings**
d **140 – 220** mm




| Principal dimensions | | | Basic load ratings dynamic | static | Fatigue load limit | Speed rating | Mass | Designation Bearings with cylindrical bore |
|---|---|---|---|---|---|---|---|---|
| d | D | B | C | $C_0$ | $P_u$ | | | |
| mm | | | kN | | kN | r/min | kg | – |
| **140** | 210 | 69 | 570 | 900 | 68 | 560 | 8,45 | 24028-2CS2/VT143 |
| | 225 | 85 | 673 | 1 160 | 112 | 450 | 12,7 | **24128-2CS2/VT143** |
| **150** | 225 | 75 | 655 | 1 040 | 100 | 530 | 10,5 | 24030-2CS2/VT143 |
| | 250 | 100 | 1020 | 1 530 | 146 | 400 | 19,5 | 24130-2CS2/VT143 |
| **160** | 240 | 80 | 750 | 1 200 | 114 | 450 | 13,0 | 24032-2CS2/VT143 |
| | 270 | 86 | 980 | 1 370 | 129 | 530 | 26,5 | 23132-2CS2/VT143 |
| **170** | 260 | 90 | 930 | 1 460 | 137 | 400 | 17,5 | 24034-2CS2/VT143 |
| | 280 | 109 | 1 280 | 1 860 | 170 | 360 | 26,5 | 24134-2CS2/VT143 |
| **180** | 280 | 100 | 937 | 1 730 | 156 | 380 | 23,0 | **24036-2CS2/VT143** |
| **190** | 320 | 128 | 1 600 | 2 500 | 212 | 340 | 42,0 | 24138-2CS2/VT143 |
| **200** | 340 | 140 | 1 800 | 2 800 | 232 | 320 | 52,0 | 24140-2CS |
| | 360 | 128 | 1 860 | 2 700 | 228 | 430 | 58,0 | 23240-2CS2/VT143 |
| **220** | 300 | 60 | 630 | 1 080 | 93 | 600 | 13,0 | 23944-2CS |

The designations of Explorer bearings are printed in blue






| Dimensions | | | | | | Abutment and fillet dimensions | | | | Calculation factors | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | $d_2$ ≈ | $D_1$ ≈ | b | K | $r_{1,2}$ min | $d_a$ min | $d_a$ max | $D_a$ max | $r_a$ max | e | $Y_1$ | $Y_2$ | $Y_0$ |
| mm | | | | | | mm | | | | – | | | |
| **140** | 152 | 194 | 5,5 | 3 | 2 | 150 | 152 | 200 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 153 | 203 | 8,3 | 4,5 | 2,1 | 152 | 153 | 213 | 2 | 0,35 | 1,9 | 2,9 | 1,8 |
| **150** | 162 | 206 | 5,5 | 3 | 2,1 | 161 | 162 | 214 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 163 | 221 | 8,3 | 4,5 | 2,1 | 162 | 163 | 238 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| **160** | 173 | 218 | 8,3 | 4,5 | 2,1 | 171 | 173 | 229 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| | 180 | 244 | 13,9 | 7,5 | 2,1 | 172 | 180 | 259 | 2 | 0,28 | 2,4 | 3,6 | 2,5 |
| **170** | 184 | 235 | 8,3 | 4,5 | 2,1 | 181 | 184 | 249 | 2 | 0,30 | 2,3 | 3,4 | 2,2 |
| | 185 | 249 | 8,3 | 4,5 | 2,1 | 182 | 185 | 268 | 2 | 0,37 | 1,8 | 2,7 | 1,8 |
| **180** | 195 | 251 | 8,3 | 4,5 | 2,1 | 191 | 195 | 269 | 2 | 0,31 | 2,2 | 3,3 | 2,2 |
| **190** | 210 | 284 | 11,1 | 6 | 3 | 204 | 210 | 306 | 2,5 | 0,40 | 1,7 | 2,5 | 1,6 |
| **200** | 220 | 300 | 11,1 | 6 | 3 | 214 | 220 | 326 | 2,5 | 0,40 | 1,7 | 2,5 | 1,6 |
| | 227 | 318 | 16,7 | 9 | 4 | 217 | 225 | 343 | 3 | 0,35 | 1,9 | 2,9 | 1,8 |
| **220** | 239 | 284 | 8,3 | 4,5 | 2,1 | 231 | 239 | 289 | 2 | 0,16 | 4,2 | 6,3 | 4 |

# Related SKF products

## Special spherical roller bearings

Their robust design and high reliability make SKF spherical roller bearings suitable for the majority of applications. However, extraordinary demands call for bearings with extraordinary features. Therefore, the SKF standard range includes special spherical roller bearings, which are adapted for specific applications:

**Sealed bearings for continuous casting applications**
These bearings are specially adapted for the high loads and operating temperatures and low speeds present in continuous casting slab guides. They feature seals made of fluoro rubber, and are filled with a very stable high temperature grease, allowing maintenance-free operation in this demanding environment.

**Bearings for vibrating applications**
Series 223 bearings with special clearance are modified to cope with shaft deflection encountered in vibrating applications. They are characterised by a hardened floating guide ring centred in the outer ring which guides the highly wear resistant, surface hardened window-type steel cages. To prevent fretting corrosion at the non-locating bearing position, a special version with PTFE-coated cylindrical bore is available.

**Rolling mill bearings**
Rolling mill bearings must meet a variety of different demands. For cold tube mills (Pilger mills), for example, the bearings must be able to withstand high acceleration forces, whereas for finishing trains or wire mills, they must be able to be mounted and dismounted with ease. SKF offers the appropriate spherical roller bearings for these applications.

**SKF Pop Release units**
These plummer block type mounted bearing units with series 222 Explorer bearing on a special adapter sleeve are greased, sealed and ready to install as delivered. With the saw-tooth profile of the inner ring and adapter sleeve, the unit can be mounted and dismounted easily via the incorporated screws without having to use special tools.

***See also SKF brochures 4954 "The SKF Copperhead system solution for vibrating screens" and 5103 "Pop Release bearing units for speedier mounting".***

# Accessories

Any system is only as strong as its weakest member. Therefore, SKF offers not only a wide range of excellent spherical roller bearings, but also an appropriate range of quality bearing accessories to go with them.

**Bearing housings**
SKF offers a comprehensive range of high-quality standard and custom housings designed to accommodate the various demands placed on the bearings which they house, e.g. load, accuracy, type of lubrication and lubricant, sealing, etc.

Along with the appropriate SKF spherical roller bearings, these SKF housings comprise an economic and interchangeable unit which meets all the performance demands of a bearing application.

***See also SKF catalogue 3766 "Bearing accessories" and SKF brochures 4403 "SNL plummer block housings solve the housing problems" and 5101 "SNL 30 and SNL 31 plummer block housings solve the housing problems".***

**Adapter and withdrawal sleeves**
Adapter and withdrawal sleeves are used to locate bearings with tapered bore on smooth or stepped shafts. They facilitate bearing mounting and dismounting and, in many cases, simplify bearing arrangement design. Several series of quality sleeves are included in the SKF product range.

**Lock nuts**
SKF lock nuts, also referred to as shaft nuts, are available in several designs to axially locate bearings on shaft ends. The most popular are those of series KM, KML and HM. These nuts have four or eight equally spaced slots in the outside diameter and are locked in position with locking washers or locking clips engaging a groove in the shaft. The nut dimensions are in accordance with ISO 2982-2:1995 as are the dimensions of the series MB and MBL locking washers.

Other lock nuts produced by SKF include series KMT, KMTA, KMK and KMFE, that do not require a groove in the shaft.

***SKF adapter and withdrawal sleeves***

***SKF lock nuts***

# Lubricants and lubrication equipment

Spherical roller bearings operate under the most varying load, speed, temperature and environmental conditions. They require the type of high-quality lubricating greases, which SKF provides.

SKF greases have been specially developed for rolling bearings in their typical applications. The SKF range includes fifteen environmentally friendly greases and covers practically all application requirements.

The range is complemented by a selection of lubrication accessories including

- automatic lubricators,
- grease guns,
- lubricant metering devices and
- a wide range of manually and pneumatically operated grease pumps.

# Products for mounting and dismounting

Like all rolling bearings, SKF spherical roller bearings require a high degree of skill when mounting or dismounting, as well as the correct tools and methods.

The comprehensive SKF range of tools and equipment includes everything that is required:

- mechanical tools,
- heaters,
- hydraulic tools and equipment,
- pullers and withdrawal tools for all sizes of bearings.

***Induction heater, hydraulic pumps, hydraulic nut, mounting fluid and anti-fretting paste from SKF***

***See also SKF catalogue MP3000 "SKF Maintenance and Lubrication Products".***


***SKF lubricants: always the best choice for any kind of bearing application***

# Condition monitoring equipment

The goal of condition monitoring is to maximise the time that the machine is functioning well and minimise the number of breakdowns, thereby significantly reducing operating downtime and maintenance costs.

To achieve this, it is recommended that the bearing and machine condition be monitored either periodically or continuously. Condition monitoring enables incipient bearing damage to be detected and evaluated, so that bearing replacement can be scheduled for a time when the machine is not in operation, to avoid unplanned stoppages. Applied to all machinery (not just sensitive or problematic machines), condition monitoring improves machinery operation to an optimum level, often exceeding the original equipment specifications.

SKF provides a comprehensive range of condition monitoring equipment to measure all important parameters. These include

- temperature,
- speed,
- noise,
- oil condition,
- shaft alignment,
- vibration and
- bearing condition.

The range includes lightweight, handheld devices for manual use as well as complex continuous monitoring systems for fixed installations in connection with preventive maintenance.

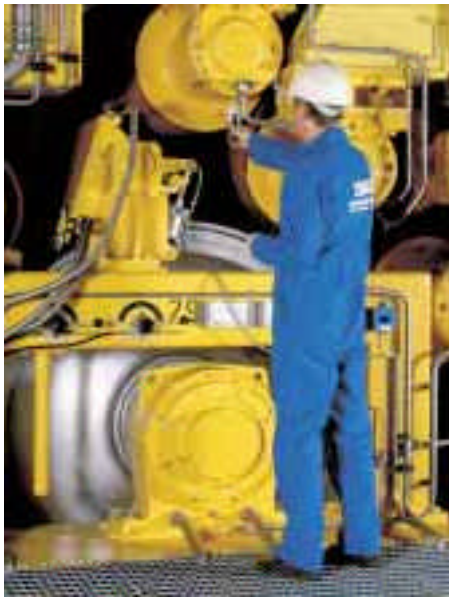
One example is the Machine Reliability Inspection System MARLIN™ which is at the leading edge of technology and allows storage of up to 2 000 measuring points. It can be used to diagnose machines and individual bearings and is backed by tailored software for the evaluation of the readings including enveloping vibration acceleration curves.

*Recording vibration values using an SKF Microlog data collection unit*



*Taking the temperature*

*Noise testing*



*The MARLIN™ machine reliability inspection system*

# The SKF Group – a worldwide corporation

SKF is an international industrial Group operating in some 130 countries and is world leader in bearings.

The company was founded in 1907 following the invention of the self-aligning ball bearing by Sven Wingquist and, after only a few years, SKF began to expand all over the world.

Today, SKF has some 40 000 employees and around 80 manufacturing facilities spread throughout the world. An international sales network includes a large number of sales companies and some 7 000 distributors and retailers. Worldwide availability of SKF products is supported by a comprehensive technical advisory service.

The key to success has been a consistent emphasis on maintaining the highest quality of its products and services. Continuous investment in research and development has also played a vital role, resulting in many examples of epoch-making innovations.

The business of the Group consists of bearings, seals, special steel and a comprehensive range of other high-tech industrial components. The experience gained in these various fields provides SKF with the essential knowledge and expertise required in order to provide the customers with the most advanced engineering products and efficient service.

*The SKF Group is the first major bearing manufacturer to have been granted approval according to ISO 14001, the international standard for environmental management systems. The certificate is the most comprehensive of its kind and covers more than 60 SKF production units in 17 countries.*

*The SKF Engineering & Research Centre is situated just outside Utrecht in The Netherlands. In an area of 17 000 square metres (185 000 sq.ft) some 150 scientists, engineers and support staff are engaged in the further improvement of bearing performance. They are developing technologies aimed at achieving better materials, better designs, better lubricants and better seals – together leading to an even better understanding of the operation of a bearing in its application. This is also where the SKF Life Theory was evolved, enabling the design of bearings which are even more compact and offer even longer operational life.*

*SKF has developed the Channel concept in factories all over the world. This drastically reduces the lead time from raw material to end product as well as work in progress and finished goods in stock. The concept enables faster and smoother information flow, eliminates bottlenecks and bypasses unnecessary steps in production. The Channel team members have the knowledge and commitment needed to share the responsibility for fulfilling objectives in areas such as quality, delivery time, production flow etc.*


*SKF manufactures ball bearings, roller bearings and plain bearings. The smallest are just a few millimetres (a fraction of an inch) in diameter, the largest several metres. SKF also manufactures bearing and oil seals which prevent dirt from entering and lubricant from leaking out. SKF's subsidiaries CR and RFT S.p.A. are among the world's largest producers of seals.*

This publication supersedes the previous publications 4401 and 4404.



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**www.skf.com**

# All purpose industrial and automotive bearing grease LGMT 2

## Description
SKF grease LGMT 2 is a mineral oil based lithium soap thickened grease. This premium quality, all purpose grease is suitable for a wide range of industrial and automative applications. SKF grease LGMT 2 is extremely thermally stable within its operating temperature range.

## Application
SKF grease LGMT 2 is suitable for the following applications:
- Agricultural equipment
- Automotive wheel bearings
- Conveyors
- Small electric motors

## Benefits
SKF grease LGMT 2 provides excellent water resistance and rust inhibiting properties. Good mechanical stability and excellent oxidation stability.

## Available pack sizes

| 35 g tube | 200 g tube | 420 ml cartridge | 1 kg can | 5 kg can | 18 kg can | 50 kg drum | 180 kg drum |
|---|---|---|---|---|---|---|---|

## Technical data

| Designation | | LGMT 2/(pack size) |
|---|---|---|
| **DIN 51825 code** | | K2K-30 |
| **NLGI consistency class** | | 2 |
| **Soap type** | | lithium |
| **Colour** | | red brown |
| **Base oil type** | | mineral |
| **Operating temperature range, °C (°F)** | | -30 to 120 (-22 to 250) |
| **Dropping point DIN ISO 2176, °C (°F)** | | 180 min. (356 min.) |
| **Base oil viscosity** | | |
| 40 °C, mm²/s | | 110 |
| 100 °C,mm²/s | | 11 |
| **Penetration DIN ISO 2137** | | |
| 60 strokes, $10^{-1}$ mm | | 265 - 295 |
| 100 000 strokes, $10^{-1}$ mm | | +50 max. (325 max.) |
| **Mechanical stability** | | |
| Roll stability, 50 hours at 80 °C, change $10^{-1}$ mm | | - |
| SKF V2F test | | 'M' |
| **Corrosion protection** | | |
| SKF Emcor: | Standard ISO 11007 | 0 - 0 |
| | Water washout test | 0 - 0 |
| | Salt water test (100% seawater) | - |
| **Water resistance** | | |
| DIN 51 807/1, 3 hrs at 90 °C | | 1 max. |
| **Oil separation** | | |
| DIN 51 817, 7 days at 40 °C, static, % | | 1 - 6 |
| **Lubricating ability** | | |
| SKF R2F, running test B at 120 °C | | pass |
| **Copper corrosion** | | |
| DIN 51 811, 100 °C | | 2 max. |
| **Rolling bearing grease life** | | |
| SKF R0F test L50 life at 10 000 rpm, hrs | | - |
| **EP performance** | | |
| Wear scar, DIN 51350/5, 1 400 N, mm | | - |
| 4 ball test, welding load, DIN 51350/4 | | - |

BALDOR • RELIANCE

# Integral Horsepower
# AC Induction Motors

## Installation & Operating Manual

2/09 MN400

# Table of Contents

# Section 1
# General Information

**Overview** This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

**Important:** **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

**Limited Warranty**

www.baldor.com/support/warranty_standard.asp

**Safety Notice:** This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

**WARNING:** **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

**WARNING:** **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

**WARNING:** **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

**WARNING:** **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

**WARNING:** **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

**WARNING:** **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

**WARNING:** **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

**WARNING:** **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

**WARNING:** **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

**WARNING:** **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

**WARNING:** **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

**Safety Notice** Continued

**WARNING:** **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

**WARNING:** **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

**WARNING:** **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

**WARNING:** **Use only UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust.**

**WARNING:** **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

**WARNING:** **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

**Caution:** **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

**Caution:** **Do not over–lubricate motor as this may cause premature bearing failure.**

**Caution:** **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

**Caution:** **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

**Caution:** **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

**Caution:** **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

**Receiving**

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

**Handling**

The motor should be lifted using the lifting lugs or eye bolts provided.

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.

4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

**Storage**

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg−Ohms and
kV is rated nameplate voltage defined as Kilo−Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg−ohms.

**Preparation for Storage**

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re−seal by taping it closed.
   c. If a zipper−closing type bag is used instead of the heat−sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti−friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti−friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” − These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” − These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

**Non−Regreaseable Motors**

Non−regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

**All Other Motor Types**

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

**Removal From Storage**

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

# Section 2
# Installation & Operation

**Overview** Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

**Location** It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip−Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non−corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

**Hazardous Locations** are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

**Mounting** The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

**Alignment** Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

**Caution:** **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.
5. Sleeve bearing motors are only suitable for coupled loads.

**Doweling & Bolting** After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

**WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

**Guarding** Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

**Power Connection** Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

**Conduit Box** For ease of making connections, an oversize conduit box is provided.
The box can be rotated 360° in 90° increments.
Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

**AC Power** Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

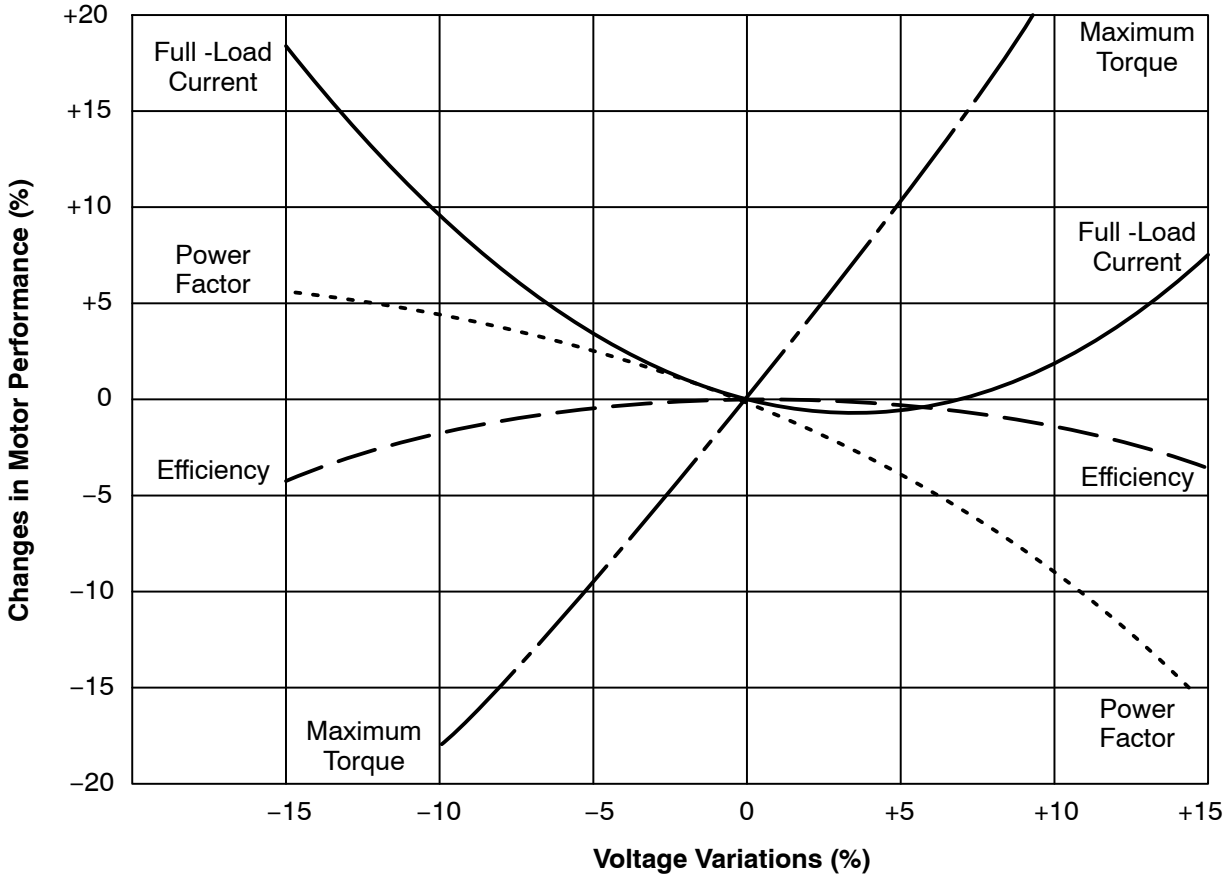
1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   **OR**
2. AC power is within ±5% of rated frequency with rated voltage.
   **OR**
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

**Figure 2-1 Accessory Connections**

| | |
|---|---|
| HEATERS<br>H1 — H2<br>H1 — H2 | One heater is installed in each end of motor.<br>Leads for each heater are labeled H1 & H2.<br>(Like numbers should be tied together). |
| THERMISTORS<br>T1 — T2 | Three thermistors are installed in windings and tied in series.<br>Leads are labeled T1 & T2. |
| WINDING RTDS<br>RED RED WHITE | Winding RTDs are installed in windings (2) per phase.<br>Each set of leads is labeled W1, W2, W3, W4, W5, & W6. |
| BEARING RTD<br>RED RED WHITE | * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.<br>* One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.<br>* Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead. |

**Figure 2-2 Typical Motor Performance VS Voltage Variations**




**Rotation** All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn−to−turn, phase−to−phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

**First Time Start Up** Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

**Coupled Start Up** This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

**Jogging and Repeated Starts** Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

**Heating** - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor District Office or Baldor Service Center.

# Section 3
# Maintenance & Troubleshooting

**WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

**General Inspection** Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

**WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

**Relubrication & Bearings** Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

**Type of Grease** A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

**Relubrication Intervals** Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

**Refer to additional information contained in Tables 3-2, 3-3 and 3-4.**

**Table 3-1 Relubrication Intervals ***

| NEMA / (IEC) Frame Size | Rated Speed - RPM | | | | | |
|---|---|---|---|---|---|---|
| | 10000 | 6000 | 3600 | 1800 | 1200 | 900 |
| Up to 210 incl. (132) | ** | 2700 Hrs. | 5500 Hrs. | 12000 Hrs. | 18000 Hrs. | 22000 Hrs. |
| Over 210 to 280 incl. (180) | | ** | 3600 Hrs. | 9500 Hrs. | 15000 Hrs. | 18000 Hrs. |
| Over 280 to 360 incl. (225) | | ** | * 2200 Hrs. | 7400 Hrs. | 12000 Hrs. | 15000 Hrs. |
| Over 360 to 5800 incl. (300) | | ** | *2200 Hrs. | 3500 Hrs. | 7400 Hrs. | 10500 Hrs. |

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

**Table 3-2 Service Conditions**

| Severity of Service | Hours per day of Operation | Ambient Temperature Maximum | Atmospheric Contamination |
|---|---|---|---|
| Standard | 8 | 40° C | Clean, Little Corrosion |
| Severe | 16 Plus | 50° C | Moderate dirt, Corrosion |
| Extreme | 16 Plus | >50° C* or Class H Insulation | Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration |
| Low Temperature | | <–29° C ** | |

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

**Table 3-3 Relubrication Interval Multiplier**

| Severity of Service | Multiplier |
|---|---|
| Standard | 1.0 |
| Severe | 0.5 |
| Extreme | 0.1 |
| Low Temperature | 1.0 |

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

**Table 3-4 Bearings Sizes and Types**

| Frame Size NEMA (IEC) | Bearing Description (These are the "Large" bearings (Shaft End) in each frame size) | | | |
|---|---|---|---|---|
| | Bearing | Weight of Grease to add * oz (Grams) | Volume of grease to be added | |
| | | | $in^3$ | teaspoon |
| 56 to 140 (90) | 6203 | 0.08 (2.4) | 0.15 | 0.5 |
| 140 (90) | 6205 | 0.15 (3.9) | 0.2 | 0.8 |
| 180 (100–112) | 6206 | 0.19 (5.0) | 0.3 | 1.0 |
| 210 (132) | 6307 | 0.30 (8.4) | 0.6 | 2.0 |
| 250 (160) | 6309 | 0.47 (12.5) | 0.7 | 2.5 |
| 280 (180) | 6311 | 0.61 (17) | 1.2 | 3.9 |
| 320 (200) | 6312 | 0.76 (20.1) | 1.2 | 4.0 |
| 360 (225) | 6313 | 0.81 (23) | 1.5 | 5.2 |
| 400 (250) | 6316 | 1.25 (33) | 2.0 | 6.6 |
| 440 (280) | 6319 | 2.12 (60) | 4.1 | 13.4 |
| 5000 to 5800 (315–450) | 6328 | 4.70 (130) | 9.2 | 30.0 |
| 5000 to 5800 (315–450) | NU328 | 4.70 (130) | 9.2 | 30.0 |
| 360 to 449 (225–280) | NU319 | 2.12 (60) | 4.1 | 13.4 |
| **AC Induction Servo** | | | | |
| 76 Frame 180 (112) | 6207 | 0.22 (6.1) | 0.44 | 1.4 |
| 77 Frame 210 (132) | 6210 | 0.32 (9.0) | 0.64 | 2.1 |
| 80 Frame 250(160) | 6213 | 0.49 (14.0) | 0.99 | 3.3 |

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

**Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.**

**Relubrication Procedure** Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

**Caution: Do not over−lubricate motor as this may cause premature bearing failure.**

**With Grease Outlet Plug**

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

**Caution: Over−lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.**

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

**Without Grease Provisions**

**Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.**

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

**Sample Relubrication Determination**

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 $in^3$ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

**Table 3-5 Troubleshooting Chart**

| Symptom | Possible Causes | Possible Solutions |
|---|---|---|
| Motor will not start | Usually caused by line trouble, such as, single phasing at the starter. | Check source of power. Check overloads, fuses, controls, etc. |
| Excessive humming | High Voltage. | Check input line connections. |
| | Eccentric air gap. | Have motor serviced at local Baldor service center. |
| Motor Over Heating | Overload. Compare actual amps (measured) with nameplate rating. | Locate and remove source of excessive friction in motor or load.<br>Reduce load or replace with motor of greater capacity. |
| | Single Phasing. | Check current at all phases (should be approximately equal) to isolate and correct the problem. |
| | Improper ventilation. | Check external cooling fan to be sure air is moving properly across cooling fins.<br>Excessive dirt build-up on motor. Clean motor. |
| | Unbalanced voltage. | Check voltage at all phases (should be approximately equal) to isolate and correct the problem. |
| | Rotor rubbing on stator. | Check air gap clearance and bearings. |
| | | Tighten “Thru Bolts”. |
| | Over voltage or under voltage. | Check input voltage at each phase to motor. |
| | Open stator winding. | Check stator resistance at all three phases for balance. |
| | Grounded winding. | Perform dielectric test and repair as required. |
| | Improper connections. | Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram. |
| Bearing Over Heating | Misalignment. | Check and align motor and driven equipment. |
| | Excessive belt tension. | Reduce belt tension to proper point for load. |
| | Excessive end thrust. | Reduce the end thrust from driven machine. |
| | Excessive grease in bearing. | Remove grease until cavity is approximately $^3/_4$ filled. |
| | Insufficient grease in bearing. | Add grease until cavity is approximately $^3/_4$ filled. |
| | Dirt in bearing. | Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled. |
| Vibration | Misalignment. | Check and align motor and driven equipment. |
| | Rubbing between rotating parts and stationary parts. | Isolate and eliminate cause of rubbing. |
| | Rotor out of balance. | Have rotor balance checked are repaired at your Baldor Service Center. |
| | Resonance. | Tune system or contact your Baldor Service Center for assistance. |
| Noise | Foreign material in air gap or ventilation openings. | Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings. |
| Growling or whining | Bad bearing. | Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled. |

## Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

**Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)**

| Motor Load | Class B Temp Rise ≤ 80°C (Typical Design) | | Class F Temp Rise ≤ 105°C | | Class H Temp Rise ≤ 125°C | |
|---|---|---|---|---|---|---|
| | Alarm | Trip | Alarm | Trip | Alarm | Trip |
| ≤ Rated Load | 130 | 140 | 155 | 165 | 175 | 185 |
| Rated Load to 1.15 S.F. | 140 | 150 | 160 | 165 | 180 | 185 |

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

**Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)**

| Bearing Type Oil or Grease | Anti–Friction | | Sleeve | |
|---|---|---|---|---|
| | Alarm | Trip | Alarm | Trip |
| Standard* | 95 | 100 | 85 | 95 |
| High Temperature** | 110 | 115 | 105 | 110 |

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- Texaco Polystar
- Mobilith SHC–100
- Darmex 707
- Rykon Premium #2
- Pennzoil Pennzlube EM–2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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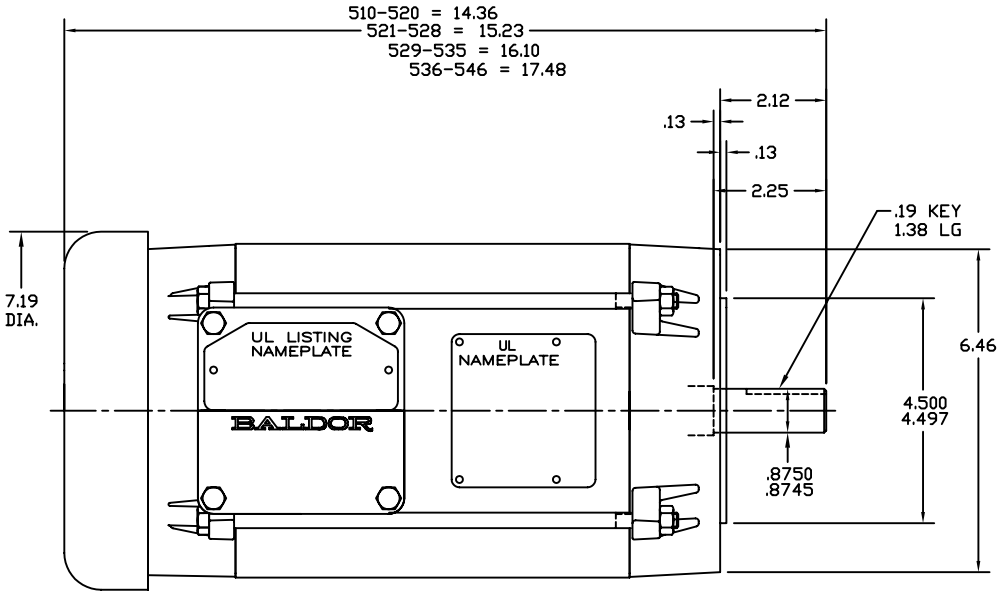
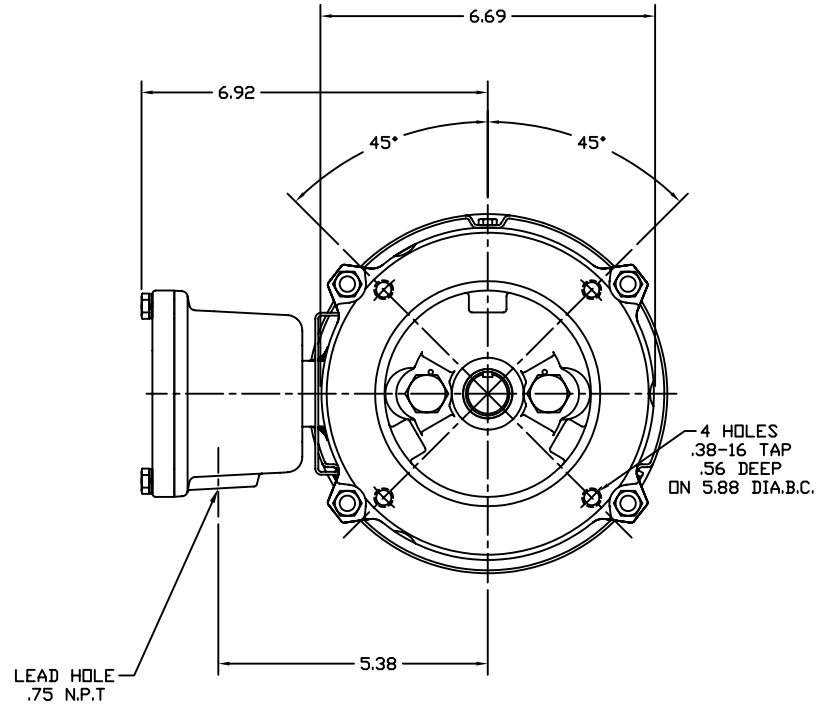
**(479) 646–4711 Fax (479) 648–5792**
**www.baldor.com**


MN400
2/09

35E380




UL CLASS I - GROUP D & CLASS II - GROUPS F & G

35E380

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CUST. NAME | | CUST. P.O. | | | REMARKS: | | |
| MODEL | INSUL | AMB | H.P. | MTG | REV: H | UPDATED TO ACAD | |
| R.P.M. | VOLTS | ENCL | PHASE | FREQ | SCALE: .4 | BY: PGM | REVISED: 09/08/93 |
| FRAME | TYPE | | CERTIFIED BY | | FILE: AAA00005398 | | TDR: 0045291 |

BALDOR ELECTRIC Co.

STANDARD VERT NEMA 143-5TC TEFC X35M CL I-GP D-CL II-GP F&G

35E380

BALDOR
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# Produktionformation

# VM7014T

## 1//.75HP,1750//1450RPM,3PH,60//50HZ,143T

| Artikeldetail | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Revision:** | A | **Status:** | PRD/A | **Änderungs-Nr.:** | | **Geschützt:** | Nein |
| **Typ:** | AC | **Produkt-Typ:** | 3516M | **Elektrische Spezifikation:** | 35VGP674 | **Anschluss-Schema:** | |
| **Beilage:** | XPFC | **Produktionsbetrieb:** | | **Mechanische Spezifikation:** | 35E380 | **Layout:** | |
| **Rahmen:** | 143TC | **Befestigung:** | F1 | **Pol:** | 04 | **Herstellungsdatum:** | 06-02-2010 |
| **Basis:** | N | **Rotation:** | R | **Isolation:** | B | **Wirk. Datum:** | 03-11-2011 |
| **Anschluss:** | 9#18 | **Literatur:** | | **Elektrisches Schema:** | | **Ersetzt durch:** | |

| Typenschild NP1426XP | | | | | |
|---|---|---|---|---|---|
| **NO.** | | **CC** | 010A | | |
| **SER.** | | | | | |
| **SPEC.** | 35E380P674H1 | | | | |
| **CAT.NO.** | VM7014T | | | | |
| **HP** | 1//.75 | **T. CODE** | T3C | | |
| **VOLTS** | 230/460//190/380 | | | | |
| **AMPS** | 3.2/1.6//3/1.5 | | | | |
| **RPM** | 1750//1450 | | | | |
| **HZ** | 60//50 | **PH** | 3 | **CL** | B |
| **SER.F.** | 1.00 | **DES** | B | **CODE** | M |
| **RATING** | 40C AMB-CONT | | | | |
| **FRAME** | 143TC | **NEMA-NOM-EFF** | 82.5 | **PF** | 73 |
| **USABLE AT 208V** | | | | | |

## Teileliste

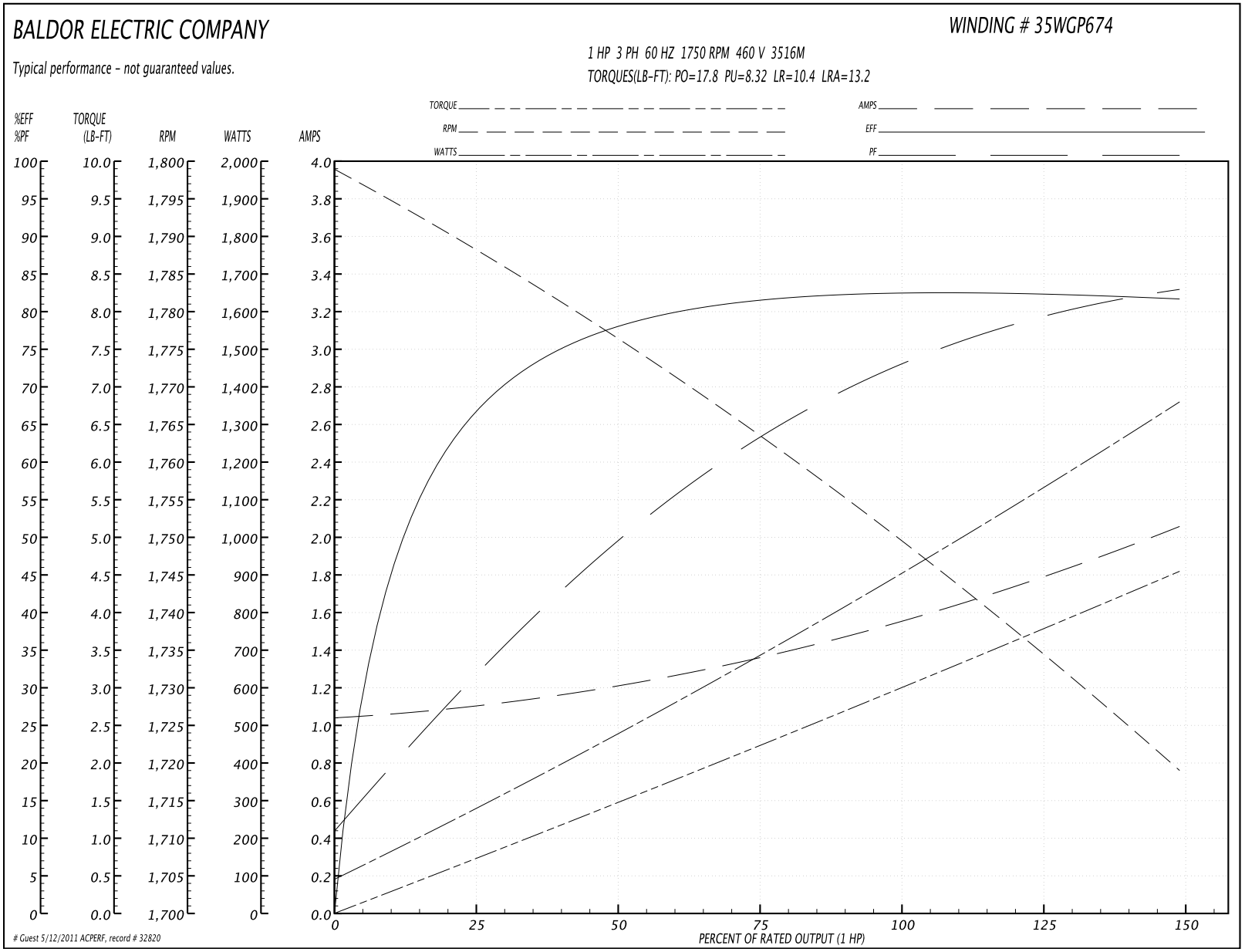
| Artikelnummer | Beschreibung | Menge |
|---|---|---|
| SA197608 | SA 35E380P674H1 | 1.000 EA |
| RA184993 | RA 35E380P674H1 | 1.000 EA |
| 35CB3001A02SP | EXPL PROOF CONDUIT BOX, 3/4"PIPE TAP LEA | 1.000 EA |
| 11XW1032G06 | 10-32 X .38, TAPTITE II, HEX WSHR SLTD U | 1.000 EA |
| HW3001B01 | BRASS CUP WASHER, FOR #8 SCREW | 1.000 EA |
| 35EP3700A01SP | FR ENDPLATE, XPFC | 1.000 EA |
| HW5100A03SP | WAVY WASHER (W1543-017) | 1.000 EA |
| 35EP3702A01SP | PU EP-205 BRG-35X-56C-143-5TC | 1.000 EA |
| 51XN1032A20 | 10-32 X 1 1/4 HX WS SL SR | 2.000 EA |
| HA3013A01 | 1/2-20X5/8 SPL.HX BOLT (WELKER) | 2.000 EA |
| HW3021C06 | 3/32 DI X .625 PIN (F/S) | 2.000 EA |
| XY3118A12 | 5/16-18 HEX NUT DIRECTIONAL SERRATION | 4.000 EA |
| 51XB1214A16 | 12-14X1.00 HXWSSLD SERTYB | 1.000 EA |
| 35FH4005A01SP | IEC FH NO GREASER W/AUTOPHORETIC PRIMER | 1.000 EA |
| 51XW1032A06 | 10-32 X .38, TAPTITE II, HEX WSHR SLTD S | 3.000 EA |
| 35CB3500A01SP | CONDUIT BOX LID, MACH | 1.000 EA |
| 10XN2520A16 | 1/4-20 X 1 HEX HEAD CAP SCR, ZINC PLATED | 4.000 EA |
| HW1001A25 | LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I | 4.000 EA |
| HW2501D13SP | KEY, 3/16 SQ X 1.375 | 1.000 EA |
| HA7000A01 | KEY RETAINER 7/8" DIA SHAFT | 1.000 EA |
| 85XU0407S04 | 4X1/4 U DRIVE PIN STAINLESS | 6.000 EA |
| NP0018 | NP-  XP CONDUIT BOX | 1.000 EA |
| MJ1000A75 | GREASE, POLYREX EM EXXON | 0.050 LB |
| 35FN3002A05SP | EXFN, PLASTIC, 6.376 OD, .638 ID | 1.000 EA |

## Teileliste (Fortsetzung)

| Artikelnummer | Beschreibung | Menge |
|---|---|---|
| MG1025G29 | PAINT 789.205 DARK GRAY METALLIC (USE W/ | 0.017 GA |
| MG1025Z20 | ACTIVATOR WILKOFAST 060.32 | 0.010 GA |
| HA3104A06 | THRUBOLT 5/16-18 X 8.50 OHIO ROD | 4.000 EA |
| LB1119 | WARNING LABEL | 1.000 EA |
| LB1125C04 | STD-E (STOCK CTN LABEL STD-E WITH FLAG) | 1.000 EA |
| LC0145B01 | CONNECTION LABEL | 1.000 EA |
| NP1426XP | UL/CSA, CLI GP-D,CLII GP-F&G,CC | 1.000 EA |
| 36PA1000 | PACK GROUP W/LB5001 | 1.000 EA |
| PK3082 | STYROFOAM CRADLE | 1.000 EA |

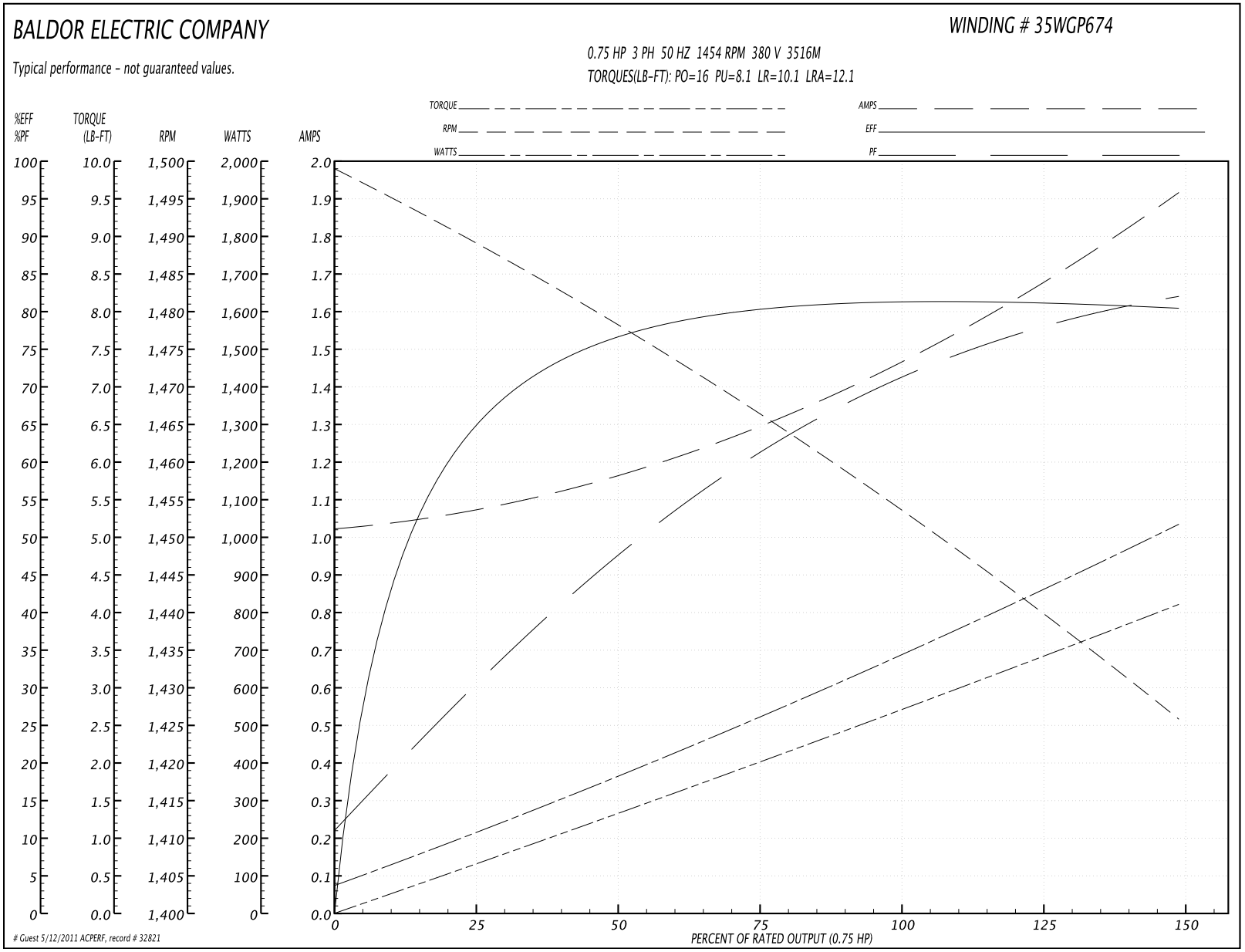
| Leistungsdaten 460V, 60Hz, 1.0HP (Typische Leistungsdaten - keine garantierten Werte) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Allgemeine Eigenschaften** | | | | | | | |
| **Volllastdrehmoment:** | 2.99 LB-FT | | | **Anfangskonfiguration:** | | DOL | |
| **Lastfreier Strom:** | 1.04 Ampere | | | **Kippmoment:** | | 17.8 LB-FT | |
| **Leiter-Leiter Widerstand bei 25 °C.:** | 16.3 Ohm A Ph / 0.0 Ohm B Ph | | | **Sattelmoment:** | | 8.32 LB-FT | |
| **Temp. Anstieg bei Nennlast:** | 41 C | | | **Drehmoment b. blockiertem Rotor:** | | 10.4 LB-FT | |
| **Temp. Anstieg bei max. Service Faktor:** | | | | **Anlaufstrom:** | | 13.2 Ampere | |
| **Lastcharakteristiken** | | | | | | | |
| **% der Nennlast** | **25** | **50** | **75** | **100** | **125** | **150** | **Service Faktor** |
| **Leistungsfaktor:** | 32.0 | 50.0 | 63.0 | 72.0 | 79.0 | 83.0 | 0.0 |
| **Wirkungsgrad:** | 66.6 | 78.0 | 81.4 | 82.6 | 82.5 | 81.6 | 0.0 |
| **Drehzahl:** | 1788.0 | 1776.0 | 1764.0 | 1750.0 | 1735.0 | 1719.0 | 0.0 |
| **Leistungsaufnahme:** | 1.11 | 1.2 | 1.36 | 1.56 | 1.77 | 2.06 | 0.0 |

Perfomance-Kurve 460V, 60Hz, 1.0HP Typische Leistungsdaten - keine garantierten Werte



| Leistungsdaten 380V, 50Hz, 0.75HP (Typische Leistungsdaten - keine garantierten Werte) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Allgemeine Eigenschaften** | | | | | | | |
| **Volllastdrehmoment:** | 2.7 LB-FT | | | **Anfangskonfiguration:** | | DOL | |
| **Lastfreier Strom:** | 1.02 Ampere | | | **Kippmoment:** | | 16.0 LB-FT | |
| **Leiter-Leiter Widerstand bei 25 °C.:** | 16.3 Ohm A Ph / 0.0 Ohm B Ph | | | **Sattelmoment:** | | 8.1 LB-FT | |
| **Temp. Anstieg bei Nennlast:** | 37 C | | | **Drehmoment b. blockiertem Rotor:** | | 10.1 LB-FT | |
| **Temp. Anstieg bei max. Service Faktor:** | | | | **Anlaufstrom:** | | 12.1 Ampere | |
| **Lastcharakteristiken** | | | | | | | |
| **% der Nennlast** | **25** | **50** | **75** | **100** | **125** | **150** | **Service Faktor** |
| **Leistungsfaktor:** | 31.0 | 48.0 | 61.0 | 71.0 | 78.0 | 82.0 | 0.0 |
| **Wirkungsgrad:** | 64.3 | 76.4 | 80.2 | 81.5 | 81.4 | 80.3 | 0.0 |
| **Drehzahl:** | 1489.0 | 1478.0 | 1467.0 | 1454.0 | 1440.0 | 1426.0 | 0.0 |
| **Leistungsaufnahme:** | 1.08 | 1.16 | 1.29 | 1.47 | 1.66 | 1.92 | 0.0 |

Perfomance-Kurve 380V, 50Hz, 0.75HP Typische Leistungsdaten - keine garantierten Werte



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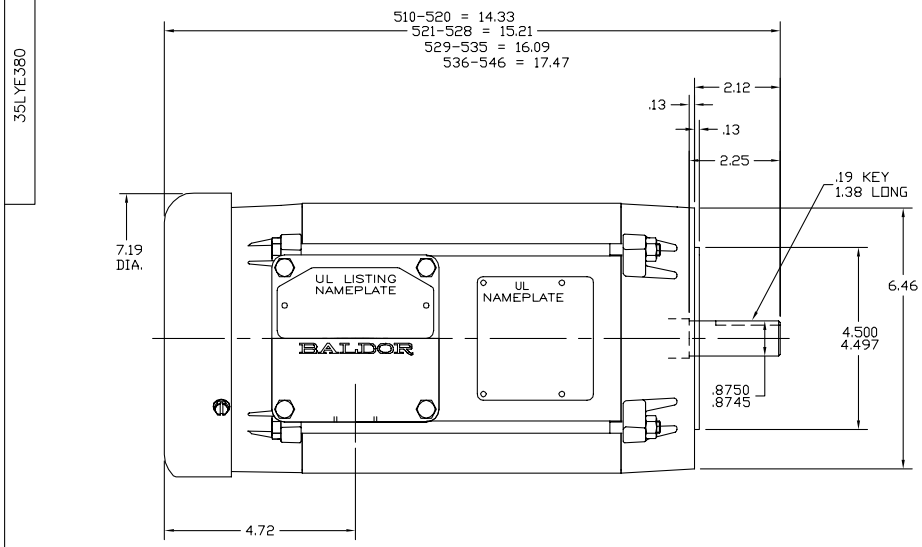


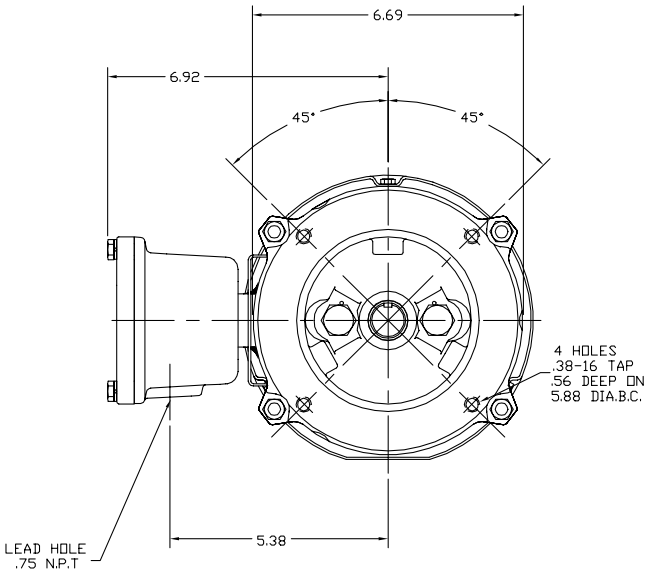


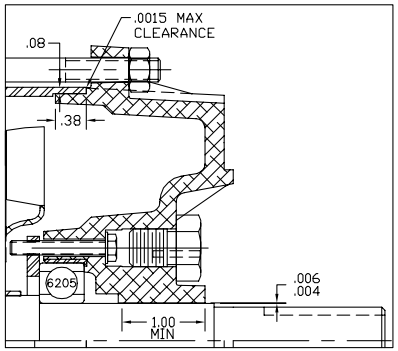


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

| | | |
|---|---|---|
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| REV. LTR: J | VERSION: 01 | TDR: 000000463039 |
| FILE: \AAA\00005\398 | REVISED: 15:56:25 04/25/2008 | BY: ENBRAM0 |
| MTL: – | | |

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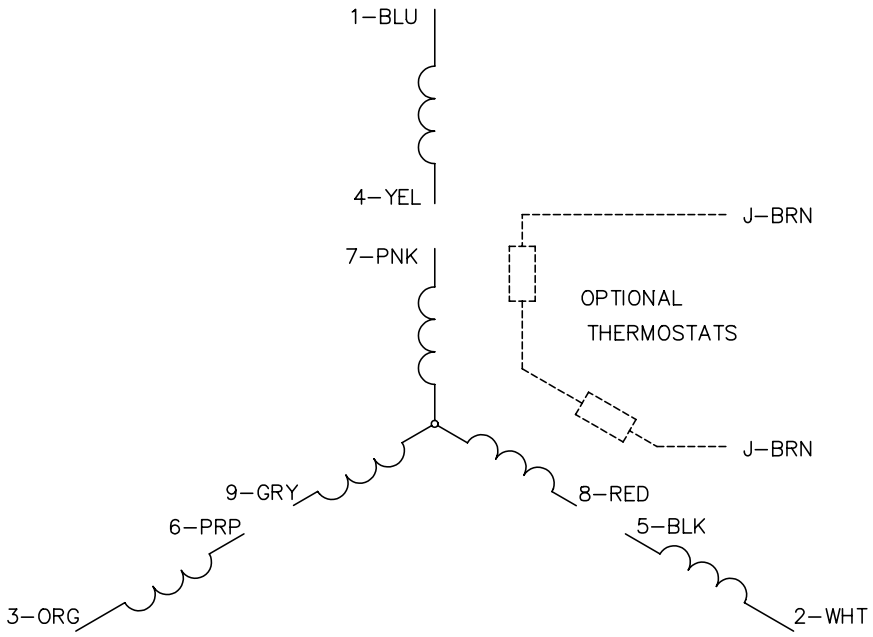
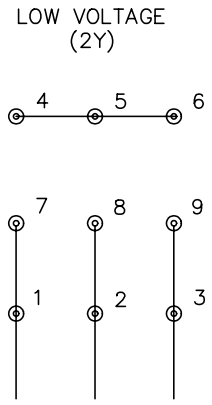
STD VERT 143-5TC XPFC X35M CL-I GP-D, CL-II GP-F&G

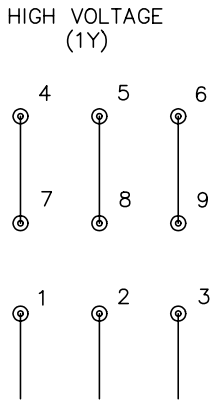
SH 1 of 1

35LYE380

CD0005




NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

| | | | |
|---|---|---|---|
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| REV. LTR: E | BY: JLP | REVISED: 01/19/99 10:15 | TDR: 0171435 |
| CD0005 | | FILE: AAA00005140 | MDL: – |
| | | MTL: – | 3PH, DV, 9 LEADS |

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# Integral Horsepower
# AC Induction Motors

## Installation & Operating Manual

2/09 MN400

# Table of Contents

# Section 1
# General Information

**Overview** This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

**Important:** **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

**Limited Warranty**

www.baldor.com/support/warranty_standard.asp

**Safety Notice:** This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

**WARNING:** **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

**WARNING:** **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

**WARNING:** **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

**WARNING:** **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

**WARNING:** **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

**WARNING:** **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

**WARNING:** **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

**WARNING:** **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

**WARNING:** **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

**WARNING:** **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

**WARNING:** **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

**Safety Notice** Continued

**WARNING:** **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

**WARNING:** **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

**WARNING:** **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

**WARNING:** **Use only UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust.**

**WARNING:** **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

**WARNING:** **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

**Caution:** **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

**Caution:** **Do not over–lubricate motor as this may cause premature bearing failure.**

**Caution:** **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

**Caution:** **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

**Caution:** **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

**Caution:** **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

**Receiving**

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

**Handling**

The motor should be lifted using the lifting lugs or eye bolts provided.

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.

4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

**Storage**

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg−Ohms and
kV is rated nameplate voltage defined as Kilo−Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg−ohms.

**Preparation for Storage**

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re−seal by taping it closed.
   c. If a zipper−closing type bag is used instead of the heat−sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti−friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti−friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” − These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” − These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

**Non−Regreaseable Motors**

Non−regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

**All Other Motor Types**

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

**Removal From Storage**

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

# Section 2
# Installation & Operation

**Overview** Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

**Location** It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip−Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non−corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

**Hazardous Locations** are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

**Caution:** **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

**Mounting** The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

**Alignment** Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

**Caution:** **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.
5. Sleeve bearing motors are only suitable for coupled loads.

**Doweling & Bolting** After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

**WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

**Guarding** Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

**Power Connection** Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

**Conduit Box** For ease of making connections, an oversize conduit box is provided.
The box can be rotated 360° in 90° increments.
Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

**AC Power** Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

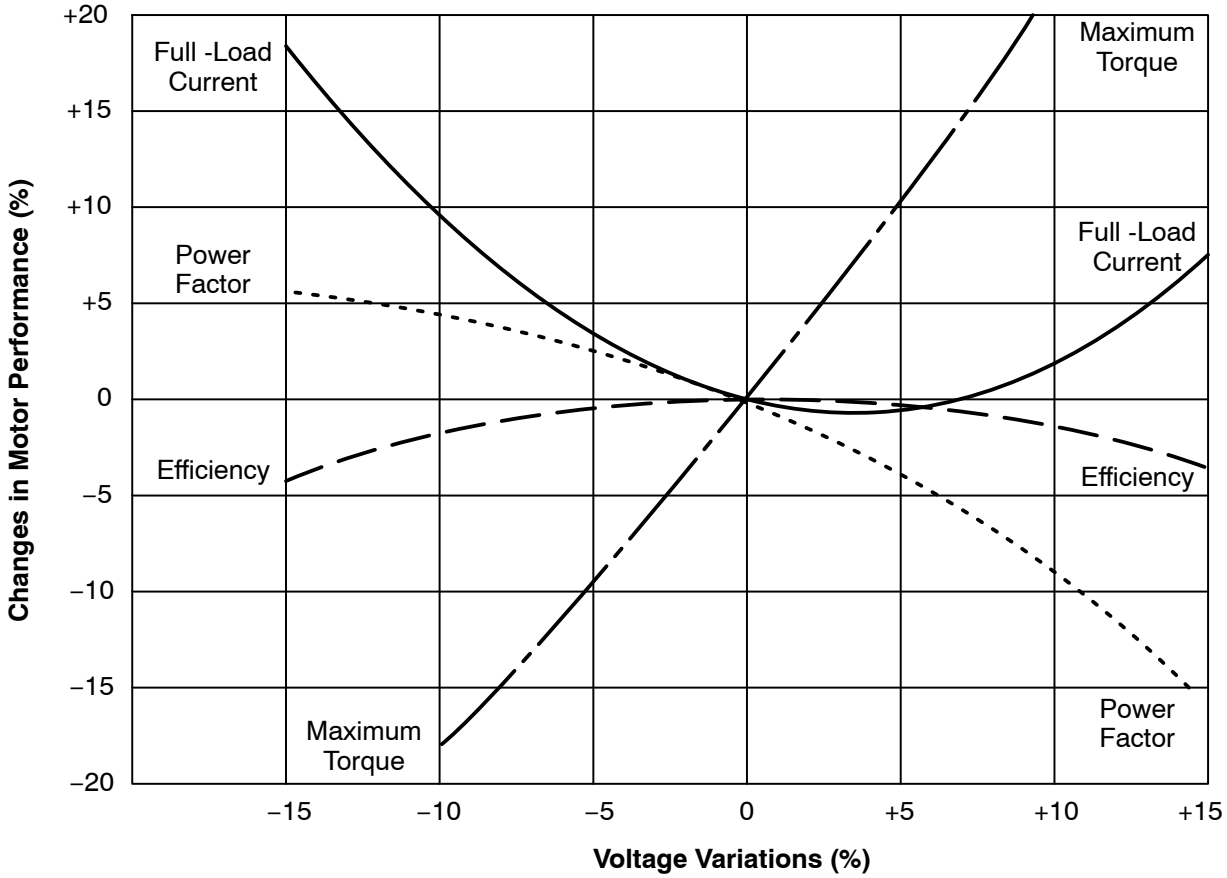
1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   **OR**
2. AC power is within ±5% of rated frequency with rated voltage.
   **OR**
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

**Figure 2-1 Accessory Connections**

| | |
|---|---|
| HEATERS<br>H1 — H2<br>H1 — H2 | One heater is installed in each end of motor.<br>Leads for each heater are labeled H1 & H2.<br>(Like numbers should be tied together). |
| THERMISTORS<br>T1 — T2 | Three thermistors are installed in windings and tied in series.<br>Leads are labeled T1 & T2. |
| WINDING RTDS<br>RED RED WHITE | Winding RTDs are installed in windings (2) per phase.<br>Each set of leads is labeled W1, W2, W3, W4, W5, & W6. |
| BEARING RTD<br>RED RED WHITE | * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.<br>* One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.<br>* Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead. |

**Figure 2-2 Typical Motor Performance VS Voltage Variations**




**Rotation** All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn−to−turn, phase−to−phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

**First Time Start Up** Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

**Coupled Start Up** This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

**Jogging and Repeated Starts** Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

**Heating** - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor District Office or Baldor Service Center.

# Section 3
# Maintenance & Troubleshooting

**WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

**General Inspection** Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

**WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

**Relubrication & Bearings** Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

**Type of Grease** A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

**Relubrication Intervals** Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

**Refer to additional information contained in Tables 3-2, 3-3 and 3-4.**

**Table 3-1 Relubrication Intervals ***

| NEMA / (IEC) Frame Size | Rated Speed - RPM | | | | | |
|---|---|---|---|---|---|---|
| | 10000 | 6000 | 3600 | 1800 | 1200 | 900 |
| Up to 210 incl. (132) | ** | 2700 Hrs. | 5500 Hrs. | 12000 Hrs. | 18000 Hrs. | 22000 Hrs. |
| Over 210 to 280 incl. (180) | | ** | 3600 Hrs. | 9500 Hrs. | 15000 Hrs. | 18000 Hrs. |
| Over 280 to 360 incl. (225) | | ** | * 2200 Hrs. | 7400 Hrs. | 12000 Hrs. | 15000 Hrs. |
| Over 360 to 5800 incl. (300) | | ** | *2200 Hrs. | 3500 Hrs. | 7400 Hrs. | 10500 Hrs. |

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

**Table 3-2 Service Conditions**

| Severity of Service | Hours per day of Operation | Ambient Temperature Maximum | Atmospheric Contamination |
|---|---|---|---|
| Standard | 8 | 40° C | Clean, Little Corrosion |
| Severe | 16 Plus | 50° C | Moderate dirt, Corrosion |
| Extreme | 16 Plus | >50° C* or Class H Insulation | Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration |
| Low Temperature | | <–29° C ** | |

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

**Table 3-3 Relubrication Interval Multiplier**

| Severity of Service | Multiplier |
|---|---|
| Standard | 1.0 |
| Severe | 0.5 |
| Extreme | 0.1 |
| Low Temperature | 1.0 |

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

**Table 3-4 Bearings Sizes and Types**

| Frame Size NEMA (IEC) | Bearing Description (These are the "Large" bearings (Shaft End) in each frame size) | | | |
|---|---|---|---|---|
| | Bearing | Weight of Grease to add * oz (Grams) | Volume of grease to be added | |
| | | | $in^3$ | teaspoon |
| 56 to 140 (90) | 6203 | 0.08 (2.4) | 0.15 | 0.5 |
| 140 (90) | 6205 | 0.15 (3.9) | 0.2 | 0.8 |
| 180 (100–112) | 6206 | 0.19 (5.0) | 0.3 | 1.0 |
| 210 (132) | 6307 | 0.30 (8.4) | 0.6 | 2.0 |
| 250 (160) | 6309 | 0.47 (12.5) | 0.7 | 2.5 |
| 280 (180) | 6311 | 0.61 (17) | 1.2 | 3.9 |
| 320 (200) | 6312 | 0.76 (20.1) | 1.2 | 4.0 |
| 360 (225) | 6313 | 0.81 (23) | 1.5 | 5.2 |
| 400 (250) | 6316 | 1.25 (33) | 2.0 | 6.6 |
| 440 (280) | 6319 | 2.12 (60) | 4.1 | 13.4 |
| 5000 to 5800 (315–450) | 6328 | 4.70 (130) | 9.2 | 30.0 |
| 5000 to 5800 (315–450) | NU328 | 4.70 (130) | 9.2 | 30.0 |
| 360 to 449 (225–280) | NU319 | 2.12 (60) | 4.1 | 13.4 |
| **AC Induction Servo** | | | | |
| 76 Frame 180 (112) | 6207 | 0.22 (6.1) | 0.44 | 1.4 |
| 77 Frame 210 (132) | 6210 | 0.32 (9.0) | 0.64 | 2.1 |
| 80 Frame 250(160) | 6213 | 0.49 (14.0) | 0.99 | 3.3 |

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

**Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.**

**Relubrication Procedure** Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

**Caution: Do not over−lubricate motor as this may cause premature bearing failure.**

**With Grease Outlet Plug**

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

**Caution: Over−lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.**

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

**Without Grease Provisions**

**Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.**

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

**Sample Relubrication Determination**

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 $in^3$ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

**Table 3-5 Troubleshooting Chart**

| Symptom | Possible Causes | Possible Solutions |
|---|---|---|
| Motor will not start | Usually caused by line trouble, such as, single phasing at the starter. | Check source of power. Check overloads, fuses, controls, etc. |
| Excessive humming | High Voltage. | Check input line connections. |
| | Eccentric air gap. | Have motor serviced at local Baldor service center. |
| Motor Over Heating | Overload. Compare actual amps (measured) with nameplate rating. | Locate and remove source of excessive friction in motor or load.<br>Reduce load or replace with motor of greater capacity. |
| | Single Phasing. | Check current at all phases (should be approximately equal) to isolate and correct the problem. |
| | Improper ventilation. | Check external cooling fan to be sure air is moving properly across cooling fins.<br>Excessive dirt build-up on motor. Clean motor. |
| | Unbalanced voltage. | Check voltage at all phases (should be approximately equal) to isolate and correct the problem. |
| | Rotor rubbing on stator. | Check air gap clearance and bearings. |
| | | Tighten “Thru Bolts”. |
| | Over voltage or under voltage. | Check input voltage at each phase to motor. |
| | Open stator winding. | Check stator resistance at all three phases for balance. |
| | Grounded winding. | Perform dielectric test and repair as required. |
| | Improper connections. | Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram. |
| Bearing Over Heating | Misalignment. | Check and align motor and driven equipment. |
| | Excessive belt tension. | Reduce belt tension to proper point for load. |
| | Excessive end thrust. | Reduce the end thrust from driven machine. |
| | Excessive grease in bearing. | Remove grease until cavity is approximately $^3/_4$ filled. |
| | Insufficient grease in bearing. | Add grease until cavity is approximately $^3/_4$ filled. |
| | Dirt in bearing. | Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled. |
| Vibration | Misalignment. | Check and align motor and driven equipment. |
| | Rubbing between rotating parts and stationary parts. | Isolate and eliminate cause of rubbing. |
| | Rotor out of balance. | Have rotor balance checked are repaired at your Baldor Service Center. |
| | Resonance. | Tune system or contact your Baldor Service Center for assistance. |
| Noise | Foreign material in air gap or ventilation openings. | Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings. |
| Growling or whining | Bad bearing. | Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled. |

## Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

**Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)**

| Motor Load | Class B Temp Rise ≤ 80°C (Typical Design) | | Class F Temp Rise ≤ 105°C | | Class H Temp Rise ≤ 125°C | |
|---|---|---|---|---|---|---|
| | Alarm | Trip | Alarm | Trip | Alarm | Trip |
| ≤ Rated Load | 130 | 140 | 155 | 165 | 175 | 185 |
| Rated Load to 1.15 S.F. | 140 | 150 | 160 | 165 | 180 | 185 |

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

**Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)**

| Bearing Type Oil or Grease | Anti–Friction | | Sleeve | |
|---|---|---|---|---|
| | Alarm | Trip | Alarm | Trip |
| Standard* | 95 | 100 | 85 | 95 |
| High Temperature** | 110 | 115 | 105 | 110 |

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- Texaco Polystar
- Mobilith SHC–100
- Darmex 707
- Rykon Premium #2
- Pennzoil Pennzlube EM–2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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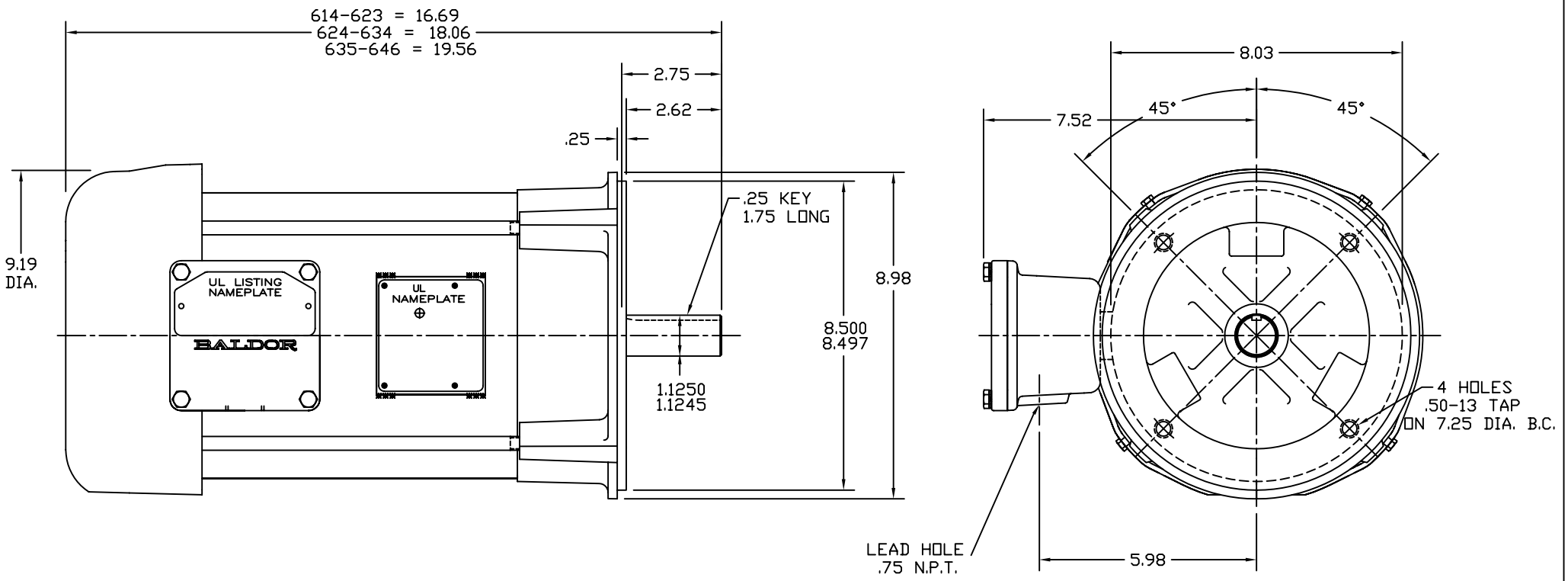
**BALDOR ELECTRIC COMPANY**
**World Headquarters**
**P.O. Box 2400 Fort Smith, AR 72901–2400**
**(479) 646–4711 Fax (479) 648–5792**
**www.baldor.com**


MN400
2/09

36E396




UL CLASS I - GROUP D - CLASS II - GROUPS F & G

| | | | | |
|---|---|---|---|---|
| CUST. NAME | | CUST. P.O. | | |
| MODEL | INSUL | AMB | H.P. | MTG |
| R.P.M. | VOLTS | ENCL | PHASE | FREQ |
| FRAME | TYPE | | CERTIFIED BY | |

| | | |
|---|---|---|
| REMARKS: | | |
| REV: G IDL TO ACAD | | |
| SCALE: .3 | BY: LW | REVISED: 07/20/94 |
| FILE: AAA00012761 | | TDR: 0051030 |

# BALDOR ELECTRIC Co.

VERT 36M XPFC 182-84TC CL I-GP D, CL II-GP F&G W/C.I. F.H.

36E396

BALDOR
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BALDOR • RELIANCE

# Produktionformation

# VM7044T

## 5//3HP,1745//1450RPM,3PH,60//50HZ,184TC

| Artikeldetail | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Revision:** | - | **Status:** | PRD/A | **Änderungs-Nr.:** | | **Geschützt:** | Nein |
| **Typ:** | AC | **Produkt-Typ:** | 3634M | **Elektrische Spezifikation:** | 36V396S543 | **Anschluss-Schema:** | |
| **Beilage:** | XPFC | **Produktionsbetrieb:** | | **Mechanische Spezifikation:** | 36E396 | **Layout:** | |
| **Rahmen:** | 184TC | **Befestigung:** | F1 | **Pol:** | 04 | **Herstellungsdatum:** | 09-07-2010 |
| **Basis:** | N | **Rotation:** | R | **Isolation:** | B | **Wirk. Datum:** | 09-16-2010 |
| **Anschluss:** | 9#16 | **Literatur:** | | **Elektrisches Schema:** | | **Ersetzt durch:** | |

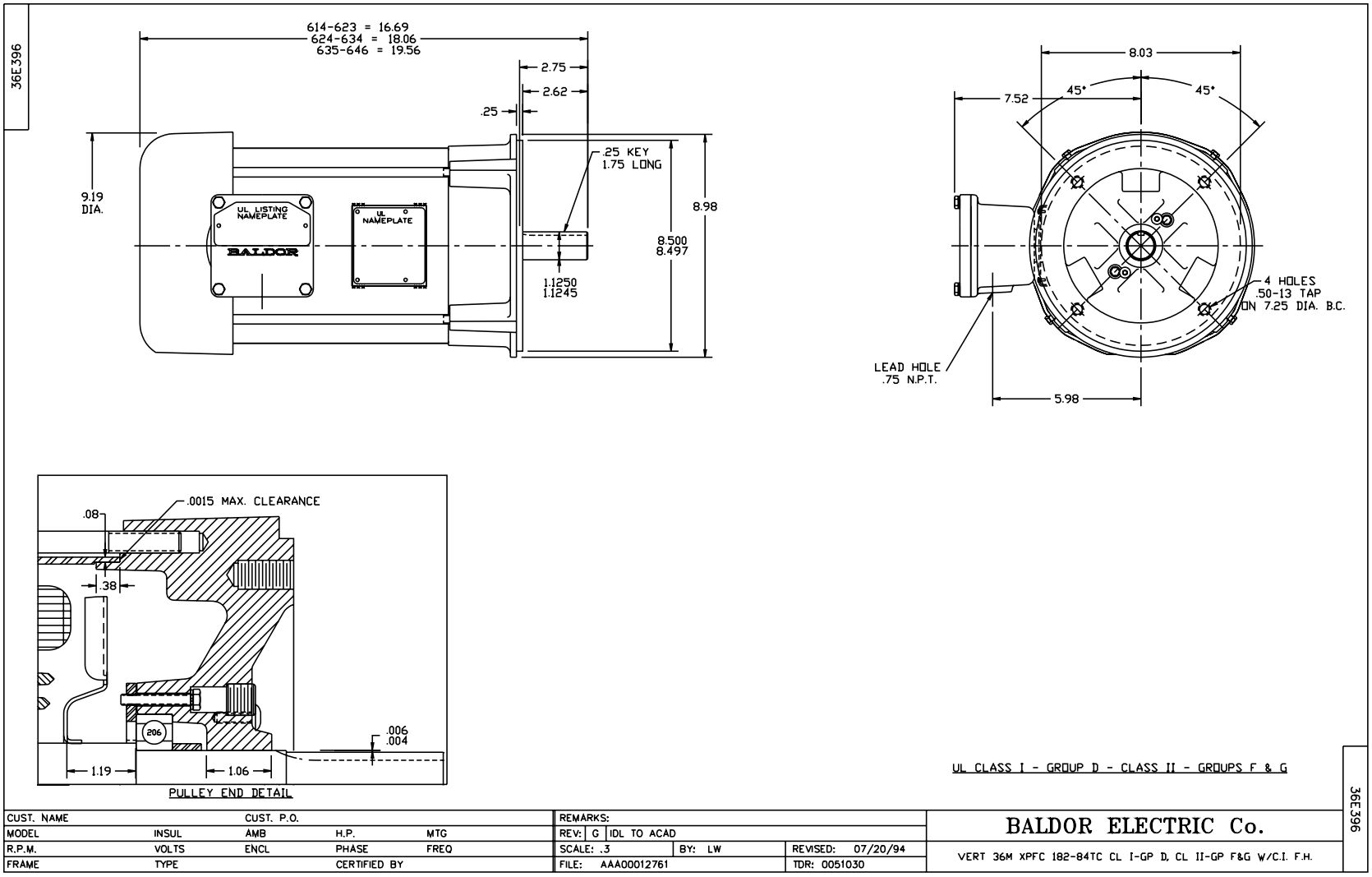
| Typenschild NP1426XP | | | | | |
|---|---|---|---|---|---|
| **NO.** | | **CC** | 010A | | |
| **SER.** | | | | | |
| **SPEC.** | 36E396S543H1 | | | | |
| **CAT.NO.** | VM7044T | | | | |
| **HP** | 5//3 | **T. CODE** | T3C | | |
| **VOLTS** | 230/460//190/380 | | | | |
| **AMPS** | 13.6/6.8//11/5.5 | | | | |
| **RPM** | 1745//1450 | | | | |
| **HZ** | 60//50 | **PH** | 3 | **CL** | B |
| **SER.F.** | 1.00 | **DES** | A | **CODE** | J |
| **RATING** | 40C AMB-CONT | | | | |
| **FRAME** | 184TC | **NEMA-NOM-EFF** | 87.5 | **PF** | 78 |
| **USABLE AT 208V** | 14.2 | | | | |

## Teileliste

| Artikelnummer | Beschreibung | Menge |
|---|---|---|
| SA202975 | SA 36E396S543H1 | 1.000 EA |
| RA190238 | RA 36E396S543H1 | 1.000 EA |
| 36FN3000A01SP | EXFN, PLASTIC, 7.00 OD, .912 ID | 1.000 EA |
| 35CB3001A02SP | EXPL PROOF CONDUIT BOX, 3/4"PIPE TAP LEA | 1.000 EA |
| 11XW1032G06 | 10-32 X .38, TAPTITE II, HEX WSHR SLTD U | 1.000 EA |
| HW3001B01 | BRASS CUP WASHER, FOR #8 SCREW | 1.000 EA |
| 36EP1702A01 | FR ENDPLATE, MACH | 1.000 EA |
| HW4500A19 | 1/4-28X1/4 SLOTTED PLUG F/S | 2.000 EA |
| HW5100A05 | WVY WSHR F/205 & 304 BRGS | 1.000 EA |
| 36EP1703A01 | PU ENDPLATE, MACH | 1.000 EA |
| 51XN1032A20 | 10-32 X 1 1/4 HX WS SL SR | 2.000 EA |
| HW4001A01 | 1/4 HXSOC PIPEPLG 3/4TAPEALLOY STEEL | 2.000 EA |
| 60XN1032A07 | 10-32 X 1/2 TRUSS HEAD, TORX SERRATED ZN | 2.000 EA |
| 51XB1214A16 | 12-14X1.00 HXWSSLD SERTYB | 1.000 EA |
| 36FH2000A01 | FAN COVER, MACH | 1.000 EA |
| 12XN1032A08 | 10-32X1/2 HEX HD SLTD | 4.000 EA |
| HW1001A10 | WASHER, #10 SPLT LK, ZN X | 4.000 EA |
| 35CB3500A01SP | CONDUIT BOX LID, MACH | 1.000 EA |
| 10XN2520A16 | 1/4-20 X 1 HEX HEAD CAP SCR, ZINC PLATED | 4.000 EA |
| HW1001A25 | LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I | 4.000 EA |
| HW2501E16 | KEY, 1/4 SQ X 1.750 | 1.000 EA |
| HA7000A02 | KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA | 1.000 EA |
| 85XU0407S04 | 4X1/4 U DRIVE PIN STAINLESS | 6.000 EA |
| NP0018 | NP-  XP CONDUIT BOX | 1.000 EA |

## Teileliste (Fortsetzung)

| Artikelnummer | Beschreibung | Menge |
|---|---|---|
| MJ1000A75 | GREASE, POLYREX EM EXXON | 0.050 LB |
| HA3105A06 | THRUBOLT- 3/8-16 X 10.500 X | 4.000 EA |
| MG1025G29 | PAINT 789.205 DARK GRAY METALLIC (USE W/ | 0.022 GA |
| MG1025Z20 | ACTIVATOR WILKOFAST 060.32 | 0.010 GA |
| LB1119 | WARNING LABEL | 1.000 EA |
| LB1125C04 | STD-E (STOCK CTN LABEL STD-E WITH FLAG) | 1.000 EA |
| LC0145B01 | CONNECTION LABEL | 1.000 EA |
| NP1426XP | UL/CSA, CLI GP-D,CLII GP-F&G,CC | 1.000 EA |
| G0PA1000 | PACKAGING GROUP | 1.000 EA |
| PK3082 | STYROFOAM CRADLE | 1.000 EA |


36E396
614-623 = 16.69
624-634 = 18.06
635-646 = 19.56
2.75
2.62
.25
.25 KEY
1.75 LONG
9.19
DIA.
UL LISTING
NAMEPLATE
UL
NAMEPLATE
BALDOR
8.98
8.500
8.497
1.1250
1.1245
8.03
7.52
45°
45°
4 HOLES
.50-13 TAP
ON 7.25 DIA. B.C.
LEAD HOLE
.75 N.P.T.
5.98
.0015 MAX. CLEARANCE
.08
.38
206
.006
.004
1.19
1.06
PULLEY END DETAIL
UL CLASS I - GROUP D - CLASS II - GROUPS F & G
36E396
CUST. NAME
CUST. P.O.
MODEL
INSUL
AMB
H.P.
MTG
R.P.M.
VOLTS
ENCL
PHASE
FREQ
FRAME
TYPE
CERTIFIED BY
REMARKS:
REV: G IDL TO ACAD
SCALE: .3
BY: LW
REVISED: 07/20/94
FILE: AAA00012761
TDR: 0051030
BALDOR ELECTRIC Co.
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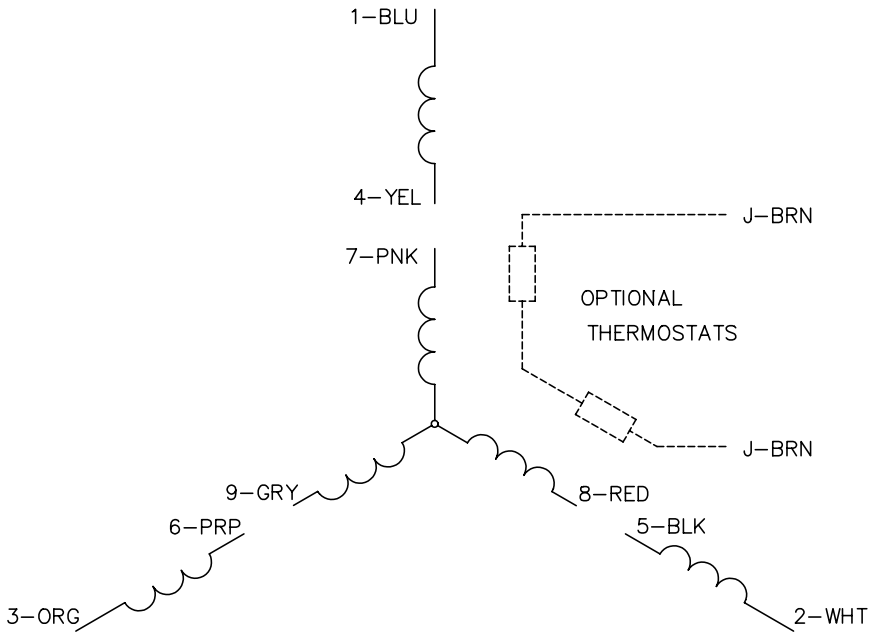
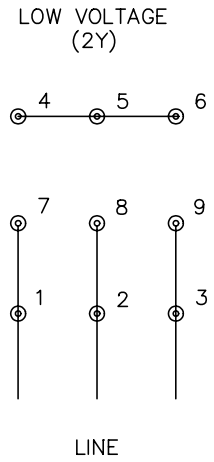
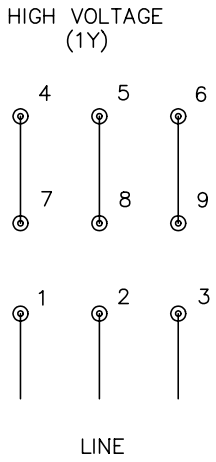
CD0005




NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

| | | | |
|---|---|---|---|
| REV. DESC: REVISE TO SHOW OPTIONAL COLORS | | | BALDOR ELECTRIC Co. |
| REV. LTR: E | BY: JLP | REVISED: 01/19/99 10:15 | TDR: 0171435 |
| CD0005 | | FILE: AAA00005140 | MDL: – |
| | | MTL: – | 3PH, DV, 9 LEADS |

SEW EURODRIVE

# Assembly and Operating Instructions

## Gear Units
## R..7, F..7, K..7, S..7, SPIROPLAN® W Series

Edition 06/2010

16970411 / EN


KKFU 144794 3
42G1

# Contents

# Contents

# 1 General Information

## 1.1 How to use the operating instructions

The operating instructions are an integral part of the product and contain important information on operation and service. The operating instructions are written for all employees who assemble, install, startup, and service this product.

The operating instructions must be accessible and legible. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. Consult SEW-EURODRIVE if you have any questions or if you require further information.

## 1.2 Structure of the safety notes

### 1.2.1 Meaning of the signal words

The following table shows the grading and meaning of the signal words for safety notes, notes on potential risks of damage to property, and other notes.

| Signal word | Meaning | Consequences if disregarded |
|---|---|---|
| ⚠ **DANGER** | Imminent danger | Severe or fatal injuries |
| ⚠ **WARNING** | Possible dangerous situation | Severe or fatal injuries |
| ⚠ **CAUTION** | Possible dangerous situation | Minor injuries |
| **NOTICE** | Possible damage to property | Damage to the drive system or its environment |
| **INFORMATION** | Useful information or tip: Simplifies the handling of the drive system. | |

### 1.2.2 Structure of the section-specific safety notes

Section safety notes do not apply to a specific action, but to several actions pertaining to one subject. The used symbols indicate either a general or a specific hazard.

This is the formal structure of a section safety note:

**⚠ SIGNAL WORD**

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the danger.

### 1.2.3 Structure of the embedded safety notes

Embedded safety notes are directly integrated in the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

- ⚠ **SIGNAL WORD** Nature and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent the danger.

## 1.3 Rights to claim under limited warranty

Adhering to the operating instructions is a prerequisite for fault-free operation and the fulfillment of any right to claim under warranty. Read the operating instructions before you start working with the unit.

## 1.4 Exclusion of liability

You must comply with the information contained in these operating instructions to ensure safe operation of the R..7, F..7, K..7, S..7, SPIROPLAN® W series gear units and to achieve the specified product characteristics and performance requirements.
SEW-EURODRIVE does not assume liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded.

## 1.5 Copyright

# 2 Safety Notes

The following basic safety notes are intended to prevent injury to persons and damage to property. The operator must ensure that the basic safety notes are read and observed. Make sure that persons responsible for the system and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, please contact SEW-EURODRIVE.

## *2.1 Preface*

The following safety notes are primarily concerned with the use of gear units. If using gearmotors, please also refer to the safety notes for motors in the corresponding operating instructions.

Also observe the supplementary safety notes in the individual sections of these operating instructions.

## *2.2 General information*

**⚠ DANGER**

During operation, the motors, gearmotors and brakes can have live, bare and movable or rotating parts as well as hot surfaces, depending on their enclosure.

Severe or fatal injuries.

- All work related to transportation, storage, setup/mounting, connection, startup, maintenance and repair may only be carried out by qualified personnel, in strict observation of:
  - The relevant detailed operating instructions
  - The warning and safety signs on the motor/gearmotor
  - All other project planning documents, operating instructions and wiring diagrams related to the drive
  - The specific regulations and requirements for the system
  - The national/regional regulations governing safety and the prevention of accidents
- Never install damaged products
- Immediately report any damage to the shipping company

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to property.

Refer to the documentation for additional information.

## 2.3 Target group

Any mechanical work may only be performed by adequately qualified personnel. Qualified personnel in this context are persons who are familiar with the setup, mechanical installation, trouble shooting and maintenance for this product. Further, they are qualified as follows:

- Training in mechanical engineering, e.g. as a mechanic or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

Any electronic work may only be performed by adequately qualified electricians. Qualified electricians in this context are persons who are familiar with the electronic installation, startup, trouble shooting and maintenance for this product. Further, they are qualified as follows:

- Training in electrical engineering, e.g. as an electrician or mechatronics technician (final examinations must have been passed).
- They are familiar with these operating instructions.

All work in further areas of transportation, storage, operation and waste disposal must only be carried out by persons who are trained appropriately.

All qualified personnel must wear appropriate protective clothing.

## 2.4 Designated use

The gear units are intended for industrial systems and may only be used in accordance with the information provided in SEW-EURODRIVE's technical documentation and the information given on the nameplate. They fulfill the applicable standards and regulations.

According to the 2006/42/EC Machinery Directive, the gear units are components for the installation in machines and plants. In the scope of the Directive, you must not take the machinery into operation in the proper fashion until you have established that the end product complies with Machinery Directive 2006/42/EC.

Using these products in potentially explosive atmospheres is prohibited, unless specifically designated otherwise.

## 2.5 Other applicable documentation

The following publications and documents have to be observed as well:

- "DR.71-225, 315 AC Motors" operating instructions for gearmotors
- Operating instructions of any attached options
- "Gear Units" catalog or
- "Gearmotors" catalog

## 2.6 Transport

Inspect the shipment immediately upon receipt for any damage that may have occurred during transportation. Inform the shipping company immediately. It may be necessary to preclude startup.

Tighten installed eyebolts. They are only intended for the weight of the motor/gearmotor; do not attach any additional loads.

The built-in lifting eyebolts comply with DIN 580. Always observe the loads and regulations listed in this standard. If the gearmotor is equipped with two suspension eye lugs or lifting eyebolts, then both of the suspension eye lugs should be used for transportation. In this case, the tension force vector of the slings must not exceed a 45° angle according to DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

## 2.7 Extended storage

Observe the notes in section "Extended storage" (page 109).

## 2.8 Installation/assembly

Observe the notes in section "Mechanical Installation" (page 17)!

## 2.9 Startup/operation

Check the oil level before startup as described in chapter Inspection/Maintenance (page 63).

Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates.

Secure keys for test mode without output elements. Do not deactivate monitoring and protection equipment even in test mode.

Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause and contact SEW-EURODRIVE, if required.

## 2.10 Inspection/maintenance

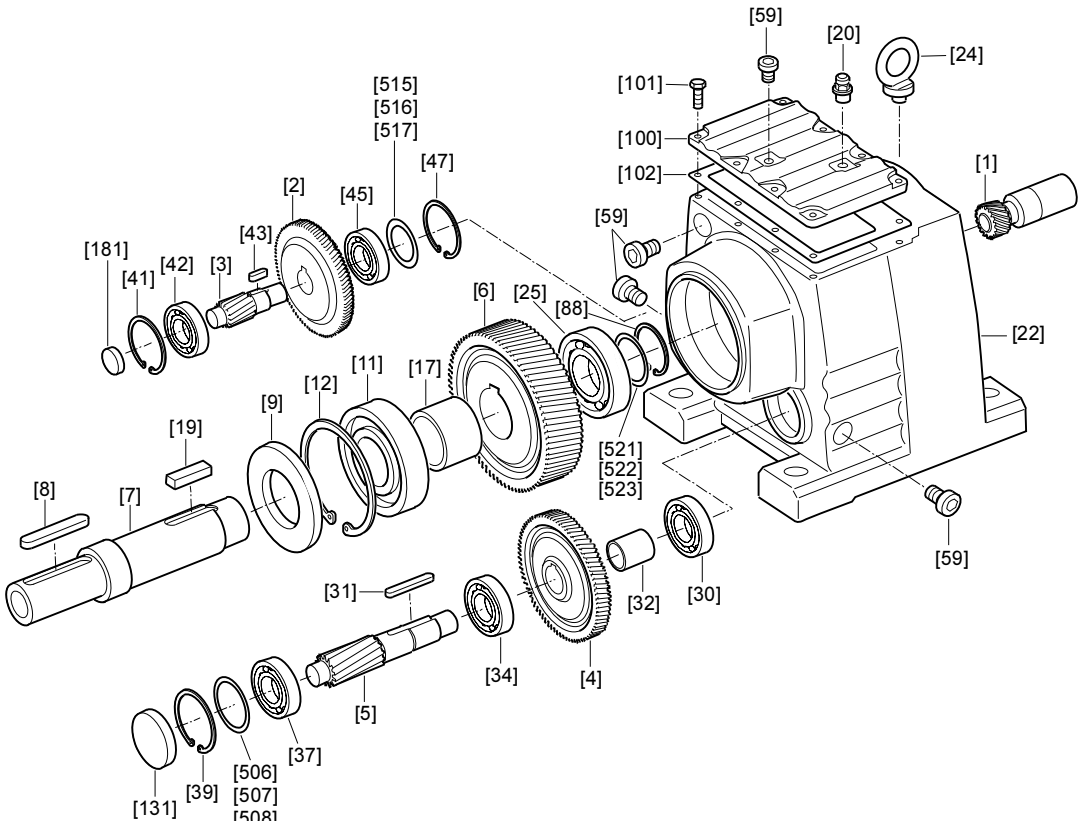
Observe the notes in chapter "Inspection/Maintenance" (page 63)!

# 3 Gear Unit Structure

**INFORMATION**

The following figures are block diagrams. They help you to assign components to the spare parts list. Discrepancies may occur depending on the gear unit size and version.

## *3.1 Basic structure of helical gear units*

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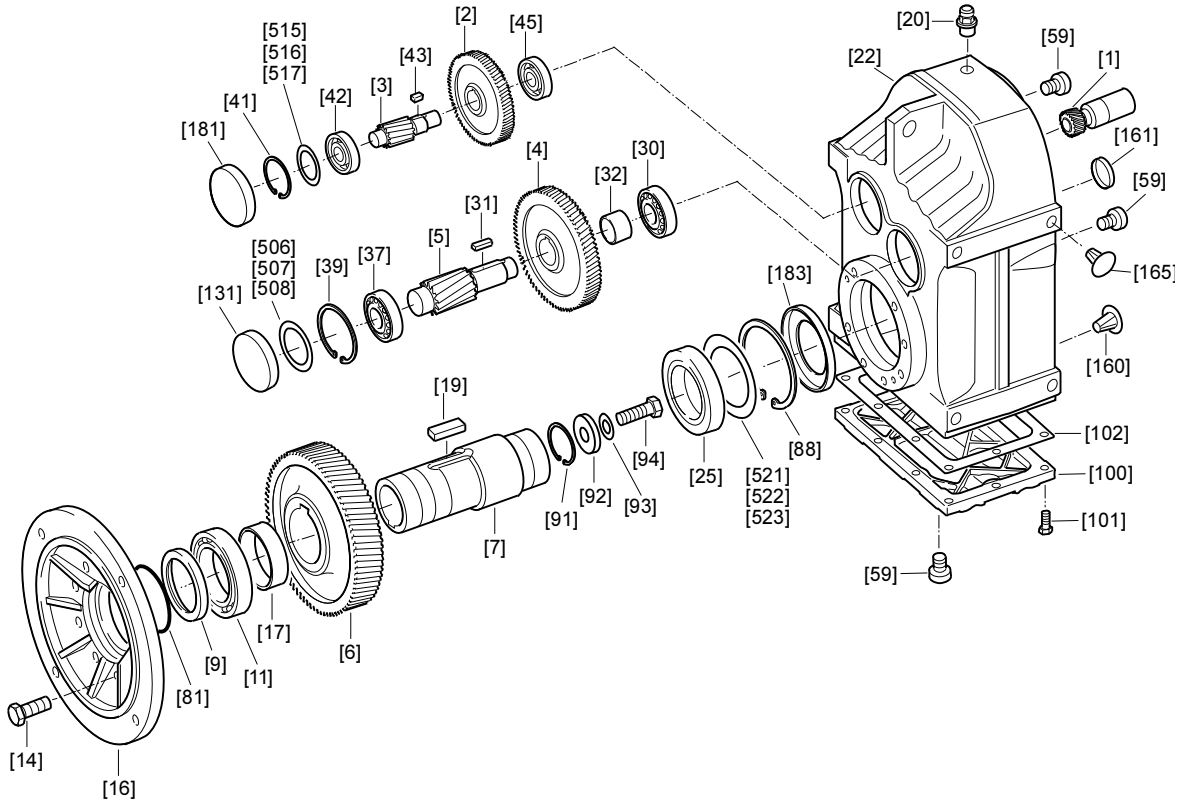
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [19] | Key | [42] | Roller bearing | [507] | Shim |
| [2] | Gearwheel | [20] | Breather valve | [43] | Key | [508] | Shim |
| [3] | Pinion shaft | [22] | Gear unit housing | [45] | Roller bearing | [515] | Shim |
| [4] | Gearwheel | [24] | Lifting eyebolt | [47] | Circlip | [516] | Shim |
| [5] | Pinion shaft | [25] | Roller bearing | [59] | Screw plug | [517] | Shim |
| [6] | Gearwheel | [30] | Roller bearing | [88] | Circlip | [521] | Shim |
| [7] | Output shaft | [31] | Key | [100] | Gear cover plate | [522] | Shim |
| [8] | Key | [32] | Spacer tube | [101] | Hex head screw | [523] | Shim |
| [9] | Oil seal | [34] | Roller bearing | [102] | Seal | | |
| [11] | Roller bearing | [37] | Roller bearing | [131] | Closing cap | | |
| [12] | Circlip | [39] | Circlip | [181] | Closing cap | | |
| [17] | Spacer tube | [41] | Circlip | [506] | Shim | | |

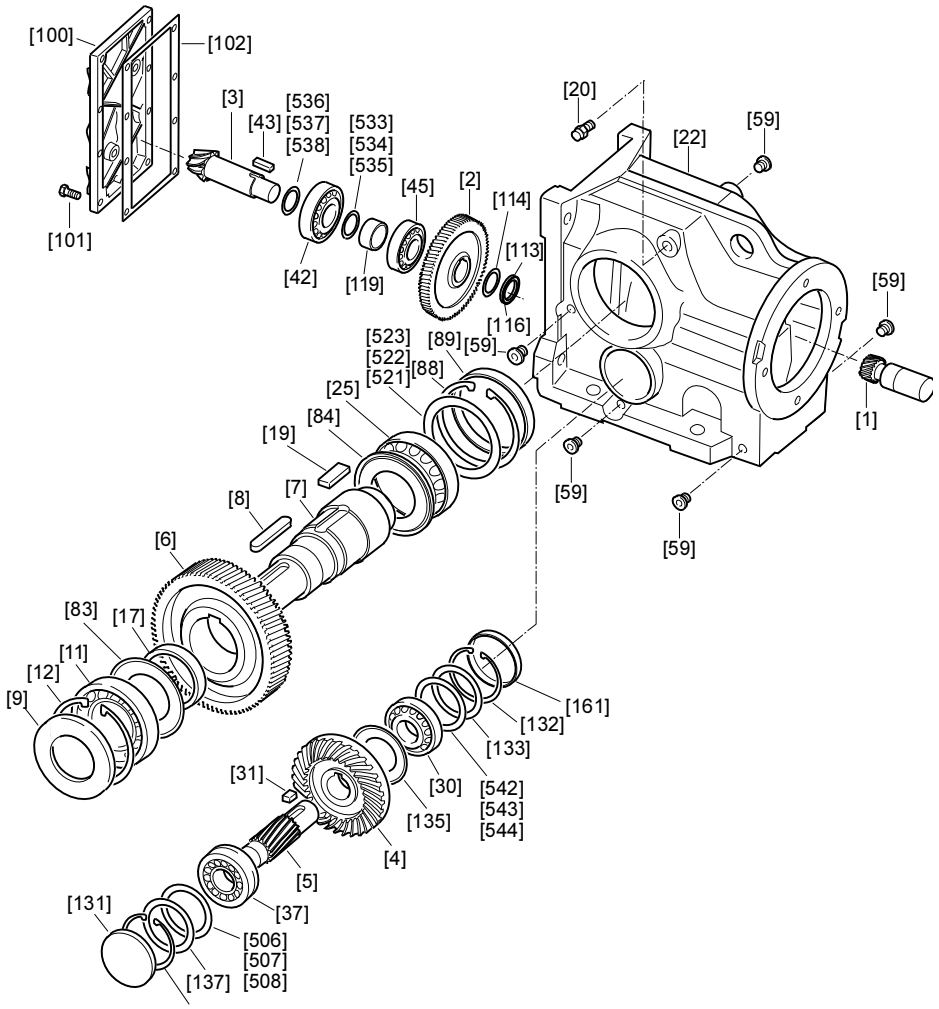
## 3.2 Basic structure of parallel shaft helical gear units




19298059

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [22] | Gear unit housing | [91] | Circlip | [506] | Shim |
| [2] | Gearwheel | [25] | Roller bearing | [92] | Disc | [507] | Shim |
| [3] | Pinion shaft | [30] | Roller bearing | [93] | Lock washer | [508] | Shim |
| [4] | Gearwheel | [31] | Key | [94] | Hex head screw | [515] | Shim |
| [5] | Pinion shaft | [32] | Spacer tube | [100] | Gear cover plate | [516] | Shim |
| [6] | Gearwheel | [37] | Roller bearing | [101] | Hex head screw | [517] | Shim |
| [7] | Hollow shaft | [39] | Circlip | [102] | Seal | [521] | Shim |
| [9] | Oil seal | [41] | Circlip | [131] | Closing cap | [522] | Shim |
| [11] | Roller bearing | [42] | Roller bearing | [160] | Closing plug | [523] | Shim |
| [14] | Hex head screw | [43] | Key | [161] | Closing cap | | |
| [16] | output flange | [45] | Roller bearing | [165] | Closing plug | | |
| [17] | Spacer tube | [59] | Screw plug | [181] | Closing cap | | |
| [19] | Key | [81] | Nilos ring | [183] | Oil seal | | |
| [20] | Breather valve | [88] | Circlip | | | | |

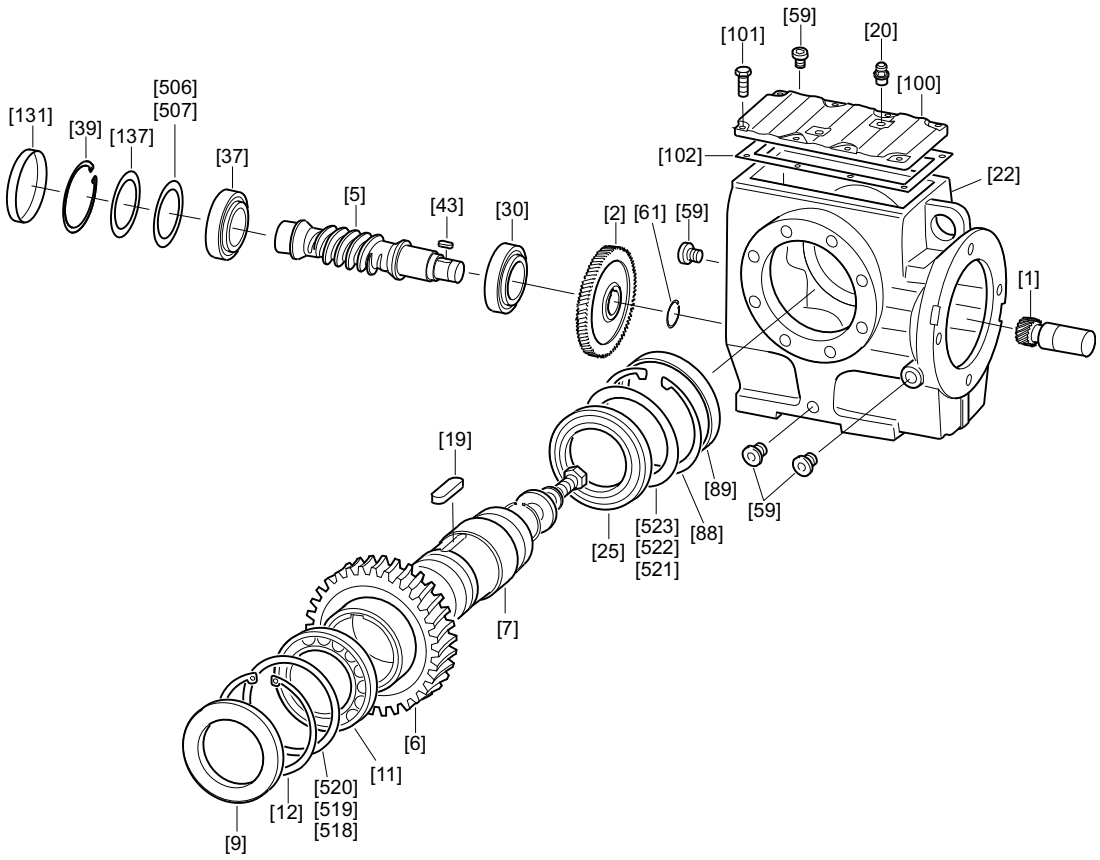
## 3.3 Basic structure of helical-bevel gear units




19301131

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [25] | Roller bearing | [102] | Seal | [522] | Shim |
| [2] | Gearwheel | [30] | Roller bearing | [113] | Slotted nut | [523] | Shim |
| [3] | Pinion shaft | [31] | Key | [114] | Multi-tang washer | [533] | Shim |
| [4] | Gearwheel | [37] | Roller bearing | [116] | Thread locker | [534] | Shim |
| [5] | Pinion shaft | [39] | Circlip | [119] | Spacer tube | [535] | Shim |
| [6] | Gearwheel | [42] | Roller bearing | [131] | Closing cap | [536] | Shim |
| [7] | Output shaft | [43] | Key | [132] | Circlip | [537] | Shim |
| [8] | Key | [45] | Roller bearing | [133] | Supporting ring | [538] | Shim |
| [9] | Oil seal | [59] | Screw plug | [135] | Nilos ring | [542] | Shim |
| [11] | Roller bearing | [83] | Nilos ring | [161] | Closing cap | [543] | Shim |
| [12] | Circlip | [84] | Nilos ring | [506] | Shim | [544] | Shim |
| [17] | Spacer tube | [88] | Circlip | [507] | Shim | | |
| [19] | Key | [89] | Closing cap | [508] | Shim | | |
| [20] | Breather valve | [100] | Gear cover plate | [521] | Shim | | |
| [22] | Gear unit housing | [101] | Hex head screw | [521] | Shim | | |

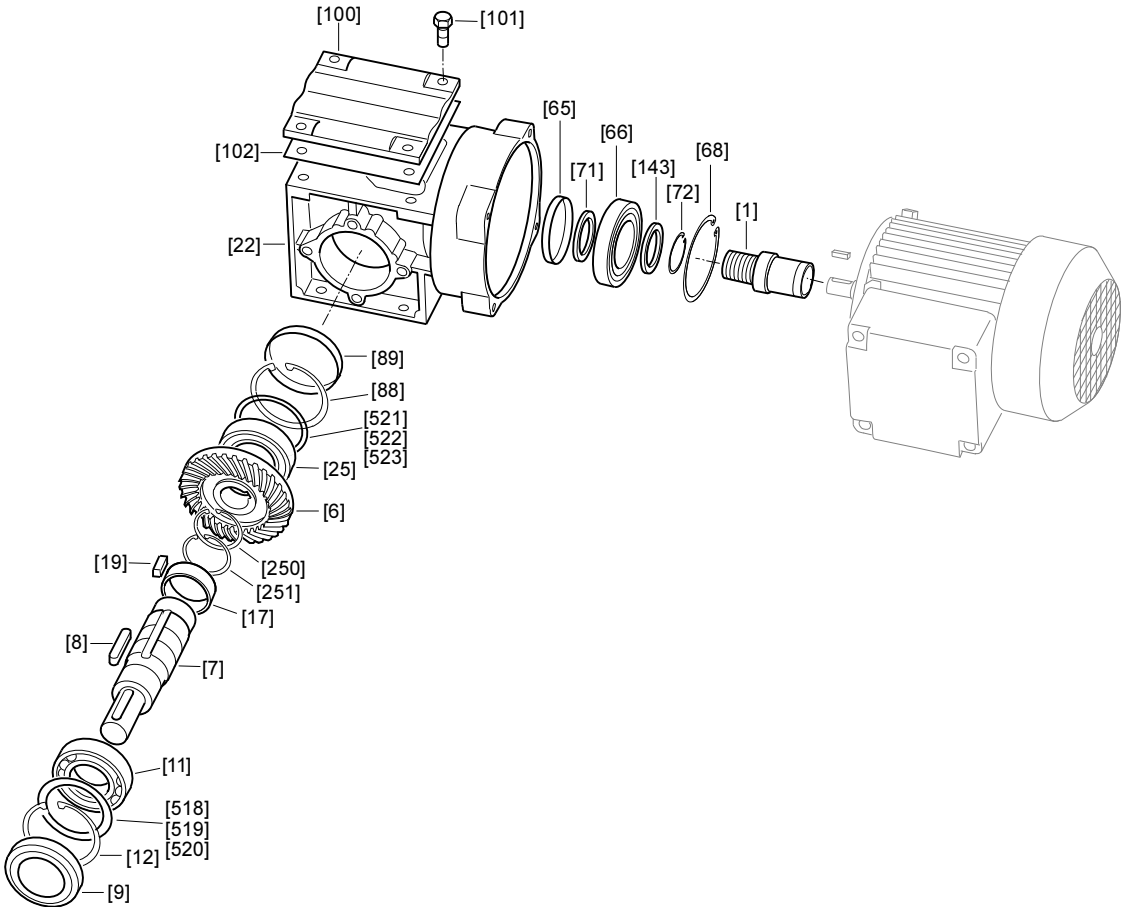
## 3.4 Basic structure of helical-worm gear units




19304203

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [20] | Breather valve | [88] | Circlip | [518] | Shim |
| [2] | Gearwheel | [22] | Gear unit housing | [89] | Closing cap | [519] | Shim |
| [5] | Worm | [25] | Roller bearing | [100] | Gear cover plate | [520] | Shim |
| [6] | Worm gear | [30] | Roller bearing | [101] | Hex head screw | [521] | Shim |
| [7] | Output shaft | [37] | Roller bearing | [102] | Seal | [522] | Shim |
| [9] | Oil seal | [39] | Circlip | [131] | Closing cap | [523] | Shim |
| [11] | Roller bearing | [43] | Key | [137] | Supporting ring | | |
| [12] | Circlip | [59] | Screw plug | [506] | Shim | | |
| [19] | Key | [61] | Circlip | [507] | Shim | | |

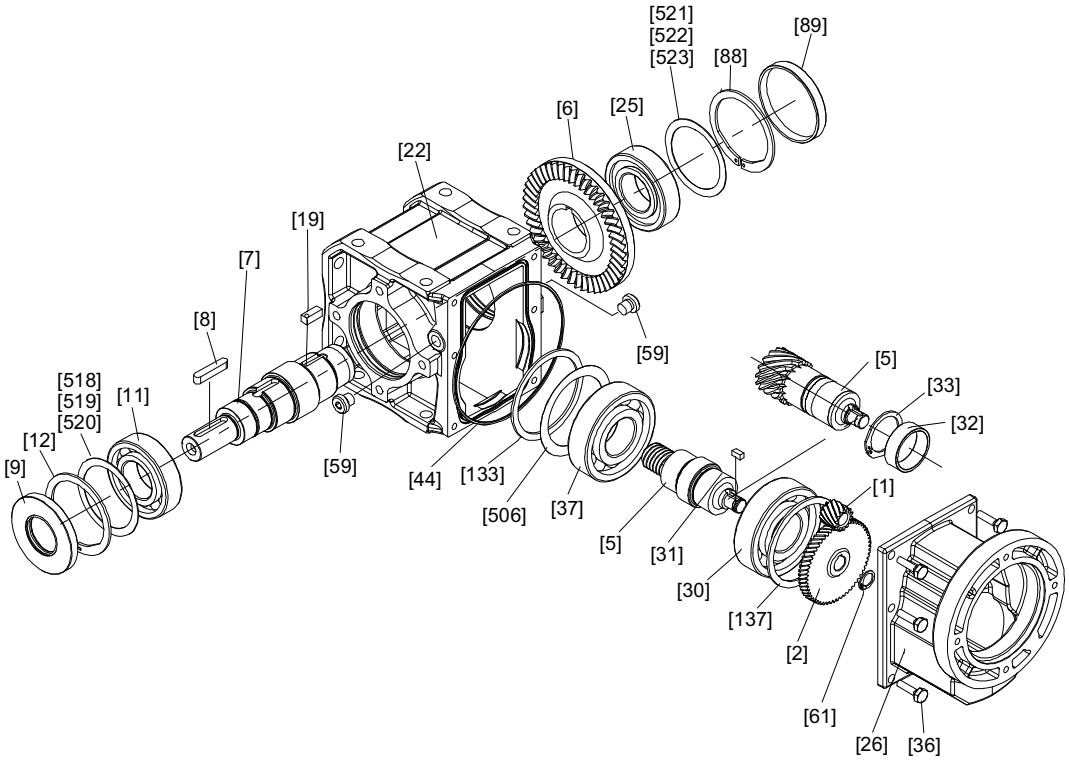
## 3.5 Basic structure of SPIROPLAN® W10-W30 gear units




19307275

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [19] | Key | [88] | Circlip | [251] | Circlip |
| [6] | Gearwheel | [22] | Gear unit housing | [89] | Closing cap | [518] | Shim |
| [7] | Output shaft | [25] | Roller bearing | [100] | Gear cover plate | [519] | Shim |
| [8] | Key | [65] | Oil seal | [101] | Hex head screw | [520] | Shim |
| [9] | Oil seal | [66] | Roller bearing | [102] | Seal | [521] | Shim |
| [11] | Roller bearing | [71] | Supporting ring | [132] | Circlip | [522] | Shim |
| [12] | Circlip | [72] | Circlip | [183] | Oil seal | [523] | Shim |
| [17] | Spacer tube | [143] | Supporting ring | [250] | Circlip | | |

## 3.6 Basic structure of SPIROPLAN® W37 gear units



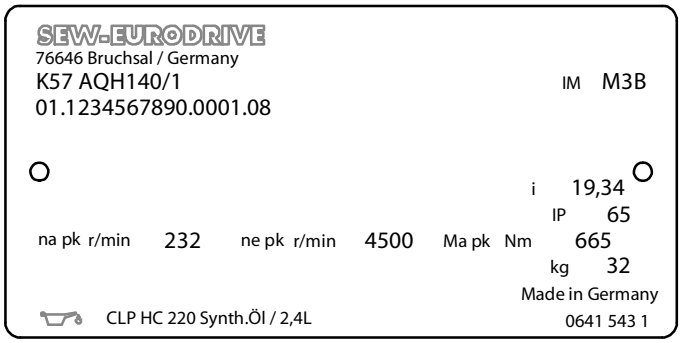

605872395

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [1] | Pinion | [22] | Gear unit housing | [44] | O-ring | [137] | Shim |
| [2] | Wheel | [24] | Eyebolt | [59] | Screw plug | [150] | Hex nut |
| [5] | Pinion shaft | [25] | Grooved ball bearing | [61] | Retaining ring | [183] | Oil seal |
| [6] | Wheel | [26] | Housing stage 1 | [68] | Retaining ring | [506] | Shim |
| [7] | Output shaft | [30] | Grooved ball bearing | [72] | Retaining ring | [518] | Shim |
| [8] | Key | [31] | Key | [80] | Key | [519] | Shim |
| [9] | Oil seal | [32] | Spacer tube | [88] | Retaining ring | [520] | Shim |
| [11] | Grooved ball bearing | [33] | Retaining ring | [89] | Closing cap | [521] | Shim |
| [12] | Retaining ring | [36] | Hex head screw | [106] | Stud | [522] | Shim |
| [19] | Key | [37] | Grooved ball bearing | [133] | Shim | [523] | Shim |

## 3.7 Nameplate/unit designation

### 3.7.1 Nameplate

The following figure shows an example of a nameplate for a helical-bevel gear unit with AQ adapter:

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| | | |
|---|---|---|
| i | | Gear unit reduction ratio |
| IM | | Mounting position |
| IP | | Degree of protection |
| $n_{epk}$ | [rpm] | Maximum permitted input speed |
| $n_{apk}$ | [rpm] | Maximum permitted output speed |
| $M_{apk}$ | [Nm] | Maximum permitted output torque |

### 3.7.2 Type designation

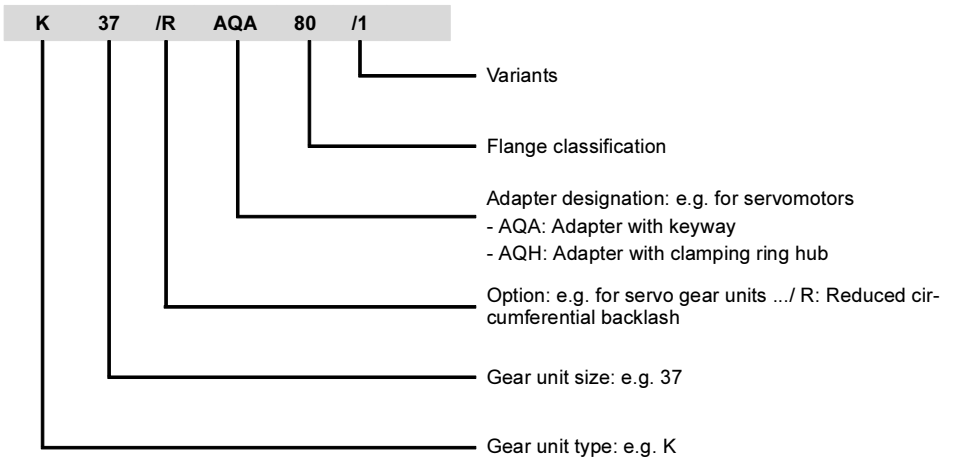
**INFORMATION**

For a detailed overview of unit designations and additional information, refer to the following publications:

- "Gear Units" catalog or
- "Gearmotors" catalog

*Example: Helical-bevel gear unit*

A helical-bevel gear unit with adapter has, for example, the following unit designation:



# 4 Mechanical Installation

## *4.1 Required tools/resources*

- Set of wrenches
- Torque wrench for:
  - Shrink disks
  - AQH motor adapter
  - Input shaft assembly with centering shoulder
- Mounting device
- Compensation elements (shims, spacing rings)
- Fasteners for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt locking compound (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not included in the delivery

### 4.1.1 Installation tolerances

| Shaft end | Flanges |
|---|---|
| Diameter tolerance in accordance with DIN 748<br>• ISO k6 for solid shafts with Ø ≤ 50 mm<br>• ISO m6 for solid shafts with Ø > 50 mm<br>• ISO H7 for hollow shafts<br>• Center bore in accordance with DIN 332, shape DR | Centering shoulder tolerance to DIN 42948<br>• ISO j6 for b1 ≤ 230 mm<br>• ISO h6 with b1 > 230 mm |

## 4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The entries on the nameplate of the gearmotor match the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:

  **For standard gear units:**

  – Ambient temperature according to the technical documentation, nameplate and lubricant table in section "Lubricants" (page 111).

  – No harmful oils, acids, gases, vapors, radiation etc. in the vicinity

  **For special versions:**

  – The drive is designed in accordance with the ambient conditions. Refer to the information on the nameplate.

  **For helical-worm/SPIROPLAN® W gear units:**

  – No large external mass moments of inertia which could exert a retrodriving load on the gear unit.

    [for η' (retrodriving) = 2 – 1/η < 0.5 self-locking]

- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not expose the sealing lips of the oil seals to the solvent – damage to the material.
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

## 4.3 Installing the gear unit

**⚠ NOTICE**

Improper assembly may result in damages to the gear unit/gearmotor.

Possible damage to property.

- Do closely observe the notes in this chapter.

- Work on the gear unit only when the machine is not in use. Secure the drive unit against unintentional power-up.
- Protect the gear unit from direct cold air currents. Condensation may cause water to accumulate in the oil.

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. Refer to the information on the nameplate. SPIROPLAN® gear units of sizes W10-W30 do not depend on a particular mounting position.

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

The maximum permitted flatness error for foot and flange mounting (guide values with reference to DIN ISO 1101):

- Gear unit size ≤ 67: Max. 0.4 mm
- Gear unit size 77 – 107: Max. 0.5 mm
- Gear unit size 137 – 147: Max. 0.7 mm
- Gear unit size 157 – 187: Max. 0.8 mm

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads! Observe chapter "Project Planning" in the Gear unit/gearmotor catalog for calculating the permitted overhung and axial loads.

Secure gearmotors using quality 8.8 screws.

Secure the following gearmotors using quality 10.9 screws:

- RF37, R37F with flange Ø = 120 mm
- RF47, R47F with flange Ø = 140 mm
- RF57, R57F with flange Ø = 160 mm
- and RZ37, RZ47, RZ57, RZ67, RZ77, RZ87

**INFORMATION**

When installing the gear unit, make sure that the oil level and drain plugs as well as the breather plugs are easily accessible!

At the same time, also check that the oil fill corresponds to the specifications for the intended mounting position (see section "Lubricant fill quantities" (page 113) or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

**If you change the mounting position, make sure that you change the lubricant fill quantities and the position of the breather valve accordingly.** Observe section"Lubricant fill quantities" (page 113) and chapter "Mounting Positions" (page 82).

Consult the SEW customer service if you intend to change the mounting position of K gear units to or between M5 and M6.

Consult the SEW customer service if you intend to change the mounting position of S gear units sizes S47 ... S97, to M2 and M3.

In case there is a risk of electrochemical corrosion between the gear unit and the driven machine, use plastic inserts that are 2 to 3 mm thick. The material used must have an electrical leakage resistance < $10^9$ Ω. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also fit the bolts with plastic washers. Ground the housing additionally – use the grounding bolts on the motor.

### 4.3.1 Tightening torques for retaining screws

Mount the gearmotors with the following tightening torques:

| Screw/nut | Tightening torque screw / nut Strength class 8.8 [Nm] |
|---|---|
| **M6** | 11 |
| **M8** | 25 |
| **M10** | 48 |
| **M12** | 86 |
| **M16** | 210 |
| **M20** | 410 |
| **M24** | 710 |
| **M30** | 1450 |
| **M36** | 2500 |
| **M42** | 4600 |
| **M48** | 6950 |
| **M56** | 11100 |

Mount the helical gearmotors in flange-mounted design with the following increased tightening torques:

| Flange | Gear unit | Screw/nut | Tightening torque screw / nut Strength class 10.9 [Nm] |
|---|---|---|---|
| **120** | RF37 | M6 | 14 |
| **140** | RF47 | M8 | 35 |
| **160** | RF57 | M8 | 35 |
| **60ZR** | RZ37 | M8 | 35 |
| **70ZR** | RZ47 | M8 | 35 |
| **80ZR** | RZ57 | M10 | 69 |
| **95ZR** | RZ67 | M10 | 69 |
| **110ZR** | RZ77 | M12 | 120 |
| **130ZR** | RZ87 | M12 | 120 |

### 4.3.2 Mounting the gear units

*Foot-mounted gear unit*

The following table shows the thread sizes of the gear units in foot-mounted design depending on the gear unit type and size:

| Screw | Gear unit type | | | | | |
|---|---|---|---|---|---|---|
| | R / R..F | RX | F / FH..B / FA..B | K / KH..B / KV..B / KA..B | S | W |
| M6 | 07 | | | | | 10/20 |
| M8 | 17/27/37 | | 27/37 | | 37 | 30/37/47 |
| M10 | | 57 | 47 | 37/47 | 47/57 | |
| M12 | 47/57/67 | 67 | 57/67 | 57/67 | 67 | |
| M16 | 77/87 | 77/87 | 77/87 | 77 | 77 | |
| M20 | 97 | 97/107 | 97 | 87 | 87 | |
| M24 | 107 | | 107 | 97 | 97 | |
| M30 | 137 | | 127 | 107/167 | | |
| M36 | 147/167 | | 157 | 127/157/187 | | |

*Gear unit with B14 flange and/or hollow shaft*

The following table shows the thread sizes of the gear units with B14 flange and/or hollow shaft depending on the gear unit type and size:

| Screw | Gear unit type | | | | |
|---|---|---|---|---|---|
| | RZ | FAZ / FHZ | KAZ / KHZ / KVZ | SA / SAZ / SHZ | WA |
| M6 | 07/17/27 | | | 37 | 10/20/30 |
| M8 | 37/47 | 27/37/47 | 37/47 | 47/57 | 37 |
| M10 | 57/67 | | | | 47 |
| M12 | 77/87 | 57/67/77 | 57/67/77 | 67/77 | |
| M16 | | 87/97 | 87/97 | 87/97 | |
| M20 | | 107/127 | 107/127 | | |
| M24 | | 157 | 157 | | |

*Gear unit with B5 flange*

The following table shows the thread sizes of the gear units with B5 flange depending on the gear unit type,size and flange diameter:

| Flange Ø [mm] | Screw | Gear unit type | | | | |
|---|---|---|---|---|---|---|
| | | RF / R..F / RM | FF / FAF / FHF | KF / KAF / KHF / KVF | SF / SAF /SHF | WF / WAF |
| 80 | M6 | | | | | 10 |
| 110 | M8 | | | | | 20 |
| 120 | M6 | 07/17/27 | | | 37 | 10/20/30/37 |
| 140 | M8 | 07/17/27 | | | | |
| 160 | M8 | 07/17/27/37/47 | 27/37 | 37 | 37/47 | 30/37/47 |
| 200 | M10 | 37/47/57/67 | 47 | 47 | 57/67 | |
| 250 | M12 | 57/67/77/87 | 57/67 | 57/67 | 77 | |
| 300 | M12 | 67/77/87 | 77 | 77 | | |
| 350 | M16 | 77/87/97/107 | 87 | 87 | 87 | |
| 450 | M16 | 97/107/137/147 | 97/107 | 97/107 | 97 | |
| 550 | M16 | 107/137/147/167 | 127 | 127 | | |
| 660 | M20 | 147/167 | 157 | 157 | | |

### 4.3.3 Installation in damp locations or in the open

Drives are supplied in corrosion-resistant versions with an according surface protection coating for use in damp areas or outdoors. Repair any damage to the paint work (e.g. on the breather valve or the eyebolts).

When mounting the motors onto AM, AQ, AR, AT adapters and to start-up and friction couplings, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.

Units installed outdoors must be protected from the sun. Suitable protective devices are required, such as covers or roofs. Avoid any heat accumulation. The operator must ensure that foreign objects do not impair the function of the gear unit (e.g., by falling objects or coverings).

### 4.3.4 Breather

The following gear units do not require a breather:

- R07 in mounting positions M1, M2, M3, M5 and M6
- R17, R27 and F27 in mounting positions M1, M3, M5 and M6
- SPIROPLAN® W10, W20, W30 gear units
- SPIROPLAN® W37 and W47 gear units in mounting positions M1, M2, M3, M5, M6

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

**Exceptions:**

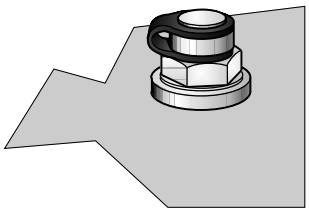
1. SEW supplies the following gear units with a screw plug on the vent hole provided:
   - Pivoted mounting positions, if possible
   - Gear units for mounting on a slant

   The breather valve is located in the motor terminal box. Before startup, you must replace the highest screw plug with the provided breather valve.
2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

*Activating the breather valve*

Check whether the breather valve is activated. If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture



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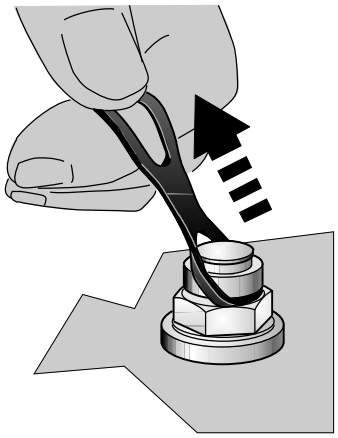
2. Removing the transport fixture



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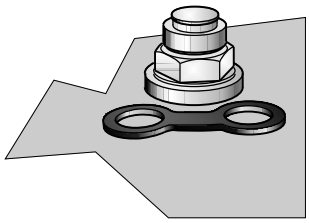
3. Activated breather valve



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#### 4.3.5 Painting the gear unit

**⚠ NOTICE**

Breather valves and oil seals may be damaged during painting or re-painting.

Potential damage to property.

- Thoroughly cover the breather valves and the sealing lip of the oil seals with strips prior to painting.
- Remove the strips after painting.

## *4.4 Gear units with solid shaft*

#### 4.4.1 Assembling input and output elements

**⚠ NOTICE**

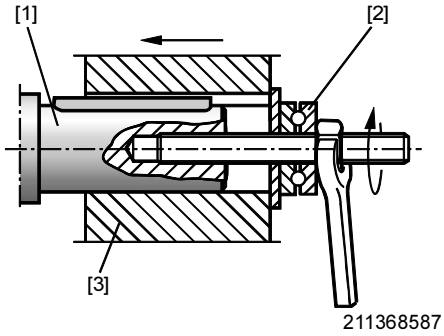
Bearing, hosing or shaft may be damaged due to improper assembly.

Possible damage to property

- Only assemble the input and output components with a mounting device. Use the center bore and the thread on the shaft end for positioning.
- Never force belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer.
- In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotors" or "Explosion-Proof Drives" catalog for permitted values).

*Using a mounting device*

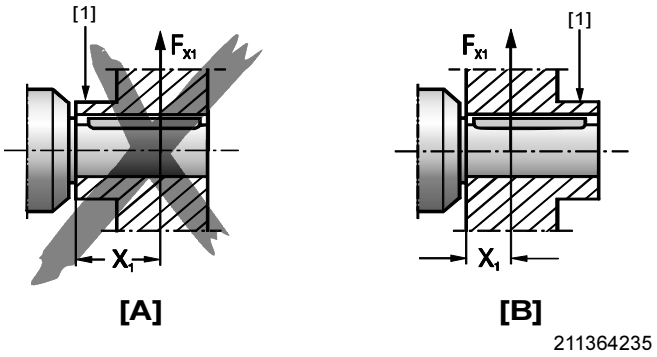
The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. Should you be able to tighten the screw without any problems, you may not need the thrust bearing on the mounting device.




[1] Gear shaft end
[2] Thrust bearing
[3] Coupling hub

*Avoiding excessive overhung loads*

Avoid high overhung loads by: Installing the gear or chain sprocket according to figure **B** if possible.




[1] Hub
[A] unfavorable
[B] correct

**INFORMATION**

Mounting is easier if you first apply lubricant to the output element or heat it up briefly (to 80 - 100 °C).

### 4.4.2 Mounting of couplings

**⚠ CAUTION**

Input and output components such as belt pulleys, couplings etc. are in fast motion during operation.

Risk of jamming and crushing.

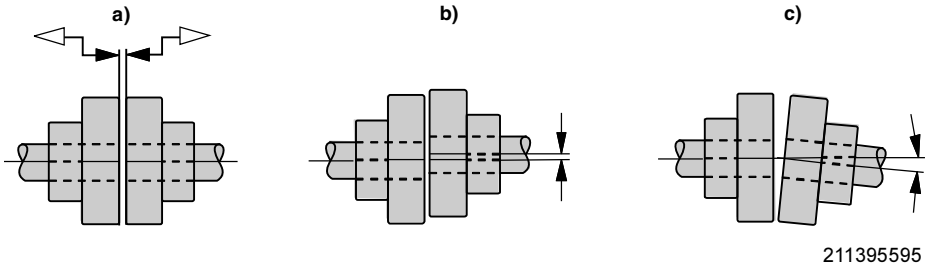
- Cover input and output components with a touch guard.

Adjust the following misalignments according to the coupling manufacturer's specifications when mounting couplings.

a) Maximum and minimum clearance

b) Axial offset

c) Angular offset



## 4.5 Torque arms for shaft-mounted gear units

**NOTICE**

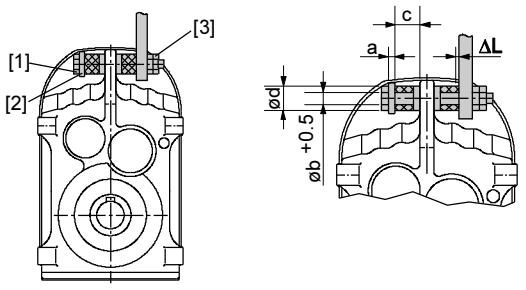
Improper assembling may result in damages to the gear unit.

Possible damage to property

- Do not place torque arms under strain during installation.
- Use bolts of quality 8.8 to fasten torque arms.

### 4.5.1 Parallel shaft helical gear units

The following figure shows the toque arm for parallel shaft helical gear units.




9007199466107403

[1] Screw
[2] Washer
[3] Nut

Proceed as follows to mount the rubber buffers:

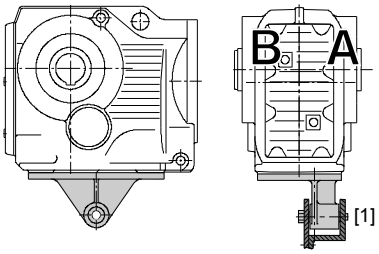
1. Use screws [1] and washers according to the following table.
2. Use two nuts to secure the screw connection [3].
3. Tighten the screw until the initial stress "Δ L" of the buffers is reached according to the table.

| Gear unit | rubber buffer | | | Washer width | Δ L (taut) |
|---|---|---|---|---|---|
| | Diameter | Internal diameter | Length (loose) | | |
| | d [mm] | b [mm] | c [mm] | a [mm] | [mm] |
| FA27 | 40 | 12.5 | 20 | 5 | 1 |
| FA37 | 40 | 12.5 | 20 | 5 | 1 |
| FA47 | 40 | 12.5 | 20 | 5 | 1.5 |
| FA57 | 40 | 12.5 | 20 | 5 | 1.5 |
| FA67 | 40 | 12.5 | 20 | 5 | 1.5 |
| FA77 | 60 | 21.0 | 30 | 10 | 1.5 |
| FA87 | 60 | 21.0 | 30 | 10 | 1.5 |
| FA97 | 80 | 25.0 | 40 | 12 | 2 |
| FA107 | 80 | 25.0 | 40 | 12 | 2 |
| FA127 | 100 | 32.0 | 60 | 15 | 3 |
| FA157 | 120 | 32.0 | 60 | 15 | 3 |

### 4.5.2 Helical-bevel gear units

The following figure shows the toque arm for helical-bevel gear units.

- Bushing [1] with bearings on both ends.
- Install connection end B as a mirror image of A.



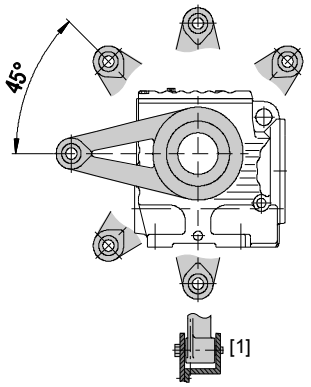

211362059

| Gear unit | bolts | Tightening torque |
|---|---|---|
| KA37 | 4 × M10 × 25 – 8.8 | 48 Nm |
| KA47 | 4 × M10 × 30 – 8.8 | 48 Nm |
| KA67 | 4 × M12 × 35 – 8.8 | 86 Nm |
| KA77 | 4 × M16 × 40 – 8.8 | 210 Nm |
| KA87 | 4 × M16 × 45 – 8.8 | 210 Nm |
| KA97 | 4 × M20 × 50 – 8.8 | 410 Nm |
| KA107 | 4 × M24 × 60 – 8.8 | 710 Nm |
| KA127 | 4 × M36 × 130 – 8.8 | 2500 Nm |
| KA157 | 4 × M36 × 130 – 8.8 | 2500 Nm |

### 4.5.3 Helical worm gear units

The following figure shows the toque arm for helical-worm gear units.

- Bushing [1] with bearings on both ends.



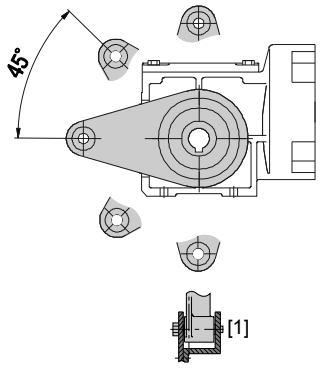

211491723

| Gear unit | bolts | Tightening torque |
|---|---|---|
| SA37 | 4 x M6 × 16 – 8.8 | 11 Nm |
| SA47 | 4 x M8 × 20 – 8.8 | 25 Nm |
| SA57 | 6 x M8 × 20 – 8.8 | 25 Nm |
| SA67 | 8 x M12 × 25 – 8.8 | 86 Nm |
| SA77 | 8 x M12 × 35 – 8.8 | 86 Nm |
| SA87 | 8 x M16 × 35 – 8.8 | 210 Nm |
| SA97 | 8 x M16 × 35 – 8.8 | 210 Nm |

### 4.5.4 SPIROPLAN®W gear units

The following figure shows the toque arm for SPIROPLAN® W gear units.

- Bushing [1] with bearings on both ends.




211489547

| Gear unit | bolts | Tightening torque Nm |
|---|---|---|
| WA10 | 4 x M6 × 16 - 8.8 | 11 |
| WA20 | 4 x M6 × 16 - 8.8 | 11 |
| WA30 | 4 x M6 × 16 - 10.9 | 15 |
| WA37 | 4 x M8 × 20 - 10.9 | 35 |
| WA47 | 4 x M10 × 25 - 10.9 | 70 |

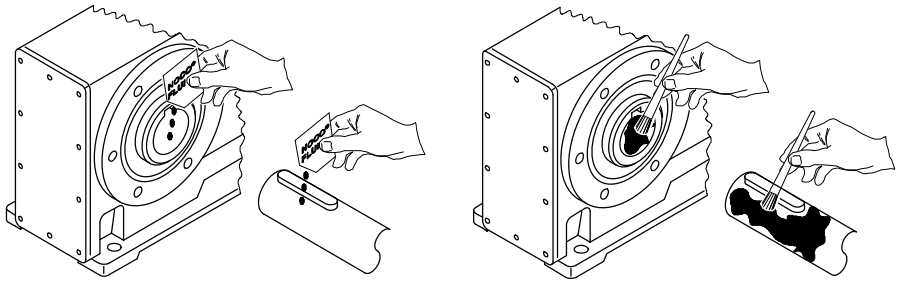
## 4.6 Shaft-mounted gear units with keyway or splined hollow shaft

**INFORMATION**

Concerning the configuration of the customer shaft, please also refer to the design notes in the Gearmotors catalog.

### 4.6.1 Assembly notes

1. Apply and thoroughly spread NOCO® Fluid



211516171

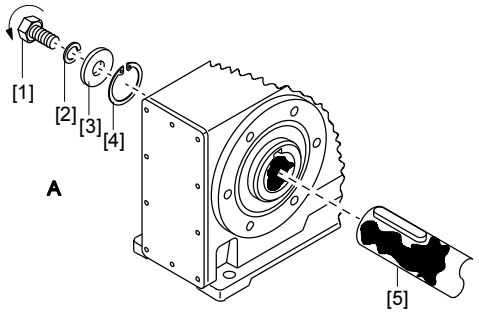
2. Install the shaft and secure it axially

   (mounting is facilitated by using a mounting device)

   The three mounting types are described below:

   - 2A: Standard scope of delivery
   - 2B: installation and removal kit for customer shaft with contact shoulder
   - 2C: installation and removal kit for customer shaft without contact shoulder

**2A: Installation with standard scope of delivery**

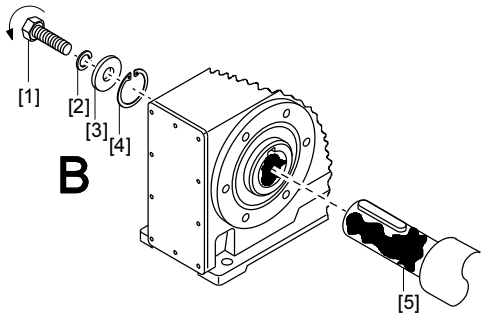



211518347

[1] Short retaining bolt (standard delivery scope)
[2] Lock washer
[3] Washer
[4] Retaining ring
[5] Customer shaft

2B: Installation with SEW-EURODRIVE installation and removal kit (page 35)

– customer shaft **with** contact shoulder

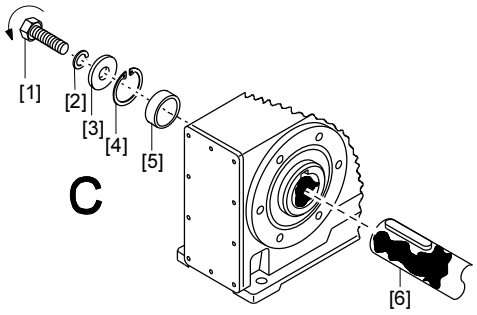



211520523

[1] Retaining screw
[2] Lock washer
[3] Washer
[4] Retaining ring
[5] Customer shaft with contact shoulder

2C: Installation with SEW-EURODRIVE installation and removal kit (page 35)

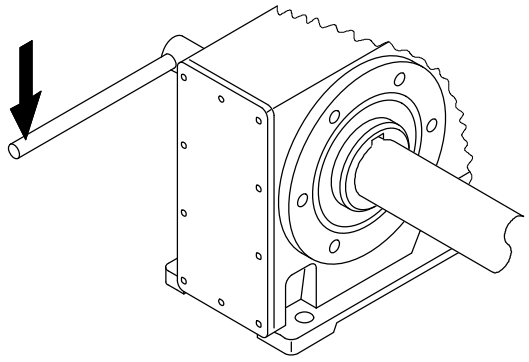
– customer shaft **without** contact shoulder




211522699

[1] Retaining screw
[2] Lock washer
[3] Washer
[4] Retaining ring
[5] Spacer tube
[6] Customer shaft without contact shoulder

3. Tighten the retaining screw to the appropriate torque (see table).



211524875

| Screw | Tightening torque [Nm] |
|---|---|
| M5 | 5 |
| M6 | 8 |
| M10/12 | 20 |
| M16 | 40 |
| M20 | 80 |
| M24 | 200 |

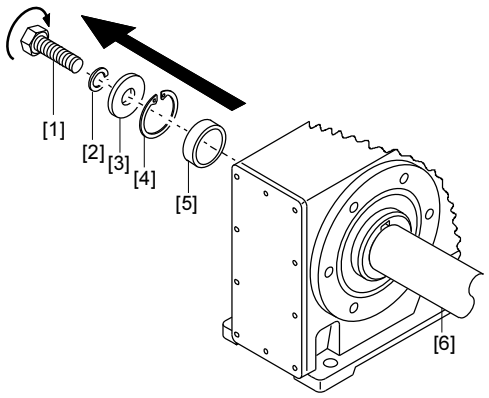
**INFORMATION**

To avoid contact corrosion, we recommend that the customer shaft should additionally be lathed down between the 2 contact surfaces.

### 4.6.2 Removal notes

This description is only applicable when the gear unit was assembled using the installation and removal kit (page 35) from SEW-EURODRIVE. Observe section "Installation notes (page 30)", 2B or 2C.

1. Loosen the retaining screw [1].
2. Remove parts [2] to [4] and, if applicable, the distance piece [5].

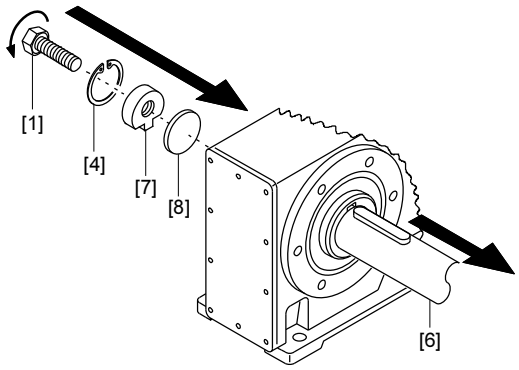



211527051

[1] Retaining screw
[2] Lock washer
[3] Washer
[4] Retaining ring
[5] Spacer tube
[6] Customer shaft

3. Insert the forcing disk [8] and the fixed nut [7] from the SEW-EURODRIVE installation/removal kit between the customer shaft [6] and the retaining ring [4].
4. Re-install the retaining ring [4].

5. Screw the retaining screw [1] back in. Now you can force the gear unit off the shaft by tightening the bolt.

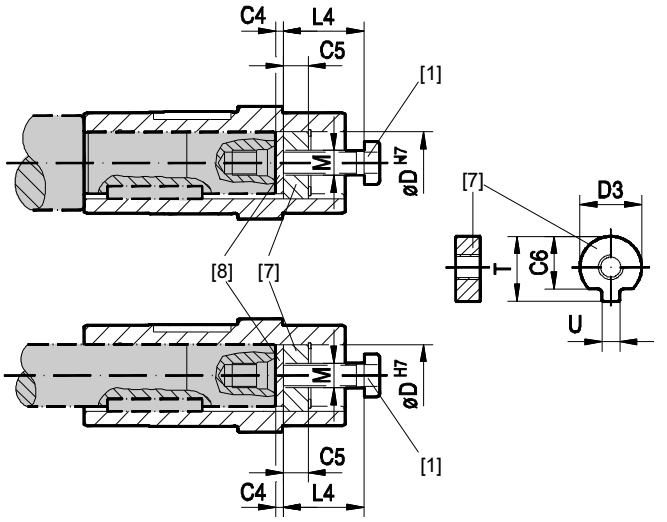



211529227

[1] Retaining screw
[4] Retaining ring
[6] Customer shaft
[7] Fixed nut
[8] Forcing disk

### 4.6.3 SEW installation and removal kit

The SEW-EURODRIVE installation/removal kit can be ordered by quoting the specified part number.




211531403

[1] Retaining screw
Fixed nut for disassembly [7]
[8] Forcing disk

| Type | $D^{H7}$ [mm] | M[1)] | C4 [mm] | C5 [mm] | C6 [mm] | $U^{-0.5}$ [mm] | $T^{-0.5}$ [mm] | $D3^{-0.5}$ [mm] | L4 [mm] | Part number of the installation/ removal kit |
|---|---|---|---|---|---|---|---|---|---|---|
| **WA..10** | 16 | M5 | 5 | 5 | 12 | 4.5 | 18 | 15.7 | 50 | 643 712 5 |
| **WA..20** | 18 | M6 | 5 | 6 | 13.5 | 5.5 | 20.5 | 17.7 | 25 | 643 682 X |
| **WA..20, WA..30, SA..37, WA..37** | 20 | M6 | 5 | 6 | 15.5 | 5.5 | 22.5 | 19.7 | 25 | 643 683 8 |
| **FA..27, SA..47, WA..47** | 25 | M10 | 5 | 10 | 20 | 7.5 | 28 | 24.7 | 35 | 643 684 6 |
| **FA..37, KA..37, SA..47, SA..57, WA..47** | 30 | M10 | 5 | 10 | 25 | 7.5 | 33 | 29.7 | 35 | 643 685 4 |
| **FA..47, KA..47, SA..57** | 35 | M12 | 5 | 12 | 29 | 9.5 | 38 | 34.7 | 45 | 643 686 2 |
| **FA..57, KA..57, FA..67, KA..67, SA..67** | 40 | M16 | 5 | 12 | 34 | 11.5 | 41.9 | 39.7 | 50 | 643 687 0 |
| **SA..67** | 45 | M16 | 5 | 12 | 38.5 | 13.5 | 48.5 | 44.7 | 50 | 643 688 9 |
| **FA..77, KA..77, SA..77** | 50 | M16 | 5 | 12 | 43.5 | 13.5 | 53.5 | 49.7 | 50 | 643 689 7 |
| **FA..87, KA..87, SA..77, SA..87** | 60 | M20 | 5 | 16 | 56 | 17.5 | 64 | 59.7 | 60 | 643 690 0 |
| **FA..97, KA..97, SA..87, SA..97** | 70 | M20 | 5 | 16 | 65.5 | 19.5 | 74.5 | 69.7 | 60 | 643 691 9 |
| **FA..107, KA..107, SA..97** | 90 | M24 | 5 | 20 | 80 | 24.5 | 95 | 89.7 | 70 | 643 692 7 |
| **FA..127, KA..127** | 100 | M24 | 5 | 20 | 89 | 27.5 | 106 | 99.7 | 70 | 643 693 5 |
| **FA..157, KA..157** | 120 | M24 | 5 | 20 | 107 | 31 | 127 | 119.7 | 70 | 643 694 3 |

1) Retaining screw

### INFORMATION

The SEW installation kit for attaching the customer shaft is a recommendation by SEW-EURODRIVE. You must always check whether this design can compensate the axial loads. In particular applications (e.g. mounting mixer shafts), a different design may have to be used to secure the shaft axially. In these cases, customers can use their own devices. However, you must ensure that these designs do not cause potential sources of combustion according to DIN EN 13463 (for example, impact sparks).

## 4.7 Shaft-mounted gear units with shrink disk

### 4.7.1 Assembly notes

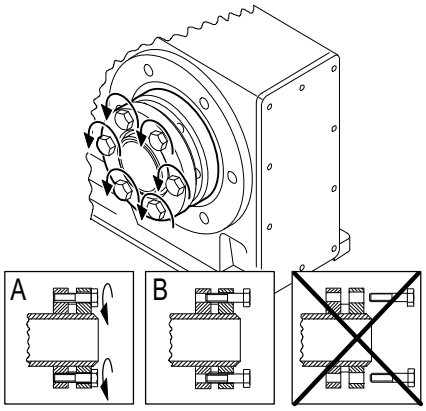
**NOTICE**

Tightening the screws without installed shaft may result in the hollow shaft being deformed.

Possible damage to property

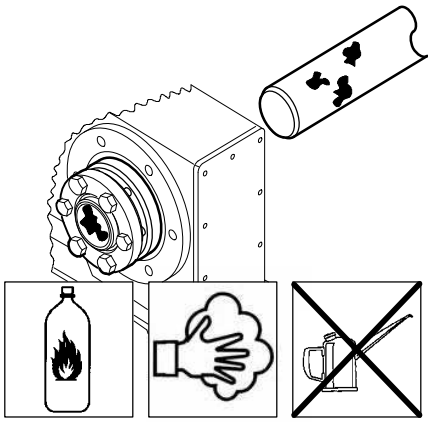
- Only tighten the locking screws with the shaft installed.

1. Loosen the locking screws by a few turns (do not unscrew them completely).



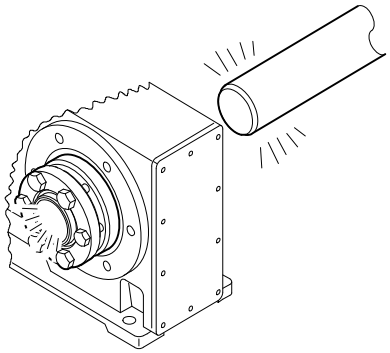

211533579

2. Carefully degrease the hollow shaft hole and the input shaft using a commercial solvent.



211535755

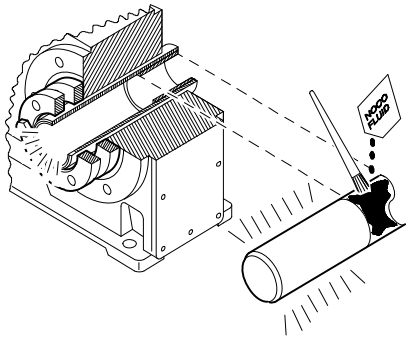
3. Hollow shaft/input shaft after degreasing.



211537931

4. Apply NOCO® fluid to the input shaft in the area of the bushing.

   It is essential to make sure that the clamping area of the shrink disk is free from grease. As a result, never apply NOCO® Fluid directly to the bush. This is because the paste may be able to get into the clamping area of the shrink disk when the input shaft is put on.

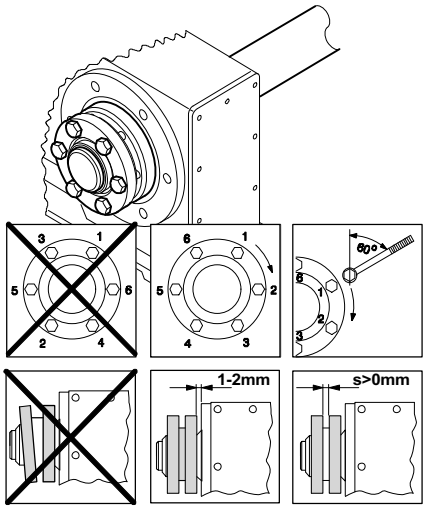



211540107

5. Install the input shaft.
   - Make sure that the locking collars of the shrink disk are installed in parallel to each other.
   - For gear unit housings with shaft shoulder:

     Mount the shrink disk onto the stop on the shaft shoulder.
   - For gear unit housings without shaft shoulder:

     Install the shrink disk with a 1 to 2 mm distance from the gear unit housing.
   - Tighten the locking screws by working round with the torque wrench several times from one screw to the next (not in diametrically opposite sequence). For tightening torques, refer to the following table.




211542283

6. After the installation, make sure the remaining gap between the outer rings is > 0 mm.
7. Grease the the area around the shrink disk outside of the hollow shaft to prevent corrosion.

| Gear unit type | | | | Screw | Nm | max.[1] |
|---|---|---|---|---|---|---|
| | | SH37 | WH37 | M5 | 5 | |
| KH37...77 | FH37...77 | SH47...77 | WH47 | M6 | 12 | |
| KH87/97 | FH87/97 | SH87/97 | | M8 | 30 | |
| KH107 | FH107 | | | M10 | 59 | 60° |
| KH127/157 | FH127/157 | | | M12 | 100 | |
| KH167 | | | | M16 | 250 | |
| KH187 | | | | M20 | 470 | |

1) Maximum tightening angle per rotation

### 4.7.2 Removal notes

**⚠ CAUTION**

Risk of jamming and crushing due to improper removal of heavy components.

Risk of injury.

- Observe the following removal notes.
- Removing the shrink disk properly.

1. Loosen the locking screws one after the other by a quarter rotation to avoid tilting the outer rings.
2. Unscrew the locking bolts evenly one after the other. Do not remove the locking screws completely.
3. Remove the shaft or pull the hub off the shaft. (remove any rust that may have formed between the hub and the end of the shaft beforehand).
4. Remove the shrink disk from the hub.

### 4.7.3 Cleaning and lubrication

There is no need to dismantle removed shrink disks before they are reinstalled.

Clean and lubricate the shrink disk if it is dirty.

Lubricate the tapered surfaces with one of the following solid lubricants:

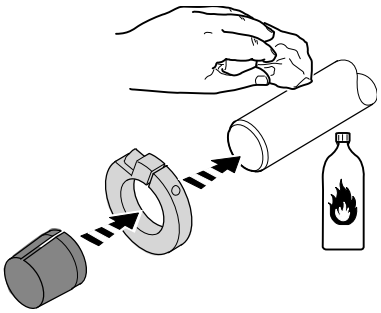
| Lubricant (Mo S2) | Sold as |
|---|---|
| Molykote 321 (lube coat) | Spray |
| Molykote spray (powder spray) | Spray |
| Molykote G Rapid | Spray or paste |
| Aemasol MO 19P | Spray or paste |
| Aemasol DIO-sétral 57 N (lube coat) | Spray |

Grease the locking screws with a multipurpose grease such as Molykote BR 2 or similar.

## 4.8 Shaft-mounted gear units with TorqLOC®

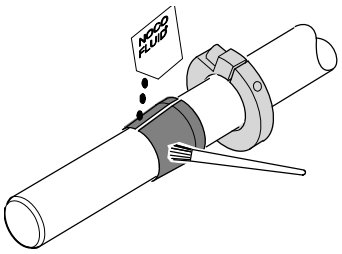
### 4.8.1 Assembly notes

1. Clean the customer shaft and the inside of the hollow shaft. Ensure that all traces of grease or oil are removed.
2. Install the stop ring and the bushing on the customer shaft.



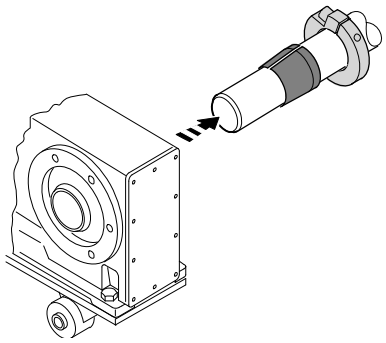
211941003

3. Apply and thoroughly spread NOCO® Fluid on the bushing.



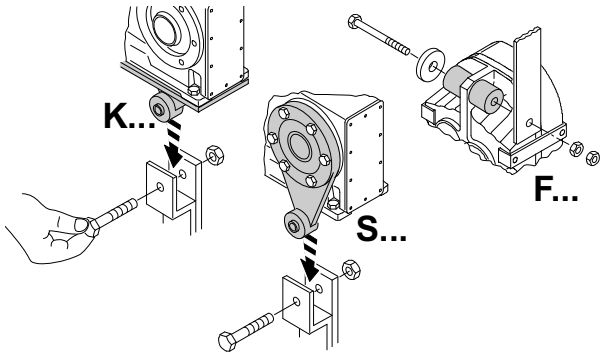

211938827

4. Push the gear unit onto the customer shaft.



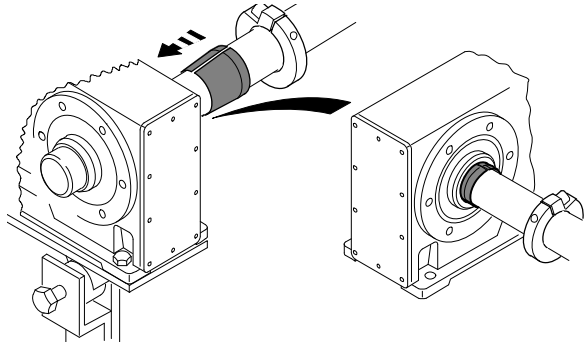
211936651

5. Preassemble the torque arm (do not tighten the screws).



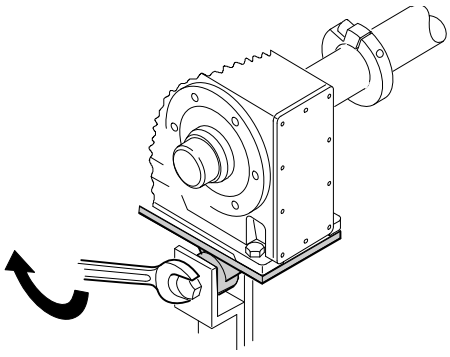

211943179

6. Push the busing onto the gear unit up to the stop.



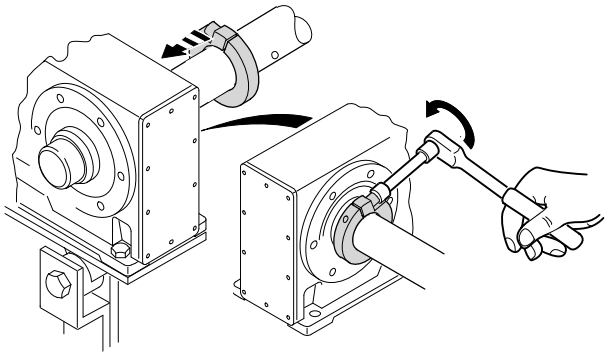
211945355

7. Tighten all the retaining screws of the torque arm.



211947531

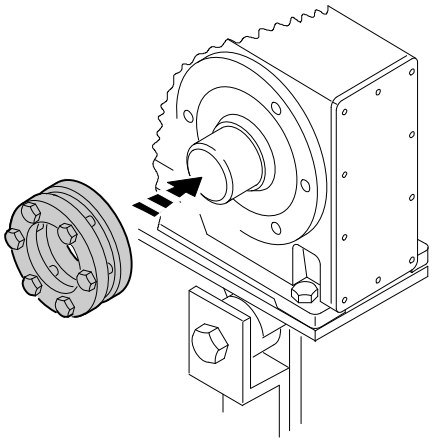
8. Secure the bushing with the split ring. Tighten the split ring on the bushing using the appropriate torque as specified in the following table:



212000907

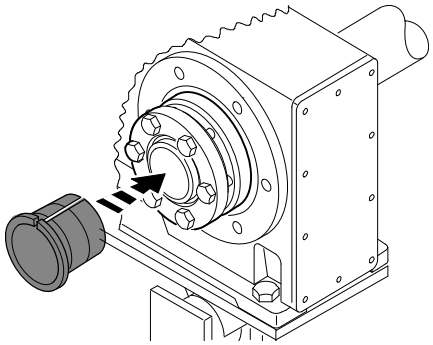
| Type | | nickel-plated [Standard] | Stainless steel |
|---|---|---|---|
| KT/FT | ST/WT | Torque [Nm] | |
| - | 37 | 18 | 7.5 |
| 37 | 47 | 18 | 7.5 |
| 47 | 57 | 18 | 7.5 |
| 57, 67 | 67 | 35 | 18 |
| 77 | 77 | 35 | 18 |
| 87 | 87 | 35 | 18 |
| 97 | 97 | 35 | 18 |
| 107 | – | 38 | 38 |
| 127 | – | 65 | 65 |
| 157 | – | 150 | 150 |

9. Make sure that all screws are loosened and slide the shrink disk onto the hollow shaft.



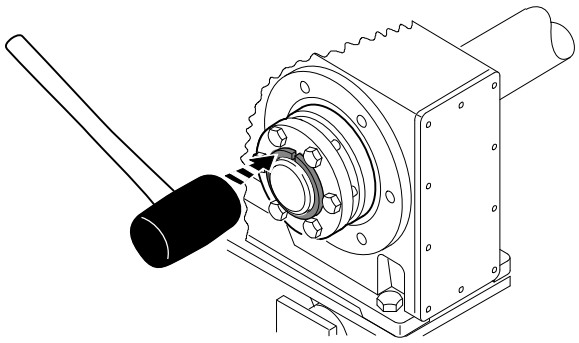
212003083

10. Slide the counter bushing onto the customer shaft and into the hollow shaft



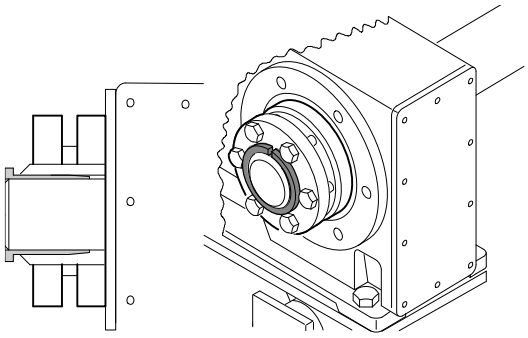
212005259

11. until the shrink disk is properly seated.
12. Tap lightly on the flange of the counter bushing to ensure that the socket is fitted securely in the hollow shaft.



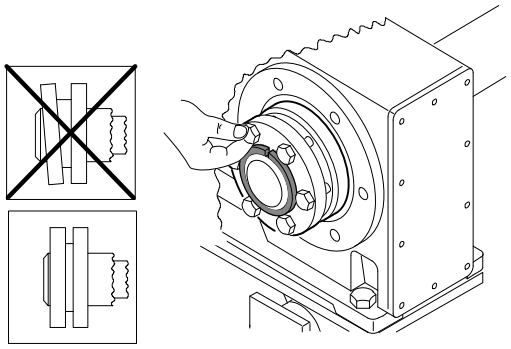
212007435

13. Make sure that the customer shaft is seated in the counter bushing.



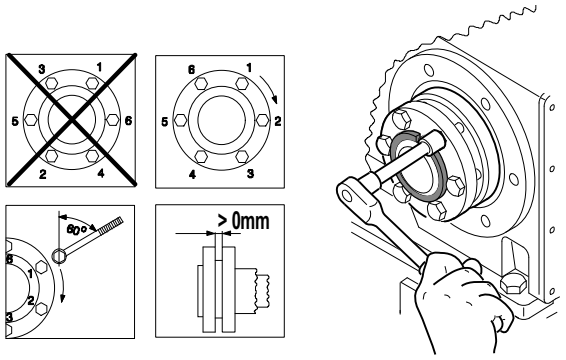
212009611

14. Manually tighten the screws of the shrink disk and ensure that the end rings of the shrink disk are parallel.



212011787

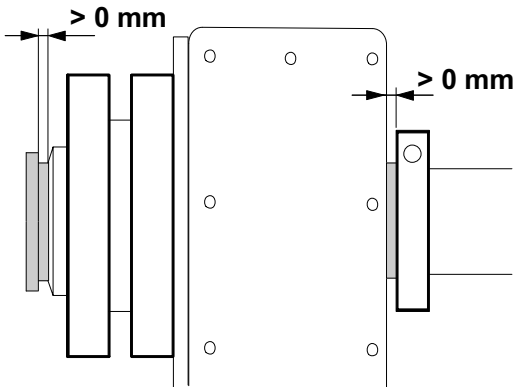
15. Tighten the locking screws with a torque wrench by working round several times from one bolt to the next (not in diametrically opposite sequence) according to the following table:




212013963

| Type | | nickel-plated [Standard] | Stainless steel |
|---|---|---|---|
| KT/FT | ST/WT | Torque [Nm] | |
| - | 37 | 4.0 | 7 |
| 37 | 47 | 10 | 7 |
| 47 | 57 | 12 | 7 |
| 57, 67 | 67 | 12 | 15 |
| 77 | 77 | 30 | 30 |
| 87 | 87 | 30 | 50 |
| 97 | 97 | 30 | 50 |
| 107 | – | 59 | 65 |
| 127 | – | 100 | 120 |
| 157 | – | 100 | 120 |

16. After the installation, make sure the remaining gap between the outer rings is > 0 mm.
17. The remaining gap between counter bushing and hollow shaft end as well as stop ring bushing and split ring must be > 0 mm.

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### 4.8.2 Removal notes

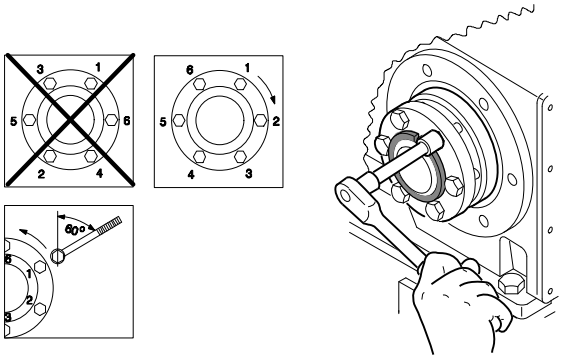
**⚠ CAUTION**

Risk of jamming and crushing due to improper removal of heavy components.

Risk of injury.

- Removing the shrink disk properly.
- Observe the following removal notes.

1. Loosen the locking screws one after the other by a quarter rotation to avoid tilting the outer rings.

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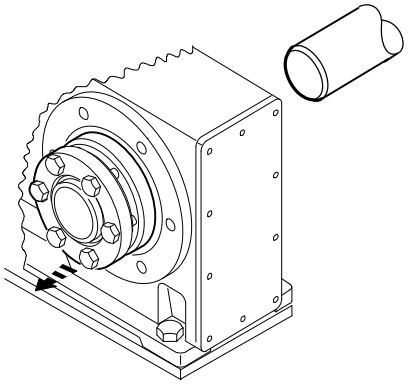
2. Unscrew the locking bolts evenly one after the other.
   Do not remove the locking screws completely.
3. Dismantle the conical steel bushing.
   If required, use the outer rings as pullers as follows:
   – Remove all the locking screws.
   – Screw the respective number of screws in the tapped holes of the shrink disk.
   – Support the inner ring against the gear unit housing.
   – Pull off the conical steel bushing by tightening the screws.
4. Remove the gear unit from the shaft.



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5. Remove the shrink disk from the hub.

#### 4.8.3 Cleaning and lubrication

There is no need to dismantle removed shrink disks before they are reinstalled.

Clean and lubricate the shrink disk if it is dirty.

Lubricate the tapered surfaces with one of the following solid lubricants:

| Lubricant (Mo S2) | Sold as |
|---|---|
| Molykote 321 (lube coat) | Spray |
| Molykote spray (powder spray) | Spray |
| Molykote G Rapid | Spray or paste |
| Aemasol MO 19P | Spray or paste |
| Aemasol DIO-sétral 57 N (lube coat) | Spray |

Grease the locking screws with a multipurpose grease such as Molykote BR 2 or similar.

## *4.9 Installing the protective cover*

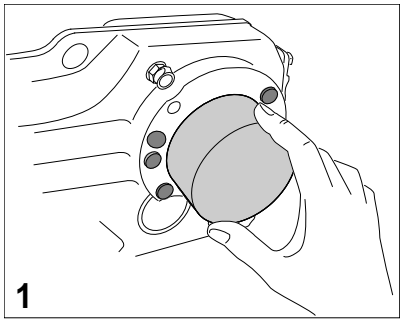
**⚠ CAUTION**

During operation, output components are in fast motion.

Risk of jamming and crushing.

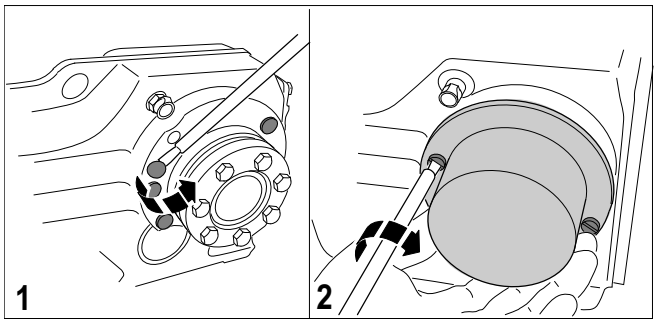
- Disconnect the motor from the power supply before starting work and safeguard against accidental startup.
- Cover input and output components with a touch guard.

#### 4.9.1 Installing the rotating cover




1. Slide the rotating cover onto the shrink disk until it snaps in.

### 4.9.2 Installing the fixed cover




1. To fasten the cover, remove the plastic plug on the gear unit housing (see figure 1)
2. Use the delivered screws to mount the cover to the gear unit housing (see figure 2).

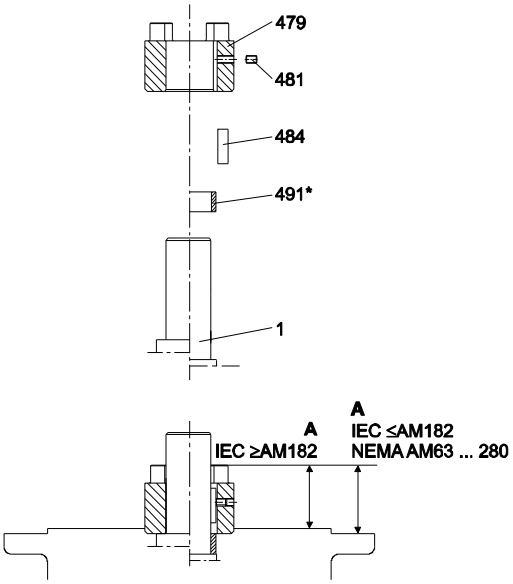
### 4.9.3 Installation without cover

In certain individual cases (e.g. through-shaft), you cannot install the cover. In such cases, the cover is not necessary if the system or unit manufacturer provides corresponding components to guarantee for the compliance with the required degree of protection.

If this results in additional maintenance, you have to describe this in the operating instructions for system/component.

## 4.10 AM adapter coupling

### 4.10.1 IEC adapter AM63 - 280 / NEMA adapter AM56 - 365

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[1] Motor shaft
[479] Coupling half
[481] Setscrew
[484] Key
[491] Spacer tube

1. Clean the motor shaft and the flange surfaces of the motor and the adapter.
2. Remove the key from the motor shaft and replace it with the supplied key [484] (not AM63 and AM250).
3. Heat the coupling half [479] to approx. 80 - 100 °C and push the coupling half onto the motor shaft. Position as follows:
   - IEC adapter AM63 - 225 Until stop at motor shaft shoulder.
   - IEC adapter AM250 - 280 to dimension**A**.
   - NEMA adapter with spacer tube [491] to dimension **A**.
4. Secure the key and coupling half using the setscrew [481] and tightening torque $T_A$ according to the table on the motor shaft.

5. Check the dimension **A**.
6. Seal the contact surfaces between the adapter and motor using a suitable sealing compound.
7. Mount the motor on the adapter. Ensure that the coupling claw of the adapter shaft is engaged in the plastic cam ring.

| IEC AM | 63 / 71 | 80 / 90 | 100 / 112 | 132 | 160 / 180 | 200 | 225 | 250 / 280 |
|---|---|---|---|---|---|---|---|---|
| **A** | 24.5 | 31.5 | 41.5 | 54 | 76 | 78.5 | 93.5 | 139 |
| **$T_A$** | 1.5 | 1.5 | 4.8 | 4.8 | 10 | 17 | 17 | 17 |
| **Thread** | M4 | M4 | M6 | M6 | M8 | M10 | M10 | M10 |
| NEMA AM | 56 | 143 / 145 | 182 / 184 | 213 / 215 | 254 / 256 | 284 / 286 | 324 / 326 | 364 / 365 |
| **A** | 46 | 43 | 55 | 63.5 | 78.5 | 85.5 | 107 | 107 |
| **$T_A$** | 1.5 | 1.5 | 4.8 | 4.8 | 10 | 17 | 17 | 17 |
| **Thread** | M4 | M4 | M6 | M6 | M8 | M10 | M10 | M10 |

### INFORMATION

To avoid contact corrosion, we recommend applying NOCO® Fluid to the motor shaft before mounting the coupling half.

### ⚠ NOTICE

Dampness might enter the adapter when mounting a motor to the adapter.

Potential damage to property

- Seal adapter with anaerobic fluid seal.

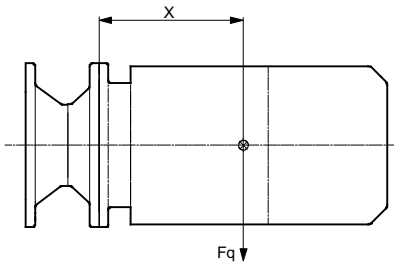
*Permitted loads*

**⚠ NOTICE**

Impermissibly high loads may occur when mounting a motor.

Potential damage to property

- The load data specified in the following table are not to be exceeded.

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| Adapter type | | | $F_q$ [1] [N] | |
|---|---|---|---|---|
| IEC | NEMA | x [1] [mm] | IEC adapter | NEMA adapter |
| **AM63/71** | **AM56** | 77 | 530 | 410 |
| **AM80/90** | **AM143/145** | 113 | 420 | 380 |
| **AM100/112** | **AM182/184** | 144 | 2000 | 1760 |
| **AM132** [2] | **AM213/215** [2] | 186 | 1600 | 1250 |
| **AM132..** | **AM213/215** | | 4700 | 3690 |
| **AM160/180** | **AM254/286** | 251 | 4600 | 4340 |
| **AM200/225** | **AM324-AM365** | 297 | 5600 | 5250 |
| **AM250/280** | - | 390 | 11200 | - |

1) **The maximum permitted weight of the attached motor $F_{qmax}$ must be reduced linearly as the center of gravity distance x increases. If this distance is reduced, the maximum permitted weight $F_{qmax}$ cannot be increased.**
2) Diameter of the adapter output flange: 160 mm

*AM../RS adapter AM with backstop*

Check the direction of rotation of the drive prior to assembly or startup. Inform the SEW-EURODRIVE service in the case of incorrect direction of rotation.

The backstop is maintenance-free in operation, and does not require any further maintenance work. Backstops have a minimum lift-off speed depending on the size (see following table).

.

**⚠ NOTICE**

If the actual speed level is below the minimum lift-off speed level, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

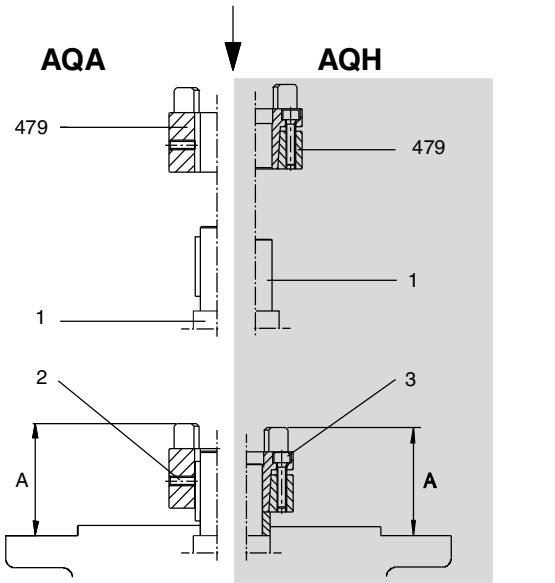
Possible damage to property

- In rated operation, the lift-off speeds must not drop below the minimum values.
- During startup or braking, the lift-off speeds may drop below the minimum levels.

| Type | Maximum locking torque of the backstop [Nm] | Minimum lift-off speed [rpm] |
|---|---|---|
| **AM80/90/RS, AM143/145/RS** | 65 | 820 |
| **AM100/112/RS, AM182/184/RS** | 425 | 620 |
| **AM132/RS, AM213/215/RS** | 850 | 530 |
| **AM160/180/RS, AM254/286/RS** | 1450 | 480 |
| **AM200/225/RS, AM324-365/RS** | 1950 | 450 |
| **AM250/280/RS,** | 1950 | 450 |

## 4.11 AQ adapter coupling

### 4.11.1 AQA80 - 190 adapter / AQH80 - 190 adapter

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1 Motor shaft
2 Grub screw
3 screws

**AQA** = With keyway
**AQH** = Without keyway

1. Clean the motor shaft and the flange surfaces of the motor and the adapter.
2. **Type AQH:**Loosen the screws of the coupling half (479) and loosen the conical connection.
3. Heat up the coupling half (80 °C - 100 °C) and slide it onto the motor shaft.

   **AQA / AQH design:** up to clearance "A" (see table)

4. **Type AQH:**Tighten the screws evenly in diametrically opposite sequence, working round several times. Make sure that all the screws are tightened with the tightening torque $T_A$ according to the following table.

   **Type AQA:**Secure the coupling halves using the setscrew (see table).

5. Check the position of the coupling half (clearance "A", see table).

   Mount the motor onto the adapter, making sure that the claws of the two coupling halves engage in each other. The force that must be applied when joining the two coupling halves is dissipated after final assembly, so there is no risk of any axial load being applied to adjacent bearings.

**INFORMATION**

**Only for AQA, not permitted for AQH:**To avoid contact corrosion, we recommend applying NOCO®® Fluid to the motor shaft before mounting the coupling half.

**⚠ NOTICE**

Dampness might enter the adapter when mounting a motor to the adapter.

Potential damage to property

- Seal adapter with anaerobic fluid seal

### 4.11.2 Setting dimensions/tightening torques

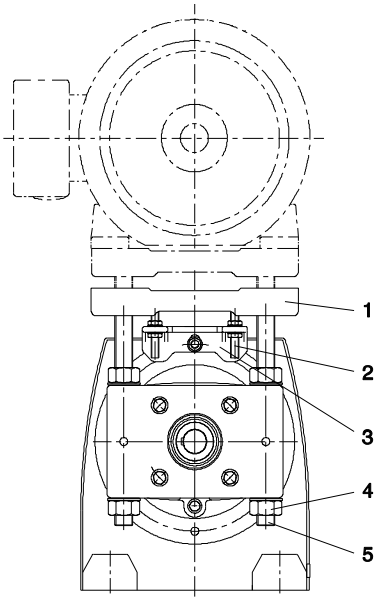
| Type | Coupling size | Clearance "A" [mm] | Bolts DIN 912 | | Tightening torque $T_A$ [Nm] | |
|---|---|---|---|---|---|---|
| | | | AQA | AQH | AQA | AQH |
| **AQA /AQH 80 /1/2/3** | 19/24 | 44,5 | M5 | M4 | 2 | 3 |
| **AQA /AQH 100 /1/2** | | 39 | | | | |
| **AQA /AQH 100 /3/4** | | 53 | | | | |
| **AQA /AQH 115 /1/2** | | 62 | | | | |
| **AQA /AQH 115 /3** | 24/28 | 62 | M5 | M5 | 2 | 6 |
| **AQA /AQH 140 /1/2** | | 62 | | | | |
| **AQA /AQH 140 /3** | 28/38 | 74,5 | M8 | M5 | 10 | 6 |
| **AQA /AQH 190 /1/2** | | 76,5 | | | | |
| **AQA /AQH 190 /3** | 38/45 | 100 | M8 | M6 | 10 | 10 |

## 4.12 AD input shaft assembly

Observe section "Assembling the input and output components" (page 25) when installing input components.

### 4.12.1 AD../P – cover with motor mounting platform

Mounting the motor and adjusting the motor mounting platform.

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[1] Motor mounting platform
[2] Stud bolt (only AD6/P / AD7/P)
[3] Support (only AD6/P / AD7/P)
[4] Nut
[5] Threaded column

1. Set the motor mounting platform to the required mounting position by evenly tightening the adjusting nuts. Remove the lifting eyebolt from helical gear units in order to achieve the lowest adjustment position. Touch up any damage to the paint work.
2. Align the motor on the motor mounting platform (shaft ends must be in alignment) and secure it.
3. Mount the input elements on the input shaft end and the motor shaft, line them up with one another and correct the motor position again, if necessary.
4. Put on the traction elements (V-belt, chain, etc.) and apply a preload by evenly adjusting the motor mounting platform. Do not stress the motor mounting platform and the columns against each other when doing this.
5. Tighten all the nuts not used for adjustment in order to fix the threaded columns.

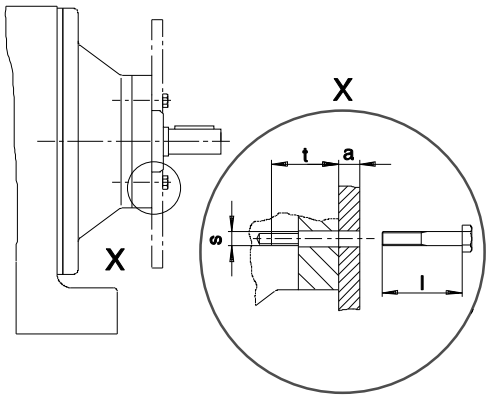
### 4.12.2 Only AD6/P and AD7/P

Unscrew the nuts on the stud bolts before adjustment to allow the stud bolts to move axially in the support without restriction. Do not tighten the nuts until the final adjustment position has been reached. Do not adjust the motor mounting platform using the support.

### 4.12.3 AD../ZR – input cover with centering shoulder

Mounting applications on the input shaft assembly with centering shoulder.

1. Retaining bolts of a suitable length must be used to secure the application. The length l of the new bolts is calculated as follows:

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[l] t+a
[t] Screw-in depth (see table)
[a] Thickness of the application
[s] Retaining thread (see table)

**Round down the calculated screw length to the next smaller standard length.**

2. Remove the retaining screws from the centering shoulder.
3. Clean the contact surface and the centering shoulder.

4. Clean the threads of the new bolts and apply a bolt locking compound (e.g. Loctite® 243) to the first few threads.
5. Attach the application to the centering shoulder and tighten the retaining screws with the specified tightening torque $T_A$ (see table).

| Type | Screw-in depth t [mm] | Retaining thread s | Tightening torque $T_A$ for connection screws of strength class 8.8 [Nm] |
|---|---|---|---|
| **AD2/ZR** | 25,5 | M8 | 25 |
| **AD3/ZR** | 31,5 | M10 | 48 |
| **AD4/ZR** | 36 | M12 | 86 |
| **AD5/ZR** | 44 | M12 | 86 |
| **AD6/ZR** | 48,5 | M16 | 210 |
| **AD7/ZR** | 49 | M20 | 410 |
| **AD8/ZR** | 42 | M12 | 86 |

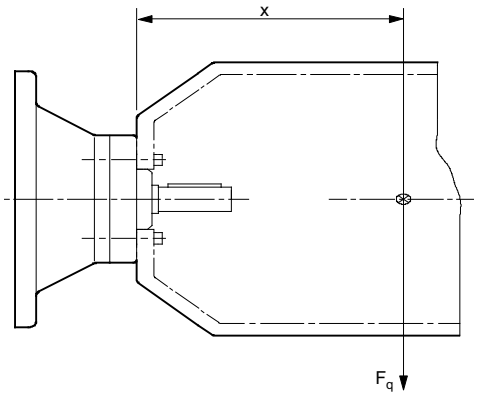
*Permitted loads*

**NOTICE**

Impermissibly high loads may occur when mounting a motor.

Potential damage to property

- The load data specified in the following table are not to be exceeded.

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| Type | x[1) ] [mm] | $F_q$[1)] [N] |
|---|---|---|
| **AD2/ZR** | 193 | 330 |
| **AD3/ZR** | 274 | 1400 |
| **AD4/ZR**[2)] | 361 | 1120 |
| **AD4/ZR** | | 3300 |
| **AD5/ZR** | 487 | 3200 |
| **AD6/ZR** | 567 | 3900 |
| **AD7/ZR** | 663 | 10000 |
| **AD8/ZR** | 516 | 4300 |

1) Maximum load values for connection screws of strength class 8.8. The maximum permitted weight of the attached motor $F_{qmax}$ must be reduced linearly as the center of gravity distance x increases. When this distance is reduced, $F_{qmax}$ cannot be increased.

2) Diameter of the adapter output flange: 160 mm

### 4.12.4 AD../RS – cover with backstop

Check the direction of rotation of the drive prior to assembly or startup. Inform the SEW-EURODRIVE service in the case of incorrect direction of rotation.

The backstop is maintenance-free in operation, and does not require any further maintenance work. Backstops have a minimum lift-off speed depending on the size (see following table).

**⚠ NOTICE**

If the actual speed level is below the minimum lift-off speed level, the backstops are subject to wear, and the resulting friction causes the temperature to increase.

Possible damage to property

- In rated operation, the lift-off speeds must not drop below the minimum values.
- During startup or braking, the lift-off speeds may drop below the minimum levels.

| Type | Maximum locking torque of the backstop [Nm] | Minimum lift-off speed [rpm] |
|---|---|---|
| **AD2/RS** | 65 | 820 |
| **AD3/RS** | 425 | 620 |
| **AD4/RS** | 850 | 530 |
| **AD5/RS** | 1450 | 480 |
| **AD6/RS** | 1950 | 450 |
| **AD7/RS** | 1950 | 450 |
| **AD8/RS** | 1950 | 450 |

# 5 Startup

## 5.1 Checking the oil level

Before startup, make sure that the oil level corresponds to the mounting position. Observe section "Checking the oil level and changing the oil" (page 67).

## 5.2 Helical-worm and SPIROPLAN® W gear units

### 5.2.1 Run-in period

SPIROPLAN® and helical-worm gear units require a running-in period of at least 48 h before reaching their maximum efficiency. A separate run-in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.

*Helical-worm gear unit*

| | Worm | |
|---|---|---|
| | **i range** | **η reduction** |
| **1-start** | approx. 50 ... 280 | approx. 12 % |
| **2-start** | approx. 20 ... 75 | approx. 6 % |
| **3-start** | approx. 20 ... 90 | approx. 3 % |
| **4-start** | - | - |
| **5-start** | approx. 6 ... 25 | approx. 3 % |
| **6-start** | approx. 7 ... 25 | approx. 2 % |

*SPIROPLAN® gear units*

| **W10 / W20 / W30** | | **W37 / W47** | |
|---|---|---|---|
| **i range** | **η reduction** | **i range** | **η reduction** |
| approx. 35 ... 75 | approx. 15 % | | |
| approx. 20 ... 35 | approx. 10 % | | |
| approx. 10 ... 20 | approx. 8 % | about 30...70 | approx. 8 % |
| About 8 | approx. 5 % | approx. 10 ... 30 | approx. 5% |
| About 6 | approx. 3 % | about 3...10 | approx. 3% |

## 5.3 Helical/parallel shaft helical/helical-bevel gear units

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with section "Mechanical Installation" (page 17).

## 5.4 Gear units with backstop

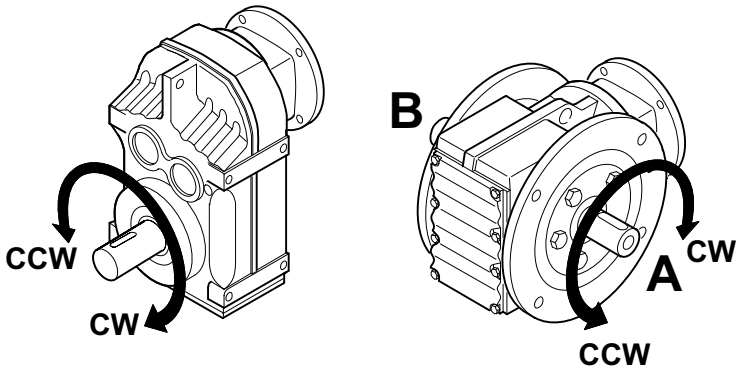
The purpose of a backstop is to prevent undesirable reverse rotation. During operation, the backstop permits rotation in one specified direction of rotation only.

**⚠ NOTICE**

Operating the motor in the blocking direction could destroy the backstop.

Possible damage to property

- Do not start up the motor in the blocking direction. Be sure that the motor power supply is correctly connected so that the motor rotates in the required direction.
- The backstop can be operated in blocking direction with half the output torque once for control purposes.

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The direction of rotation is determined with a view to the output shaft (LSS).

- Clockwise (CW)
- Counterclockwise (CCW)

The permitted direction of rotation is indicated on the housing.

# 6 Inspection/Maintenance

The following gear units are lubricated for life:

- Helical gear units R07, R17, R27
- Parallel shaft helical gear unit F27
- SPIROPLAN® gear units

Depending on external factors, the surface/corrosion protection might have to be repaired or renewed.

## *6.1 Preliminary work regarding gear unit inspection/maintenance*

Observe the following notes before you start with the inspection/maintenance work.

**⚠ WARNING**

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- Disconnect the gearmotor from the power supply before starting work and protect it against unintentional re-start.

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- Only remove the oil level and oil drain plug very carefully.

**⚠ NOTICE**

Filling in the wrong oil may result in significantly different lubricant characteristics.

Potential damage to property

- Do not mix different synthetic lubricants and do not mix synthetic with mineral lubricants.
- Mineral oil is used as standard lubricant.

**NOTICE**

Improper maintenance may result in damages to the gear unit.

Possible damage to property.

- Heed the information in this chapter.

**INFORMATION**

The position of the oil level plug, oil drain plug and the breather valve depends on the mounting position. Refer to the diagrams of the mounting positions. See chapter "Mounting Positions" (page 82).

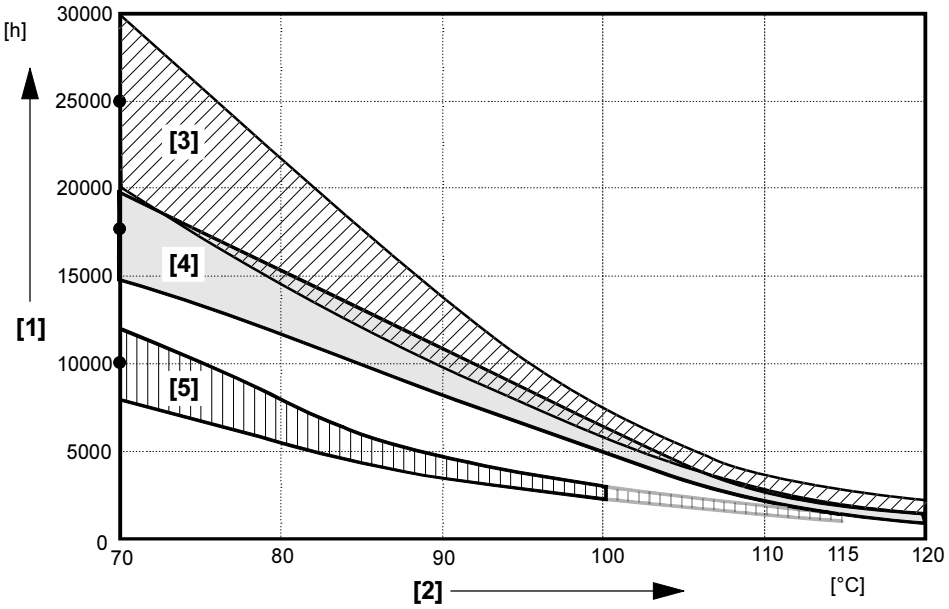
- Strict adherence to the inspection and maintenance intervals is absolutely necessary to ensure safe working conditions.
- Before releasing shaft connections, be sure that there are no active torsional moments present (tensions within the system).
- Prevent foreign bodies from entering into the gear unit during maintenance and inspection work.
- Do not clean the gear unit with a high-pressure cleaning system as water might enter the gear unit and the seals might be damaged.
- Perform safety and function tests following all maintenance and repair work.

## *6.2 Inspection/maintenance intervals*

| Time interval | What do I do? |
|---|---|
| • Every 3000 operating hours, at least every 6 months | • Check oil and oil level<br>• Check running noise for possible bearing damage<br>• Visually check the seals for leakage<br>• For gear units with a torque arm: Check the rubber buffer and change it, if necessary |
| • Depending on the operating conditions (see illustration below), at the latest every 3 years<br>• according to oil temperature | • Change mineral oil |
| | • Replace anti-friction bearing grease (recommendation)<br>• Replace oil seal (do not install it in the same track) |
| • Depending on the operating conditions (see illustration below), at the latest every 5 years<br>• according to oil temperature | • Change synthetic oil |
| | • Replace anti-friction bearing grease (recommendation)<br>• Replace oil seal (do not install it in the same track) |
| • Varying (depending on external factors) | • Touch up or renew the surfaces/anticorrosion coating |

## *6.3 Lubricant change intervals*

The following figure shows the change intervals for standard gear units under normal environmental conditions. Change the oil more frequently when using special versions subject to more severe/aggressive environmental conditions!




[1] Operating hours

[2] Sustained oil bath temperature

- Average value per oil type at 70 °C

[3] CLP PG

[4] CLP HC / HCE

[5] CLP / HLP / E

## 6.4 Inspection/maintenance for the AL/AM/AQ adapter

| Time interval | What do I do? |
|---|---|
| • Every 3000 operating hours, at least every 6 months | • Check running noise for possible bearing damage<br>• Visually check the adapter for leakage |
| • After 10000 operating hours | • Check torsional play<br>• Visually check the elastic annular gear |
| • after 25 000 - 30 000 hours of operation | • Renew the anti-friction bearing grease<br>• Replace oil seal (do not install it in the same track)<br>• Change the elastic annular gear |

## 6.5 Inspection/maintenance for the AD input cover

| Time interval | What do I do? |
|---|---|
| • Every 3000 operating hours, at least every 6 months | • Check running noise for possible bearing damage<br>• Visually check the adapter for leakage |
| • after 25 000 - 30 000 hours of operation | • Renew the anti-friction bearing grease |
| | • Replace the oil seal |

## 6.6 Inspection/maintenance for the gear unit

### 6.6.1 Checking the oil level and changing the oil

The procedure when checking the oil level and changing the oil depends on the following factors:

- Gear unit type
- Size
- Mounting position

Observe the references to the respective sections as well as the following table. Refer to chapter "Mounting Positions" (page 82) for notes on the mounting positions. You cannot check the oil level of gear units in pivoted mounting position. The gear units are delivered with the correct oil level. Observe the designations and fill quantities on the nameplate if you have to change the oil.

| Code letter | Section "Checking the oil level and changing the oil" | Reference |
|---|---|---|
| **A:** | • Helical gear units...<br>• Parallel shaft helical gear units...<br>• Helical-bevel gear units...<br>• Helical-worm gear units...<br>**With oil level plug** | (page 68) |
| **B:** | • Helical gear units...<br>• Parallel shaft helical gear units...<br>• SPIROPLAN® gear units...<br>**without oil level plug, with cover plate** | (page 70) |
| **C:** | • S37... helical-worm gear units<br>**without oil level plug and cover plate** | (page 74) |
| **D:** | • SPIROPLAN® W37 / W47...<br>**in mounting positions: M1, M2, M3, M5, M6 with oil level plug** | (page 77) |
| **E:** | • SPIROPLAN® W37 / W47...<br>**in M4 mounting position without oil level plug and cover plate** | (page 79) |

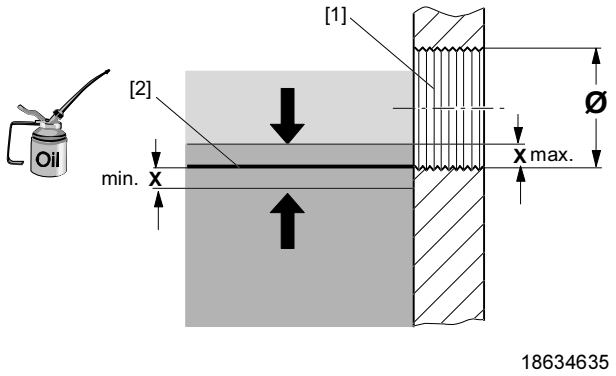
| Series | Gear unit | Code letter for section "Checking the oil level and changing the oil" | | | | | |
|---|---|---|---|---|---|---|---|
| | | M1 | M2 | M3 | M4 | M5 | M6 |
| R | R07...R27 | B | | | | | |
| | R37 / R67 | A | | | | | |
| | R47 / R57 | A | | | | B | A |
| | R77...R167 | A | | | | | |
| | RX57...R107 | A | | | | | |
| F | F27 | B | | | | | |
| | F37..F157 | A | | | | | |
| K | K37...K187 | A | | | | | |
| S | S37 | C | | | | | |
| | S47...S97 | A | | | | | |
| W | W10...W30 | B | | | | | |
| | W37...W47 | D | | | E | D | |

### 6.6.2 A: Helical, parallel shaft helical, helical-bevel and helical-worm gear units with oil level plug

*Checking the oil levelvia the oil level plug*

Proceed as follows to check the oil level of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Determine the position of the oil level plug and the breather valve using the mounting position sheets. See chapter "Mounting Positions" (page 82).
3. Place a container underneath the oil level plug.
4. Slowly remove the oil level plug. Small amounts of oil may leak out as the permitted max. oil level is higher than the lower edge of the oil level bore.
5. Check the oil level according to the following figure and the corresponding table.




18634635

[1] Oil level bore
[2] Reference oil level

| ? Oil level bore | Min and max fill level = x [mm] |
|---|---|
| **M10 x 1** | 1.5 |
| **M12 x 1.5** | 2 |
| **M22 x 1.5** | 3 |
| **M33 x 2** | 4 |
| **M42 x 2** | 5 |

6. If the oil level is too low, do the following:
   - Remove the breather valve.
   - Fill in additional oil of the same type via the vent hole until the oil level is at the lower edge of the oil level bore.
   - Re-insert the breather valve.
7. Re-insert the oil level plug.

*Checking the oil via the oil drain plug*

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Determine the position of the oil drain plug using the mounting position sheets. See chapter "Mounting Positions" (page 82).
3. Remove a little oil from the oil drain plug.
4. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (page 64).
5. Check the oil level. See previous section.

*Changing the oil via the oil drain plug and the breather valve*

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- However, the gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil properly.

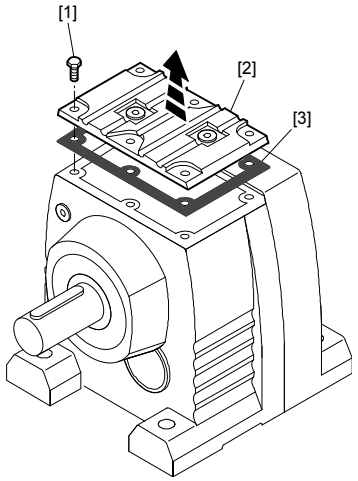
1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Determine the position of the oil drain plug, the oil level plug and the breather valve using the mounting position sheets. See chapter "Mounting Positions" (page 82).
3. Place a container underneath the oil drain plug.
4. Remove the oil level plug, the breather valve and the oil drain plug.
5. Drain all the oil.
6. Re-insert the oil drain plug.
7. Fill in new oil of the same type via the vent hole (otherwise consult the customer service). Do not mix different synthetic lubricants.
   - Observe the oil fill quantities according to the specifications on the nameplate or according to the mounting position. See sect "Lubricant fill quantities" (page 110).
   - Check the oil level at the oil level plug.
8. Re-insert the oil level plug and the breather valve.

### 6.6.3 B: Helical, parallel shaft helical, SPIROPLAN® gear units without oil level plug with cover plate

*Checking the oil level via the cover plate*

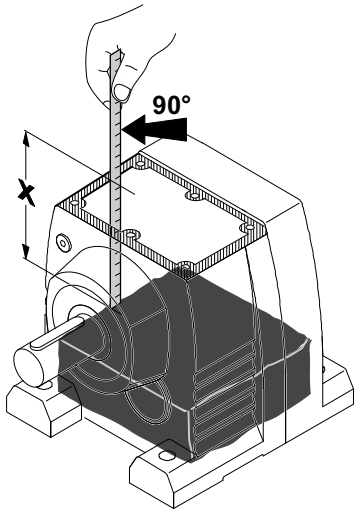
For gear units without oil level bore, the oil level is checked via the cover plate opening. Proceed as follows:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. For the cover plate to be on top, you have to set up the gear unit in the following mounting position.
   - R07 - R57 in M1 mounting position
   - F27 in M3 mounting position
   - W10 - W30 in M1 mounting position
3. Loosen the screws [1] of the cover plate [2] and remove the cover plate [2] and the corresponding seal [3] (see following figure).




18643211

4. Determine the vertical distance "x" between oil level and sealing surface of the gear unit housing (see following figure).

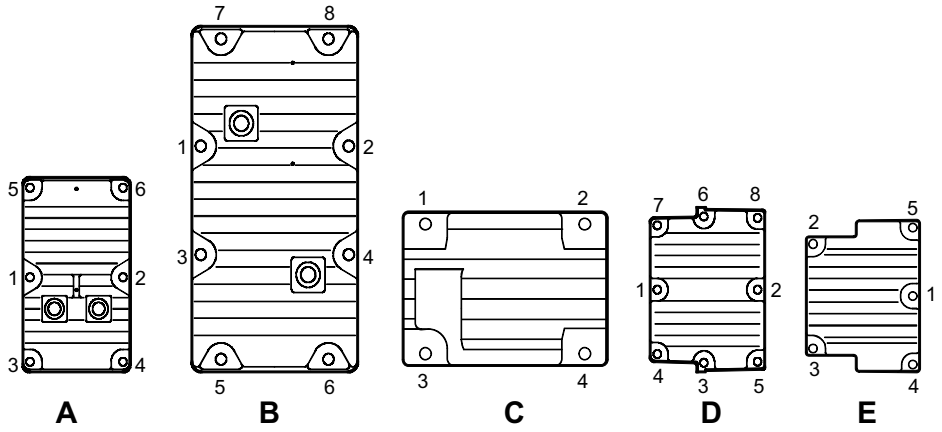



18646283

5. Compare the determined value "x" to the max. distance between oil level and sealing surface of the gear unit housing specified in the following table. Adjust the fill level if required.

| Gear unit type | | Max. distance x [mm] between oil level and sealing surface of the gear unit housing for mounting position | | | | | |
|---|---|---|---|---|---|---|---|
| | | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** |
| **R07** | 2 stages | 52 ± 1 | 27 ± 1 | 27 ± 1 | 27 ± 1 | 27 ± 1 | 27 ± 1 |
| | 3 stages | 49 ± 1 | 21 ± 1 | 21 ± 1 | 21 ± 1 | 21 ± 1 | 21 ± 1 |
| **R17** | 2 stages | 63 ± 1 | 18 ± 1 | 46 ± 1 | 18 ± 1 | 46 ± 1 | 46 ± 1 |
| | 3 stages | 58 ± 1 | 11 ± 2 | 40 ± 2 | 11 ± 2 | 40 ± 2 | 40 ± 2 |
| **R27** | 2 stages | 74 ± 1 | 22 ± 1 | 45 ± 1 | 22 ± 1 | 45 ± 1 | 45 ± 1 |
| | 3 stages | 76 ± 1 | 19 ± 1 | 42 ± 1 | 19 ± 1 | 42 ± 1 | 42 ± 1 |
| **R47** | 2 stages | – | – | – | – | 39 ± 1 | – |
| | 3 stages | – | – | – | – | 32 ± 1 | – |
| **R57** | 2 stages | – | – | – | – | 32 ± 1 | – |
| | 3 stages | – | – | – | – | 28 ± 1 | – |
| | | | | | | | |
| **F27** | 2 stages | 78 ± 1 | 31 ± 1 | 72 ± 1 | 56 ± 1 | 78 ± 1 | 78 ± 1 |
| | 3 stages | 71 ± 1 | 24 ± 1 | 70 ± 1 | 45 ± 1 | 71 ± 1 | 71 ± 1 |
| | | | | | | | |
| | | irrespective of the mounting position | | | | | |
| **W10** | | 12 ± 1 | | | | | |
| **W20** | | 19 ± 1 | | | | | |
| **W30** | | 31 ± 1 | | | | | |

6. Close the gear unit after the oil level check:
   - Re-attach the seal of the cover plate. Make sure that the sealing surfaces are clean and dry.
   - Screw on the cover plate. Tighten the cover screws with the rated tightening torque according to the following table from the inside to the outside in the order illustrated in the figure. Repeat the tightening procedure until the screws are properly tightened. Only use impulse drivers or torque wrenches in order to prevent the cover plate from being damaged (no impact drivers).




18649739

| Gear unit type | Figure | Retaining thread | Rated tightening torque $T_N$ [Nm] | Minimum tightening torque $T_N$ [Nm] |
|---|---|---|---|---|
| R/RF07 | E | M5 | 6 | 4 |
| R/RF17/27 | D | M6 | 11 | 7 |
| R/RF47/57 | A | | | |
| F27 | B | | | |
| W10 | C | M5 | 6 | 4 |
| W20 | C | M6 | 11 | 7 |
| W30 | A | | | |

*Checking the oil via the cover plate*

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Open the cover plate of the gear unit according to section "Checking the oil via the cover plate" (page 70).
3. Take an oil sample via the cover plate opening.
4. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (page 64).
5. Check the oil level. See section "Checking the oil level via the cover plate" (page 70).
6. Screw on the cover plate. Observe the order and the tightening torques according to section "Checking the oil level via the cover plate" (page 70)

*Checking the oil via the cover plate*

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- However, the gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil properly.

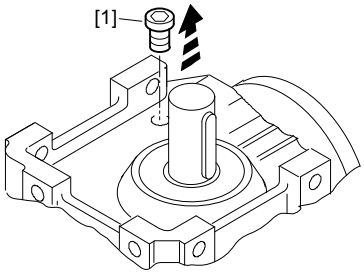
1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Open the cover plate of the gear unit according to section "Checking the oil via the cover plate".
3. Completely drain the oil in to a vessel via the cover plate opening.
4. Fill in new oil of the same type via the cover plate opening (otherwise consult the customer service). Do not mix different synthetic lubricants.
   - Pour in the oil in accordance with the mounting position or as specified on the nameplate. See section "Lubricant fill quantities" (page 110).
5. Check the oil level.
6. Screw on the cover plate. Observe the order and the tightening torques according to section "Checking the oil level via the cover plate" (page 70)

### 6.6.4 C: S37 helical-worm gear units without oil level plug and cover plate

*Checking the oil level via the screw plug*

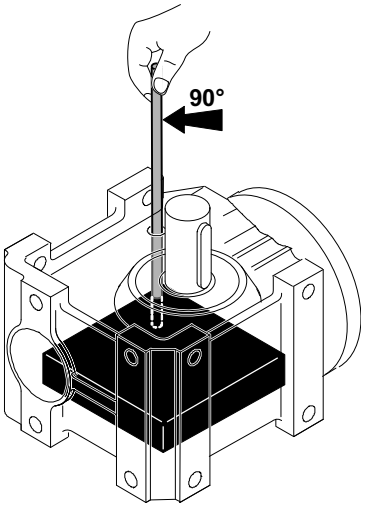
The S37 gear unit is not equipped with an oil level plug or a cover plate. This is why the oil level is checked via the control bore.

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Set up the gear unit in M5 or M6 mounting position, i.e. control bore always on top.
3. Remove the screw plug [1] (see following figure).



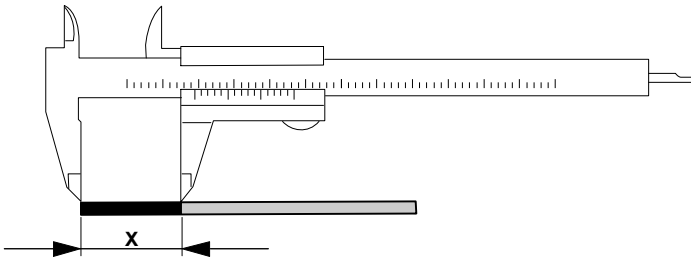

18655371

4. Insert the dipstick vertically via the control bore all the way to the bottom of the gear unit housing. Pull out the dipstick vertically (see following figure).




18658699

5. Determine the size of the section "x" of the dipstick covered with lubricant using a caliper (see following figure).




18661771

6. Compare the determined value "x" to the min. value depending on the mounting position specified in the following table. Correct the fill level if required.

| Gear unit type | Oil level = wetted section x [mm] of the dipstick<br>Mounting position | | | | | |
|---|---|---|---|---|---|---|
| | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** |
| **S37** | 10 ± 1 | 24 ± 1 | 34 ± 1 | 37 ± 1 | 24 ± 1 | 24 ± 1 |

7. Re-insert and tighten the screw plug.

*Checking the oil via the screw plug*

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Open the cover plate of the gear unit according to section "Checking the oil via the screw plug".
3. Take an oil sample via the screw plug bore.
4. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (page 64).
5. Check the oil level. See previous section.
6. Re-insert and tighten the screw plug.

*Changing the oil via the screw plug*

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- However, the gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil properly.

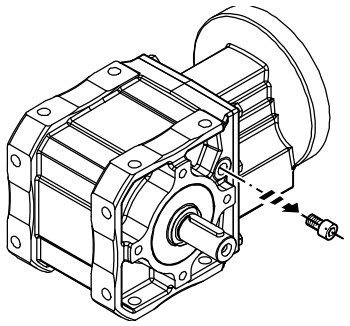
1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Open the cover plate of the gear unit according to section "Checking the oil via the screw plug".
3. Completely drain the oil via the screw plug bore.
4. Fill in new oil of the same type via the control bore (otherwise consult the customer service). Do not mix different synthetic lubricants.
   - Observe the oil fill quantities according to the specifications on the nameplate or according to the mounting position. Observe section "Lubricant fill quantities" (page 111).
5. Check the oil level.
6. Re-insert and tighten the screw plug.

### 6.6.5 D: SPIROPLAN® W37/W47 in mounting positions M1, M2, M3, M5, M6 with oil level plug

*Checking the oil levelvia the oil level plug*

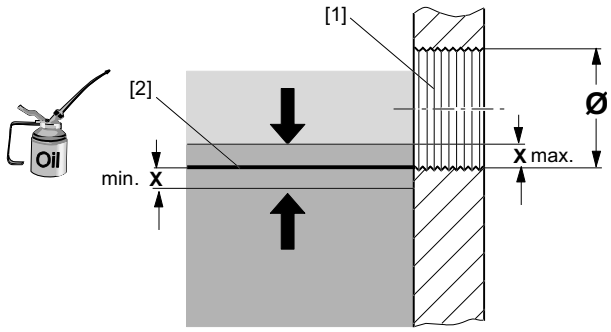
Proceed as follows to check the oil level of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Set up the gear unit in M1 mounting position.
3. Slowly remove the oil level plug (see following figure). Small amounts of oil may leak out.



787235211

4. Check the oil level according to the following figure.




634361867

[1] Oil level bore
[2] Reference oil level

| Ø oil level bore | Min and max fill level = x [mm] |
|---|---|
| **M10 x 1** | 1.5 |

5. If the oil level is too low, fill in new oil of the same type via the oil level bore until the oil level reaches the lower edge of the bore.
6. Re-insert the oil level plug.

*Checking the oil via the oil level plug*

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Remove a little oil at the oil level plug.
3. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (page 64).
4. Check the oil level. See previous section.

*Changing the oil via the oil level plug*

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- However, the gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil properly.

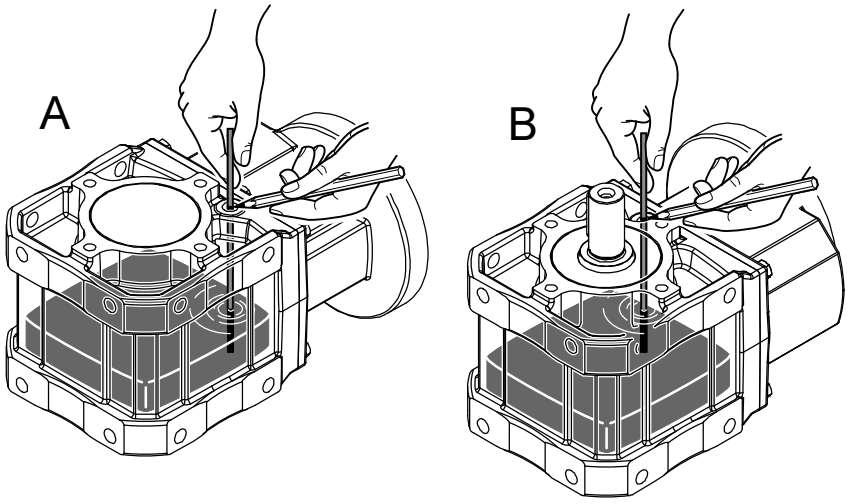
1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Set up the gear unit in M5 or M6 mounting position. See chapter "Mounting Positions" (page 82).
3. Place a container underneath the oil level plug.
4. Remove the oil level plugs on the A and B side of the gear unit.
5. Drain all the oil.
6. Re-insert the lower oil level plug.
7. Fill in new oil of the same type via the upper oil level plug bore (otherwise consult the customer service). Do not mix different synthetic lubricants.
   - Observe the oil fill quantities according to the specifications on the nameplate or according to the mounting position. See sect "Lubricant fill quantities" (page 110).
   - Check the oil level according to section "Checking the oil level via the oil level plug"
8. Re-insert the upper oil level plug.

### 6.6.6 E: SPIROPLAN® W37/W47 in M4 mounting position without oil level plug and cover plate

*Checking the oil level via the screw plug*

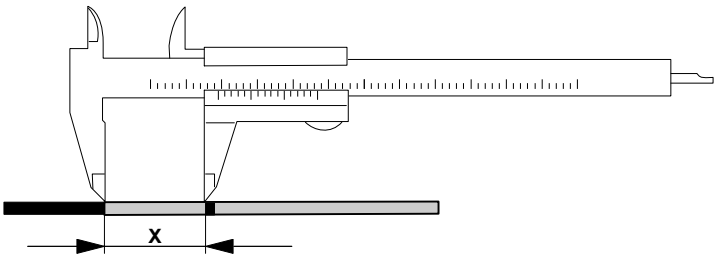
The W37/W47 gear units are not equipped with an oil level plug or a cover plate. This is why the oil level is checked via the control bore.

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Set up the gear unit in M5 or M6 mounting position.
3. Remove the screw plug.
4. Insert the dipstick vertically via the control bore all the way to the bottom of the gear unit housing. Mark the point of the dipstick where it exits the gear unit. Pull out the dipstick vertically (see following figure).




784447371

5. Determine the section "x" between the wetted part and the marking using a caliper (see following figure).

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6. Compare the determined value "x" to the min. value depending on the mounting position specified in the following table. Correct the fill level if required.

| Gear unit type | Oil level = wetted section x [mm] of the dipstick<br>Mounting position during the check | |
|---|---|---|
| | M5<br>Lying on the A side | M6<br>Lying on the B side |
| W37 in M4 mounting position | 37 ± 1 | 29 ± 1 |
| W47 in M4 mounting position | 41 ± 1 | 30 ± 1 |

7. Re-insert and tighten the screw plug.

*Checking the oil via the screw plug*

Proceed as follows to check the oil of the gear unit:

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Remove a little oil at the oil screw plug.
3. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance intervals" (page 64).
4. Check the oil level. See previous section.

*Changing the oil via the screw plug*

**⚠ WARNING**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you begin with your work.
- However, the gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil properly.

1. Observe the notes in section "Preliminary work regarding gear unit inspection/ maintenance" (page 63).
2. Set up the gear unit in M5 or M6 mounting position. See chapter "Mounting Positions" (page 82).
3. Place a container underneath the screw plug.
4. Remove the screw plugs on the A and B side of the gear unit.
5. Drain all the oil.

6. Re-insert the lower screw plug.
7. Fill in new oil of the same type via the upper screw plug bore (otherwise consult the customer service). Do not mix different synthetic lubricants.
   – Observe the oil fill quantities according to the specifications on the nameplate or according to the mounting position. See sect "Lubricant fill quantities" (page 110).
   – Check the oil level according to section "Checking the oil level via the oil level plug"
8. Re-insert the upper screw plug.

### 6.6.7 Replacing the oil seal

**⚠ NOTICE**

Oil seals with a temperature below 0° C may get damaged during installation.

Potential damage to property.

- Store oil seals at ambient temperatures over 0° C.
- Warm up the oil seals prior to installation if required.

1. When changing the oil seal, ensure that there is a sufficient grease reservoir between the dust lip and protective lip, depending on the type of gear unit.
2. If you use double oil seals, fill one-third of the gap with grease.

### 6.6.8 Gear unit coating

**⚠ NOTICE**

Breather valves and oil seals may be damaged during painting or re-painting.

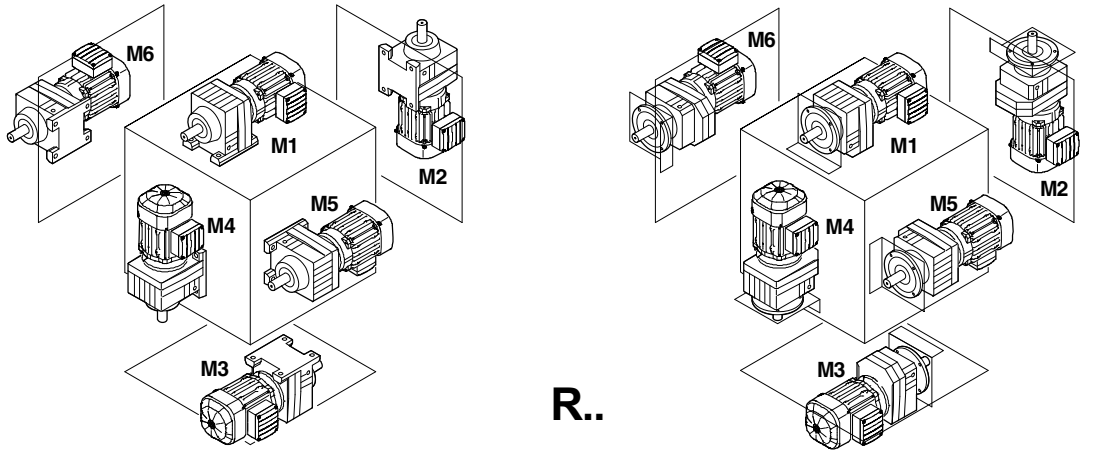
Potential damage to property.

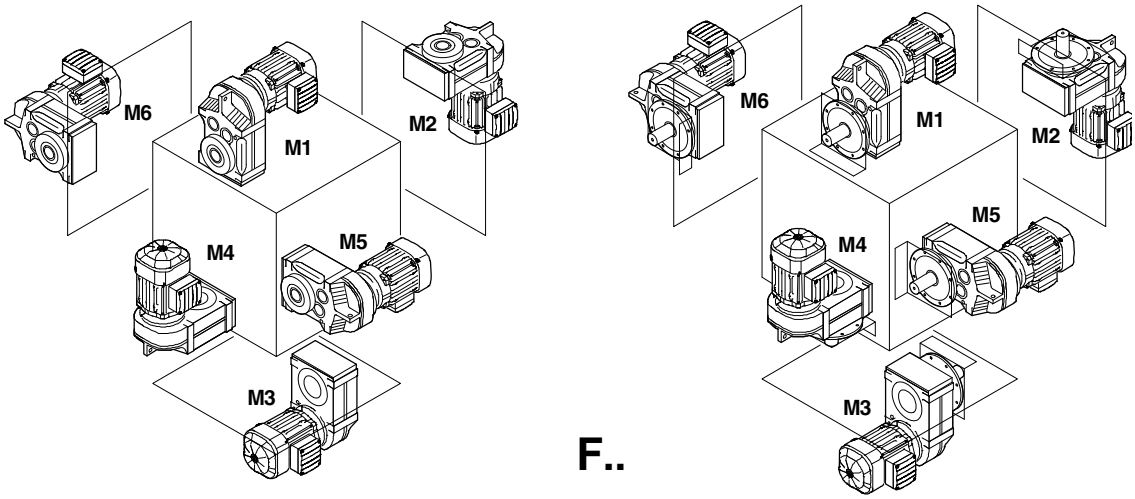
- Thoroughly cover the breather valves and the sealing lip of the oil seals with strips prior to painting.
- Remove the strips after painting.

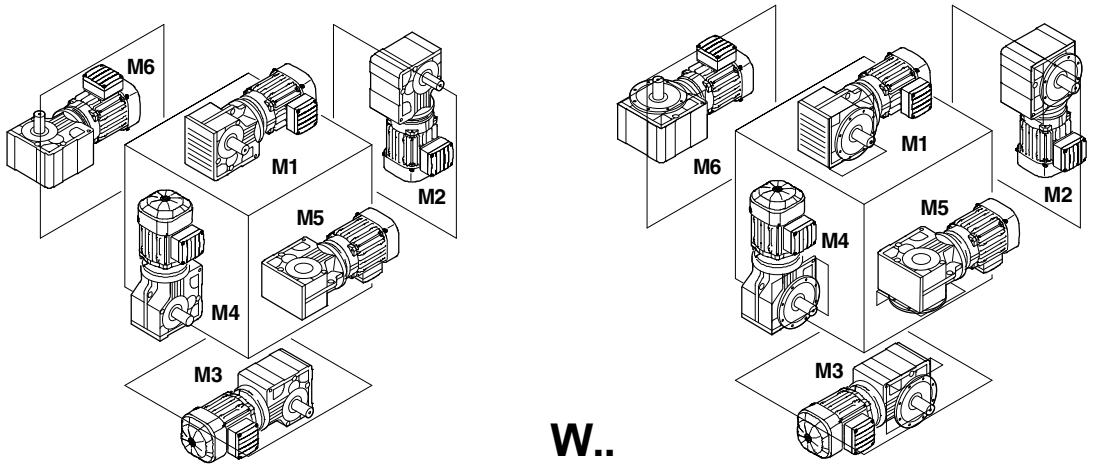
# 7 Mounting Positions

## 7.1 Designation of the mounting positions

SEW differentiates between six mounting positions, M1 – M6. The following figure shows the spatial orientation of the gearmotor in mounting positions M1 – M6.



## 7.2 Churning losses

Churning losses may occur in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

| Mounting position | Gear unit type | Gear unit size | Input speed [rpm] |
|---|---|---|---|
| **M2, M4** | R | 97 – 107 | > 2500 |
| | | > 107 | >1500 |
| **M2, M3, M4, M5, M6** | F | 97 – 107 | > 2500 |
| | | > 107 | > 1500 |
| | K | 77 – 107 | > 2500 |
| | | > 107 | > 1500 |
| | S | 77 – 97 | > 2500 |
| **M1, M2, M3, M4, M5, M6** | W | 37 – 47 | > 1500 |

## 7.3 Key

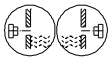
### INFORMATION

The SPIROPLAN® gearmotors are not dependent on the mounting position, except for W37 and W47 in the M4 mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

**Note:** SPIROPLAN® gearmotors of sizes W10 – W30 cannot be equipped with breather valves, oil level plugs or drain plugs.

### 7.3.1 Symbols used

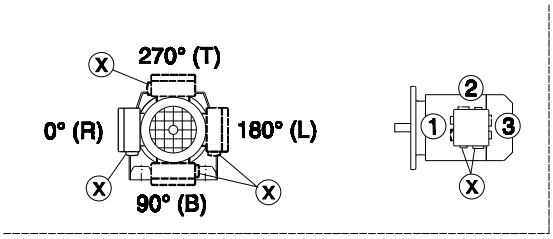
The following table shows the symbols used in the mounting position sheets and what they mean:

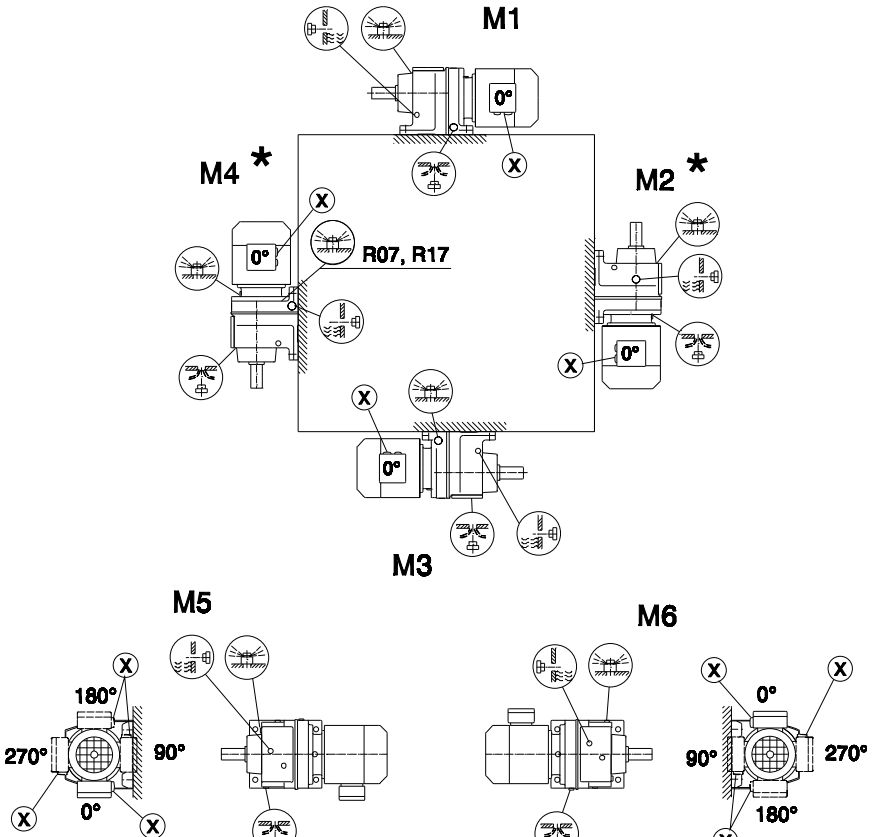
| Symbol | Meaning |
|---|---|
|  | Breather valve |
|  | Oil level plug |
|  | Oil drain plug |

## 7.4 Helical gearmotors R

### 7.4.1 R07 ... R167

**04 040 03 00**

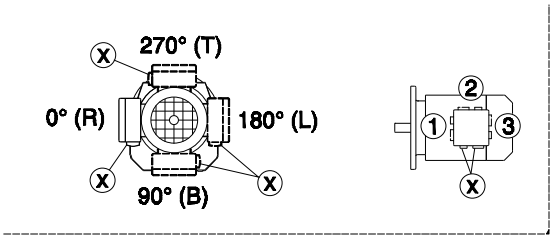


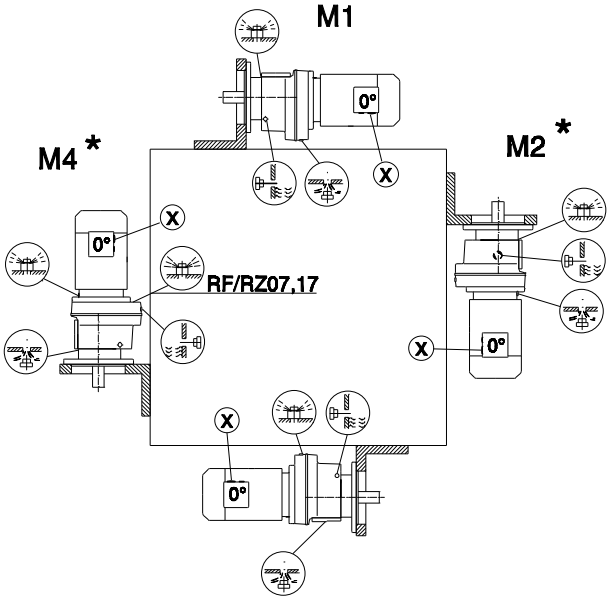



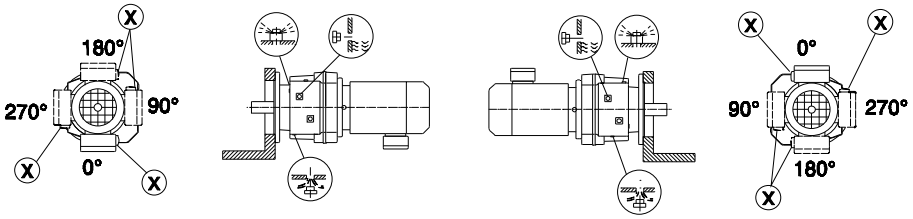

| | | |
|---|---|---|
| R07 | | M1, M2 , M3 , M5 , M6 |
| R17, R27 | | M1, M3 , M5 , M6 |
| R07, R17, R27 | | |
| R47, R57 | | M5 |

### 7.4.2 RF07 ... RF167, RZ07 ... RZ87

04 041 03 00



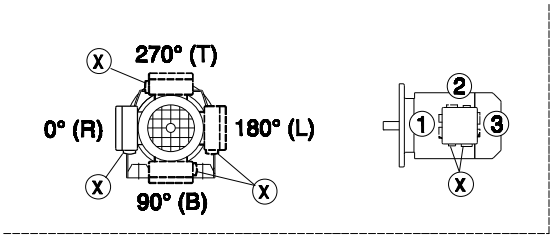



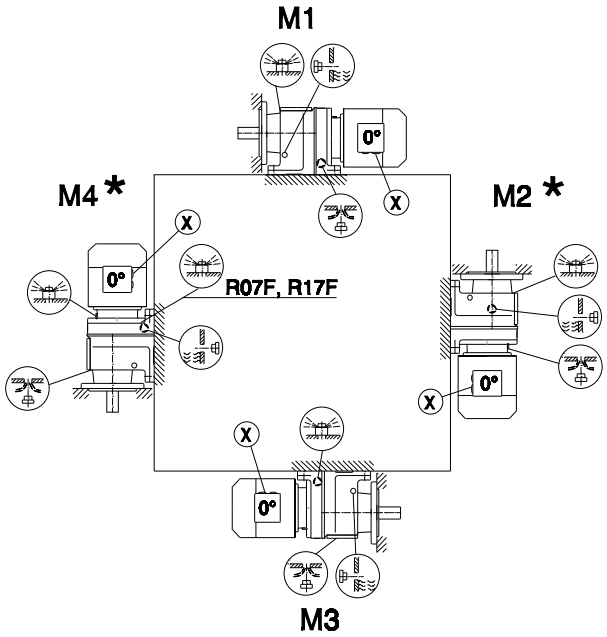



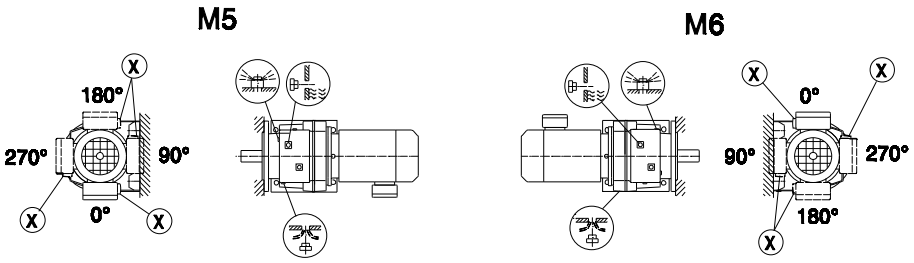

| | | |
|---|---|---|
| RF/RZ07 | | M1, M2 , M3 , M5 , M6 |
| RF/RZ17,27 | | M1, M3 , M5 , M6 |
| RF/RZ07, 17, 27 | | |
| RF/RZ47, 57 | | M5 |

### 7.4.3 R07F ... R87F

**04 042 03 00**



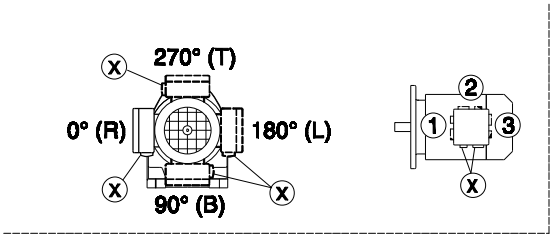



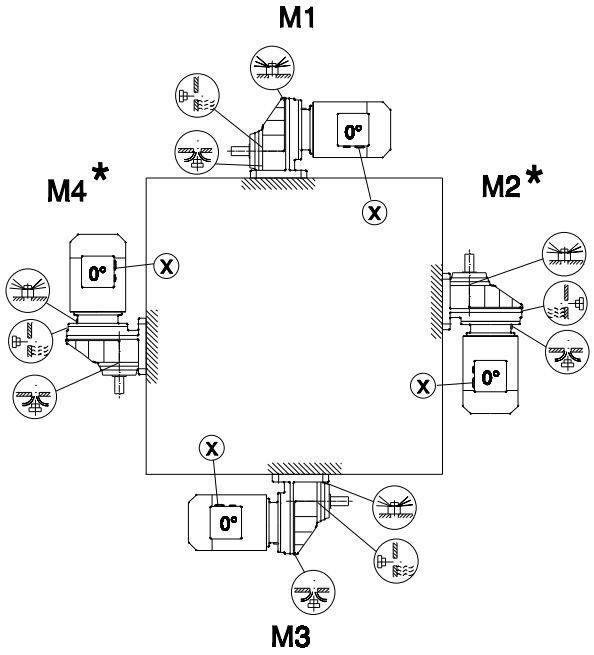

| | | |
|---|---|---|
| R07F |  | M1, M2 , M3 , M5 , M6 |
| R17F, R27F |  | M1, M3 , M5 , M6 |
| R07F, R17F, R27F |  | |
| R47F, R57F |  | M5 |

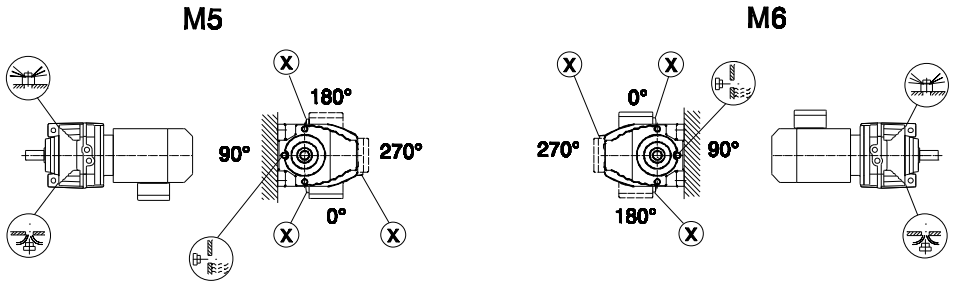
## 7.5 Helical gearmotors RX

### 7.5.1 RX57 ... RX107

04 043 02 00

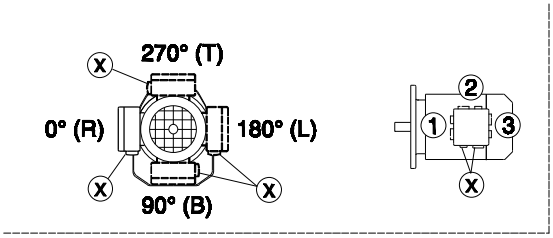


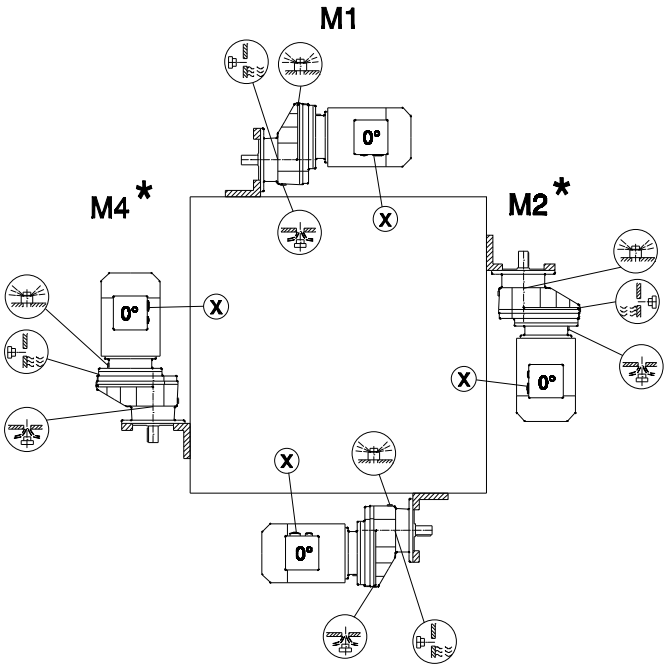



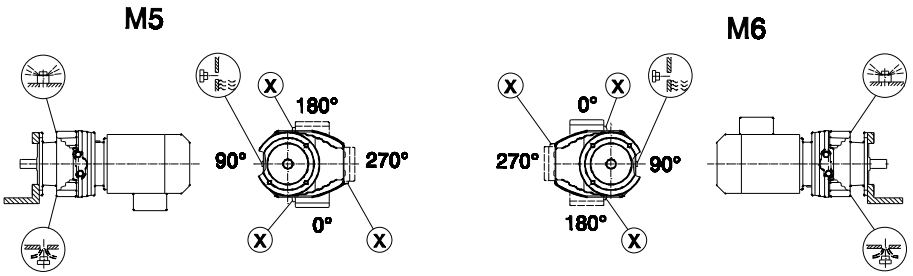



### 7.5.2 RXF57 ... RXF107

**04 044 02 00**



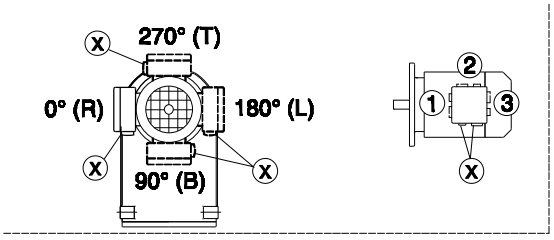



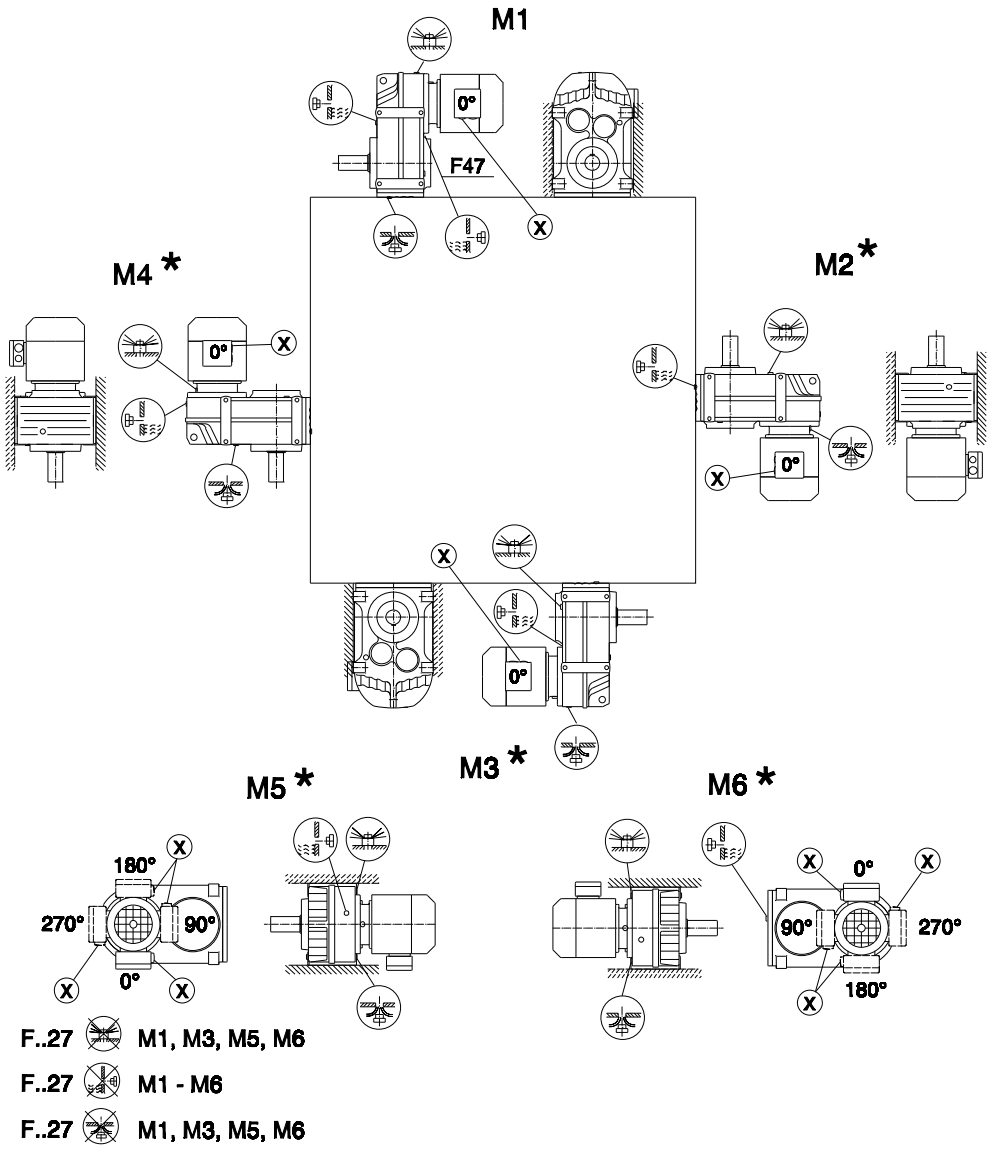



## 7.6 Parallel-shaft helical gearmotors F

### 7.6.1 F27 ... F157 / FA27B ... F157B / FH27B .. FH157B / FV27B ... FV107B

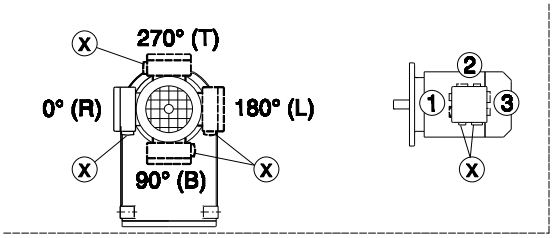
42 042 03 00

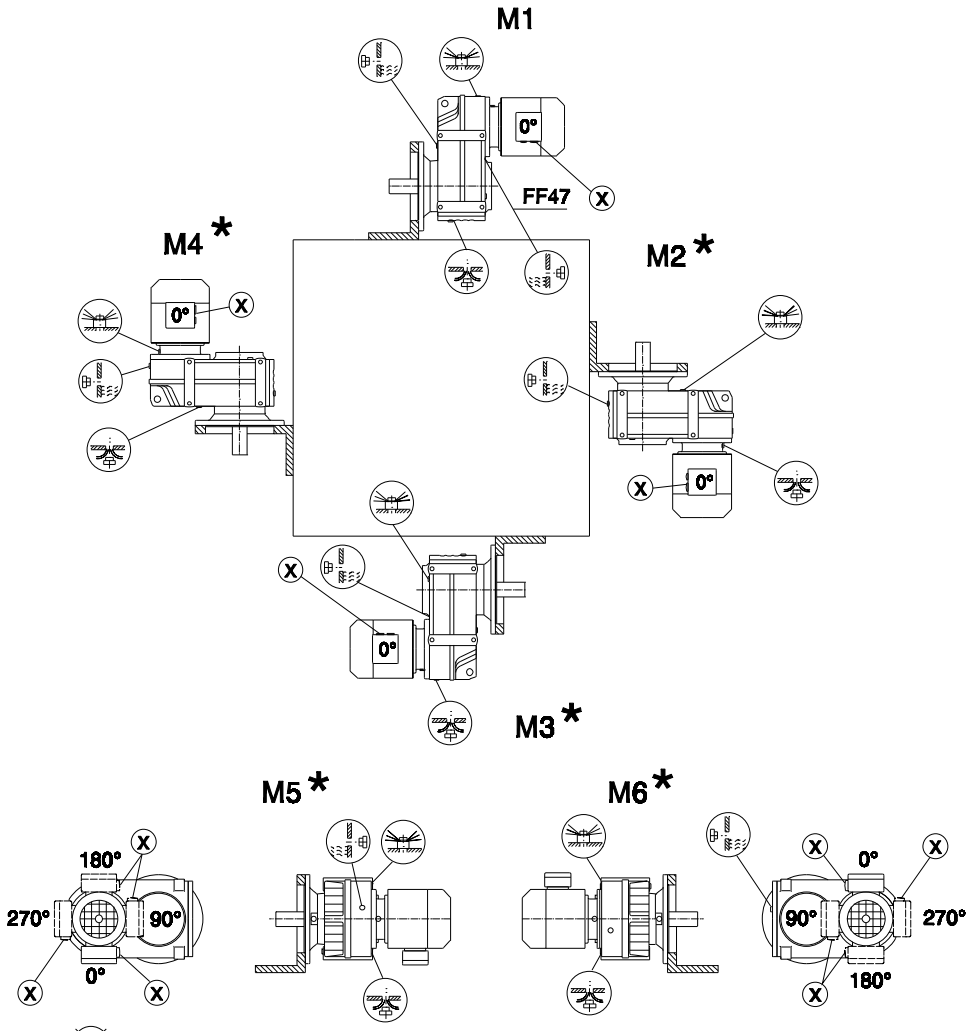


### 7.6.2 FF27 ... FF157 / FAF27 ... FAF157 / FHF27 ... FHF157 / FAZ27 ... FAZ157 / FHZ27 ... FHZ157 / FVF27 ... FVF107 / FVZ27 ... FVZ107

**42 043 03 00**



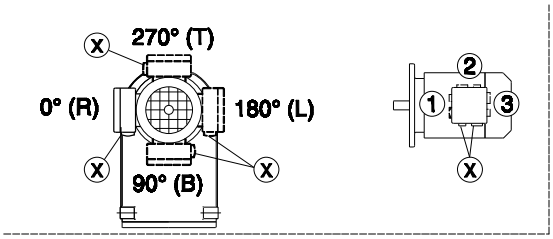

F..27 M1, M3, M5, M6

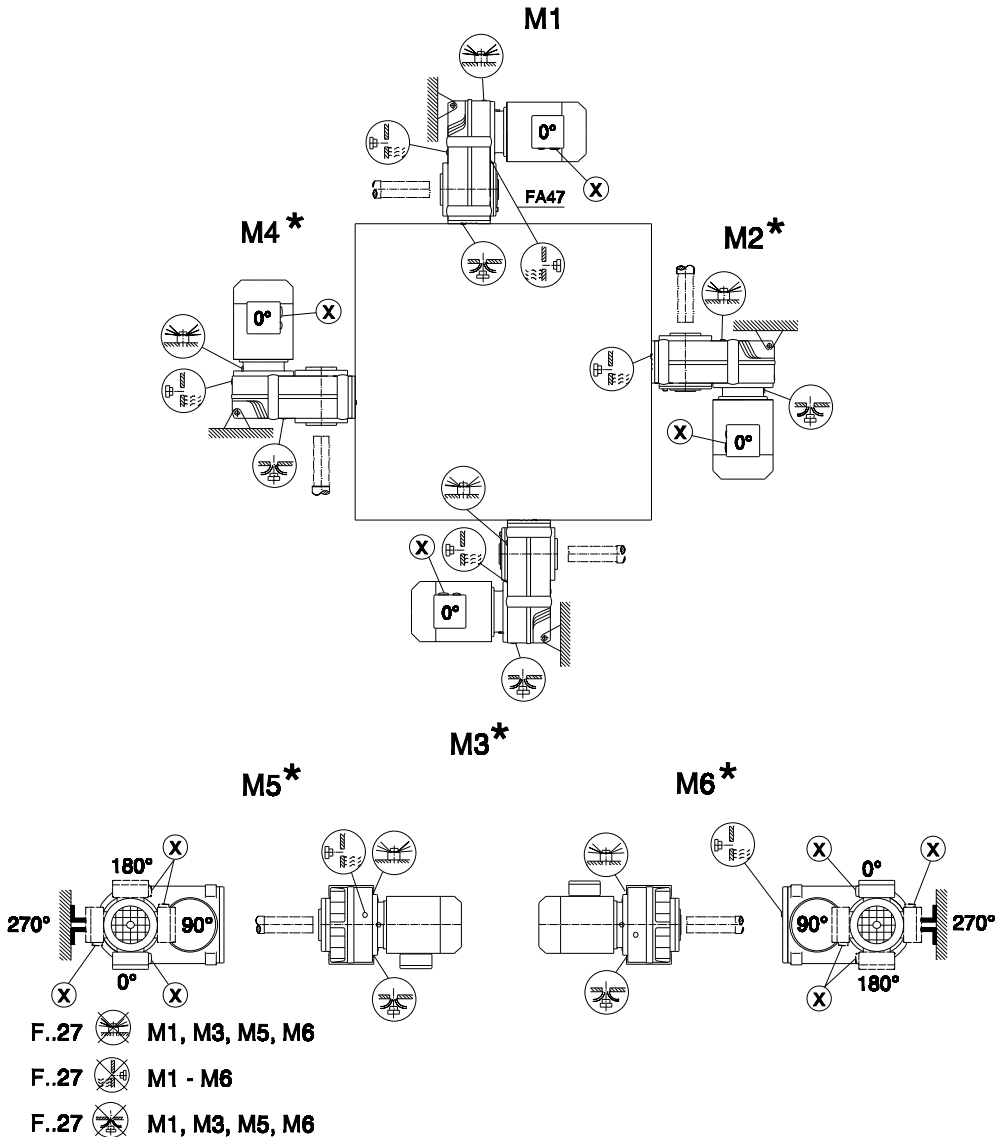
F..27 M1 - M6

F..27 M1, M3, M5, M6

### 7.6.3 FA27 ... FA157 / FH27 ... FH157 / FV27 ... FV107 / FT37 ... FT157

**42 044 03 00**




F..27 M1, M3, M5, M6

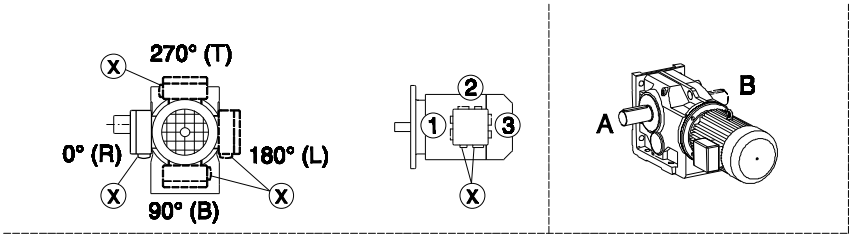
F..27 M1 - M6

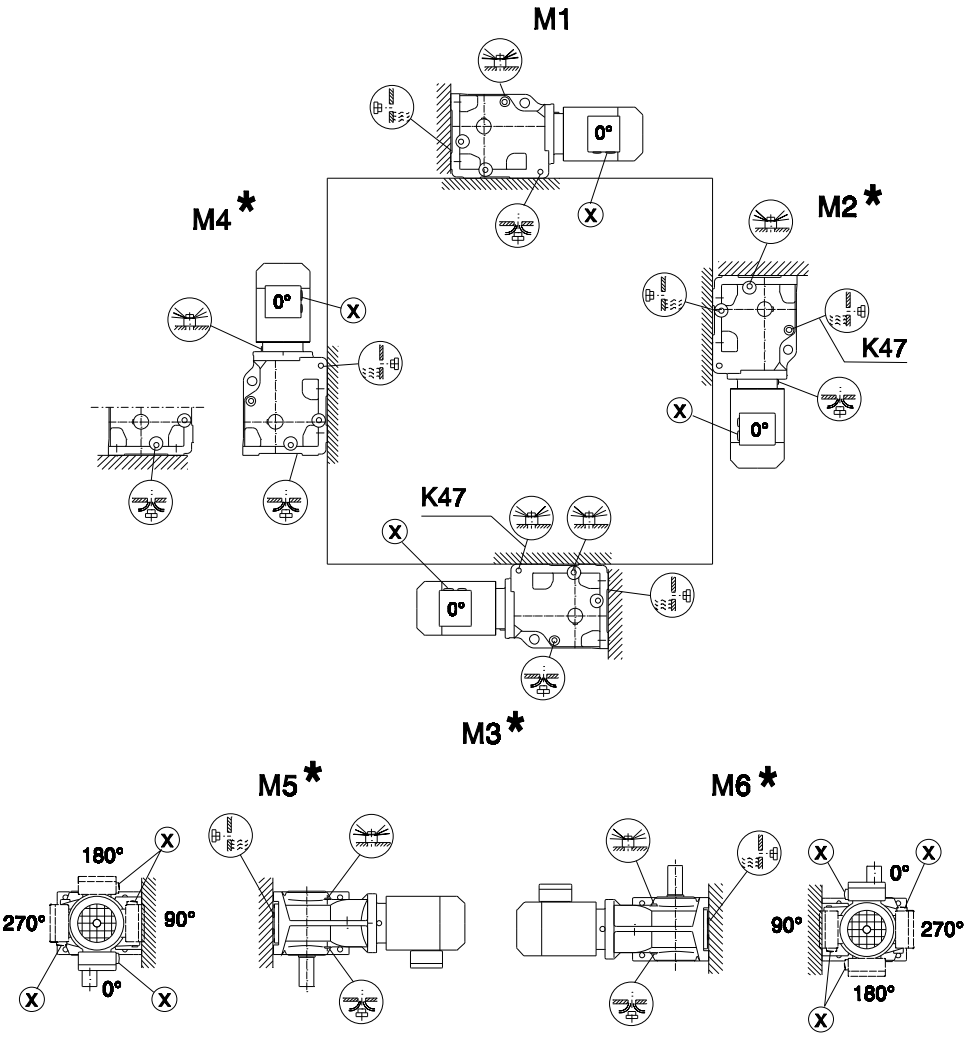
F..27 M1, M3, M5, M6

## 7.7 Helical-bevel gearmotors K

### 7.7.1 K37 ... K157 / KA37B ... KA157B / KH37B ... KH157B / KV37B ... KV107B

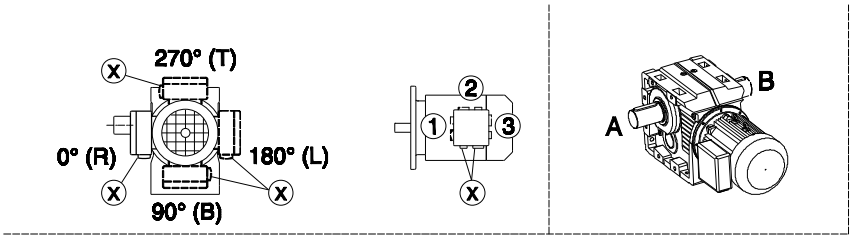
**34 025 03 00**

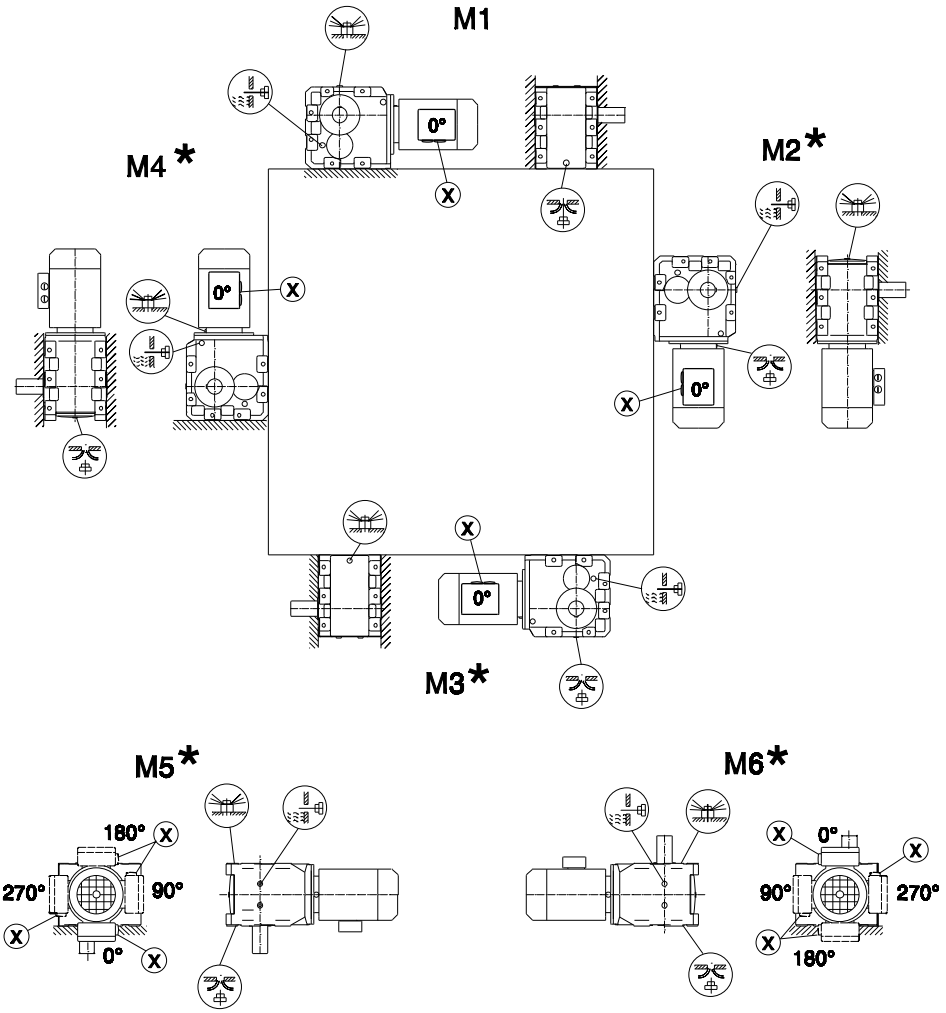


### 7.7.2 K167 ... K187 / KH167B ... KH187B

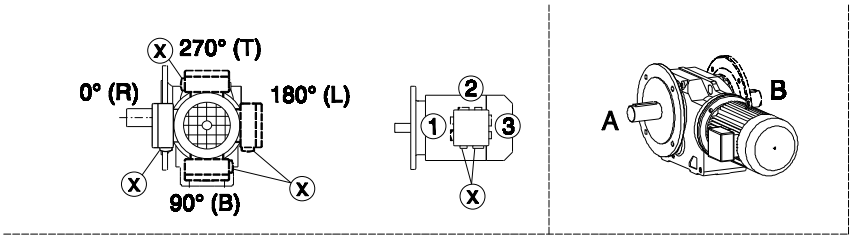
34 026 03 00

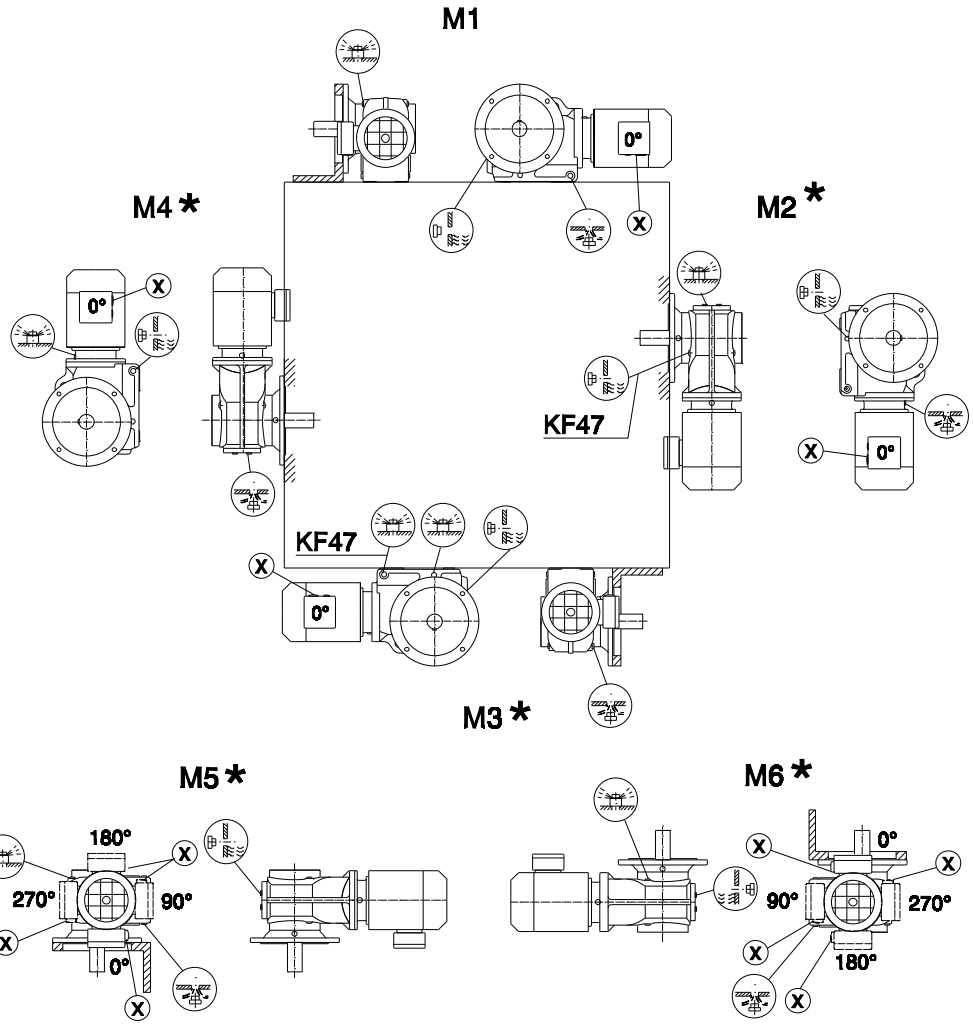


### 7.7.3 KF37 ... KF157 / KAF37 ... KAF157 / KHF37 ... KHF157 / KAZ37 ... KAZ157 / KHZ37 ... KHZ157 / KVF37 ... KVF107 / KVZ37 ... KVZ107

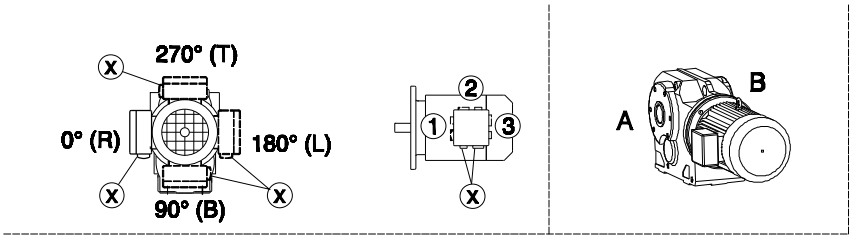
34 027 03 00

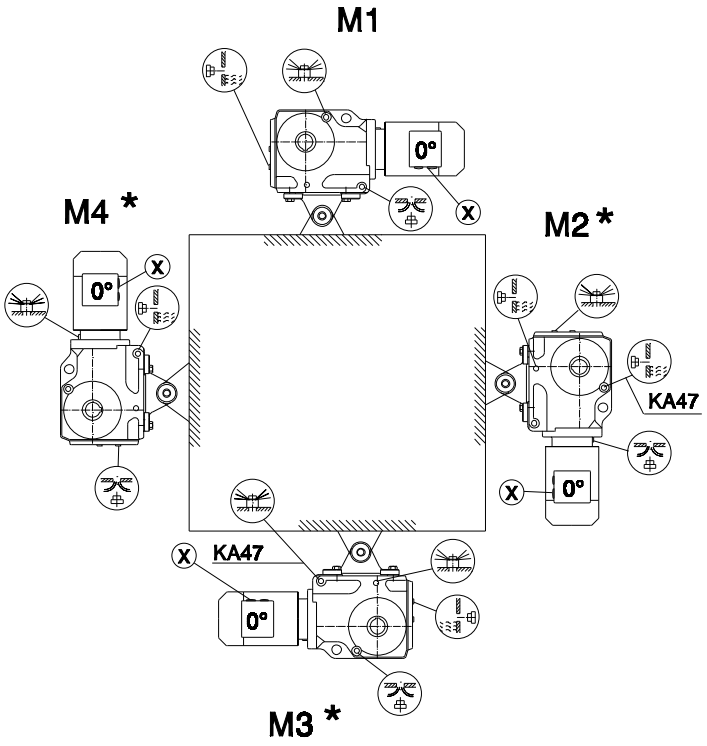


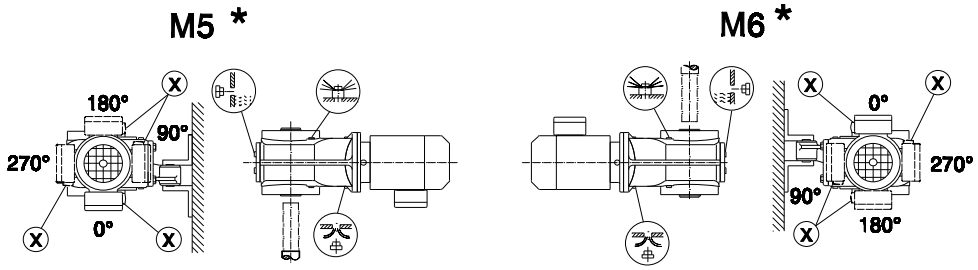



### 7.7.4 KA37 ... KA157 / KH37 ... KH157 / KV37 ... KV107 / KT37 ... KT157

**39 025 04 00**

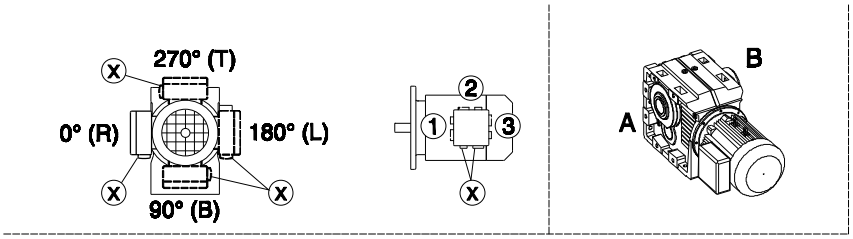


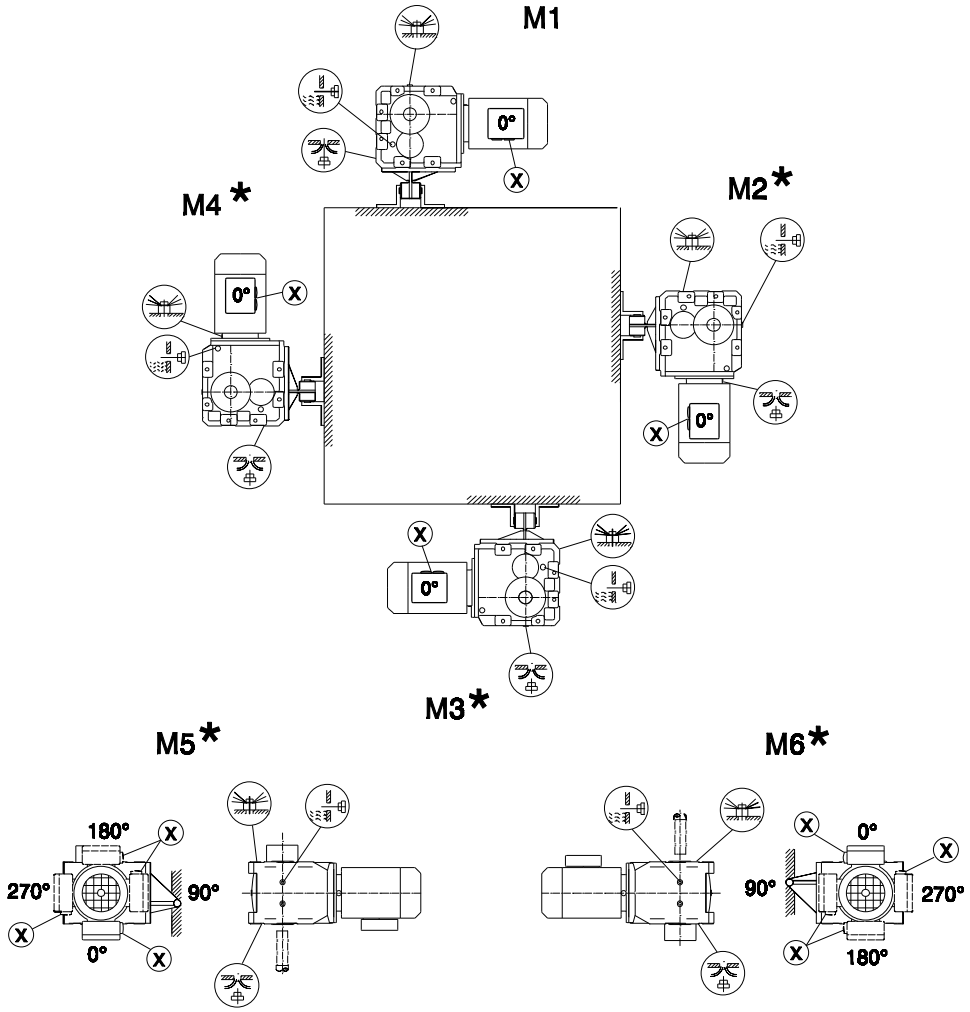



### 7.7.5 KH167 ... KH187

39 026 04 00

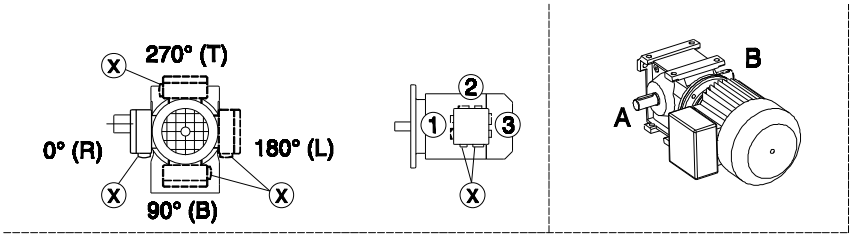


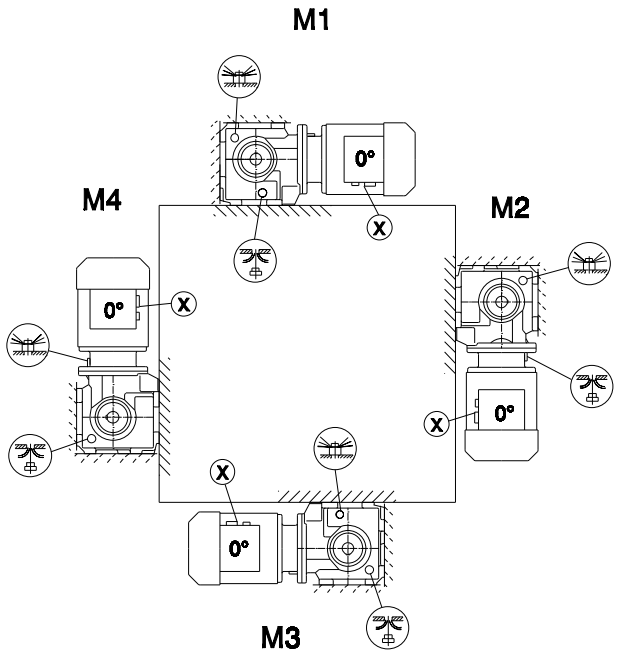



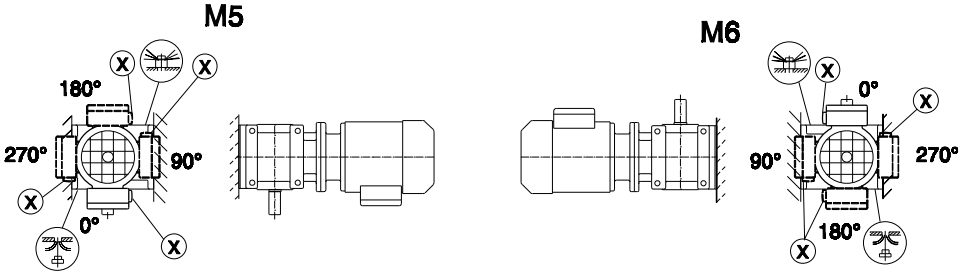
## 7.8 Helical-worm gearmotors S

### 7.8.1 S37

05 025 03 00

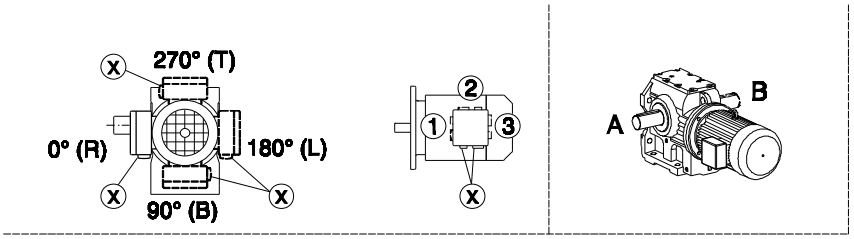


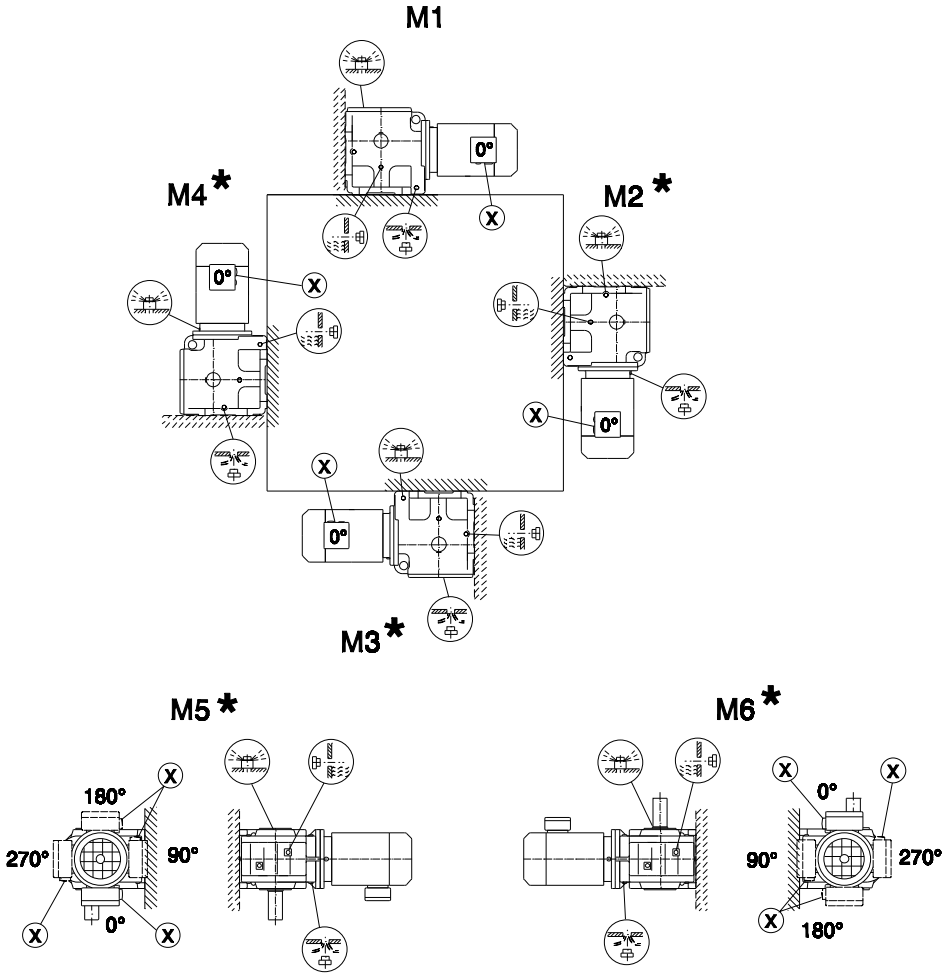



### 7.8.2 S47 ... S97

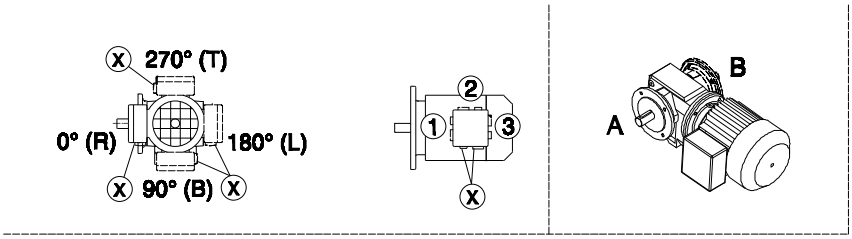
05 026 03 00

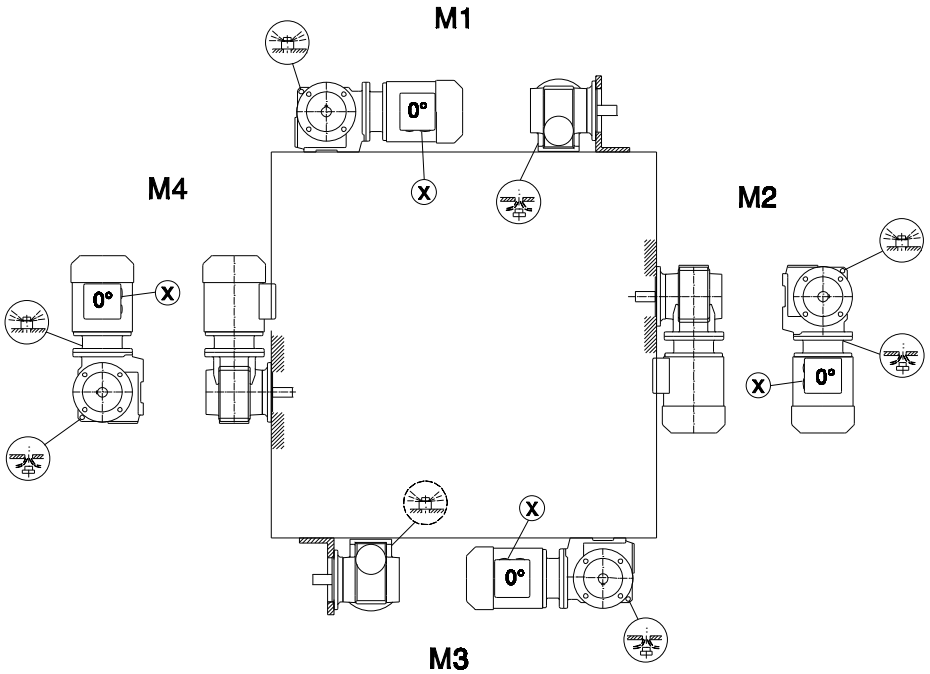


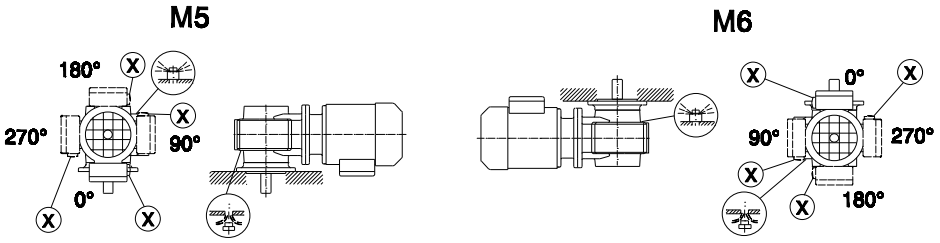



### 7.8.3 SF37 / SAF37 / SHF37

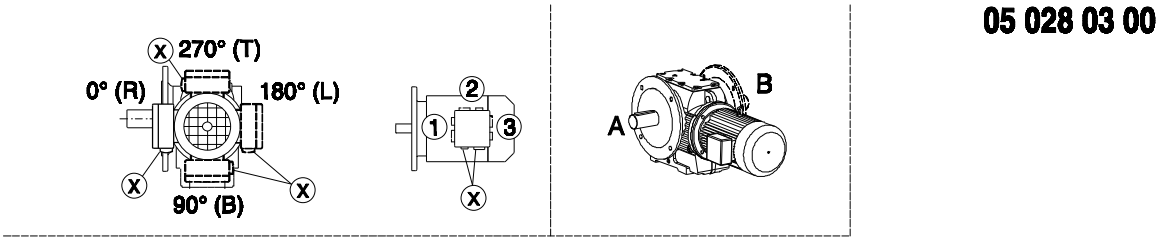
**05 027 03 00**

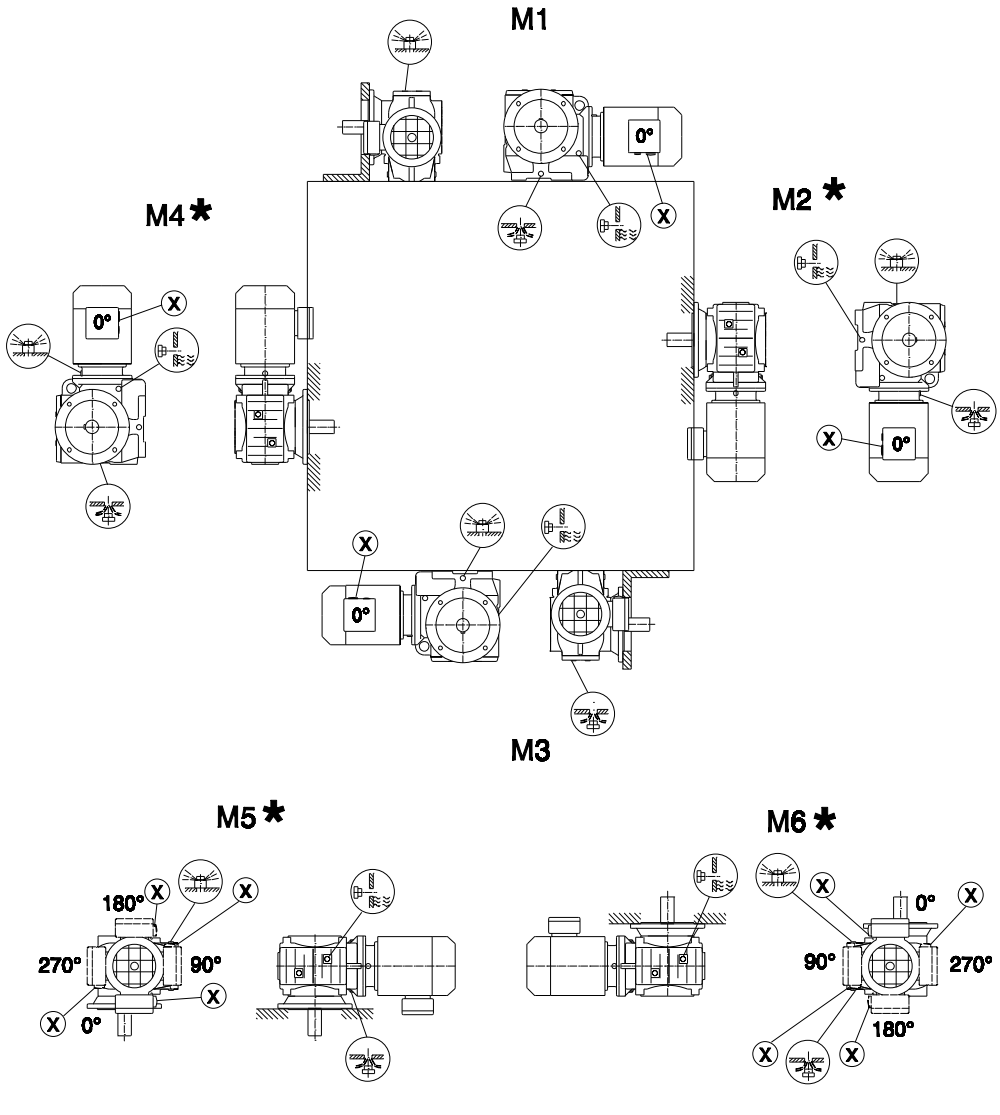


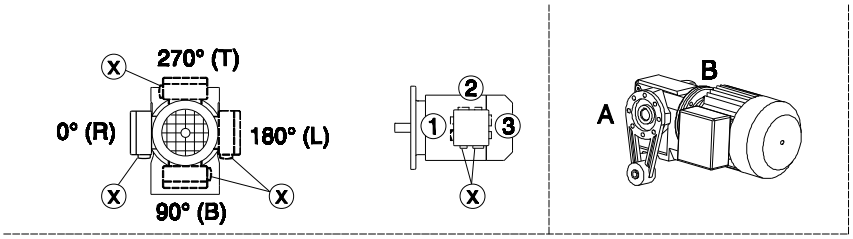
### 7.8.4 SF47 ... SF97 / SAF47 ... SAF97 / SHF47 ... SHF97 / SAZ47 ... SAZ97 / SHZ47 ... SHZ97

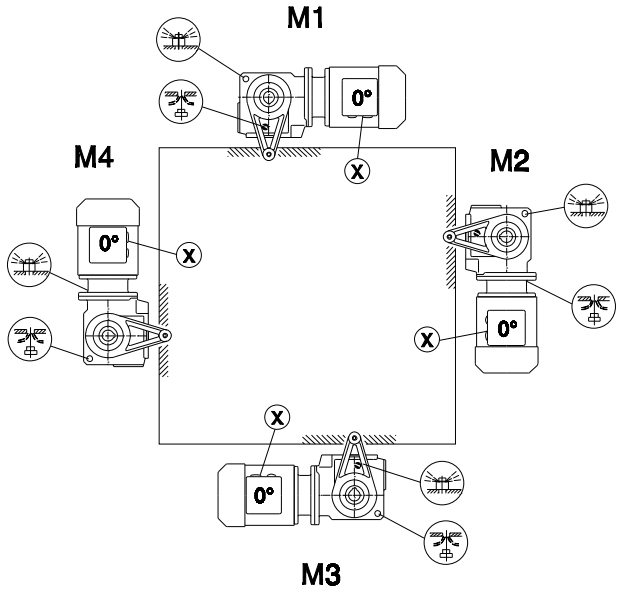


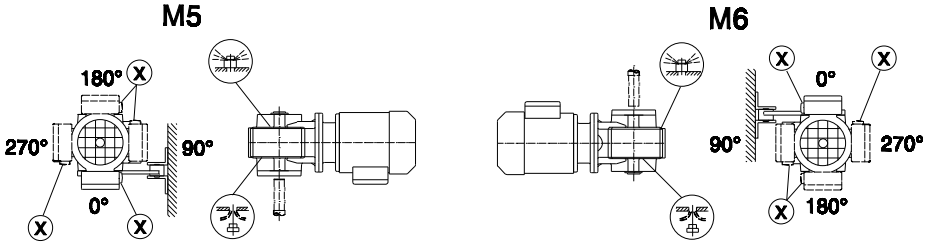



### 7.8.5 SA37 / SH37 / ST37

28 020 04 00

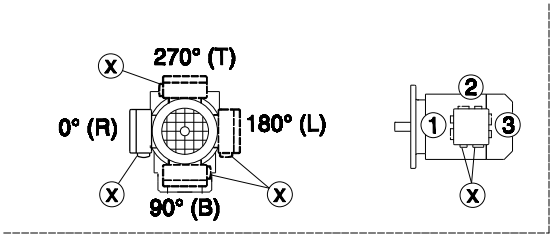


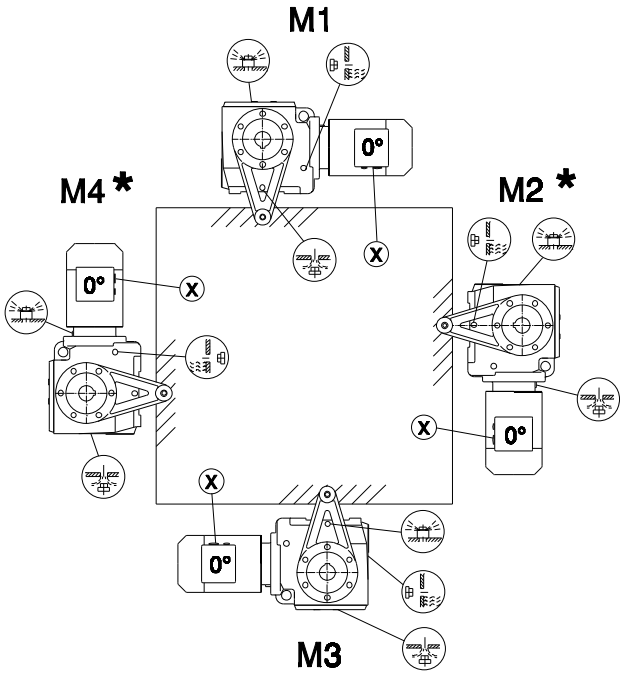



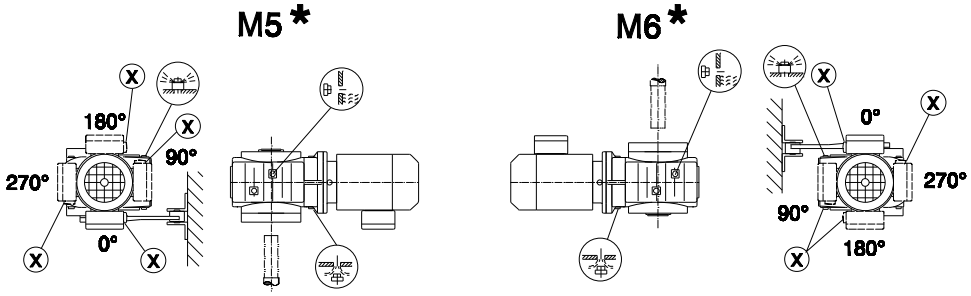



### 7.8.6 SA47 ... SA97 / SH47 ... SH97 / ST47 ... ST97

**28 021 03 00**

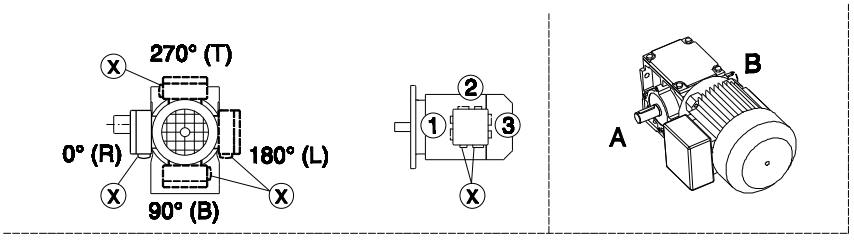


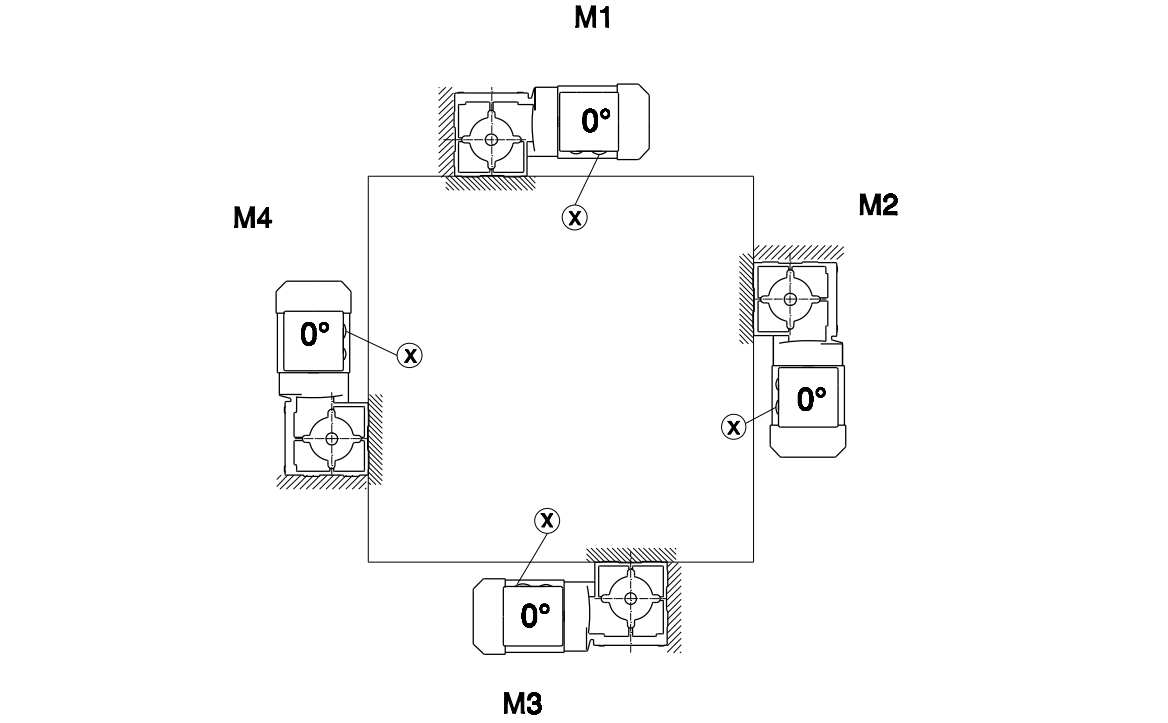



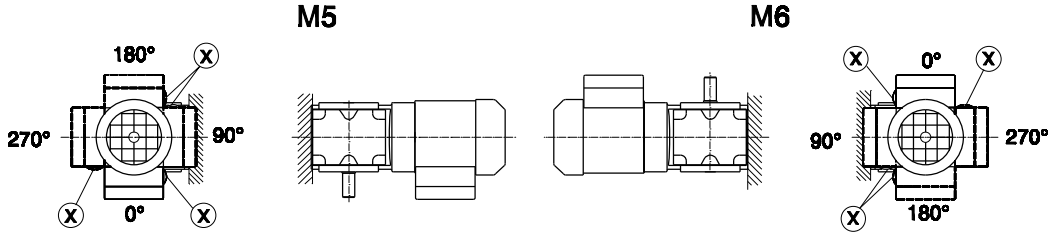



## 7.9 SPIROPLAN® W gearmotors

### 7.9.1 W10 ... W30

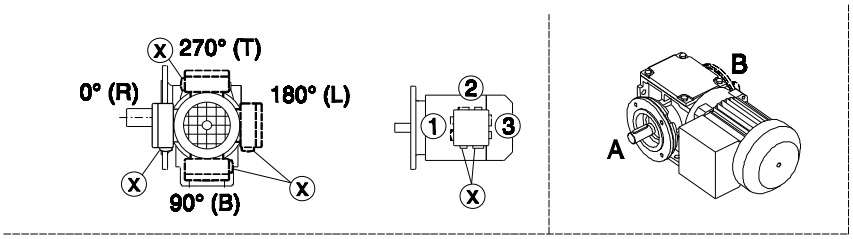


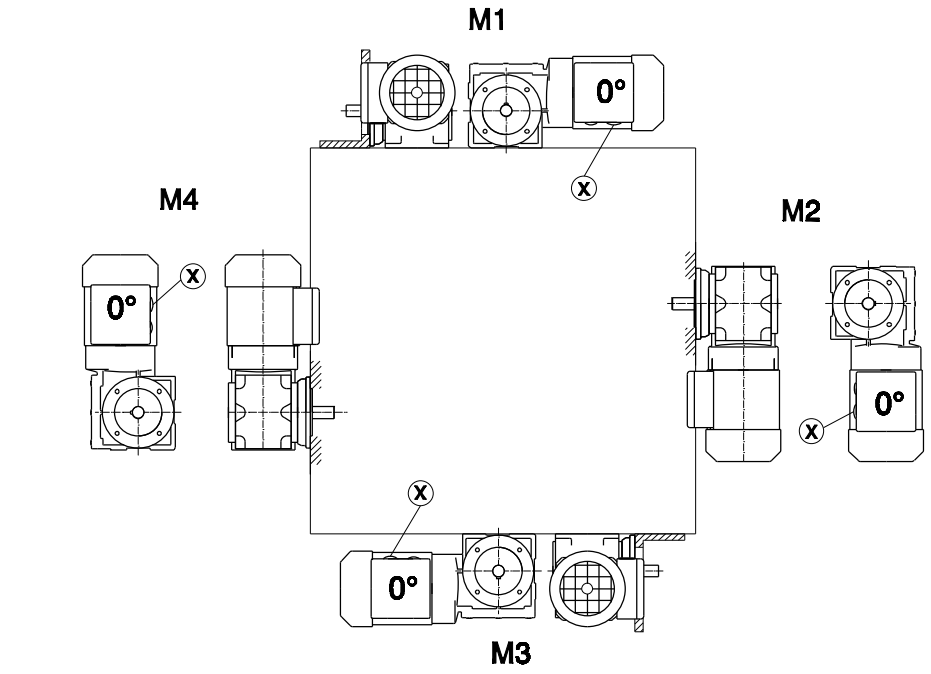



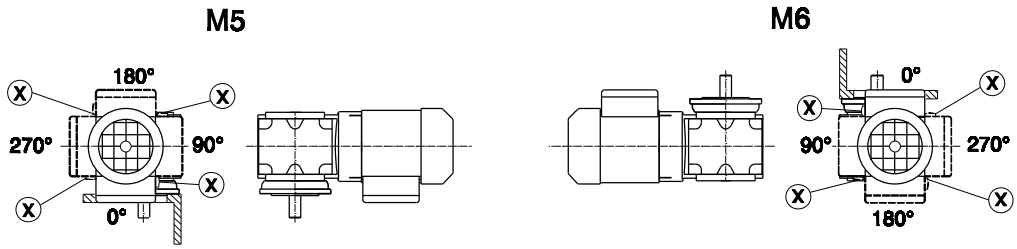



### 7.9.2 WF10 ... WF30 / WAF10 ... WAF30

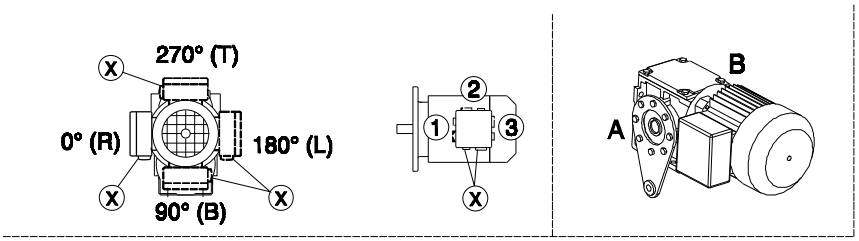
20 002 01 02

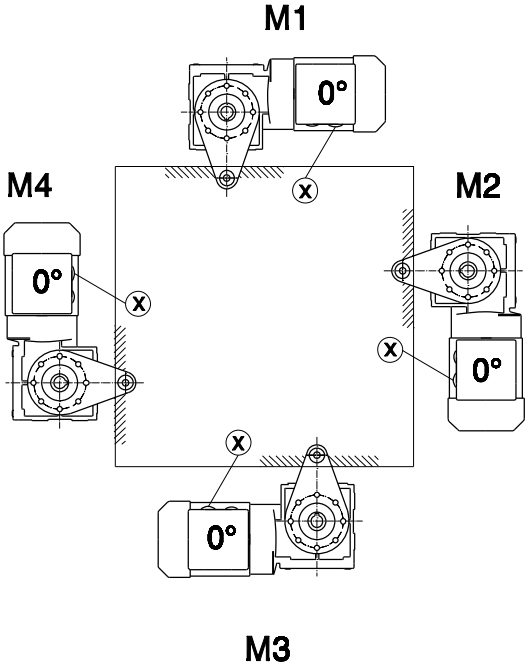


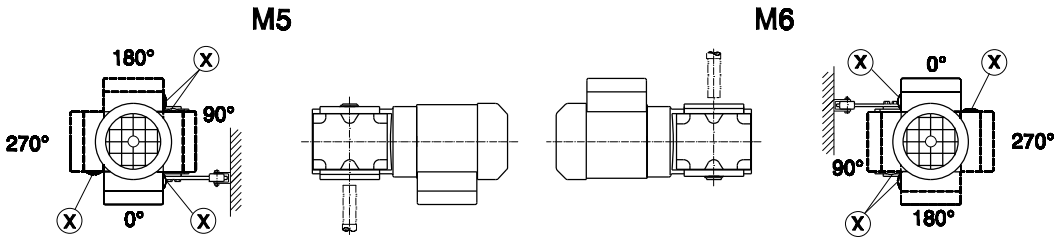



### 7.9.3 WA10 ... WA30

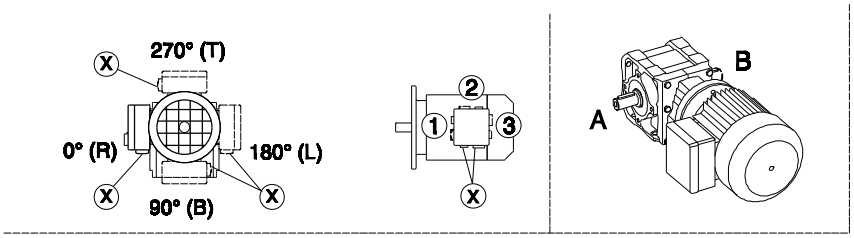


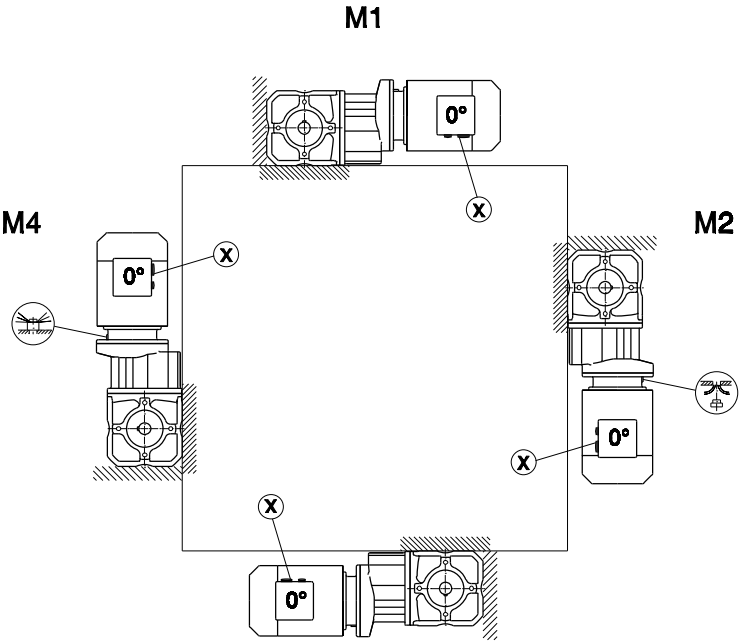



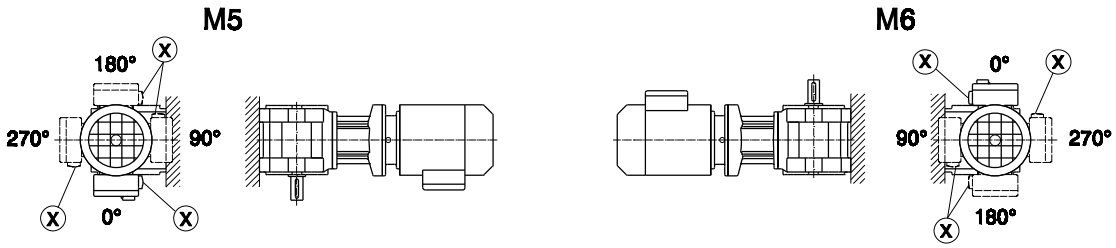



### 7.9.4 W37 ... W47 / WA37B ... WA47B / WH37B ... WH47B

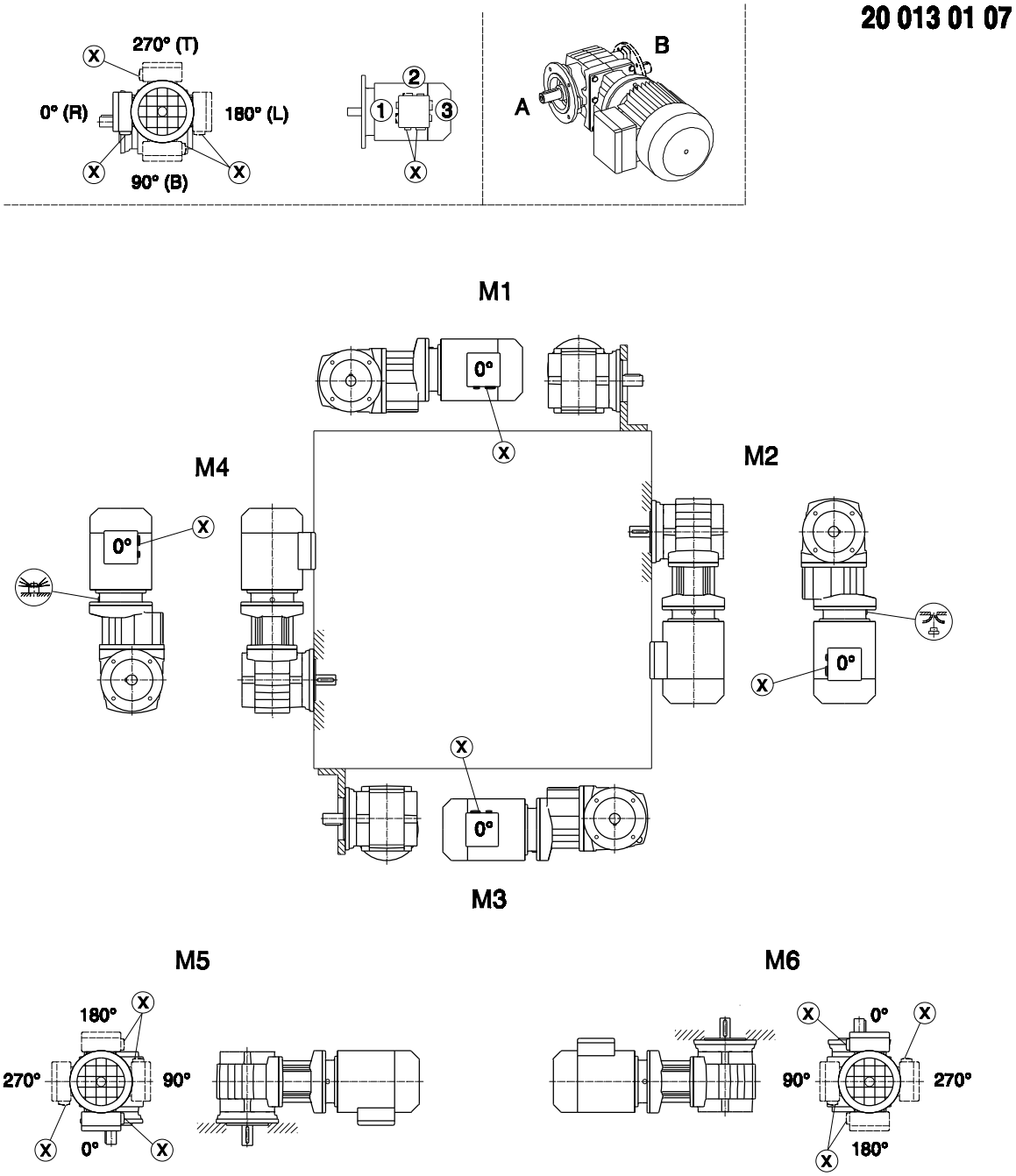
20 012 01 07



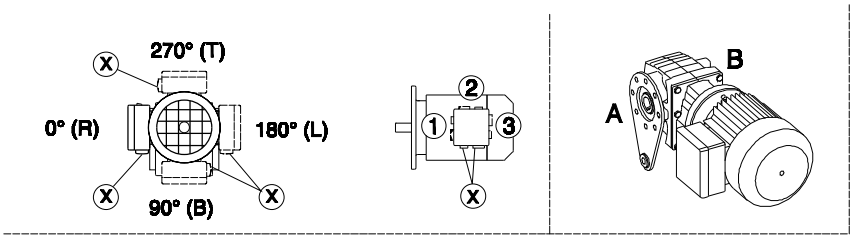



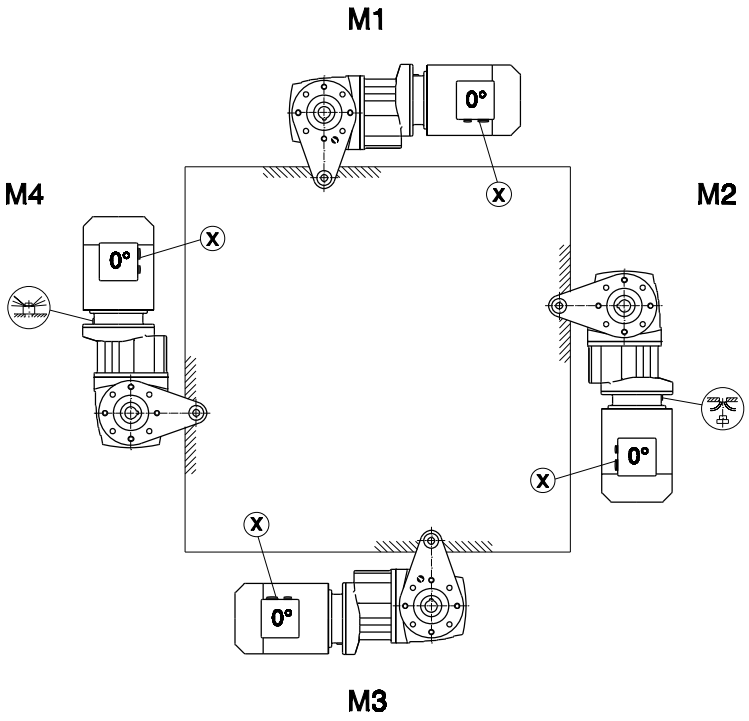
### 7.9.5 WF37 ... WF47 / WAF37 ... WAF47 / WHF37 ... WHF47

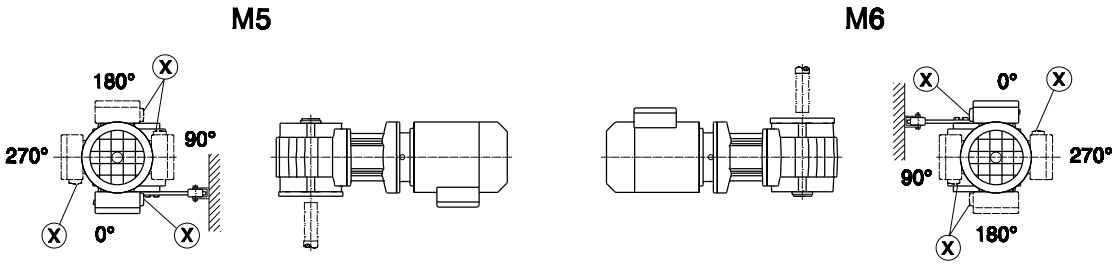


### 7.9.6 WA37 ... WA47 / WH37 ... WH47 / WT37 ... WT47

20 014 01 07



# 8 Technical Data

## 8.1 Extended storage

**INFORMATION**

For storage periods longer than 9 months, SEW-EURODRIVE recommends the "Extended storage" design. Gear units in this design are designated with a corresponding label.

In this case, a VCI corrosion inhibitor (volatile corrosion inhibitor) is added to the lubricant in these gear units. Please note that this VCI anti-corrosion agent is only effective in a temperature range of -25 °C to +50 °C. The flange contact surfaces and shaft ends are also treated with an anti-corrosion agent.

Observe the storage conditions specified in the following table for extended storage:

### 8.1.1 Storage conditions

The gear units must remain tightly sealed until taken into operation to prevent the VCI corrosion protection agent from evaporating.

The gear units come with the oil fill according to the specified mounting position (M1 – M6). Check the oil level before you start operating the gear unit for the first time.

| Climate zone | Packaging[1)] | Storage[2)] | Storage duration |
|---|---|---|---|
| **Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)** | Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. | Under roof, protected against rain and snow, no shock loads. | Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%). |
| | Open | Under roof and enclosed at constant temperature and atmospheric humidity (5°C < ϑ < 60°C, < 50% relative humidity).<br>No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks. | 2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection. |
| **Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)** | Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.<br>Protected against insect damage and mildew by chemical treatment. | With roof, protected against rain and shocks. | Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%). |
| | Open | Under roof and enclosed at constant temperature and atmospheric humidity (5°C < ϑ < 50°C, < 50% relative humidity).<br>No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks. Protected against insect damage. | 2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection. |

1) The packaging must be carried out by an experienced company using the packaging materials that have been explicitly specified for the particular application.

2) SEW-EURODRIVE recommends to store the gear units according to the mounting position.

## 8.2 Lubricants

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The mounting position (M1 – M6 section "Mounting positions") must be specified with the order. You must adapt the lubricant fill in case of any subsequent changes made to the mounting position, see section "Lubricant fill quantities (page 113)"

### 8.2.1 Anti-friction bearing greases

The rolling bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil.

| | Ambient temperature | Manufacturer | Type |
|---|---|---|---|
| Gear unit rolling bearings | -40 °C to +80 °C | Fuchs | Renolit CX-TOM 15 |
| | -40 °C to +80 °C | Klüber | Petamo GHY 133 N |
|  | -40 °C to +40 °C | Castrol | Obeen FS 2 |
|  | -20 °C to +40 °C | Fuchs | Plantogel 2S |

**INFORMATION**

The following grease quantities are required:

- **For fast-running bearings (gear unit input end):**

  Fill the cavities between the rolling elements one-third full with grease.
- **For slow-running bearings (gear unit output end):**

  Fill the cavities between the rolling elements two-thirds full with grease.

### 8.2.2 Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Observe the following legend with regards to the lubricant table.

*Key to the lubricant table*

Abbreviations, meaning of shading and notes:

| | |
|---|---|
| CLP | = Mineral oil |
| CLP PG | = Polyglycol (W gear units, conforms to USDA-H1) |
| CLP HC | = Synthetic hydrocarbons |
| E | = Ester oil (water hazard classification 1) |
| HCE | = Synthetic hydrocarbons + ester oil (USDA - H1 certification) |
| HLP | = Hydraulic oil |
| | = Synthetic lubricant (= synthetic-based roller bearing grease) |
| | = Mineral lubricant (= mineral-based rolling bearing grease) |

| | |
|---|---|
| 1) | Helical-worm gear units with PG oil: consult SEW-EURODRIVE. |
| 2) | Special lubricant for Spiroplan® gear units only |
| 3) | Recommendation: Select SEW $f_B \geq 1.2$ |
| 4) | Observe the critical starting behavior at low temperatures. |
| 5) | Low-viscosity grease |
| 6) | Ambient temperature |
| 7) | Grease |
|  | Lubricant for the food industry (food grade oil) |
|  | Biodegradable oil (lubricant for agriculture, forestry, and water management) |

*Lubricant table*

01 751 05 04

| | 6) °C -50 0 +60 +100 | DIN (ISO) | ISO.NLGI | Mobil® | Shell | Klüber | ARAL | bp | TEXACO | Castrol Tribol | Castrol Optimol | FUCHS | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R... | Standard -15 +40 | CLP(CC) | VG 220 | Mobilgear 600 XP 220 | Shell Omala 220 | Klüberoil GEM 1-220 N | Aral Degol BG 220 | BP Energol GR-XP 220 | Meropa 220 | Tribol 1100/220 | Optigear BM 220 | Renolin CLP 220 | Carter EP 220 |
| | -20 +80 | CLP PG | VG 220 | Mobil Glygoyle 220 | Shell Tivela S 220 | Klübersynth GH 6-220 | Aral Degol GS 220 | BP Enersyn SG-XP 220 | Synlube CLP 220 | Tribol 800/220 | Optiflex A 220 | Renolin PG 220 | Carter SY 220 |
| K...(HK...) | 4) -20 +60 | CLP HC | VG 220 | Mobil SHC 630 | Shell Omala HD 220 | Klübersynth GEM 4-220 N | Aral Degol PAS 220 | | Pinnacle EP 220 | Tribol 1510/220 | Optigear Synthetic X 220 | Renolin Unisyn CLP 220 | |
| | 4) -40 -40 | CLP HC | VG 150 | Mobil SHC 629 | Shell Omala HD 150 | Klübersynth GEM 4-150 N | | | Pinnacle EP 150 | | Optigear Synthetic X 150 | Renolin Unisyn CLP 150 | Carter SH 150 |
| | -20 +25 | CLP (CC) | VG 150 VG 100 | Mobilgear 600 XP 100 | Shell Omala 100 | Klüberoil GEM 1-150 N | Aral Degol BG 100 | BP Energol GR-XP 100 | Meropa 150 | Tribol 1100/100 | Optigear BM 100 | Renolin CLP 150 | Carter EP 100 |
| F...(HK...) | -30 +10 | HLP (HM) | VG 68-46 VG 32 | Mobil DTE 10 Excel 32 | Shell Tellus T 32 | Klüberoil GEM 1-68 N | Aral Degol BG 46 | | Rando EP Ashless 46 | Tribol 1100/68 | Optigear 32 | Renolin B 46 HVI | Equivis ZS 46 |
| | 4) -40 +20 | CLP HC | VG 68 | Mobil SHC 626 | Shell Omala HD 68 | | | | | | | Renolin Unisyn CLP 68 | |
| | 4) -40 + 0 | CLP HC | VG 32 | Mobil SHC 624 | | Klüber-Summit HySyn FG-32 | | | Cetus PAO 46 | | Optilieb HY 32 | Renolin Unisyn OL 32 | Dacnis SH 32 |
| | 4) -40 -20 | HLP (HM) | VG 22 VG 15 | Mobil DTE 10 Excel 15 | Shell Tellus T 15 | Isoflex MT 30 ROT | | BP Energol HLP-HM 15 | Rando HDZ 15 | | Hyspin AWS 22 | Renolin MR 310 | Equivis ZS 15 |
| | Standard 0 +40 | CLP (CC) | VG 680 | Mobilgear 600 XP 680 | Shell Omala 680 | Klüberoil GEM 1-680 N | Aral Degol BG 680 | BP Energol GR-XP 680 | Meropa 680 | Tribol 1100/680 | Optigear BM 680 | Renolin SEW 680 | Carter EP 680 |
| | -20 +80 | CLP PG | VG 680 1) | Mobil Glygoyle 680 | Shell Tivela S 680 | Klübersynth GH 6-680 | | BP Enersyn SG-XP 680 | Synlube CLP 680 | Tribol 800/680 | Optiflex A 680 | Renolin PG 680 | |
| S...(HS...) | 4) -20 +60 | CLP HC | VG 460 | Mobil SHC 634 | Shell Omala HD 460 | Klübersynth GEM 4-460 N | | | Pinnacle EP 460 | | Optigear Synthetic X 460 | Renolin CLP 460 | |
| | 4) -40 +30 | CLP HC | VG 150 | Mobil SHC 629 | Shell Omala HD 150 | Klübersynth GEM 4-150 N | | | Pinnacle EP 150 | | Optigear Synthetic X 150 | Renolin Unisyn CLP 150 | Carter SH 150 |
| | -20 +10 | CLP (CC) | VG 150 VG 100 | Mobilgear 600 XP 100 | Shell Omala 100 | Klüberoil GEM 1-150 N | Aral Degol BG 100 | BP Energol GR-XP 100 | Meropa 150 | Tribol 1100/100 | Optigear BM 100 | Renolin CLP 150 | Carter EP 100 |
| | -20 +40 | CLP PG | VG 220 1) | Mobil Glygoyle 220 | Shell Tivela S 220 | Klübersynth GH 6-220 | Aral Degol GS 220 | BP Enersyn SG-XP 220 | Synlube CLP 220 | Tribol 800/220 | Optiflex A 220 | Renolin PG 220 | Carter SY 220 |
| | 4) -40 +20 | CLP HC | VG 68 | Mobil SHC 626 | Shell Omala HD 68 | | | | | | | Renolin Unisyn CLP 68 | |
| | 4) -40 0 | CLP HC | VG 32 | Mobil SHC 624 | | Klüber-Summit HySyn FG-32 | | | Cetus PAO 46 | | Alphasyn T32 | Renolin Unisyn OL 32 | Dacnis SH 32 |
| | 4) -10 +40 | CLP HC NSF H1 | VG 460 | | Shell Cassida Fluid GL 460 | Klüberoil 4UH1-460 N | | | | | | Optileb GT 460 | Geralyn SF 460 |
| R...K...(HK...), F...S...(HS...) | -20 +30 | | VG 220 | | Shell Cassida Fluid GL 220 | Klüberoil 4UH1-220 N | | | | | | Optileb GT 220 | |
| | -40 0 | | VG 68 | | Shell Cassida Fluid HF 68 | Klüberoil 4UH1-68 N | | | | | | Optileb HY 68 | |
| | E | | VG 460 | | | Klüberbio CA2-460 | | | | Tribol Bio Top 1418/460 | | | Plantogear 460 S |
| | Standard -20 +40 | CLP PG 460 -SEW | VG 460 2) | | | Klüber SEW HT-460-5 | | | | | | | |
| W...(HW...) | 4) -40 +10 | API GL5 | SAE 75W90 (-VG 100) | Mobil Synthetic Gear Oil 75 W90 | | | | | | | | | |
| | | H1 PG | VG 460 2) 3) | | | Klübersynth UH1 6-460 | | | | | | | |
| | Standard -20 +40 | CLP PG | VG 220 | | | Klübersynth GH 6-220 | | | | | | | |
| PS.F.. | -20 +60 | H1 PG | VG 460 2) 3) | | | Klübersynth UH1 6-460 | | | | | | | |
| | -40 0 | CLP HC | VG 32 | Mobil SHC 624 | | | | | | | | | |
| | Standard | CLP (CC) | VG 220 | Mobilgear 600 XP 220 | | | | | | | | | |
| PS.C.. | -20 +40 | DIN 51 818 | 00 5) | Mobilux EP 004 | | | | | | | | | |
| | -20 +40 | | 1 7) | | | Klübersynth UH1 14-151 | | | | | | | |
| | -40 0 | CLP HC | VG 32 | Mobil SHC 624 | | | | | | | | | |
| | Standard | API GL5 | SAE 75W90 (-VG 100) | Mobil Synth Gear Oil 75 W90 | | | | | | | | | |
| BS.F.. | -20 +60 | H1 PG | VG 460 2) 3) | | | Klübersynth UH1 6-460 | | | | | | | |

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### 8.2.3 Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil volume**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 ... M6.

*Helical (R) gear units*

R.., R..F

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1[1)] | M2 | M3 | M4 | M5 | M6 |
| **R07** | 0.12 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| **R17** | 0.25 | 0.55 | 0.35 | 0.55 | 0.35 | 0.40 |
| **R27** | 0.25/0.40 | 0.70 | 0.50 | 0.70 | 0.50 | 0.50 |
| **R37** | 0.30/0.95 | 0.85 | 0.95 | 1.05 | 0.75 | 0.95 |
| **R47** | 0.70/1.50 | 1.60 | 1.50 | 1.65 | 1.50 | 1.50 |
| **R57** | 0.80/1.70 | 1.90 | 1.70 | 2.10 | 1.70 | 1.70 |
| **R67** | 1.10/2.30 | 2.40 | 2.80 | 2.90 | 1.80 | 2.00 |
| **R77** | 1.20/3.00 | 3.30 | 3.60 | 3.80 | 2.50 | 3.40 |
| **R87** | 2.30/6.0 | 6.4 | 7.2 | 7.2 | 6.3 | 6.5 |
| **R97** | 4.60/9.8 | 11.7 | 11.7 | 13.4 | 11.3 | 11.7 |
| **R107** | 6.0/13.7 | 16.3 | 16.9 | 19.2 | 13.2 | 15.9 |
| **R137** | 10.0/25.0 | 28.0 | 29.5 | 31.5 | 25.0 | 25.0 |
| **R147** | 15.4/40.0 | 46.5 | 48.0 | 52.0 | 39.5 | 41.0 |
| **R167** | 27.0/70.0 | 82.0 | 78.0 | 88.0 | 66.0 | 69.0 |

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

RF..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1[1)] | M2 | M3 | M4 | M5 | M6 |
| **RF07** | 0.12 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| **RF17** | 0.25 | 0.55 | 0.35 | 0.55 | 0.35 | 0.40 |
| **RF27** | 0.25/0.40 | 0.70 | 0.50 | 0.70 | 0.50 | 0.50 |
| **RF37** | 0.35/0.95 | 0.90 | 0.95 | 1.05 | 0.75 | 0.95 |
| **RF47** | 0.65/1.50 | 1.60 | 1.50 | 1.65 | 1.50 | 1.50 |
| **RF57** | 0.80/1.70 | 1.80 | 1.70 | 2.00 | 1.70 | 1.70 |
| **RF67** | 1.20/2.50 | 2.50 | 2.70 | 2.80 | 1.90 | 2.10 |
| **RF77** | 1.20/2.60 | 3.10 | 3.30 | 3.60 | 2.40 | 3.00 |
| **RF87** | 2.40/6.0 | 6.4 | 7.1 | 7.2 | 6.3 | 6.4 |
| **RF97** | 5.1/10.2 | 11.9 | 11.2 | 14.0 | 11.2 | 11.8 |
| **RF107** | 6.3/14.9 | 15.9 | 17.0 | 19.2 | 13.1 | 15.9 |
| **RF137** | 9.5/25.0 | 27.0 | 29.0 | 32.5 | 25.0 | 25.0 |
| **RF147** | 16.4/42.0 | 47.0 | 48.0 | 52.0 | 42.0 | 42.0 |
| **RF167** | 26.0/70.0 | 82.0 | 78.0 | 88.0 | 65.0 | 71.0 |

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

RX..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **RX57** | 0.60 | 0.80 | 1.30 | 1.30 | 0.90 | 0.90 |
| **RX67** | 0.80 | 0.80 | 1.70 | 1.90 | 1.10 | 1.10 |
| **RX77** | 1.10 | 1.50 | 2.60 | 2.70 | 1.60 | 1.60 |
| **RX87** | 1.70 | 2.50 | 4.80 | 4.80 | 2.90 | 2.90 |
| **RX97** | 2.10 | 3.40 | 7.4 | 7.0 | 4.80 | 4.80 |
| **RX107** | 3.90 | 5.6 | 11.6 | 11.9 | 7.7 | 7.7 |

RXF..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **RXF57** | 0.50 | 0.80 | 1.10 | 1.10 | 0.70 | 0.70 |
| **RXF67** | 0.70 | 0.80 | 1.50 | 1.40 | 1.00 | 1.00 |
| **RXF77** | 0.90 | 1.30 | 2.40 | 2.00 | 1.60 | 1.60 |
| **RXF87** | 1.60 | 1.95 | 4.90 | 3.95 | 2.90 | 2.90 |
| **RXF97** | 2.10 | 3.70 | 7.1 | 6.3 | 4.80 | 4.80 |
| **RXF107** | 3.10 | 5.7 | 11.2 | 9.3 | 7.2 | 7.2 |

*Parallel shaft helical (F) gear units*

F.., FA..B, FH..B, FV..B

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **F..27** | 0.60 | 0.80 | 0.65 | 0.70 | 0.60 | 0.60 |
| **F..37** | 0.95 | 1.25 | 0.70 | 1.25 | 1.00 | 1.10 |
| **F..47** | 1.50 | 1.80 | 1.10 | 1.90 | 1.50 | 1.70 |
| **F..57** | 2.60 | 3.50 | 2.10 | 3.50 | 2.80 | 2.90 |
| **F..67** | 2.70 | 3.80 | 1.90 | 3.80 | 2.90 | 3.20 |
| **F..77** | 5.9 | 7.3 | 4.30 | 8.0 | 6.0 | 6.3 |
| **F..87** | 10.8 | 13.0 | 7.7 | 13.8 | 10.8 | 11.0 |
| **F..97** | 18.5 | 22.5 | 12.6 | 25.2 | 18.5 | 20.0 |
| **F..107** | 24.5 | 32.0 | 19.5 | 37.5 | 27.0 | 27.0 |
| **F..127** | 40.5 | 54.5 | 34.0 | 61.0 | 46.3 | 47.0 |
| **F..157** | 69.0 | 104.0 | 63.0 | 105.0 | 86.0 | 78.0 |

FF..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **FF27** | 0.60 | 0.80 | 0.65 | 0.70 | 0.60 | 0.60 |
| **FF37** | 1.00 | 1.25 | 0.70 | 1.30 | 1.00 | 1.10 |
| **FF47** | 1.60 | 1.85 | 1.10 | 1.90 | 1.50 | 1.70 |
| **FF57** | 2.80 | 3.50 | 2.10 | 3.70 | 2.90 | 3.00 |
| **FF67** | 2.70 | 3.80 | 1.90 | 3.80 | 2.90 | 3.20 |
| **FF77** | 5.9 | 7.3 | 4.30 | 8.1 | 6.0 | 6.3 |
| **FF87** | 10.8 | 13.2 | 7.8 | 14.1 | 11.0 | 11.2 |
| **FF97** | 19.0 | 22.5 | 12.6 | 25.6 | 18.9 | 20.5 |
| **FF107** | 25.5 | 32.0 | 19.5 | 38.5 | 27.5 | 28.0 |
| **FF127** | 41.5 | 55.5 | 34.0 | 63.0 | 46.3 | 49.0 |
| **FF157** | 72.0 | 105.0 | 64.0 | 106.0 | 87.0 | 79.0 |

FA.., FH.., FV.., FAF.., FAZ.., FHF.., FHZ.., FVF.., FVZ.., FT..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **F..27** | 0.60 | 0.80 | 0.65 | 0.70 | 0.60 | 0.60 |
| **F..37** | 0.95 | 1.25 | 0.70 | 1.25 | 1.00 | 1.10 |
| **F..47** | 1.50 | 1.80 | 1.10 | 1.90 | 1.50 | 1.70 |
| **F..57** | 2.70 | 3.50 | 2.10 | 3.40 | 2.90 | 3.00 |
| **F..67** | 2.70 | 3.80 | 1.90 | 3.80 | 2.90 | 3.20 |
| **F..77** | 5.9 | 7.3 | 4.30 | 8.0 | 6.0 | 6.3 |
| **F..87** | 10.8 | 13.0 | 7.7 | 13.8 | 10.8 | 11.0 |
| **F..97** | 18.5 | 22.5 | 12.6 | 25.2 | 18.5 | 20.0 |
| **F..107** | 24.5 | 32.0 | 19.5 | 37.5 | 27.0 | 27.0 |
| **F..127** | 39.0 | 54.5 | 34.0 | 61.0 | 45.0 | 46.5 |
| **F..157** | 68.0 | 103.0 | 62.0 | 104.0 | 85.0 | 79.5 |

*Helical-bevel (K) gear units*

K.., KA..B, KH..B, KV..B

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **K..37** | 0.50 | 1.00 | 1.00 | 1.25 | 0.95 | 0.95 |
| **K..47** | 0.80 | 1.30 | 1.50 | 2.00 | 1.60 | 1.60 |
| **K..57** | 1.10 | 2.20 | 2.20 | 2.80 | 2.30 | 2.10 |
| **K..67** | 1.10 | 2.40 | 2.60 | 3.45 | 2.60 | 2.60 |
| **K..77** | 2.20 | 4.10 | 4.40 | 5.8 | 4.20 | 4.40 |
| **K..87** | 3.70 | 8.0 | 8.7 | 10.9 | 8.0 | 8.0 |
| **K..97** | 7.0 | 14.0 | 15.7 | 20.0 | 15.7 | 15.5 |
| **K..107** | 10.0 | 21.0 | 25.5 | 33.5 | 24.0 | 24.0 |
| **K..127** | 21.0 | 41.5 | 44.0 | 54.0 | 40.0 | 41.0 |
| **K..157** | 31.0 | 62.0 | 65.0 | 90.0 | 58.0 | 62.0 |
| **K..167** | 33.0 | 95.0 | 105.0 | 123.0 | 85.0 | 84.0 |
| **K..187** | 53.0 | 152.0 | 167.0 | 200 | 143.0 | 143.0 |

KF..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **KF37** | 0.50 | 1.10 | 1.10 | 1.50 | 1.00 | 1.00 |
| **KF47** | 0.80 | 1.30 | 1.70 | 2.20 | 1.60 | 1.60 |
| **KF57** | 1.20 | 2.20 | 2.40 | 3.15 | 2.50 | 2.30 |
| **KF67** | 1.10 | 2.40 | 2.80 | 3.70 | 2.70 | 2.70 |
| **KF77** | 2.10 | 4.10 | 4.40 | 5.9 | 4.50 | 4.50 |
| **KF87** | 3.70 | 8.2 | 9.0 | 11.9 | 8.4 | 8.4 |
| **KF97** | 7.0 | 14.7 | 17.3 | 21.5 | 15.7 | 16.5 |
| **KF107** | 10.0 | 21.8 | 25.8 | 35.1 | 25.2 | 25.2 |
| **KF127** | 21.0 | 41.5 | 46.0 | 55.0 | 41.0 | 41.0 |
| **KF157** | 31.0 | 66.0 | 69.0 | 92.0 | 62.0 | 62.0 |

KA.., KH.., KV.., KAF.., KHF.., KVF.., KAZ.., KHZ.., KVZ.., KT..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **K..37** | 0.50 | 1.00 | 1.00 | 1.40 | 1.00 | 1.00 |
| **K..47** | 0.80 | 1.30 | 1.60 | 2.15 | 1.60 | 1.60 |
| **K..57** | 1.20 | 2.20 | 2.40 | 3.15 | 2.70 | 2.40 |
| **K..67** | 1.10 | 2.40 | 2.70 | 3.70 | 2.60 | 2.60 |
| **K..77** | 2.10 | 4.10 | 4.60 | 5.9 | 4.40 | 4.40 |
| **K..87** | 3.70 | 8.2 | 8.8 | 11.1 | 8.0 | 8.0 |
| **K..97** | 7.0 | 14.7 | 15.7 | 20.0 | 15.7 | 15.7 |
| **K..107** | 10.0 | 20.5 | 24.0 | 32.4 | 24.0 | 24.0 |
| **K..127** | 21.0 | 41.5 | 43.0 | 52.0 | 40.0 | 40.0 |
| **K..157** | 31.0 | 66.0 | 67.0 | 87.0 | 62.0 | 62.0 |
| **K..167** | 33.0 | 95.0 | 105.0 | 123.0 | 85.0 | 84.0 |
| **K..187** | 53.0 | 152.0 | 167.0 | 200 | 143.0 | 143.0 |

*Helical-worm (S) gear units*

S

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **S..37** | 0.25 | 0.40 | 0.50 | 0.55 | 0.40 | 0.40 |
| **S..47** | 0.35 | 0.80 | 0.70/0.90 | 1.00 | 0.80 | 0.80 |
| **S..57** | 0.50 | 1.20 | 1.00/1.20 | 1.45 | 1.30 | 1.30 |
| **S..67** | 1.00 | 2.00 | 2.20/3.10 | 3.10 | 2.60 | 2.60 |
| **S..77** | 1.90 | 4.20 | 3.70/5.4 | 5.9 | 4.40 | 4.40 |
| **S..87** | 3.30 | 8.1 | 6.9/10.4 | 11.3 | 8.4 | 8.4 |
| **S..97** | 6.8 | 15.0 | 13.4/18.0 | 21.8 | 17.0 | 17.0 |

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SF..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **SF37** | 0.25 | 0.40 | 0.50 | 0.55 | 0.40 | 0.40 |
| **SF47** | 0.40 | 0.90 | 0.90/1.05 | 1.05 | 1.00 | 1.00 |
| **SF57** | 0.50 | 1.20 | 1.00/1.50 | 1.55 | 1.40 | 1.40 |
| **SF67** | 1.00 | 2.20 | 2.30/3.00 | 3.20 | 2.70 | 2.70 |
| **SF77** | 1.90 | 4.10 | 3.90/5.8 | 6.5 | 4.90 | 4.90 |
| **SF87** | 3.80 | 8.0 | 7.1/10.1 | 12.0 | 9.1 | 9.1 |
| **SF97** | 7.4 | 15.0 | 13.8/18.8 | 22.6 | 18.0 | 18.0 |

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SA.., SH.., SAF.., SHZ.., SAZ.., SHF.., ST..

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **S..37** | 0.25 | 0.40 | 0.50 | 0.50 | 0.40 | 0.40 |
| **S..47** | 0.40 | 0.80 | 0.70/0.90 | 1.00 | 0.80 | 0.80 |
| **S..57** | 0.50 | 1.10 | 1.00/1.50 | 1.50 | 1.20 | 1.20 |
| **S..67** | 1.00 | 2.00 | 1.80/2.60 | 2.90 | 2.50 | 2.50 |
| **S..77** | 1.80 | 3.90 | 3.60/5.0 | 5.8 | 4.50 | 4.50 |
| **S..87** | 3.80 | 7.4 | 6.0/8.7 | 10.8 | 8.0 | 8.0 |
| **S..97** | 7.0 | 14.0 | 11.4/16.0 | 20.5 | 15.7 | 15.7 |

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

*SPIROPLAN® (W) gear units*

The fill quantity of SPIROPLAN® gear units W..10 to W..30 does not vary, irrespective of their mounting position. Only the fill quantity of SPIROPLAN® gear units W..37 and W..47 in mounting position M4 are different from that of other mounting positions.

| Gear unit | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **W..10** | 0.16 | | | | | |
| **W..20** | 0.24 | | | | | |
| **W..30** | 0.40 | | | | | |
| **W..37** | 0.50 | | | 0.70 | 0.50 | |
| **W..47** | 0.90 | | | 1.40 | 0.90 | |
| **WF47** | 0.90 | | | 1.40 | 0.90 | |
| **WA47** | 0.90 | | | 1.25 | 0.90 | |

# 9 Malfunctions/Service

**⚠ WARNING**

Risk of crushing if the drive starts up unintentionally.

Severe or fatal injuries.

- De-energize the motor before you start working on the unit.
- Secure the motor against unintended power-up.

**⚠ CAUTION**

Danger of burns due to hot gear unit and hot gear unit oil.

Severe injuries.

- Let the gear unit cool down before you start working on it.
- Only remove the oil level and oil drain plug very carefully.

**⚠ NOTICE**

Improper handling of the gear unit and the motor may lead to damages.

Possible damage to property

- Any repair work on SEW drives may be performed by qualified personnel only.
- Only qualified personnel is permitted to separate drive and motor.
- Consult SEW-EURODRIVE customer service.

## *9.1 Gear unit*

| Fault | Possible cause | Remedy |
|---|---|---|
| Unusual, regular running noise | Meshing/grinding noise: Bearing damage | Check the oil →see "Inspection/maintenance for the gear unit" (page 67), change bearings. |
| | Knocking noise: Irregularity in the gearing | Contact customer service. |
| Unusual, irregular running noise | Foreign bodies in the oil | • Check the oil →see "Inspection/maintenance for the gear unit" (page 67),<br>• Stop the drive, contact customer service |
| Oil leakage[1)]<br>• From inspection cover<br>• From the motor flange<br>• From the motor oil seal<br>• From the gear unit flange<br>• From the output end oil seal. | Rubber seal on the gear cover plate leaking | Tighten the screws on the gear cover plate and observe the gear unit. If oil still leaks: Contact customer service. |
| | Seal defective. | Contact customer service. |
| | Gear unit not ventilated | Vent the gear unit → see "Mounting Positions (page 82)". |
| Oil leaking from breather valve | Too much oil | Correct the oil fill quantity →see "Inspection/maintenance for the gear unit" (page 67), |
| | Drive installed in incorrect mounting position | • Properly adjust the breather valve, see "Mounting Positions (page 82)"<br>• Correct the oil level →see "Inspection/ maintenance for the gear unit" (page 67), |
| | Frequent cold starts (oil foams) and/or high oil level. | Use an oil expansion tank |
| Output shaft does not turn although the motor is running or the input shaft is rotated | Connection between shaft and hub in gear unit interrupted | Send in the gear unit/gearmotor for repair. |

1) Short-term oil / grease leakage at the oil seal is possible in the run-in phase (48 hours running time).

## 9.2 AM/AQ/AL adapter

| Malfunction | Possible cause | Remedy |
|---|---|---|
| Unusual, regular running noise | Meshing/grinding noise: Bearing damage. | Contact SEW-EURODRIVE customer service |
| Oil leaking | Seal defective | Contact SEW-EURODRIVE customer service |
| Output shaft does not turn although the motor is running or the input shaft is rotated | Connection between shaft and hub in gear unit interrupted | Send the gear unit to SEW-EURODRIVE for repair. |
| Change in running noise and / or vibrations. | Annular gear wear, short-term torque transfer through metal contact | Change the annular gear |
| | Bolts to secure hub axially are loose. | Tighten the screws |
| Premature wear in annular gear | • Contact with aggressive fluids / oils; ozone influence; too high ambient temperatures etc, which can cause a change in the physical properties of the annular gear.<br>• Impermissibly high ambient/contact temperature for the annular gear; maximum permitted temperature: -20 °C to +80 °C<br>• Overload | Contact SEW-EURODRIVE customer service |

## 9.3 AD input shaft assembly

| Malfunction | Possible cause | Remedy |
|---|---|---|
| Unusual, regular running noise | Meshing/grinding noise: Bearing damage. | Contact SEW-EURODRIVE customer service |
| Oil leaking | Seal defective | Contact SEW-EURODRIVE customer service |
| Output shaft does not turn although the input shaft is rotated. | Connection between shaft and hub in gear unit or cover interrupted | Send the gear unit to SEW-EURODRIVE for repair. |

## 9.4 Customer service

**Please have the following information available if you require customer service assistance:**

- Nameplate data (complete)
- Type and extent of the problem
- Time the problem occurred and any accompanying circumstances
- Assumed cause

A digital photograph if possible

## 9.5 Disposal

Dispose gear units in accordance with the regulations in force regarding respective materials:

- Steel scrap
  - Housing parts
  - Gears
  - Shafts
  - Roller bearing
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears as appropriate.
- Collect waste oil and dispose of it according to the regulations in force.

# 10 Address List

| Germany | | | |
|---|---|---|---|
| **Headquarters**<br>**Production**<br>**Sales** | **Bruchsal** | SEW-EURODRIVE GmbH & Co KG<br>Ernst-Blickle-Straße 42<br>D-76646 Bruchsal<br>P.O. Box<br>Postfach 3023 • D-76642 Bruchsal | Tel. +49 7251 75-0<br>Fax +49 7251 75-1970<br>http://www.sew-eurodrive.de<br>sew@sew-eurodrive.de |
| **Service Competence Center** | **Central** | SEW-EURODRIVE GmbH & Co KG<br>Ernst-Blickle-Straße 1<br>D-76676 Graben-Neudorf | Tel. +49 7251 75-1710<br>Fax +49 7251 75-1711<br>sc-mitte@sew-eurodrive.de |
| | **North** | SEW-EURODRIVE GmbH & Co KG<br>Alte Ricklinger Straße 40-42<br>D-30823 Garbsen (near Hannover) | Tel. +49 5137 8798-30<br>Fax +49 5137 8798-55<br>sc-nord@sew-eurodrive.de |
| | **East** | SEW-EURODRIVE GmbH & Co KG<br>Dänkritzer Weg 1<br>D-08393 Meerane (near Zwickau) | Tel. +49 3764 7606-0<br>Fax +49 3764 7606-30<br>sc-ost@sew-eurodrive.de |
| | **South** | SEW-EURODRIVE GmbH & Co KG<br>Domagkstraße 5<br>D-85551 Kirchheim (near München) | Tel. +49 89 909552-10<br>Fax +49 89 909552-50<br>sc-sued@sew-eurodrive.de |
| | **West** | SEW-EURODRIVE GmbH & Co KG<br>Siemensstraße 1<br>D-40764 Langenfeld (near Düsseldorf) | Tel. +49 2173 8507-30<br>Fax +49 2173 8507-55<br>sc-west@sew-eurodrive.de |
| | **Electronics** | SEW-EURODRIVE GmbH & Co KG<br>Ernst-Blickle-Straße 42<br>D-76646 Bruchsal | Tel. +49 7251 75-1780<br>Fax +49 7251 75-1769<br>sc-elektronik@sew-eurodrive.de |
| | **Drive Service Hotline / 24 Hour Service** | | +49 180 5 SEWHELP<br>+49 180 5 7394357 |
| | Additional addresses for service in Germany provided on request! | | |

| France | | | |
|---|---|---|---|
| **Production**<br>**Sales**<br>**Service** | **Haguenau** | SEW-USOCOME<br>48-54 route de Soufflenheim<br>B. P. 20185<br>F-67506 Haguenau Cedex | Tel. +33 3 88 73 67 00<br>Fax +33 3 88 73 66 00<br>http://www.usocome.com<br>sew@usocome.com |
| **Production** | **Forbach** | SEW-USOCOME<br>Zone industrielle<br>Technopôle Forbach Sud<br>B. P. 30269<br>F-57604 Forbach Cedex | Tel. +33 3 87 29 38 00 |
| **Assembly**<br>**Sales**<br>**Service** | **Bordeaux** | SEW-USOCOME<br>Parc d'activités de Magellan<br>62 avenue de Magellan - B. P. 182<br>F-33607 Pessac Cedex | Tel. +33 5 57 26 39 00<br>Fax +33 5 57 26 39 09 |
| | **Lyon** | SEW-USOCOME<br>Parc d'affaires Roosevelt<br>Rue Jacques Tati<br>F-69120 Vaulx en Velin | Tel. +33 4 72 15 37 00<br>Fax +33 4 72 15 37 15 |
| | **Nantes** | SEW-USOCOME<br>Parc d'activités de la forêt<br>4 rue des Fontenelles<br>F-44140 Le Bignon | Tel. +33 2 40 78 42 00<br>Fax +33 2 40 78 42 20 |
| | **Paris** | SEW-USOCOME<br>Zone industrielle<br>2 rue Denis Papin<br>F-77390 Verneuil l'Etang | Tel. +33 1 64 42 40 80<br>Fax +33 1 64 42 40 88 |
| | Additional addresses for service in France provided on request! | | |

| Algeria | | | |
|---|---|---|---|
| **Sales** | **Alger** | REDUCOM Sarl<br>16, rue des Frères Zaghnoune<br>Bellevue<br>16200 El Harrach Alger | Tel. +213 21 8214-91<br>Fax +213 21 8222-84<br>sew-algeria@reducom-dz.com<br>http://www.reducom-dz.com |

| Argentina | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Buenos Aires** | SEW EURODRIVE ARGENTINA S.A.<br>Centro Industrial Garin, Lote 35<br>Ruta Panamericana Km 37,5<br>1619 Garin | Tel. +54 3327 4572-84<br>Fax +54 3327 4572-21<br>sewar@sew-eurodrive.com.ar<br>http://www.sew-eurodrive.com.ar |

| Australia | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Melbourne** | SEW-EURODRIVE PTY. LTD.<br>27 Beverage Drive<br>Tullamarine, Victoria 3043 | Tel. +61 3 9933-1000<br>Fax +61 3 9933-1003<br>http://www.sew-eurodrive.com.au<br>enquires@sew-eurodrive.com.au |
| | **Sydney** | SEW-EURODRIVE PTY. LTD.<br>9, Sleigh Place, Wetherill Park<br>New South Wales, 2164 | Tel. +61 2 9725-9900<br>Fax +61 2 9725-9905<br>enquires@sew-eurodrive.com.au |

| Austria | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Wien** | SEW-EURODRIVE Ges.m.b.H.<br>Richard-Strauss-Strasse 24<br>A-1230 Wien | Tel. +43 1 617 55 00-0<br>Fax +43 1 617 55 00-30<br>http://www.sew-eurodrive.at<br>sew@sew-eurodrive.at |

| Belarus | | | |
|---|---|---|---|
| **Sales** | **Minsk** | SEW-EURODRIVE BY<br>RybalkoStr. 26<br>BY-220033 Minsk | Tel.+375 (17) 298 38 50<br>Fax +375 (17) 29838 50<br>sales@sew.by |

| Belgium | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Brussels** | **SEW Caron-Vector**<br>Research park Haasrode<br>Evenementenlaan 7<br>BE-3001 Leuven | Tel. +32 16 386-311<br>Fax +32 16 386-336<br>http://www.sew-eurodrive.be<br>info@sew-eurodrive.be |
| **Service Competence Center** | **Industrial Gears** | **SEW Caron-Vector**<br>Rue de Parc Industriel, 31<br>BE-6900 Marche-en-Famenne | Tel. +32 84 219-878<br>Fax +32 84 219-879<br>http://www.sew-eurodrive.be<br>service-wallonie@sew-eurodrive.be |
| | **Antwerp** | **SEW Caron-Vector**<br>Glasstraat, 19<br>BE-2170 Merksem | Tel. +32 3 64 19 333<br>Fax +32 3 64 19 336<br>http://www.sew-eurodrive.be<br>service-antwerpen@sew-eurodrive.be |

| Brazil | | | |
|---|---|---|---|
| **Production**<br>**Sales**<br>**Service** | **Sao Paulo** | SEW-EURODRIVE Brasil Ltda.<br>Avenida Amâncio Gaiolli, 152 - Rodovia Presidente Dutra Km 208<br>Guarulhos - 07251-250 - SP<br>SAT - SEW ATENDE - 0800 7700496 | Tel. +55 11 2489-9133<br>Fax +55 11 2480-3328<br>http://www.sew-eurodrive.com.br<br>sew@sew.com.br |

| Bulgaria | | | |
|---|---|---|---|
| **Sales** | **Sofia** | BEVER-DRIVE GmbH<br>Bogdanovetz Str.1<br>BG-1606 Sofia | Tel. +359 2 9151160<br>Fax +359 2 9151166<br>bever@mail.bg |

| Cameroon | | | |
|---|---|---|---|
| **Sales** | **Douala** | Electro-Services<br>Rue Drouot Akwa<br>B.P. 2024<br>Douala | Tel. +237 33 431137<br>Fax +237 33 431137<br>electrojemba@yahoo.fr |

| Canada | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Toronto** | SEW-EURODRIVE CO. OF CANADA LTD.<br>210 Walker Drive<br>Bramalea, ON L6T 3W1 | Tel. +1 905 791-1553<br>Fax +1 905 791-2999<br>http://www.sew-eurodrive.ca<br>l.watson@sew-eurodrive.ca |
| | **Vancouver** | SEW-EURODRIVE CO. OF CANADA LTD.<br>Tilbury Industrial Park<br>7188 Honeyman Street<br>Delta, BC V4G 1G1 | Tel. +1 604 946-5535<br>Fax +1 604 946-2513<br>b.wake@sew-eurodrive.ca |
| | **Montreal** | SEW-EURODRIVE CO. OF CANADA LTD.<br>2555 Rue Leger<br>Lasalle, PQ H8N 2V9 | Tel. +1 514 367-1124<br>Fax +1 514 367-3677<br>a.peluso@sew-eurodrive.ca |
| | Additional addresses for service in Canada provided on request! | | |

| Chile | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Santiago de Chile** | SEW-EURODRIVE CHILE LTDA.<br>Las Encinas 1295<br>Parque Industrial Valle Grande<br>LAMPA<br>RCH-Santiago de Chile<br>P.O. Box<br>Casilla 23 Correo Quilicura - Santiago - Chile | Tel. +56 2 75770-00<br>Fax +56 2 75770-01<br>http://www.sew-eurodrive.cl<br>ventas@sew-eurodrive.cl |

| China | | | |
|---|---|---|---|
| **Production**<br>**Assembly**<br>**Sales**<br>**Service** | **Tianjin** | SEW-EURODRIVE (Tianjin) Co., Ltd.<br>No. 46, 7th Avenue, TEDA<br>Tianjin 300457 | Tel. +86 22 25322612<br>Fax +86 22 25323273<br>info@sew-eurodrive.cn<br>http://www.sew-eurodrive.com.cn |
| **Assembly**<br>**Sales**<br>**Service** | **Suzhou** | SEW-EURODRIVE (Suzhou) Co., Ltd.<br>333, Suhong Middle Road<br>Suzhou Industrial Park<br>Jiangsu Province, 215021 | Tel. +86 512 62581781<br>Fax +86 512 62581783<br>suzhou@sew-eurodrive.cn |
| | **Guangzhou** | SEW-EURODRIVE (Guangzhou) Co., Ltd.<br>No. 9, JunDa Road<br>East Section of GETDD<br>Guangzhou 510530 | Tel. +86 20 82267890<br>Fax +86 20 82267922<br>guangzhou@sew-eurodrive.cn |
| | **Shenyang** | SEW-EURODRIVE (Shenyang) Co., Ltd.<br>10A-2, 6th Road<br>Shenyang Economic Technological Development Area<br>Shenyang, 110141 | Tel. +86 24 25382538<br>Fax +86 24 25382580<br>shenyang@sew-eurodrive.cn |
| | **Wuhan** | SEW-EURODRIVE (Wuhan) Co., Ltd.<br>10A-2, 6th Road<br>No. 59, the 4th Quanli Road, WEDA<br>430056 Wuhan | Tel. +86 27 84478388<br>Fax +86 27 84478389<br>wuhan@sew-eurodrive.cn |
| | **Xi'An** | SEW-EURODRIVE (Xi'An) Co., Ltd.<br>No. 12 Jinye 2nd Road<br>Xi'An High-Technology Industrial Development Zone<br>Xi'An 710065 | Tel. +86 29 68686262<br>Fax +86 29 68686311<br>xian@sew-eurodrive.cn |
| | Additional addresses for service in China provided on request! | | |

| Colombia | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Bogotá** | SEW-EURODRIVE COLOMBIA LTDA.<br>Calle 22 No. 132-60<br>Bodega 6, Manzana B<br>Santafé de Bogotá | Tel. +57 1 54750-50<br>Fax +57 1 54750-44<br>http://www.sew-eurodrive.com.co<br>sewcol@sew-eurodrive.com.co |

| Croatia | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Zagreb** | KOMPEKS d. o. o.<br>Zeleni dol 10<br>HR 10 000 Zagreb | Tel. +385 1 4613-158<br>Fax +385 1 4613-158<br>kompeks@inet.hr |

| Czech Republic | | | |
|---|---|---|---|
| **Sales** | **Prague** | SEW-EURODRIVE CZ S.R.O.<br>Business Centrum Praha<br>Lužná 591<br>CZ-16000 Praha 6 - Vokovice | Tel. +420 255 709 601<br>Fax +420 220 121 237<br>http://www.sew-eurodrive.cz<br>sew@sew-eurodrive.cz |

| Denmark | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Copenhagen** | SEW-EURODRIVEA/S<br>Geminivej 28-30<br>DK-2670 Greve | Tel. +45 43 9585-00<br>Fax +45 43 9585-09<br>http://www.sew-eurodrive.dk<br>sew@sew-eurodrive.dk |

| Egypt | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Cairo** | Copam Egypt<br>for Engineering & Agencies<br>33 El Hegaz ST, Heliopolis, Cairo | Tel. +20 2 22566-299 + 1 23143088<br>Fax +20 2 22594-757<br>http://www.copam-egypt.com/<br>copam@datum.com.eg |

| Estonia | | | |
|---|---|---|---|
| **Sales** | **Tallin** | ALAS-KUUL AS<br>Reti tee 4<br>EE-75301 Peetri küla, Rae vald, Harjumaa | Tel. +372 6593230<br>Fax +372 6593231<br>veiko.soots@alas-kuul.ee |

| Finland | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Lahti** | SEW-EURODRIVE OY<br>Vesimäentie 4<br>FIN-15860 Hollola 2 | Tel. +358 201 589-300<br>Fax +358 3 780-6211<br>sew@sew.fi<br>http://www.sew-eurodrive.fi |
| **Production**<br>**Assembly** | **Karkkila** | SEW Industrial Gears Oy<br>Valurinkatu 6, PL 8<br>FI-03600 Karkkila, 03601 Karkkila | Tel. +358 201 589-300<br>Fax +358 201 589-310<br>sew@sew.fi<br>http://www.sew-eurodrive.fi |

| Gabon | | | |
|---|---|---|---|
| **Sales** | **Libreville** | ESG Electro Services Gabun<br>Feu Rouge Lalala<br>1889 Libreville<br>Gabun | Tel. +241 741059<br>Fax +241 741059<br>esg_services@yahoo.fr |

| Great Britain | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Normanton** | SEW-EURODRIVE Ltd.<br>Beckbridge Industrial Estate<br>P.O. Box No.1<br>Normanton, West-Yorkshire<br>WF6 1QR | Tel. +44 1924 893-855<br>Fax +44 1924 893-702<br>http://www.sew-eurodrive.co.uk<br>info@sew-eurodrive.co.uk |

| Greece | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Athens** | Christ. Boznos & Son S.A.<br>12, K. Mavromichali Street<br>P.O. Box 80136<br>GR-18545 Piraeus | Tel. +30 2 1042 251-34<br>Fax +30 2 1042 251-59<br>http://www.boznos.gr<br>info@boznos.gr |

| Hong Kong | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Hong Kong** | SEW-EURODRIVE LTD.<br>Unit No. 801-806, 8th Floor<br>Hong Leong Industrial Complex<br>No. 4, Wang Kwong Road<br>Kowloon, Hong Kong | Tel. +852 36902200<br>Fax +852 36902211<br>contact@sew-eurodrive.hk |

| Hungary | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Budapest** | SEW-EURODRIVE Kft.<br>H-1037 Budapest<br>Kunigunda u. 18 | Tel. +36 1 437 06-58<br>Fax +36 1 437 06-50<br>office@sew-eurodrive.hu |

| India | | | |
|---|---|---|---|
| **Registered Office**<br>**Assembly**<br>**Sales**<br>**Service** | **Vadodara** | SEW-EURODRIVE India Private Limited<br>Plot No. 4, GIDC<br>POR Ramangamdi • Vadodara - 391 243<br>Gujarat | Tel. +91 265 3045200, +91 265 2831086<br>Fax +91 265 3045300, +91 265 2831087<br>http://www.seweurodriveindia.com<br>sales@seweurodriveindia.com<br>subodh.ladwa@seweurodriveindia.com |
| **Assembly**<br>**Sales**<br>**Service** | **Chennai** | SEW-EURODRIVE India Private Limited<br>Plot No. K3/1, Sipcot Industrial Park Phase II<br>Mambakkam Village<br>Sriperumbudur - 602105<br>Kancheepuram Dist, Tamil Nadu | Tel. +91 44 37188888<br>Fax +91 44 37188811<br>c.v.shivkumar@seweurodriveindia.com |

| Ireland | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Dublin** | Alperton Engineering Ltd.<br>48 Moyle Road<br>Dublin Industrial Estate<br>Glasnevin, Dublin 11 | Tel. +353 1 830-6277<br>Fax +353 1 830-6458<br>info@alperton.ie<br>http://www.alperton.ie |

| Israel | | | |
|---|---|---|---|
| **Sales** | **Tel-Aviv** | Liraz Handasa Ltd.<br>Ahofer Str 34B / 228<br>58858 Holon | Tel. +972 3 5599511<br>Fax +972 3 5599512<br>http://www.liraz-handasa.co.il<br>office@liraz-handasa.co.il |

| Italy | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Solaro** | SEW-EURODRIVE di R. Blickle & Co.s.a.s.<br>Via Bernini,14<br>I-20020 Solaro (Milano) | Tel. +39 02 96 9801<br>Fax +39 02 96 799781<br>http://www.sew-eurodrive.it<br>sewit@sew-eurodrive.it |

| Ivory Coast | | | |
|---|---|---|---|
| **Sales** | **Abidjan** | SICA<br>Société industrielle & commerciale pour l'Afrique<br>165, Boulevard de Marseille<br>26 BP 1115 Abidjan 26 | Tel. +225 21 25 79 44<br>Fax +225 21 25 88 28<br>sicamot@aviso.ci |

| Japan | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Iwata** | SEW-EURODRIVE JAPAN CO., LTD<br>250-1, Shimoman-no,<br>Iwata<br>Shizuoka 438-0818 | Tel. +81 538 373811<br>Fax +81 538 373855<br>http://www.sew-eurodrive.co.jp<br>sewjapan@sew-eurodrive.co.jp |

| Kazakhstan | | | |
|---|---|---|---|
| **Sales** | **Almaty** | ТОО "СЕВ-ЕВРОДРАЙВ"<br>050061, Республика Казахстан<br>г.Алматы, пр.Райымбека, 348 | Тел. +7 (727) 334 1880<br>Факс +7 (727) 334 1881<br>http://www.sew-eurodrive.kz<br>sew@sew-eurodrive.kz |

| Latvia | | | |
|---|---|---|---|
| **Sales** | **Riga** | SIA Alas-Kuul<br>Katlakalna 11C<br>LV-1073 Riga | Tel. +371 6 7139253<br>Fax +371 6 7139386<br>http://www.alas-kuul.com<br>info@alas-kuul.com |

| Lebanon | | | |
|---|---|---|---|
| **Sales** | **Beirut** | Gabriel Acar & Fils sarl<br>B. P. 80484<br>Bourj Hammoud, Beirut | Tel. +961 1 510 532<br>Fax +961 1 494 971<br>ssacar@info.com.lb |
| Jordan<br>Kuwait<br>Saudi Arabia<br>Syria | **Beirut** | Middle East Drives S.A.L. (offshore)<br>Sin El Fil.<br>B. P. 55-378<br>Beirut | Tel. +961 1 494 786<br>Fax +961 1 494 971<br>info@medrives.com<br>http://www.medrives.com |

| Lithuania | | | |
|---|---|---|---|
| **Sales** | **Alytus** | UAB Irseva<br>Statybininku 106C<br>LT-63431 Alytus | Tel. +370 315 79204<br>Fax +370 315 56175<br>info@irseva.lt<br>http://www.sew-eurodrive.lt |

| Luxembourg | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Brüssel** | CARON-VECTOR S.A.<br>Avenue Eiffel 5<br>B-1300 Wavre | Tel. +32 10 231-311<br>Fax +32 10 231-336<br>http://www.sew-eurodrive.lu<br>info@caron-vector.be |

| Malaysia | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Johore** | SEW-EURODRIVE SDN BHD<br>No. 95, Jalan Seroja 39, Taman Johor Jaya<br>81000 Johor Bahru, Johor<br>West Malaysia | Tel. +60 7 3549409<br>Fax +60 7 3541404<br>sales@sew-eurodrive.com.my |

| Mexico | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Quéretaro** | SEW-EURODRIVE MEXICO SA DE CV<br>SEM-981118-M93<br>Tequisquiapan No. 102<br>Parque Industrial Quéretaro<br>C.P. 76220<br>Quéretaro, México | Tel. +52 442 1030-300<br>Fax +52 442 1030-301<br>http://www.sew-eurodrive.com.mx<br>scmexico@seweurodrive.com.mx |

| Morocco | | | |
|---|---|---|---|
| **Sales** | **Casablanca** | Afit<br>Route D'El Jadida<br>KM 14 RP8<br>Province de Nouaceur<br>Commune Rurale de Bouskoura<br>MA 20300 Casablanca | Tel. +212 522633700<br>Fax +212 522621588<br>fatima.haquiq@premium.net<br>http://www.groupe-premium.com |

| Netherlands | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Rotterdam** | VECTOR Aandrijftechniek B.V.<br>Industrieweg 175<br>NL-3044 AS Rotterdam<br>Postbus 10085<br>NL-3004 AB Rotterdam | Tel. +31 10 4463-700<br>Fax +31 10 4155-552<br>http://www.vector.nu<br>info@vector.nu |

| New Zealand | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Auckland** | SEW-EURODRIVE NEW ZEALAND LTD.<br>P.O. Box 58-428<br>82 Greenmount drive<br>East Tamaki Auckland | Tel. +64 9 2745627<br>Fax +64 9 2740165<br>http://www.sew-eurodrive.co.nz<br>sales@sew-eurodrive.co.nz |
| | **Christchurch** | SEW-EURODRIVE NEW ZEALAND LTD.<br>10 Settlers Crescent, Ferrymead<br>Christchurch | Tel. +64 3 384-6251<br>Fax +64 3 384-6455<br>sales@sew-eurodrive.co.nz |

| Norway | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Moss** | SEW-EURODRIVE A/S<br>Solgaard skog 71<br>N-1599 Moss | Tel. +47 69 24 10 20<br>Fax +47 69 24 10 40<br>http://www.sew-eurodrive.no<br>sew@sew-eurodrive.no |

| Pakistan | | | |
|---|---|---|---|
| **Sales** | **Karachi** | Industrial Power Drives<br>Al-Fatah Chamber A/3, 1st Floor Central Commercial Area,<br>Sultan Ahmed Shah Road, Block 7/8,<br>Karachi | Tel. +92 21 452 9369<br>Fax +92-21-454 7365<br>seweurodrive@cyber.net.pk |

| Peru | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Lima** | SEW DEL PERU MOTORES REDUCTORES S.A.C.<br>Los Calderos, 120-124<br>Urbanizacion Industrial Vulcano, ATE, Lima | Tel. +51 1 3495280<br>Fax +51 1 3493002<br>http://www.sew-eurodrive.com.pe<br>sewperu@sew-eurodrive.com.pe |

| Poland | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Lodz** | SEW-EURODRIVE Polska Sp.z.o.o.<br>ul. Techniczna 5<br>PL-92-518 Łódź | Tel. +48 42 676 53 00<br>Fax +48 42 676 53 45<br>http://www.sew-eurodrive.pl<br>sew@sew-eurodrive.pl |
| | **24 Hour Service** | | Tel. +48 602 739 739<br>(+48 602 SEW SEW)<br>serwis@sew-eurodrive.pl |

| Portugal | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Coimbra** | SEW-EURODRIVE, LDA.<br>Apartado 15<br>P-3050-901 Mealhada | Tel. +351 231 20 9670<br>Fax +351 231 20 3685<br>http://www.sew-eurodrive.pt<br>infosew@sew-eurodrive.pt |

| Romania | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Bucharest** | Sialco Trading SRL<br>str. Madrid nr.4<br>011785 Bucuresti | Tel. +40 21 230-1328<br>Fax +40 21 230-7170<br>sialco@sialco.ro |

| Russia | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **St. Petersburg** | ZAO SEW-EURODRIVE<br>P.O. Box 36<br>195220 St. Petersburg Russia | Tel. +7 812 3332522 +7 812 5357142<br>Fax +7 812 3332523<br>http://www.sew-eurodrive.ru<br>sew@sew-eurodrive.ru |

| Senegal | | | |
|---|---|---|---|
| **Sales** | **Dakar** | SENEMECA<br>Mécanique Générale<br>Km 8, Route de Rufisque<br>B.P. 3251, Dakar | Tel. +221 338 494 770<br>Fax +221 338 494 771<br>senemeca@sentoo.sn<br>http://www.senemeca.com |

| Serbia | | | |
|---|---|---|---|
| **Sales** | **Beograd** | DIPAR d.o.o.<br>Ustanicka 128a<br>PC Košum, IV floor<br>SCG-11000 Beograd | Tel. +381 11 347 3244 / +381 11 288 0393<br>Fax +381 11 347 1337<br>office@dipar.rs |

| Singapore | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Singapore** | SEW-EURODRIVE PTE. LTD.<br>No 9, Tuas Drive 2<br>Jurong Industrial Estate<br>Singapore 638644 | Tel. +65 68621701<br>Fax +65 68612827<br>http://www.sew-eurodrive.com.sg<br>sewsingapore@sew-eurodrive.com |

| Slovakia | | | |
|---|---|---|---|
| **Sales** | **Bratislava** | SEW-Eurodrive SK s.r.o.<br>Rybničná 40<br>SK-831 06 Bratislava | Tel. +421 2 33595 202<br>Fax +421 2 33595 200<br>sew@sew-eurodrive.sk<br>http://www.sew-eurodrive.sk |
| | **Žilina** | SEW-Eurodrive SK s.r.o.<br>Industry Park - PChZ<br>ulica M.R.Štefánika 71<br>SK-010 01 Žilina | Tel. +421 41 700 2513<br>Fax +421 41 700 2514<br>sew@sew-eurodrive.sk |
| | **Banská Bystrica** | SEW-Eurodrive SK s.r.o.<br>Rudlovská cesta 85<br>SK-974 11 Banská Bystrica | Tel. +421 48 414 6564<br>Fax +421 48 414 6566<br>sew@sew-eurodrive.sk |
| | **Košice** | SEW-Eurodrive SK s.r.o.<br>Slovenská ulica 26<br>SK-040 01 Košice | Tel. +421 55 671 2245<br>Fax +421 55 671 2254<br>sew@sew-eurodrive.sk |

| Slovenia | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Celje** | Pakman - Pogonska Tehnika d.o.o.<br>UI. XIV. divizije 14<br>SLO - 3000 Celje | Tel. +386 3 490 83-20<br>Fax +386 3 490 83-21<br>pakman@siol.net |

| South Africa | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Johannesburg** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>Eurodrive House<br>Cnr. Adcock Ingram and Aerodrome Roads<br>Aeroton Ext. 2<br>Johannesburg 2013<br>P.O.Box 90004<br>Bertsham 2013 | Tel. +27 11 248-7000<br>Fax +27 11 494-3104<br>http://www.sew.co.za<br>info@sew.co.za |
| | **Cape Town** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>Rainbow Park<br>Cnr. Racecourse & Omuramba Road<br>Montague Gardens<br>Cape Town<br>P.O.Box 36556<br>Chempet 7442<br>Cape Town | Tel. +27 21 552-9820<br>Fax +27 21 552-9830<br>Telex 576 062<br>cfoster@sew.co.za |

| South Africa | | | |
|---|---|---|---|
| | **Durban** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>2 Monaco Place<br>Pinetown<br>Durban<br>P.O. Box 10433, Ashwood 3605 | Tel. +27 31 700-3451<br>Fax +27 31 700-3847<br>cdejager@sew.co.za |
| | **Nelspruit** | SEW-EURODRIVE (PTY) LTD.<br>7 Christie Crescent<br>Vintonia<br>P.O.Box 1942<br>Nelspruit 1200 | Tel. +27 13 752-8007<br>Fax +27 13 752-8008<br>robermeyer@sew.co.za |

| South Korea | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Ansan-City** | SEW-EURODRIVE KOREA CO., LTD.<br>B 601-4, Banweol Industrial Estate<br>1048-4, Shingil-Dong<br>Ansan 425-120 | Tel. +82 31 492-8051<br>Fax +82 31 492-8056<br>http://www.sew-korea.co.kr<br>master.korea@sew-eurodrive.com |
| | **Busan** | SEW-EURODRIVE KOREA Co., Ltd.<br>No. 1720 - 11, Songjeong - dong<br>Gangseo-ku<br>Busan 618-270 | Tel. +82 51 832-0204<br>Fax +82 51 832-0230<br>master@sew-korea.co.kr |

| Spain | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Bilbao** | SEW-EURODRIVE ESPAÑA, S.L.<br>Parque Tecnológico, Edificio, 302<br>E-48170 Zamudio (Vizcaya) | Tel. +34 94 43184-70<br>Fax +34 94 43184-71<br>http://www.sew-eurodrive.es<br>sew.spain@sew-eurodrive.es |

| Sweden | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Jönköping** | SEW-EURODRIVE AB<br>Gnejsvägen 6-8<br>S-55303 Jönköping<br>Box 3100 S-55003 Jönköping | Tel. +46 36 3442 00<br>Fax +46 36 3442 80<br>http://www.sew-eurodrive.se<br>jonkoping@sew.se |

| Switzerland | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Basel** | Alfred Imhof A.G.<br>Jurastrasse 10<br>CH-4142 Münchenstein bei Basel | Tel. +41 61 417 1717<br>Fax +41 61 417 1700<br>http://www.imhof-sew.ch<br>info@imhof-sew.ch |

| Thailand | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Chonburi** | SEW-EURODRIVE (Thailand) Ltd.<br>700/456, Moo.7, Donhuaroh<br>Muang<br>Chonburi 20000 | Tel. +66 38 454281<br>Fax +66 38 454288<br>sewthailand@sew-eurodrive.com |

| Tunisia | | | |
|---|---|---|---|
| **Sales** | **Tunis** | T. M.S. Technic Marketing Service<br>Zone Industrielle Mghira 2<br>Lot No. 39<br>2082 Fouchana | Tel. +216 79 40 88 77<br>Fax +216 79 40 88 66<br>tms@tms.com.tn |

| Turkey | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Istanbul** | SEW-EURODRIVE<br>Hareket Sistemleri San. ve Tic. Ltd. Sti.<br>Bagdat Cad. Koruma Cikmazi No. 3<br>TR-34846 Maltepe ISTANBUL | Tel. +90 216 4419163 / 4419164<br>Fax +90 216 3055867<br>http://www.sew-eurodrive.com.tr<br>sew@sew-eurodrive.com.tr |

| Ukraine | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Dnepropetrovsk** | SEW-EURODRIVE<br>Str. Rabochaja 23-B, Office 409<br>49008 Dnepropetrovsk | Tel. +380 56 370 3211<br>Fax +380 56 372 2078<br>http://www.sew-eurodrive.ua<br>sew@sew-eurodrive.ua |

| United Arab Emirates | | | |
|---|---|---|---|
| **Sales**<br>**Service** | **Sharjah** | Copam Middle East (FZC)<br>Sharjah Airport International Free Zone<br>P.O. Box 120709<br>Sharjah | Tel. +971 6 5578-488<br>Fax +971 6 5578-499<br>copam_me@eim.ae |

| USA | | | |
|---|---|---|---|
| **Production**<br>**Assembly**<br>**Sales**<br>**Service**<br>**Corporate Offices** | **Southeast Region** | SEW-EURODRIVE INC.<br>1295 Old Spartanburg Highway<br>P.O. Box 518<br>Lyman, S.C. 29365 | Tel. +1 864 439-7537<br>Fax Sales +1 864 439-7830<br>Fax Manufacturing +1 864 439-9948<br>Fax Assembly +1 864 439-0566<br>Fax Confidential/HR +1 864 949-5557<br>http://www.seweurodrive.com<br>cslyman@seweurodrive.com |
| **Assembly**<br>**Sales**<br>**Service** | **Northeast Region** | SEW-EURODRIVE INC.<br>Pureland Ind. Complex<br>2107 High Hill Road, P.O. Box 481<br>Bridgeport, New Jersey 08014 | Tel. +1 856 467-2277<br>Fax +1 856 845-3179<br>csbridgeport@seweurodrive.com |
| | **Midwest Region** | SEW-EURODRIVE INC.<br>2001 West Main Street<br>Troy, Ohio 45373 | Tel. +1 937 335-0036<br>Fax +1 937 332-0038<br>cstroy@seweurodrive.com |
| | **Southwest Region** | SEW-EURODRIVE INC.<br>3950 Platinum Way<br>Dallas, Texas 75237 | Tel. +1 214 330-4824<br>Fax +1 214 330-4724<br>csdallas@seweurodrive.com |
| | **Western Region** | SEW-EURODRIVE INC.<br>30599 San Antonio St.<br>Hayward, CA 94544 | Tel. +1 510 487-3560<br>Fax +1 510 487-6433<br>cshayward@seweurodrive.com |
| | Additional addresses for service in the USA provided on request! | | |

| Venezuela | | | |
|---|---|---|---|
| **Assembly**<br>**Sales**<br>**Service** | **Valencia** | SEW-EURODRIVE Venezuela S.A.<br>Av. Norte Sur No. 3, Galpon 84-319<br>Zona Industrial Municipal Norte<br>Valencia, Estado Carabobo | Tel. +58 241 832-9804<br>Fax +58 241 838-6275<br>http://www.sew-eurodrive.com.ve<br>ventas@sew-eurodrive.com.ve<br>sewfinanzas@cantv.net |

| Vietnam | | | |
|---|---|---|---|
| **Sales** | **Ho Chi Minh City** | Nam Trung Co., Ltd<br>91 - 93 Tran Minh Quyen Street,<br>District 10, HCMC | Tel. +84 8 8301026<br>Fax +84 8 8392223<br>namtrungco@hcm.vnn.vn |

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**Driving the world**

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sew@sew-eurodrive.com

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