

SIEMENS



Operating Instructions

SIMOGEAR

Gearbox

BA 2030

Edition

02/2018

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SIMOGEAR

Gearbox BA 2030

Operating Instructions

General information and safety notes	1
Technical description	2
Incoming goods, transport, and storage	3
Installation	4
Commissioning	5
Operation	6
Faults, causes and remedies	7
Service and maintenance	8
Disposal	9
Technical data	10
Spare parts	11
Declaration of incorporation, declaration of conformity	12
Your suggestions	13

Translation of the original instructions

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

1	General information and safety notes	7
1.1	General information	7
1.2	Copyright.....	9
1.3	Intended use	9
1.4	Geared motor with encoder for safety-relevant applications	10
1.5	Obligations of the user	10
1.6	The five safety rules.....	11
1.7	Particular types of hazards	12
2	Technical description	13
2.1	General technical description	13
2.2	Shaft seals	15
2.3	Cooling.....	15
2.4	Rating plate.....	16
2.5	Surface treatment	16
2.5.1	General information on surface treatment	16
2.5.2	Painted version	17
2.5.3	Primed version	20
3	Incoming goods, transport, and storage.....	21
3.1	Incoming goods.....	21
3.2	Transport.....	21
3.2.1	General information on transport	21
3.2.2	Fastening for suspended transport.....	22
3.3	Storage	23
3.3.1	General information for storage	23
3.3.2	Storage up to 36 months with long-term preservation (optional).....	24
3.3.2.1	General notes for storage up to 36 months	24
3.3.2.2	Gearbox filled with operating oil and anti-corrosive agent.....	24
3.3.2.3	Gearbox completely filled with oil	24
4	Installation	25
4.1	Unpacking	25
4.2	General information on installation	25
4.3	Thread sizes and tightening torques for fastening bolts	27
4.4	Gearbox with foot mounting	28
4.5	Gearbox with flange fastening	29

4.6	Gearboxes in foot or flange version	30
4.7	Mounting an input or output element on the gearbox shaft	31
4.8	Removing and installing the protection cover	33
4.9	Installing and removing the shaft-mounted gearbox	34
4.9.1	General information on installing the shaft-mounted gearbox	34
4.9.2	Hollow shaft with parallel key	35
4.9.2.1	Mounting the hollow shaft with parallel key	35
4.9.2.2	Removing the hollow shaft with parallel key	36
4.9.3	Hollow shaft with shrink disk	38
4.9.3.1	Mounting the hollow shaft with shrink disk	38
4.9.3.2	Mounting the shrink disk	39
4.9.3.3	Pulling off the shrink disk	42
4.9.3.4	Cleaning and lubricating shrink disks	42
4.9.4	SIMOLOC assembly system	43
4.9.4.1	General notes for the SIMOLOC assembly system	43
4.9.4.2	Installing SIMOLOC	44
4.9.4.3	Removing SIMOLOC	46
4.9.5	Hollow shaft with splines	47
4.9.6	Torque arms with shaft-mounted gearboxes	48
4.9.6.1	General information regarding torque arms	48
4.9.6.2	Mounting torque arms on parallel shaft gearboxes	49
4.9.6.3	Mounting torque arms on bevel gearboxes and helical worm gearboxes	50
5	Commissioning	51
5.1	General information for commissioning	51
5.2	Checking the oil level prior to commissioning	51
5.3	Mount the oil expansion unit	52
5.4	Installing the oil temperature monitoring device	54
5.5	Options of the VLplus heavy-duty bearing system	55
5.5.1	Automatic regreasing device	55
5.5.2	Dry-well version with oil sensor	58
6	Operation	59
7	Faults, causes and remedies	61
8	Service and maintenance	65
8.1	General notes about maintenance work	65
8.2	Checking and changing lubricants	67
8.2.1	General safety notes	67
8.2.2	Checking the oil level	68
8.2.3	Checking the oil level using the oil sight glass (optional)	70
8.2.4	Checking the oil level using the oil dipstick (optional)	70
8.2.5	Checking the oil quality	71
8.2.6	Changing the oil	72
8.2.6.1	General safety notes for changing the oil	72
8.2.6.2	Draining the oil	73
8.2.6.3	Flushing the gearbox when changing between incompatible oils	73
8.2.6.4	Filling in oil	75

8.2.7	Topping up with oil	76
8.2.8	Change the roller bearing grease	76
8.2.9	Service life of the lubricants	77
8.2.10	Recommended lubricants	79
8.3	Lubrication of the XLplus and VLplus heavy-duty bearing systems	80
8.4	Replace bearings	82
8.5	Checking the gearbox for leaks	83
8.6	Replacing the vent valve.....	84
8.7	Checking the oil level sensor (optional)	84
8.8	Cleaning the gearbox.....	84
8.9	Checking tightness of fastening bolts	85
8.10	Inspecting the gearbox.....	85
8.11	Replacing the hose of the oil expansion unit	86
9	Disposal.....	87
10	Technical data	89
10.1	Type designation.....	89
10.2	General technical data	91
10.3	Weight.....	94
10.4	Sound energy level	94
10.5	Mounting positions	95
10.5.1	General notes on mounting positions	95
10.5.2	Single-stage helical gearboxes	96
10.5.3	Two- and three-stage helical gearbox	98
10.5.4	Parallel shaft gearbox	105
10.5.5	Bevel gearbox	111
10.5.6	Helical worm gearbox	120
10.5.7	Tandem gearboxes - Intermediate helical gearboxes	126
10.6	Oil quantities	128
10.6.1	Helical gearbox	129
10.6.2	Parallel shaft gearbox	130
10.6.3	Bevel gearbox	131
10.6.4	Helical worm gearbox	133
10.6.5	Tandem gearbox - intermediate helical gearbox	134
10.6.5.1	Two- and three-stage helical gearboxes.....	134
10.6.5.2	Parallel shaft gearboxes	135
10.6.5.3	Bevel gearbox	137
10.6.5.4	Helical worm gearboxes.....	139
11	Spare parts	141
11.1	Stocking of spare parts	141
11.2	Lists of spare parts.....	142
11.2.1	Helical gearbox E, sizes 39 - 149	142
11.2.2	Helical gearbox D / Z, sizes 19 - 189.....	144

11.2.3	Parallel shaft gearbox F, sizes 29 - 189	146
11.2.4	Bevel gearbox B, sizes 19 - 49	148
11.2.5	Bevel gearbox K, sizes 39 - 189	150
11.2.6	Helical worm gearbox C, sizes 29 - 89	152
11.2.7	SIMOLOC assembly system, sizes 29 - 89	154
11.2.8	XLplus and VLplus heavy-duty bearing systems, sizes 89-169	156
12	Declaration of incorporation, declaration of conformity.....	159
12.1	Declaration of incorporation	159
12.2	EU Declaration of Conformity DIN EN 80079-36.....	160
12.3	EU declaration of conformity motors for direct mounting DIN EN 80079-36	161
13	Your suggestions	163

General information and safety notes

1.1 General information



ATEX version gearboxes

Instructions and measures applying in particular to ATEX version gearboxes.

Note

Siemens AG does not accept any liability for damage and failures that result from the non-observance of these operating instructions.

These operating instructions are part of the gearbox delivery. Store the operating instructions near the gearbox. Please read the operating instructions prior to handling the gearbox and observe the information they contain. This is how you ensure safe and disturbance-free function.

These operating instructions apply to the standard version of SIMOGEAR gearboxes:

- Helical gearboxes E, D and Z, sizes 19 to 189
- Parallel shaft gearboxes FD / FZ, sizes 29 to 189
- Bevel gearboxes B, K, sizes 19 to 189
- Helical worm gearboxes C, sizes 29 to 89

For the description of the precise designation see Type designation (Page 89).

Table 1- 1 Article number code

SIMOGEAR gearbox	Article number position				
	1	2	3	4	5
Helical gearbox E	2	K	J	3	0
Helical gearbox D	2	K	J	3	2
Helical gearbox Z	2	K	J	3	1
Parallel shaft gearbox FD	2	K	J	3	4
Parallel shaft gearbox FZ	2	K	J	3	3
Bevel gearbox B, K	2	K	J	3	5
Helical worm gearbox C	2	K	J	3	6

Note

In addition to these operating instructions, special contractual agreements and technical documentation apply to a special gearbox design and the associated supplementary equipment.

Please refer to the other operating instructions supplied with the product.

The described gearboxes correspond to the state-of-the-art at the time these operating instructions were printed.

Siemens AG reserves the right to change individual components and accessory parts in the interest of further development. The changes serve to improve the performance and safety. The significant features are retained. The operating instructions are always being updated with new contents.

The latest versions of the operating instructions, the declaration of incorporation and the declarations of conformity are available in electronic form in the Industry Online Support (<https://support.industry.siemens.com/cs/ww/de/ps/13424/man>).

You can find technical configuration data, spare parts lists and certificates of compliance on the Intranet at Once Delivered (https://c0p.siemens.com:8443/sie/1nce_delivered).

You can find the contact data of your Technical Support in the Database of contacts at Siemens AG (www.siemens.com/yourcontact).

If you have any technical questions, please contact Technical Support (<https://support.industry.siemens.com/cs/ww/en/sc/2090>).

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Valid operating instructions for SIMOGEAR

- BA 2030 - operating instructions for SIMOGEAR gearboxes
- BA 2031 - operating instructions for permissible mounting position deviations of SIMOGEAR gearboxes
- KA 2032 - compact operating instructions for SIMOGEAR worm geared motor S
- BA 2039 - operating instructions for adapters for mounting on SIMOGEAR gearboxes
- BA 2330 - operating instructions for LA/LE/LER motors for mounting on SIMOGEAR gearboxes
- BA 2535 - operating instructions for SIMOGEAR gearboxes for monorail conveyors
- BA 2730 - operating instructions for SIMOGEAR geared motors with encoder for safety-relevant applications

1.2 Copyright

The copyright to these operating instructions is held by Siemens AG.

These operating instructions must not be wholly or partly reproduced for competitive purposes, used in any unauthorized way or made available to third parties without agreement of Siemens AG.

1.3 Intended use



ATEX version gearboxes

The ATEX gearbox fulfills the requirements of the Explosion Protection Directive 2014/34/EU.

In the case of ATEX version gearboxes, please observe the instructions marked with this symbol.

The SIMOGEAR gearboxes described in these operating instructions have been designed for stationary use in general engineering applications.

Unless otherwise agreed, the gearboxes have been designed for use in plants and equipment in industrial environments.

The gearboxes have been built based on state-of-the-art technology and are shipped in an operationally reliable condition. Changes made by users could affect this operational reliability and are forbidden.

Note

The performance data assumes an installation altitude of up to 2000 m above sea level and the following ambient temperatures:

- -15° C to +40° C for gearbox types E, Z, D, F, K
- -25° C to +40° C for gearbox types B, C

For different installation altitudes and ambient temperatures, please contact Technical Support.

The gearboxes have been designed solely for the application described in the Technical data (Page 89). Do not operate the gearbox outside the specified power limit. Other operating conditions must be contractually agreed.

Do not climb on the gearbox. Do not place any objects on the gearbox.

1.4 Geared motor with encoder for safety-relevant applications

For a SIMOGEAR geared motor with encoder for safety-relevant applications, it is crucial that you observe the operating instructions BA 2730. These operating instructions are valid for the functionally safe encoders that are mounted onto SIMOGEAR geared motors. The functionally safe encoders are in compliance with the relevant standards for safety-relevant applications listed in the declaration of conformity of BA 2730.

The SIMOGEAR geared motor with functionally safe encoder has a signal yellow marking on the fan cover. Marking SI04 for the functionally safe encoder is stamped on the rating plate. The safety level is marked on the functionally safe encoder.

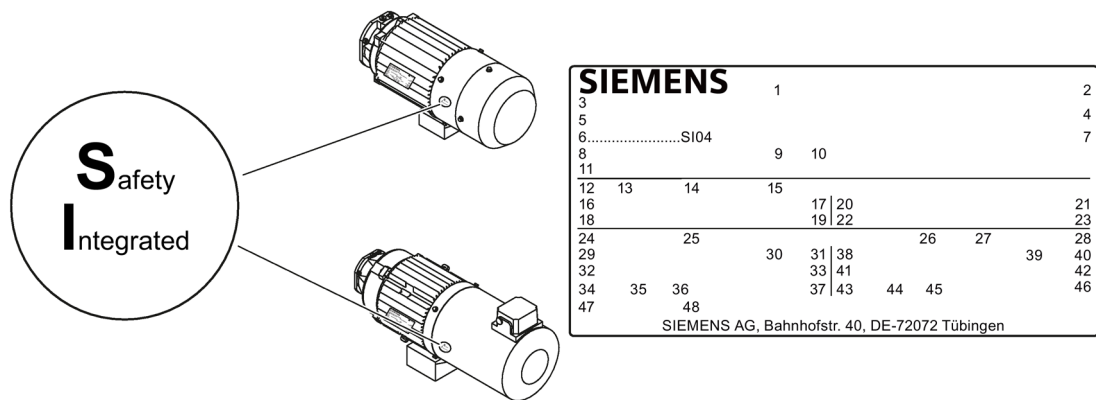


Figure 1-1 Marking for functional safety

1.5 Obligations of the user

The operator must ensure that all persons assigned to work on the geared motor have read and understood these operating instructions and that they follow them in all points in order to:

- Eliminate the risk to life and limb of users and other persons.
- Ensure the operational safety of the geared motor.
- Avoid disruptions and environmental damage through incorrect use.

Note the following safety information:

Shut down the geared motors and disconnect the power before you carry out any work on them.

Make sure that the drive unit cannot be turned on accidentally, e.g. lock the key-operated switch. Place a warning notice at the drive connection point which clearly indicates that work is in progress on the geared motor.

Carry out all work with great care and with due regard to "safety".

For all work, observe the relevant regulations for work safety and environment protection.

Read the instructions on the rating plates attached to the geared motor. The rating plates must be kept free from paint and dirt at all times. Replace any missing rating plates.

In the event of changes during operation, switch off the drive unit immediately.

Take appropriate protective measures to prevent accidental contact with rotating drive parts, such as couplings, gear wheels or belt drives.

Take appropriate protective measures to prevent accidental contact with parts and equipment that heat up to over +70 °C during operation.

When removing protective equipment, keep fasteners in a safe place. Re-attach removed protective equipment before commissioning.

Collect and dispose of used oil in accordance with regulations. Remove oil spillages immediately with an oil-binding agent in compliance with environmental requirements.

Do not carry out any welding work on the geared motor. Do not use the geared motor as a grounding point for welding operations.

Carry out equipotential bonding in accordance with applicable regulations and directives by electrotechnology specialists.

Do not use high-pressure cleaning equipment or sharp-edged tools to clean the geared motor.

Observe the permissible tightening torque of the fastening bolts.

Replace damaged bolts with new bolts of the same type and strength class.

Siemens AG accepts the warranty only for original spare parts.

The manufacturer who installs the geared motors in a plant must include the regulations contained in the operating instructions in its own operating instructions.

1.6 The five safety rules

For your own personal safety and to prevent material damage when carrying out any work, always observe the safety-relevant instructions and the following five safety rules according to EN 50110-1 Working in a voltage-free state. Apply the five safety rules in the sequence stated before starting work.

Five safety rules

1. Disconnect.
Also disconnect the auxiliary circuits, for example the anti-condensation heating.
2. Secure against reconnection.
3. Verify absence of operating voltage.
4. Ground and short circuit.
5. Cover or safeguard neighboring live parts.

After the work has been completed, undo the measures taken in the reverse order.

1.7 Particular types of hazards

 **WARNING**

Extreme surface temperatures

Hot surfaces over +55 °C pose a burn risk.

Cold surfaces below 0 °C pose a risk of damage due to freezing.

Do not touch the gearbox without protection.

 **WARNING**

Hot, escaping oil

Before starting any work wait until the oil has cooled down to below +30 °C.

 **WARNING**

Poisonous vapors when working with solvents

Avoid breathing in vapors when working with solvents.

Ensure adequate ventilation.

 **WARNING**

Risk of explosion when working with solvents

Ensure adequate ventilation.

Do not smoke!

 **WARNING**

Risk of eye injury

Rotating parts can throw off small foreign particles such as sand or dust.

Wear protective eyewear!

In addition to the prescribed personal protection gear, also wear suitable protective gloves and safety glasses.

Technical description

2.1 General technical description

The gearbox is supplied with one, two or three transmission stages.

The gearbox is suitable for various mounting positions. Observe the correct oil level.

Gearbox housing

The housings for sizes 19 and 29 are made of die-cast aluminum.

Depending on the gearbox type, the housings of sizes 39 and 49 are made of die-cast aluminum or cast iron.

Table 2- 1 Housing material

Gearbox type	Size	
	39	49
Helical gearbox E	Cast iron	Cast iron
Helical gearbox D/Z	Aluminum	Cast iron
Parallel shaft gearbox	Cast iron	Cast iron
Bevel gearbox B	Aluminum	Aluminum
Bevel gearbox K	Cast iron	Cast iron
Helical worm gearbox C	Cast iron	Cast iron

From size 59, the gearbox housings are made of cast iron.

Geared components

The geared components are hardened and ground.

For the helical worm gearbox, the worm is hardened and ground. The gear is manufactured from high-quality bronze.

The bevel gear stage of the bevel gearbox is lapped in pairs.

Lubrication

The geared components are supplied with adequate lubricant by means of dip lubrication.

Shaft bearings

All shafts are mounted in roller bearings. The roller bearings are lubricated using splash lubrication or oil-spray lubrication. Bearings that are not supplied with lubricant are closed and grease-lubricated.

XLplus and VLplus heavy-duty bearing systems

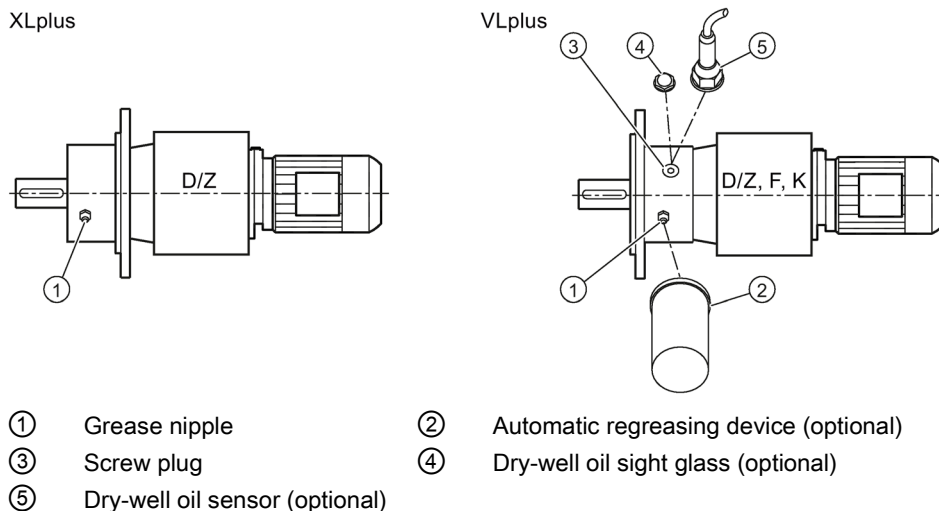


Figure 2-1 XLplus and VLplus heavy-duty bearing systems

The multi-stage helical gearbox sizes 89-169 can be supplied with an XLplus or VLplus heavy-duty bearing system.

The parallel-shaft gearbox and the helical gearbox sizes 89-169 can be supplied with a VLplus heavy-duty bearing system.

With an upstream locating bearing, the bearing system is suitable for high external forces. The absorbed radial and axial loads are transmitted to the machine via the flange.

The bearings are lubricated independently of the frame size. Initial greasing has already been carried out. The relubrication is made with the provided grease nipple.

Options for the VLplus heavy-duty bearing system:

An automatic regreasing device ② can be supplied as option. The automatic regreasing device ② can be installed at any position and can be used underwater.

A dry-well version with oil sight glass ④ or oil sensor ⑤ can be supplied as option. The dry-well version offers increased protection against oil leaks when the output shaft points down. The flange captures any escaping gear oil for leakages at the oil chamber. The escaping oil is signaled optically with an oil sight glass ④ or electronically by an oil sensor ⑤. If the oil sensor ⑤ is deployed in ATEX version gearboxes, the sensor must be operated with a disconnecter approved for ATEX.

2.2 Shaft seals

The shaft sealing rings on the output side prevent lubricant from escaping from the housing at the shaft outlet and prevent pollution from entering the housing.

The optimum use of the seals depends on the ambient conditions and the lubricant being used.

Radial shaft sealing ring

A high-quality radial shaft sealing ring is used as standard seal. The ring is provided with an additional dust lip to protect against contaminants from outside.

Sealing ring for a longer service life (optional)

The radial shaft sealing ring with dust lip has an additional buffer axial seal towards the inside of the gearbox. The buffer axial seal has a sinusoidal sealing lip that protects the sealing ring from contaminations.

Sealing ring to handle increased environmental stress (optional)

The sealing ring is equipped with an additional fiber disk. In addition to the longer service life, the disk also provides increased protection against higher environmental stress as a result of moisture and dust.

2.3 Cooling

NOTICE
Dust deposits prevent heat radiation
Dust deposits prevent heat radiation and cause a high housing temperature.
Keep the gearbox free from dirt, dust, etc.

The gearbox does not normally require additional cooling. The generously dimensioned housing surface is sufficient for dissipating heat losses where there is free convection. If the housing temperature exceeds a value of +80 °C, please contact Technical Support.

2.4 Rating plate

The rating plate on the gearbox or geared motor is of coated aluminum foil. The rating plate is glued using a special masking film. The film ensures permanent resistance to UV radiation and media of all kinds, such as oils, greases, salt water and cleaning agents.

The adhesive and the material ensure firm adhesion and long-term legibility within the operating temperature range from -40 °C to +155 °C.

The edges of the rating plate are paint-finished to match the color of the gearbox or motor to which it is affixed.

2.5 Surface treatment

2.5.1 General information on surface treatment

All paint finishes are sprayed on.



ATEX version gearboxes

The gearbox is delivered complete with primer and paint finish.

If the gearbox is delivered with primer only or unpainted, a paint finish must be applied which meets the applicable guidelines for the specific application. The primer does not provide adequate corrosion protection.



ATEX version gearboxes

When applying conductive paint, the operator must ensure that the paint remains in a perfect state.

The paint finish must be checked at intervals of approximately 2 - 3 years.



ATEX version gearboxes

An excessively high electrostatic charge must be avoided.

Ensure that highly active mechanisms that cause the paint finish to generate a charge are avoided.

Highly active mechanisms that can generate charges:

- Fast air with high dust content directed past the gearbox
- Sudden escape of compressed gases that contain particles
- Harsh abrasive processes (this does not mean manual cleaning / wiping with cleaning cloths)

<p>⚠ WARNING</p> <p>Danger due to electrostatic discharge</p> <p>For paint finishes in explosion group III, the paint can be electrostatically charged as a result of intensive dust turbulence or processes with high levels of electrostatic charging.</p> <p>Risk of explosion as a result of processes with high levels of electrostatic charging</p> <p>Minimize the risk of electrostatic charging by applying effective measures according to IEC 60079-32-1.</p>
--

<p>NOTICE</p> <p>Failure of the external protection</p> <p>If the paint finish is damaged, the geared motor may corrode.</p> <p>Do not damage the paint finish.</p>

Note

Information about the ability to be repainted does not guarantee the quality of the paint product supplied by your supplier.

Only the paint manufacturer is liable for the quality and compatibility.

2.5.2 Painted version

The corrosion protection system is classified according to the corrosiveness categories in DIN EN ISO 12944-2.

Table 2- 2 Paint according to corrosiveness categories

Paint system	Description
Corrosiveness category C1, unpainted for gearbox and motor housings made of aluminum	
-	<ul style="list-style-type: none"> • Indoor installation • Heated buildings with neutral atmospheres • Resistance to greases and some resistance to mineral oils, aliphatic solvents • Standard

Paint system	Description
Corrosiveness category C1 for normal environmental stress	
1-component hydro paint, top coat	<ul style="list-style-type: none"> • Indoor installation • Heated buildings with neutral atmospheres • Resistance to greases and some resistance to mineral oils, aliphatic solvents • Standard paint for gearbox housings made of cast iron
Corrosiveness category C2 for low environmental stress	
2-component - polyurethane top coat	<ul style="list-style-type: none"> • Indoor and outdoor installation • Unheated buildings with condensation, production areas with low humidity, e.g. warehouses and sports facilities • Atmospheres with little contamination, mostly rural areas • Resistance to greases, mineral oils and sulfuric acid (10 %), caustic soda (10 %) and some resistance to aliphatic solvents
Corrosiveness category C3 for medium environmental stress	
2-component epoxy zinc phosphate base coat, 2-component polyurethane top coat	<ul style="list-style-type: none"> • Indoor and outdoor installation • Production areas with high humidity and some air contamination, e.g. food production areas, dairies, breweries and laundries • Urban and industrial atmospheres, moderate contamination from sulfur dioxide, coastal areas with low salt levels • Resistance to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (10 %)

Paint system	Description
Corrosiveness category C4 for high environmental stress	
2-component epoxy zinc phosphate base coat, 2-component polyurethane top coat	<ul style="list-style-type: none"> • Indoor and outdoor installation • Chemical plants, swimming pools, wastewater treatment plants, electroplating shops, and boathouses above seawater • Industrial areas and coastal areas with moderate salt levels • Resistance to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (10 %)
Corrosiveness category C5 for very high environmental stress	
2-component epoxy zinc phosphate base coat, 2-component polyurethane intermediate coat, 2-component polyurethane top coat	<ul style="list-style-type: none"> • Indoor and outdoor installation • Buildings and areas with almost constant condensation and high contamination, e.g. malt factories and aseptic areas • Industrial areas with high humidity and aggressive atmosphere, coastal areas and offshore environments with high salt levels • Resistance to greases, mineral oils, aliphatic solvents, sulfuric acid (10 %), caustic soda (20 %)

In case of corrosiveness category C1, overpainting with a 1-component hydrosystem after prior rubbing down is possible.

In case of corrosiveness categories C2 to C5, overpainting with 2-component polyurethane paint, 2-component epoxide paint and 2-component acrylic paint after prior rubbing down is possible.

2.5.3 Primed version

Table 2- 3 Primer according to corrosiveness category

Paint system	Can be overpainted with
Unpainted corrosiveness category C1	
Cast iron parts immersion primed, steel parts primed or zinc-plated, aluminum and plastic parts untreated	<ul style="list-style-type: none"> • Synthetic paint, synthetic resin paint, oil paint • 2-component polyurethane paint • 2-component epoxy paint
Primed according to corrosiveness category C2 G	
2-component epoxy zinc phosphate, desired coat thickness 60 µm	<ul style="list-style-type: none"> • 2-component - polyurethane paint • 2-component - epoxy paint • 2-component - acrylic paint • Acid-hardening paint
Primed according to corrosiveness category C4 G	
2-component epoxy zinc phosphate, desired coat thickness 120 µm	<ul style="list-style-type: none"> • 2-component - polyurethane paint • 2-component - epoxy paint • 2-component - acrylic paint • Acid-hardening paint

Incoming goods, transport, and storage

3.1 Incoming goods

NOTICE
Transport damage impairs correct functioning
Do not commission faulty gearboxes or geared motors.

Note

Do not open or damage parts of the packaging that preserve the product.

Note

Check that the technical specifications are in accordance with the purchase order.

Inspect the delivery immediately on arrival for completeness and any transport damage.

Notify the freight company of any damage caused during transport immediately (this is the only way to have damage rectified free of charge). Siemens AG will not accept any claims relating to items missing from the delivery and which are submitted at a later date.

The gearbox or geared motor is delivered in a fully assembled condition. Additional items are sometimes delivered packaged separately.

The products supplied are listed in the dispatch papers.

3.2 Transport

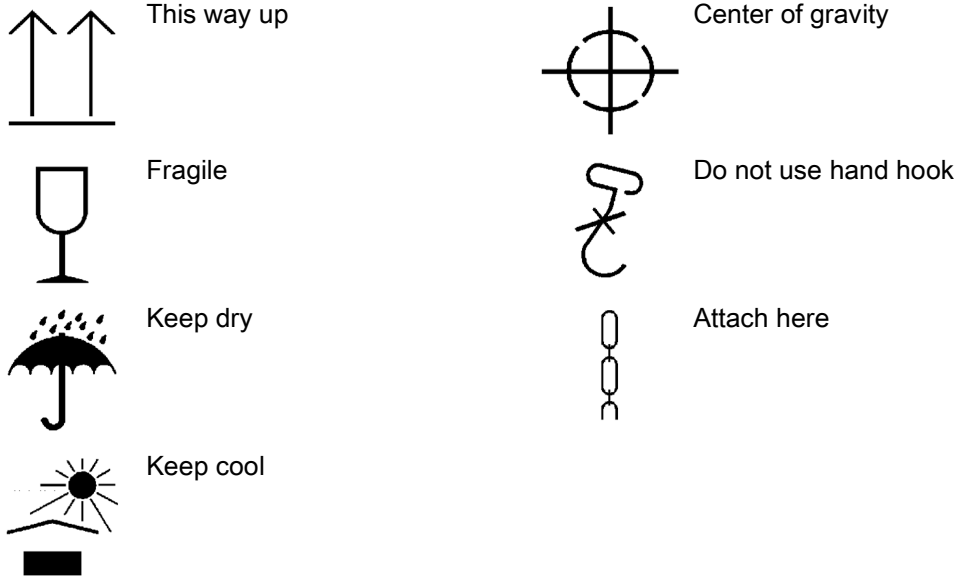
3.2.1 General information on transport

NOTICE
The use of force will damage the gearbox or geared motor
Transport the gearbox or geared motor carefully. Avoid knocks.
Before putting the drive into operation, remove any transport fixtures and keep them safe or render them ineffective. You can then use them again for transporting further items or you can apply them again.

3.2 Transport

Different forms of packaging may be used, depending on the size of the gearbox or geared motor and the method of transport. Unless contractually agreed otherwise, the seaworthy packaging complies with HPE Packaging Guidelines (Bundesverband Holzpackmittel Paletten Exportverpackungen e.V., the German Federal Association for wooden packaging, pallets, and export packaging).

Note the symbols which appear on the packaging. These have the following meanings:



3.2.2 Fastening for suspended transport


 WARNING
Inadequately secured gearbox or geared motors can free themselves
Use only the transport eye or eyebolt of the gearbox to transport the gearbox or geared motor. Because they are designed only for the weight of the gearbox or geared motor, it is not permissible to add additional loads.
Do not rig eyebolts to the front threads at the shaft ends for transportation purposes.
Do not use the integrally cast lifting eyes on the motor for transport because of the risk of breaking.
If necessary, use additional, suitable lifting accessories for transport or during installation.
When attaching by a number of chains and ropes just two strands must be sufficient to bear the entire load. Secure lifting accessories against slipping.


Table 3- 1 Maximum load of the eyebolt on the gearbox

Thread size	m	d ₃	Thread size	m	d ₃
	[kg]	[mm]		[kg]	[mm]
M8	140	36	M20	1 200	72
M10	230	45	M24	1 800	90
M12	340	54	M30	3 200	108
M16	700	63	-	-	-

The eyebolt corresponds to DIN 580.

3.3 Storage

3.3.1 General information for storage

 WARNING Danger of serious injuries caused by falling objects Danger of damage to the gearbox when stacked Do not stack gearboxes or geared motors on each other.
--

NOTICE Failure of the external protection Mechanical damage, chemical damage and thermal damage, such as scratches, acids, alkalis, sparks, welding beads and heat cause corrosion. Do not damage the paint finish.
--

Unless contractually agreed otherwise, the guarantee period for the standard preservative lasts 6 months from the date of delivery.

In the case of storage in transit over 6 months, special arrangements must be made for preservation. Please contact Technical Support.

Store the gearbox or geared motor in dry, dust-free rooms that are maintained at a constant temperature.

The storage location must be vibration- and shock-free.

The free shaft ends, sealing elements and flange surfaces must have a protective coating.

3.3 Storage

3.3.2 Storage up to 36 months with long-term preservation (optional)

3.3.2.1 General notes for storage up to 36 months

Store the gearbox or geared motor in dry, dust-free rooms that are maintained at a constant temperature. Special packing is then not necessary.

If such premises are not available, pack the gearbox or the geared motor in plastic film or air-tight sealed film and materials. The films and materials must be able to accept moisture. Cover them to provide protection against heat, direct sunlight and rain.

The permissible ambient temperature is -25 °C to +50 °C.

The life of the corrosion protection is 36 months from delivery.

3.3.2.2 Gearbox filled with operating oil and anti-corrosive agent

NOTICE
Damage to the gearbox caused by incorrect oil quantities
Check the oil level before commissioning.
Observe the information and procedures for Checking the oil level (Page 67).

The gearbox is filled with oil corresponding to the mounting position so that it is ready for operation, and is sealed airtight using a screw plug or with a pressure breather valve with transport fixture.

For storage up to 36 months, a VCI anti-corrosion agent (Volatile Corrosion Inhibitor) is added.

3.3.2.3 Gearbox completely filled with oil

NOTICE
Damage to the gearbox caused by incorrect oil quantities
Prior to commissioning, remove excessive oil until it has the correct oil level.
Observe the information and procedures for Correcting the oil level (Page 67).

When biodegradable oils or oils for the food-processing sector are used, the gearbox is filled completely with operating oil. The gearbox is closed air-tight with a sealing plug or a pressure venting with transport fixture.

Do not lower the oil level during short-time commissioning for 10 minutes in no-load operation.

Installation

4.1 Unpacking

NOTICE
Transport damage impairs the correct function of the gearbox
Never commission faulty gearboxes.

Check the gearbox for completeness and for damage. Report any missing parts or damage immediately.

Remove and dispose of the packaging material and transport equipment in compliance with regulations.


4.2 General information on installation



ATEX version gearboxes

Effect on bearings of stray electric currents from electrical equipment.

When mounting the gearbox on or connecting it to the machine, take care to ensure potential equalization. The information on grounding and equipotential bonding provided by the motor supplier must be observed.

 WARNING
Operating under load
Under load, the system can start or reverse in an uncontrolled fashion.
The entire system must be load-free so that there is no danger during this work.

NOTICE
Destruction caused by welding
Welding destroys the geared parts and bearings.
Do not weld on the gearbox. The gearbox must not be used as a grounding point for welding operations.

NOTICE
Overheating caused by solar radiation Overheating of the gearbox due to exposure to direct sunlight. Provide suitable protective equipment such as covers or roofs. Prevent heat accumulation.

NOTICE
Malfunction resulting from foreign objects The operator must ensure that no foreign objects impair the function of the gearbox.

NOTICE
Damaged components impair the correct function of the gearbox If any components are damaged, the correct function of the gearbox will no longer be ensured. Do not install any damaged gearbox components.

NOTICE
Violation of the maximum permissible oil sump temperature The oil sump temperature may be exceeded if the temperature monitoring equipment is incorrectly set. An alarm must be output when the maximum permissible oil sump temperature is reached. The geared motor must be switched off when the maximum permissible temperature is exceeded. If the geared motor is shut down, then this can cause the machine to come to a stop.

Exercise particular care during mounting and installation. The manufacturer cannot be held liable for damage caused by incorrect mounting and installation.

Make sure that there is sufficient space around the gearbox or geared motor for mounting, maintenance and repair.

On geared motors with a fan, leave sufficient free space for the entry of air. Observe the installation conditions for the geared motor.

Provide sufficient lifting gear at the start of mounting and fitting work.

Observe the mounting position specified on the rating plate. This ensures that the correct quantity of lubricant is provided.

Use all the fastening means that have been assigned to the particular mounting position and mounting type.

Cap bolts cannot be used in some cases due to a lack of space. In such cases, please contact Technical Support quoting the type of gearbox.

4.3 Thread sizes and tightening torques for fastening bolts

The general tolerance for the tightening torque is 10 %. The tightening torque is based on a friction coefficient of $\mu = 0.14$.

Table 4- 1 Tightening torques for fastening bolts

Thread size	Tightening torque for strength class		
	8.8	10.9	12.9
	[Nm]	[Nm]	[Nm]
M4	3	4	5
M5	6	9	10
M6	10	15	18
M8	25	35	41
M10	50	70	85
M12	90	120	145
M16	210	295	355
M20	450	580	690
M24	750	1 000	1 200
M30	1 500	2 000	2 400
M36	2 500	3 600	4 200

4.4 Gearbox with foot mounting

NOTICE
Impermissible housing loadings when unevenness present
Do not subject the gearbox to excessive stress when tightening the fastening bolts.
The foundation must be level and free from dirt.
The deviation in flatness of the gearbox's contact surface may not exceed the following values:
For gearboxes up to size 89: 0.1 mm
For gearboxes from size 109: 0.2 mm.

The foundation should be designed in such a way that no resonance vibrations are created and no vibrations are transmitted from adjacent foundations.

The foundation structure on which the gearbox is to be mounted must be torsionally rigid. It must be dimensioned according to the weight and torque, taking into account the forces acting on the gearbox. If the substructure is too weak, it will cause radial or axial displacement offset during operation that cannot be measured at a standstill.

If the gearbox is fastened to a concrete foundation, use foundation blocks for the appropriate recesses.

Align and grout the slide rails into the foundation.

Align the gearbox carefully with the units on the input and output side. Take into account the elastic deformation due to operating forces.

Prevent displacement from external forces due to lateral impacts.

Use stud bolts or headless screws of strength class 8.8 or higher for the mounting foot. Observe the tightening torque.

Table 4- 2 Thread size of the fastening bolt

Thread size	Helical gearbox		Parallel shaft gearbox F	Bevel gearbox B, K	Helical worm gearbox C
	E	D/Z			
	Size				
M8	-	19, 29, 39	29, 39	B19, B29, B39	29
M10	39	-	49	B49, K39, K49	39, 49
M12	49	49, 59, 69	69, 79	K69, K79	69
M16	69, 89	79, 89	89, 109	K89	89
M20	109, 129	109	129	K109	-
M24	-	129	149	K129	-
M30	149	149	169	K149	-
M36	-	169, 189	189	K169, K189	-

4.5 Gearbox with flange fastening

Note

Siemens AG recommends an anaerobic adhesive to enhance the friction lock between flange and mounting surface.

Table 4- 3 Thread size of the fastening bolt

Thread size	Flange	Helical gearbox E, D/Z	Parallel shaft gearbox F	Bevel gearbox B, K	Helical worm gearbox C
		Size			
M6	A120	19, 29, 39	29	B29	29
M8	A140, A160	19, 29, 39, 49, 59	29, 39	B29, B39, K39	39
M10	A200	39, 49, 59, 69	49	B39, B49, K49	49, 69
M12	A250, A300	49, 59, 69, 79, 89, 109	69, 79, 89	K69, K79, K89	89
M16	A350	89, 109, 129, 149	109	K109	-
M16	A450	109, 129, 149, 169	129, 149	K129, K149	-
M16	A550	169, 189	169	K169	-
M20	A660	189	189	K189	-

Use screws / nuts of strength class 8.8 for gearboxes with a flange-mounted design.

Note the following exceptions:

Table 4- 4 Strength class of the fastening bolt for FF/FAF and KF/KAF

Gearbox size	Flange	Strength class for motor size										
		90	100	112	132	160	180	200	225	250	280	315
39	A160	10.9	10.9	-	-	-	-	-	-	-	-	-
49	A200	8.8	10.9	10.9	10.9	-	-	-	-	-	-	-
69	A250	8.8	8.8	8.8	10.9	-	-	-	-	-	-	-
79	A250	8.8	8.8	8.8	10.9	10.9	-	-	-	-	-	-
89	A300	8.8	10.9	10.9	10.9	10.9	10.9	-	-	-	-	-
109	A350	8.8	8.8	8.8	8.8	10.9	10.9	10.9	10.9	-	-	-
129	A450	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	-	-	-
149	A450	-	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9	-	-
169	A550	-	-	8.8	8.8	8.8	10.9	10.9	10.9	10.9	10.9	-
189	A660	-	-	8.8	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9

4.6 Gearboxes in foot or flange version

Table 4- 5 Strength class of the fastening bolt / nut for EZ, EF, DZ/ZZ and DF/ZF

Gearbox size		Flange	Strength class
E	D/Z		
39	29, 39	A120	10.9 ¹⁾
-	49	A140	10.9
49	59	A160	
69	69	A200	
89	79	A250	
109	89	A300	
129, 149	109, 129	A350	
-	149, 169	A450	
-	189	A550	

1) Use suitable washers under the nuts / bolt heads

4.6 Gearboxes in foot or flange version

NOTICE

Impermissible housing loadings caused by incorrectly installed add-on elements

Do not subject the gearbox housing to excessive stress by adding add-on elements to the foot or flange.

Add-on elements must not transmit forces, torques, and vibrations to the gearbox.

To prevent strains on the housing, fasten the gearbox only on the flange or the foot fastening for force and torque transmission. Refer to Gearbox with foot mounting (Page 28).

The second mounting option (foot or flange) is intended for add-on elements, e.g. protection covers with an intrinsic weight of up to max. 30 % of the weight of the gearbox.

4.7 Mounting an input or output element on the gearbox shaft

 WARNING
--

Risk of burns caused by hot parts
--

Do not touch the gearbox without protection.
--

NOTICE

Damage to shaft sealing rings caused by solvent
--

Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE

Damage to shaft sealing rings caused by heating
--

Use thermal shields to protect shaft sealing rings from heating above 100 °C due to radiant heat.

NOTICE

Premature wear or material damage due to misalignment
--

Misalignment caused by excessive angular or axis displacement to the connecting shaft ends.

Ensure precise alignment of the individual components.
--

NOTICE

Damage caused by improper handling

Bearings, housing, shaft and locking rings are damaged due to improper handling.
--

Do not use impacts or knocks to force the input and output elements to be mounted onto the shaft.

Note

Deburr the parts of elements to be fitted in the area of the hole or keyways.

Recommendation: 0.2 x 45°

Where couplings are to be fitted in a heated condition, observe the specific operating instructions for the coupling. Unless otherwise specified, apply the heat inductively using a torch or in a furnace.

Use the center holes in the shaft end faces.

Use a fitting device to fit the input or output elements.

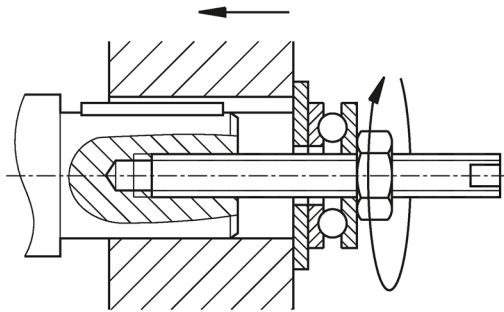
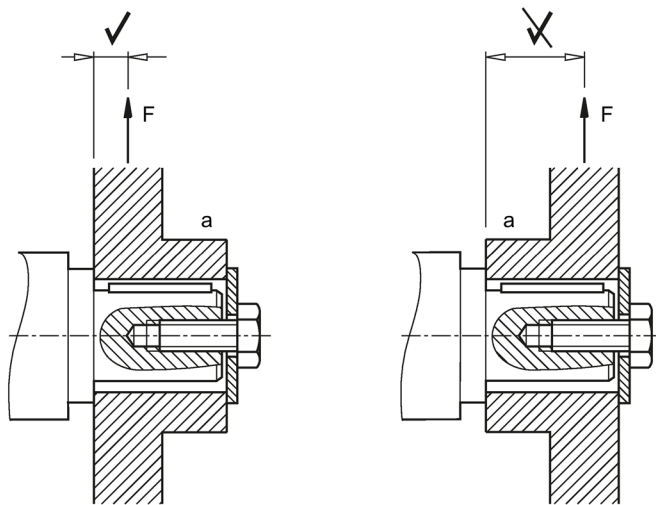


Figure 4-1 Example of a fitting device

Observe the correct mounting arrangement to minimize stress on shafts and bearings due to lateral forces.

Correct

Incorrect



a Hub
F Force

Figure 4-2 Mounting arrangement for low stress on shafts and bearings

Procedure

1. Use either benzine or solvent to remove the anti-corrosion protection from the shaft ends and flanges or remove the applied protective skin.
2. Fit the drive input and output elements to the shafts. Fasten the elements when necessary.

You have now fitted the input or output element.

4.8 Removing and installing the protection cover



ATEX version gearboxes

Sparks may be caused by a damaged protection cover. Replace damaged protection covers immediately.

Secure bolts ① with, e.g. Loctite 243 medium-strength adhesive.

The protection cover of the hollow shaft is delivered ready-fitted to the gearbox flange. Dismantle the protection cover for installation of the output shaft.

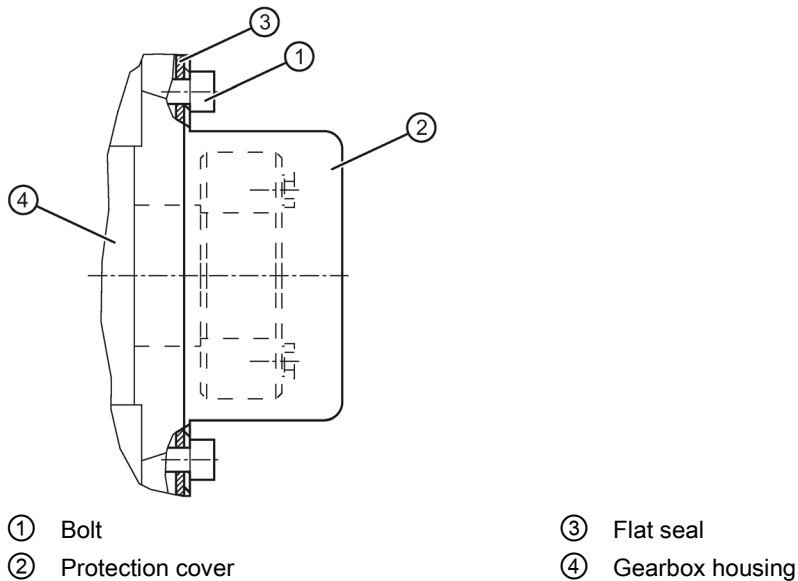


Figure 4-3 Protection cover for hollow shaft

Procedure

1. Unscrew the bolts ① and remove the protection cover ② together with the flat gasket ③.
 2. Fit the output shaft.
 3. Use a suitable cleaning agent to clean the contact surface of the protection cover ② on the gearbox.
 4. Ensure that the flat seal ③ is correctly seated.
 5. Wet the bolts ① with medium-strength adhesive, e.g. Loctite 243.
 6. Screw on the protection cover ②.
 7. Protect all remaining bare areas with a suitable permanent anti-corrosive agent.
- You have now installed the protection cover for operation.

4.9 Installing and removing the shaft-mounted gearbox

4.9.1 General information on installing the shaft-mounted gearbox

NOTICE
Damage to shaft sealing rings caused by solvent Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE
Subjecting stress to the hollow shaft causes bearing failure Skewing or stressing the hollow shaft increases the loading. This can cause bearing failure. The hollow shaft must be flush with the machine shaft to avoid misalignment. Do not subject the hollow shaft to axial and radial stress.

NOTICE
For shrink disks: Lubricants in the area between the hollow shaft and machine shaft impair torque transmission Keep the bore in the hollow shaft and the machine shaft completely grease-free. Do not use impure solvents and soiled cleaning cloths.

Note

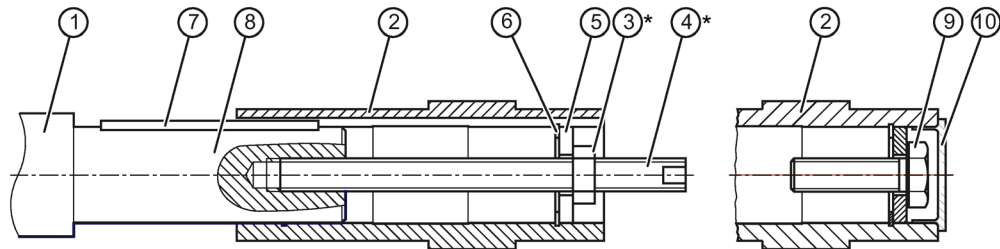
Coat the contact surfaces with the mounting paste supplied with the product or any suitable lubricant to prevent frictional corrosion.

Note

Observe the permissible concentricity tolerance of the cylindrical shaft extension of the machine shaft to the housing axle according to DIN 42955.

4.9.2 Hollow shaft with parallel key

4.9.2.1 Mounting the hollow shaft with parallel key



* Not included in scope of supply

- | | |
|--------------------|------------------|
| ① Machine shaft | ⑥ Circlip |
| ② Hollow shaft | ⑦ Parallel key |
| ③ Hexagon nut | ⑧ Mounting paste |
| ④ Threaded spindle | ⑨ Bolt |
| ⑤ Disk | ⑩ Sealing caps |

Figure 4-4 Mounting the hollow shaft with parallel key

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as hydraulic lifting equipment may be used.

Procedure

1. Using benzine or a solvent, remove the anti-corrosion protection from the shaft ends and flanges.
2. Check the seats or edges of the hollow and machine shafts for damage. Contact Technical Support if you notice any damage.
3. Apply the mounting paste provided ① to the machine shaft ⑧. Apply the paste uniformly.
4. Fit the gearbox using the disk ⑤, threaded spindle ④ and nut ③. Support is provided by the hollow shaft ②.
5. Replace the nut ③ and the threaded spindle ④ with a screw ⑨. Tighten the bolts ⑨ to the specified torque.
6. Close the open hollow shaft end using a sealing cap ⑩.

You have mounted the hollow shaft with feather key.

Table 4- 6 Tightening torque for the screw

Thread size	M5	M6	M8	M10	M12	M16	M20	M24	M30
Tightening torque [Nm]	5	8	8	14	24	60	120	200	400

4.9.2.2 Removing the hollow shaft with parallel key

⚠ WARNING

Inadequately secured gearbox or geared motors can free themselves

Before driving out the machine shaft, fasten a suitably dimensioned means of absorbing load to the gearbox.

Slightly pretension the pulling equipment so that the gearbox does not drop onto it when the insert shaft is released.

NOTICE

Subjecting stress to the hollow shaft causes bearing failure

It is essential to prevent misalignment when removing the unit.

NOTICE

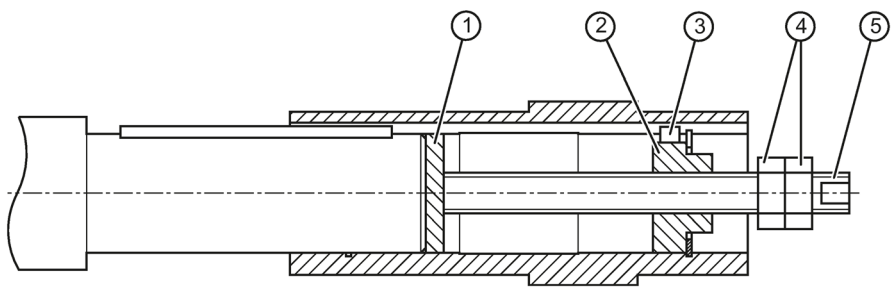
Excessive forces during removal

Excessive forces can occur during removal of the hollow shaft via the housing.

Stresses in the hollow shaft can lead to bearing failure and damage to the gearbox housing.

Note

If frictional corrosion has occurred on the seat surfaces, use rust solvent to facilitate the removal of the gearbox. Allow an adequately long time for the rust solvent to take effect.



- Items ① to ⑤ are not included in the scope of supply.
- | | |
|------------------|---------------|
| ① Disk | ④ Hexagon nut |
| ② Threaded block | ⑤ Leadscrew |
| ③ Parallel key | |

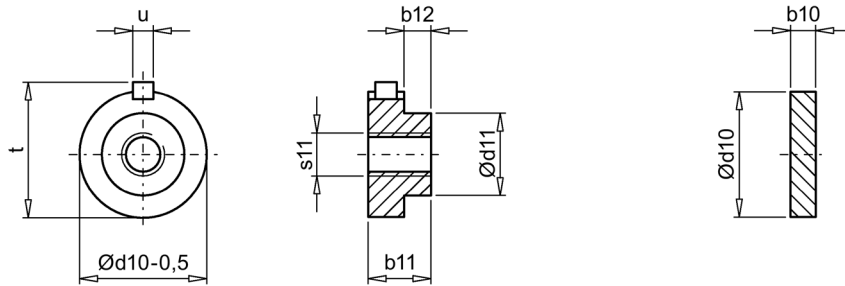
Figure 4-5 Removing the hollow shaft with parallel key

Procedure

1. Remove the axial locking element from the hollow shaft.
2. Drive out the machine shaft using the disk ①, threaded block ②, feather key ③, threaded spindle ⑤ and hexagon nuts ④.

You have now removed the hollow shaft with parallel key.

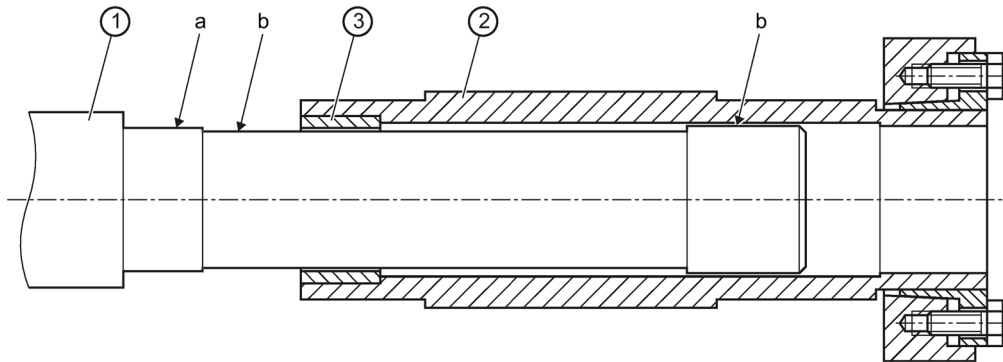
Design suggestion for threaded block and disk



Gearbox	Size	Hollow shaft \varnothing	b10	b11	b12	d10	d11	s11	t _{max}	u
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
B	19	20	3	15	10	19.9	10	M6	22.5	6
B, C	29	20	3	15	10	19.9	10	M6	22.5	6
B, F	29	25	3	15	10	24.9	16	M10	28	8
C	39	25	3	15	10	24.9	16	M10	28	8
B, K, F, C		30	6	15	10	29.9	18	M10	33	8
B		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
C	49	30	6	15	10	29.9	18	M10	33	8
K, F, C		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
K, F, C	69	40	6	20	9	39.9	28	M16	43	12
C		45	6	20	9	44.9	36	M16	48	14
K, F	79	40	6	20	9	39.9	28	M16	43	12
K, F, C	89	50	7	20	10	49.9	36	M16	53.5	14
C		60	7	20	10	59.9	45	M20	64	18
K, F	109	60	10	24	14	59.9	45	M20	64	18
K, F	129	70	10	24	14	69.9	54	M20	74.5	20
K, F	149	90	10	24	14	89.9	72	M20	95	25
K, F	169	100	10	30	15	99.9	80	M24	106	28
K, F	189	120	10	30	15	109.9	80	M24	127	32

4.9.3 Hollow shaft with shrink disk

4.9.3.1 Mounting the hollow shaft with shrink disk



- a Greased
- b Absolutely grease-free
- * Not included in scope of supply
- ① Machine shaft
- ② Hollow shaft
- ③ Bushing


Figure 4-6 Mounting the hollow shaft with shrink disk

Procedure

1. Using benzine or a solvent, remove the anti-corrosion protection from the shaft ends and flanges.
2. Check the seats or edges of the hollow and machine shafts for damage. Contact Technical Support if you notice any damage.
3. Mount the gearbox with the shrink disk shaft onto the machine shaft. Carefully ensure the correct position and that the shrink disk seat completely covers the machine shaft.

You have mounted the hollow shaft with shrink disk.

4.9.3.2 Mounting the shrink disk

 WARNING
Risk of injury due to freely rotating parts Fit a cover cap or protection cover.

NOTICE
Lubricants in the shrink disk seat impair torque transmission Keep the bore in the hollow shaft and the machine shaft completely grease-free. Do not use impure solvents and soiled cleaning cloths.

NOTICE
Plastic deformation of the hollow shaft caused by tightening the tightening bolts Plastic deformation of the hollow shaft when tightening the tightening bolts before fitting the machine shaft. First fit machine shaft. Then tighten the tightening bolts.

NOTICE
Avoid overloading the individual bolts Do not exceed the maximum tightening torque for the tightening bolt. Frame sizes 29 - 69: tighten clamping screws ⑥ Frame sizes 79 - 189: it is important that the face surfaces of the outer ring ④ and the inner ring ⑤ are flush with one another. If they are not flush with one another when tensioning, the tolerance of the insert shaft must be checked.

Note

The shrink disk, item ③, is delivered ready for installation.

Do not dismantle it before the initial fitting.

Note

The machine shaft material must comply with the following criteria in order to safely and reliably transfer the forces and torques.

- Yield point $Re \geq 360 \text{ N/mm}^2$
- Modulus of elasticity: approx. 206 kN/mm^2
- No face end thread in the machine shaft because it would reduce the transferred torque

Note

The shrink-fitted disc connection fastens the hollow shaft axially on the machine shaft.

Note

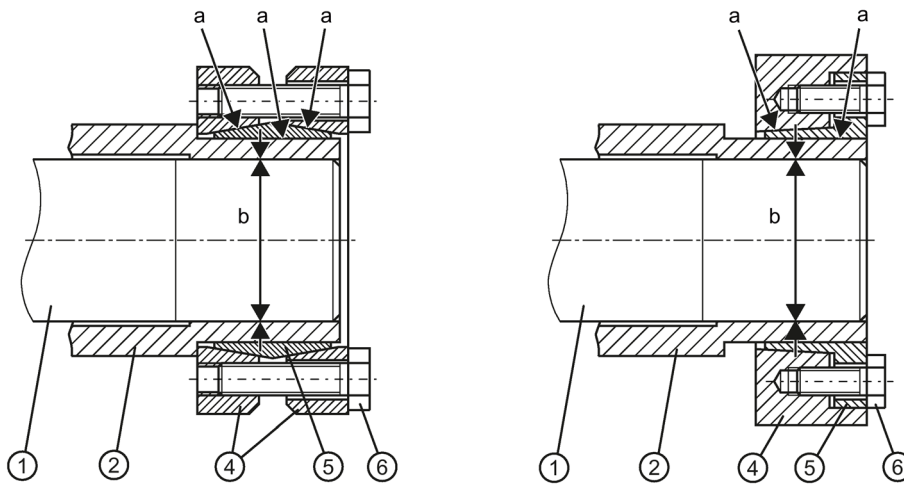
Apply a thin layer of grease to the shrink disk seat on the hollow shaft.

Note

Coat with a suitable lubricant to prevent frictional corrosion of the contact surface on the customer's machine shaft in the vicinity of the bush.

Sizes 29 - 69

Sizes 79 - 189



- a Greased
- b Absolutely grease-free
- ① Machine shaft
- ② Hollow shaft
- ③ Shrink disk comprising items ④ - ⑥
- ④ Outer ring
- ⑤ Inner ring
- ⑥ Tightening bolt

Figure 4-7 Mounting the shrink disk

Procedure

1. Push the shrink disk ③ onto the hollow shaft ③.
 - 3-part shrink disk until the limit for sizes 29 - 69.
 - 2-part shrink disk flush with the shaft end for sizes 79 - 189.
2. Tighten the clamping bolts ⑥, initially by hand. Align the shrink disk ③ so that the clamping flanges are plane-parallel with one other.
3. Use the torque wrench to turn each of the clamping screws ⑥ equally by 1/6 revolution (not crosswise); repeat this procedure several times. Observe the tightening torque.
4. Attach the rubber cover or protection cover included in the scope of supply, see Removing and installing the protection cover (Page 33).

You have now installed the shrink disk.

Table 4- 7 Tightening torque for the tightening bolt

Gearbox size	Thread size	Strength class	Tightening torque
			[Nm]
29	M5	8.8	5
39, 49, 69	M6	8.8	12
79, 89	M8	12.9	35
109	M10	12.9	70
129	M10	12.9	70
149	M12	12.9	121
169, 189	M14	12.9	193

4.9.3.3 Pulling off the shrink disk

Procedure

1. Successively release the tightening bolts ⑥ one after the other through a ¼ turn each time using a wrench. Do not completely remove the bolts.
2. Pull the shrink disk off the hollow shaft.

Sizes 79 - 189:

If the outer ring does not come away from the inner ring, remove some of the tightening bolts and insert them into neighboring forcing threads.

Pull the shrink disk off the hollow shaft.

4.9.3.4 Cleaning and lubricating shrink disks

Soiled shrink disks must be cleaned and regreased prior to fitting.

Shrink disks that have been released need not be disassembled and regreased before being retensioned.

Procedure

1. Only grease the inner friction surfaces of the shrink disks. To do this, use a solid lubricant with a friction coefficient of $\mu = 0.04$.
2. Use a paste containing MoS₂ to grease the bolts, applying the paste to the thread and underneath the head.


Clean the shrink disk.

Table 4- 8 Lubricants for shrink disks

Lubricant	Sold as	Manufacturer
Molykote 321 R (lubricant paint)	Spray	DOW Corning
Molykote spray (powder spray)		
Molykote G Rapid	Spray or paste	Klüber Lubrication
Molykombin UMFT 1	Spray	
Unimily P5	Powder	
Aemasol MO 19 P	Spray or paste	A. C. Matthes

4.9.4 SIMOLOC assembly system

4.9.4.1 General notes for the SIMOLOC assembly system

 WARNING
Risk of injury due to freely rotating parts
Fit a cover cap or protection cover.

NOTICE
Damaged components impair the correct function of the gearbox
If any components are damaged, the correct function of the gearbox will no longer be ensured.
Do not install any damaged gearbox components.

NOTICE
Lubricant on the machine shaft ① impairs the torque transmission
Keep the bore in the tapered bushing ⑨ and the machine shaft ① completely grease-free.
Do not use impure solvents and soiled cleaning cloths.

NOTICE
Avoid overloading the individual bolts
Do not exceed the maximum tightening torque for the tightening bolts ④ und ⑩.

Note

The SIMOLOC assembly system secures the hollow shaft axially on the machine shaft.

Note

In the hollow shaft ⑥, oil the locating hole for the tapered bushing ⑨ and bronze bushing ② lightly with the provided oil.

Oil type of the provided oil: CLP VG 68 DIN 51517-3

Note

The thrust collar ⑤ must be placed at the correct position as in the delivered state.

Note

Before installing the SIMOLOC, mount the torque arms ⑦ on the gearbox.

4.9.4.2 Installing SIMOLOC

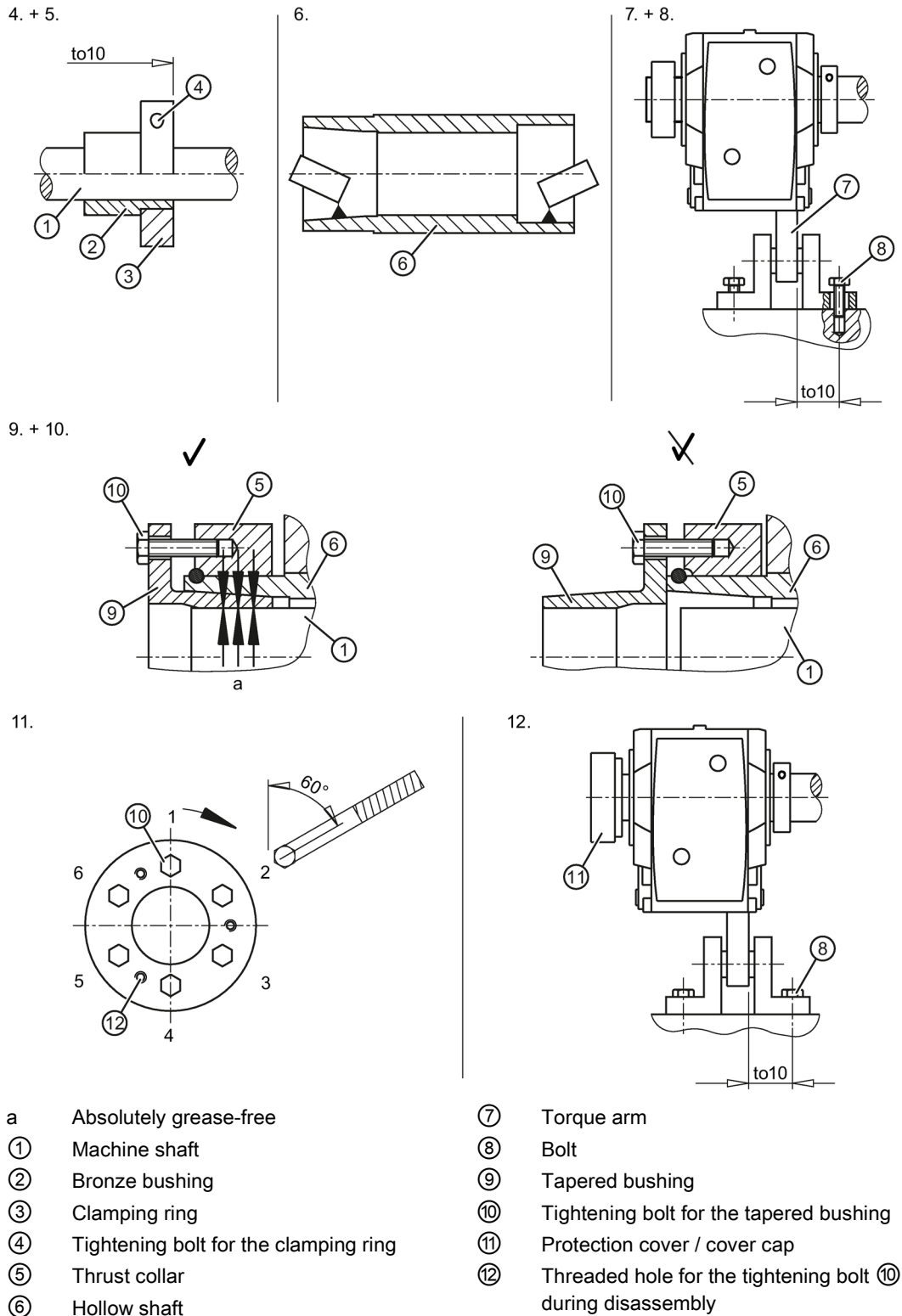


Figure 4-8 Installing SIMOLOC

Procedure

1. Attach the torque arm ⑦ to the gearbox, see Torque arms with shaft-mounted gearboxes (Page 48).
2. Remove the corrosion protection coating using white spirit or a solvent on:
 - The shaft ends of the machine shaft ①
 - The clamping ring ③
 - The bronze bushing ②.
3. Check the seats or edges of the hollow shaft ⑥ and the machine shaft ① for damage. Please contact Technical Support if you notice any damage.
4. Place the clamping ring ③ on the bronze bushing ②.
5. Position the bronze bushing ② with the clamping ring ③ on the machine shaft ①. Observe the tightening torque of the tightening bolt ④ and the tolerance dimension to 10.
6. Oil lightly the locating holes in the hollow shaft ⑥ for the tapered bushing ⑨ and bronze bushing ②. Remove any excessive oil using a clean cloth.
7. Push the gearbox with the installed torque arm ⑦ on the machine shaft ① against the clamping ring ③.
8. Tighten the torque arm ⑦ with the bolts ⑧ only gently because the gearbox must have clearance for the subsequent mounting.
9. Ensure that the thrust collar ⑨ is placed at the correct position.
If the thrust collar ⑤ is not placed at the correct position, bring the ring ⑤ into the correct position by tightening the tightening bolts ⑩ with turned tapered bushing ⑨.
10. Place the tapered bushing ⑨ on the machine shaft ①.
11. Use the torque wrench to turn each of the tightening bolts ⑩ equally (not crosswise), repeating this procedure several times. Observe the tightening torque of the tightening bolt ⑩.
12. Tighten the bolts ⑧ of the torque-arm fastening, see Torque arms with shaft-mounted gearboxes (Page 48).
13. Attach the rubber cover or protection cover ⑪ included in the scope of delivery, see Removing and installing the protection cover (Page 33).

You have installed the SIMOLOC assembly system.

4.9 Installing and removing the shaft-mounted gearbox

Table 4- 9 Tolerance dimension, tightening bolt ④ tightening torque

Gearbox type	Size	Tolerance dimension to10	Thread size ④	Tightening torque
		[mm]	Strength class 10.9	[Nm]
F, B, C	29	0.6 ... 2.1	M6	15
F, B, K, C	39	0.7 ... 2.2		
F, B, K, C	49	0.8 ... 2.6		
F, K, C	69	0.7 ... 2.5	M8	35
F, K	79	1.4 ... 3.2		
F, K, C	89	1.5 ... 3.4		

Table 4- 10 Tightening bolt ⑩ tightening torque

Gearbox type	Size	Thread size ⑩	Tightening torque
		Strength class 12.9	[Nm]
F, B, C	29	M5	10
F, B, K, C	39		
F, B, K, C	49	M6	16
F, K, C	69		
F, K	79	M8	38
F, K, C	89		

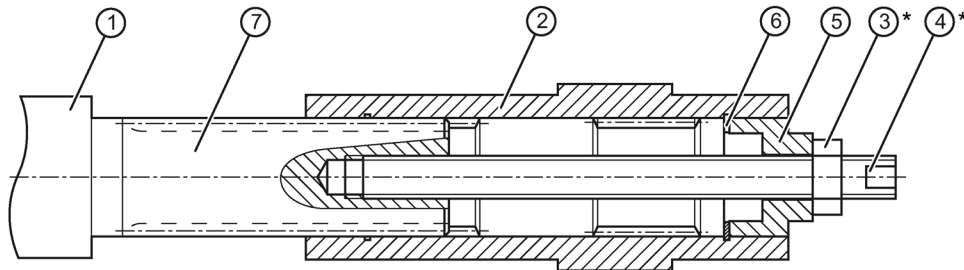
4.9.4.3 Removing SIMOLOC

Procedure

1. Remove all bolts ⑩ completely.
2. Screw the bolts ⑩ into the threaded holes ⑫.
3. Use the torque wrench to turn each of the bolts ⑩ equally (not crosswise), repeating this procedure several times. Observe the tightening torque of the bolt ⑩. Repeat the task until the tapered bushing ⑨ has been freed.
4. Unscrew the bolts ⑩ and remove the tapered bushing ⑨.
5. Lower the gearbox from the machine shaft ①.

You have removed the SIMOLOC assembly system.

4.9.5 Hollow shaft with splines



* Not included in scope of supply

- ① Machine shaft
- ② Hollow shaft
- ③ Hexagon nut
- ④ Threaded spindle
- ⑤ Disk
- ⑥ Locking ring
- ⑦ Mounting paste

Figure 4-9 Mounting the hollow shaft with splines

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as hydraulic lifting equipment may be used.

Procedure

1. Using benzine or a solvent, remove the anti-corrosion protection from the shaft ends and flanges.
2. Check the seats or edges of the hollow and machine shafts for damage. Please contact Technical Support if you notice any damage.
3. Apply the mounting paste ⑦ to the machine shaft ①. Apply the paste uniformly.
4. Fit the gearbox using the disk ⑤, threaded spindle ④ and nut ③. Support is provided by the hollow shaft ②.
5. Replace the nut ③ and the threaded spindle ④ with a screw. Tighten the bolts to the specified torque.

You have mounted the hollow shaft with splined shaft.

Table 4- 11 Tightening torque for the screw

Thread size	M5	M6	M8	M10	M12	M16	M20	M24	M30
Tightening torque [Nm]	5	8	8	14	24	60	120	200	400

4.9.6 Torque arms with shaft-mounted gearboxes

4.9.6.1 General information regarding torque arms

Torque arms can absorb the reaction torque and the weight force of the gearbox.



ATEX version gearboxes

Worn or irreparably damaged rubber elements will not function properly.

Impacts can cause sparks.

Damaged rubber elements must be replaced immediately.

NOTICE
Dangerous transient torques due to excess backlash
Take care to prevent the torque arm causing excessive constraining forces, e.g. due to the driven shaft running out-of-true.

NOTICE
Impermissible gearbox loading caused by incorrect mounting
Do not tension torque arms when mounting.

NOTICE
Damage to the rubber elements caused by solvent
Solvents, oils, greases, and fuels damage rubber elements.
Avoid contact at all times.

4.9.6.2 Mounting torque arms on parallel shaft gearboxes

We recommend using pretensioned, damping rubber elements.

Fixing accessories such as brackets, bolts, nuts, etc., are not included in the scope of supply.

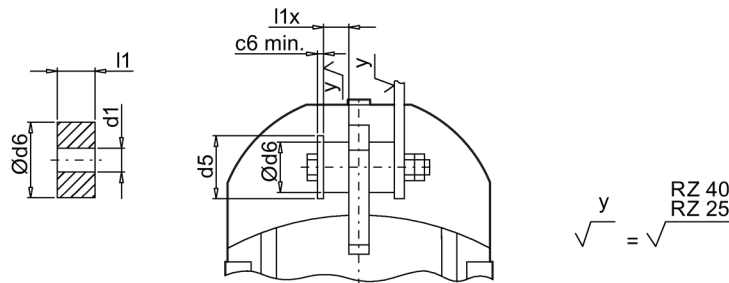


Figure 4-10 Installation suggestion for torque arms on F.29 - F.189

Size	Rubber buffer				Washer	
	Untensioned	Tensioned				
	l1	l1x	d6	d1	d5	c6 _{min}
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
29	15	14.0	30	10.5	40	4
39		13.5				
49	20	18.5	40	12.5	50	6
69		18.5				
79		17.5				
89	30	28	60	21	75	8
109		27.5				
129	40	37.5	80	25	100	10
149		36.5				
169	50	47.5	120	31	140	12
189		46.5				

Procedure

1. Use the washers according to the table above.
2. Use two nuts to secure the screw connection (lock nuts).
3. Tighten the bolts until the rubber buffers are pretensioned to the dimension l1x.

You have now installed the torque arm.

4.9.6.3 Mounting torque arms on bevel gearboxes and helical worm gearboxes

NOTICE

Impermissible loading caused by incorrect mounting

The torque arm bush must be supported by bearings on both sides.
After assembly, the sleeve must have some axial play.

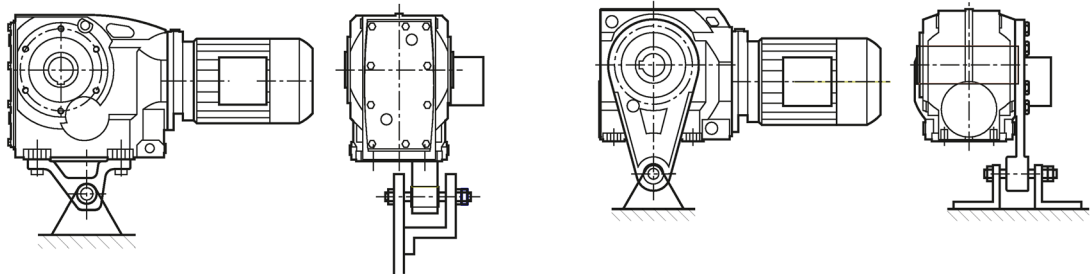


Figure 4-11 Mounting suggestion for torque arm on foot and flange

The torque arm can be fitted in various positions, depending on the hole circle pitch.

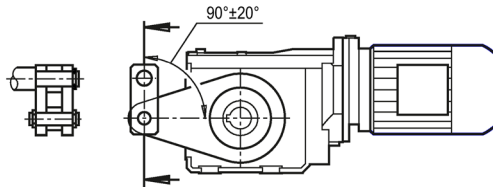


Figure 4-12 Toggle lever design

For a toggle lever design, derive the force in the range of $90^\circ \pm 20^\circ$.

Procedure

1. Clean the contact surfaces between the housing and the torque arm.
2. Tighten the bolts to the specified torque.

You have now mounted the torque arm.

Table 4- 12 Tightening torque for screws of strength class 8.8

Thread size	M8	M10	M12	M16	M20	M24	M36
Tightening torque [Nm]	25	50	90	210	450	750	2 600

5.1 General information for commissioning

⚠ WARNING
Unintentional starting of the drive unit Secure the drive unit to prevent it from being started up unintentionally. Attach a warning notice to the start switch.

⚠ WARNING
Risk of slipping on oil Remove any oil spillage immediately with an oil-binding agent in compliance with environmental requirements.

Checking the pressure breather valve

Check that the breather valve is activated.

If the breather valve has a transport fixture, it must be removed before commissioning.

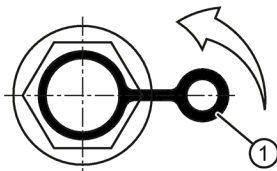


Figure 5-1 Pressure breather valve with securing clip

Remove the transport fixture by pulling the securing clip ① in the direction of the arrow.

5.2 Checking the oil level prior to commissioning

Check the oil level before commissioning. Correct the oil quantity when required. Please observe Checking and changing lubricants (Page 67).

Siemens AG recommends a complete oil change after a storage time longer than 24 months:

- For gearboxes with long-term preservation.
- For gearboxes supplied completely filled with oil.

Please observe Checking and changing lubricants (Page 67).

Gearbox in special mounting position

The gearbox is intended for a specific rotation angle and is delivered with the correct quantity of oil for this purpose.

It is not possible to check the oil level. You will find information regarding oil quantity and type of oil on the rating plate.

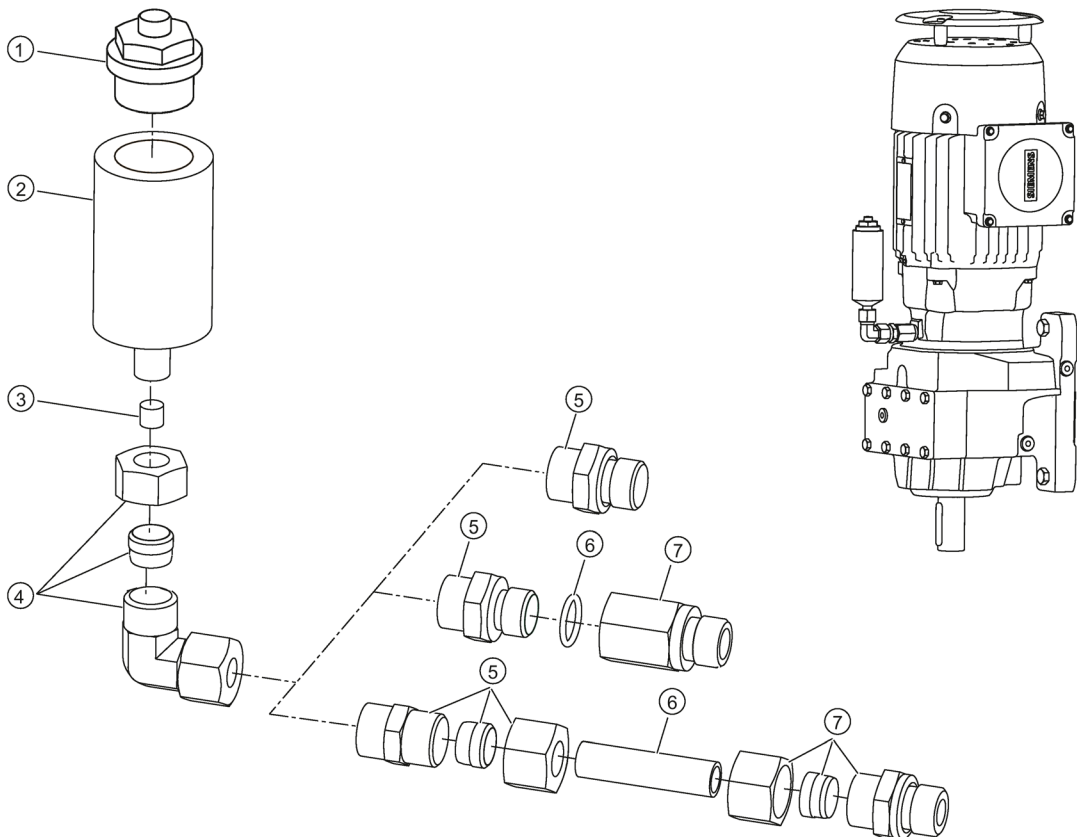
5.3 Mount the oil expansion unit

An oil expansion unit can be used depending on the power, drive speed, mounting position and transmission ratio. The oil expansion unit is used to equalize changes in the oil volume caused by temperature fluctuations in operation.

Before commissioning the gearbox, replace the screw plug with the oil expansion unit.

Oil expansion unit size 39 - 89

The unit is supplied as a mounting kit, and can be attached to the geared motor vertically or at an angle.



- | | | | |
|---|-----------------------|---|-------------------------------|
| ① | Pressure relief valve | ⑤ | Reducer or screwed connection |
| ② | Unit | ⑥ | O ring or pipe |
| ③ | Filter | ⑦ | Screwed connection |
| ④ | Elbow union | | |

Figure 5-2 Installing oil expansion unit size 39 - 89

Procedure

1. Preassemble the mounting kit ① - ⑦.
2. Screw on the unit with the screwed connection ⑤ or ⑦ at the uppermost drill hole of the gearbox housing or of the motor bearing shield.
3. Align the oil expansion unit so that it is vertical.

Oil expansion unit size 109 - 189**NOTICE****Hose with leaks**

The hose of the oil expansion unit is subject to a natural aging process.

Check the hose for tears or leaks.

Never commission a leaky hose. Replace the hose, if necessary.

The unit is supplied as a mounting kit. The installation is described in the supplied Compact Installation Instructions KA 2530-1.

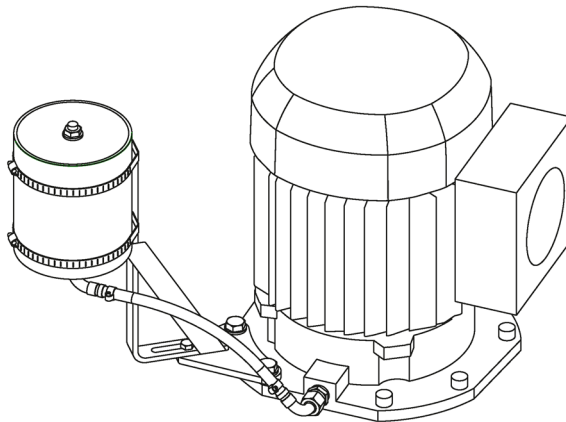


Figure 5-3 Example of an oil expansion unit size 109-189

5.4 Installing the oil temperature monitoring device

The PT100 resistance thermometer monitors the oil temperature. The resistance thermometer is deployed in the hazardous area and in the non-hazardous area.

The position of the resistance thermometer is defined by Siemens AG. The sensor pocket of the thermometer is installed in the gearbox and closed with a sealing cap.

The sensor is supplied as a mounting kit. The installation is described in the Compact Installation Instructions KA 2530-2.



ATEX version gearboxes

The PT100 resistance thermometer operates with a disconnecter.

The disconnecter must be approved for the ATEX version.

The disconnecter is installed outside the hazardous area.

Observe the operating instructions of the disconnecter.



CAUTION

Functional restriction of the sensor

Note the following:

- The sensor must be free of any dirt and residues.
- Do not damage the cables or the insulation.
- Lay the supply line with strain relief.
- Avoid strong bending loads, buckling and point mechanical loads.

Technical specifications of the sensor

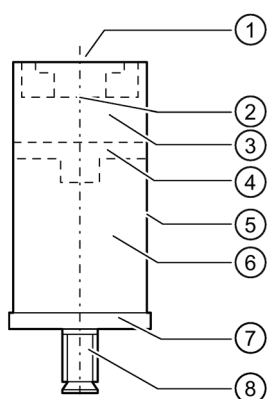
- Explosion protection type: II 2G Ex ia IIC Gb, II 2D Ex ia IIC Db
- Protection class IP68
- 3-wire input
- Supply line of the sensor: S3x22/7-PTFE/PTFE, 0.36 mm², 2000 mm long, WH (RD/RD/WH), external diameter 3.8 mm, free ends
- Sensor ambient temperature: -40° C to +180° C
- Sensor pocket ambient temperature: -40° C to +125° C

5.5 Options of the VLplus heavy-duty bearing system

5.5.1 Automatic regreasing device

Gearboxes with the VLplus heavy-duty bearing system can be optionally supplied with an automatic regreasing device.

The automatic regreasing device can be installed in any position and can be used underwater.



- | | |
|-------------------------------|-------------------------|
| ① Lubrication time controller | ⑤ Transparent housing |
| ② Pressure generator | ⑥ Roller bearing grease |
| ③ H ₂ gas | ⑦ Unit floor |
| ④ Pressure piston | ⑧ Connection thread |

Figure 5-4 Automatic regreasing device

Table 5- 1 Technical data

Grease fill quantity	125 ml
Adjustable lubrication time	0 ... 12 months
Permissible ambient temperature	-20° C ... +55° C
Maximum operating pressure	3 bar
Pressure generator	Hydrogen gas generating cell
Recommended storage temperature	+20° C
Usage period	Within 2 years of filling date
Weight including grease fill	approx. 190 g

⚠ CAUTION
Closed lubricator bursts
Overpressure will result if the lubricator is not opened and the grease channels are contaminated. At an overpressure of approximately 5 bar, the lubricator will burst at the preset breaking point between the housing and the funnel.
Open the lubricator before commissioning.
Press fresh grease into blocked channels with a grease gun.

Note

Fill the lubricant channels and bearings with grease before installing the lubricator.

Procedure

1. Clean the area around the connection thread of the greasing point.
2. Use a knife to cut off the seal at the lubricator outlet. Or remove the screw plug.

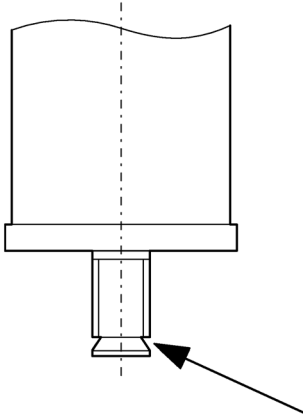


Figure 5-5 Sealing the lubricator

3. Screw the lubricator into the connection thread.

Setting the lubrication time

⚠ CAUTION

Setting the wrong lubrication time

The lubrication time is heavily influenced by the resistance in the lubricant channels and the ambient temperature.

Check the actual lubrication time during operation.

The actual lubrication time is the time it takes for the lubricator to be completely emptied. The lubrication time is influenced by the resistance in the lubricant channels and the ambient temperature.

At an ambient temperature of -10°C , the actual lubrication time is twice that for the set temperature.

At an ambient temperature of $+40^{\circ}\text{C}$, the actual lubrication time drops to approximately half that for the set temperature.

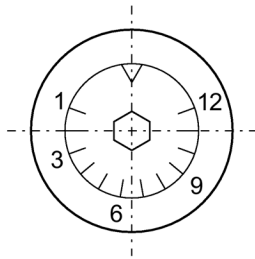


Figure 5-6 Lubrication time controller

Procedure

1. Set the lubrication time with a 3 mm Allen key.
2. Note the date of commissioning and the lubrication time on the lubricator.

The times in months listed in the table are guide values.

Table 5- 2 Timing in months on the lubrication time controller

Size	89	109	129	149	169
Months	12	12	12	12	11

5.5.2 Dry-well version with oil sensor

Please refer to the separate operating instructions for the oil level sensor.

The oil sensor can also be deployed for ATEX version gearboxes.




ATEX version gearboxes

The oil sensor operates with a disconnecter.

The disconnecter must be approved for the ATEX version.

The disconnecter is installed outside the hazardous area.

Observe the operating instructions of the disconnecter.

 CAUTION
Functional restriction of the sensor
Note the following:
<ul style="list-style-type: none">• The sensor must be free of any dirt and residues.• Do not damage the cables or the insulation.• Lay the supply line with strain relief.• Avoid strong bending loads, buckling and point mechanical loads.



ATEX version gearboxes

The difference between the temperature of the housing and the ambient temperature of max. +40° C must not exceed 70 K.

Using a suitable temperature sensor, measure the temperature at the lowest point of the housing (oil sump) or at the mounting surface in the case of output units. We recommend that you monitor the gearbox temperature indirectly by monitoring the motor current.

Changes are an indication of possible incipient damage.

CAUTION

Malfunctions can cause injuries or gearbox damage

In the event of changes during operation, the drive unit must be switched off immediately.

Determine the cause of the fault using the fault table (Page 61). Remedy faults or have faults remedied.

Check the gearbox during operation for:

- Excessive operating temperature
- Changes in gear noise
- Possible oil leakage at the housing and shaft seals

Faults, causes and remedies

Note

Faults and malfunctions that occur during the warranty period and requiring repair work on the gearbox must be remedied only by Technical Support. If faults occur without a clearly identifiable cause, Siemens AG recommends the services of the Technical Support even after the warranty period has elapsed.

If you need the help from the Technical Support, please have the following information ready:

- Rating plate data
- Nature and extent of the fault
- Suspected cause

Table 7- 1 Faults, causes and remedies

Faults	Causes	Remedy
Unusual noise on the gearbox.	Oil level too low.	Check the oil level (Page 67).
	Foreign objects in the oil (irregular noise).	Checking the oil quality (Page 71). Cleaning the gearbox (Page 84). Change the oil (Page 67).
	Excessive bearing play and / or bearing defective.	Check the bearing and replace if necessary.
	Defective gearing.	Check the gearing and replace if necessary.
	Fastening bolts loose.	Checking tightness of fastening bolts (Page 85).
	Excessive external load on the drive input and output.	Check the load against rated data (you might need to correct the belt tension, for example).
	Transport damage.	Check the gearbox for damage in transit.
	Damage due to blockage during commissioning.	Call Technical Support.
Unusual noise from the drive unit.	Drive unit bearing not lubricated (motor size 160 and higher).	Regrease bearing (Page 76).
	Excessive bearing play and / or bearing defective.	Check the bearing and replace if necessary.
	Fastening bolts loose.	Checking tightness of fastening bolts (Page 85).

Faults	Causes	Remedy
Unusual motor noise.	Excessive bearing play and / or bearing defective.	Check the bearing and replace if necessary.
	Motor brake is rubbing.	Check air gap and adjust if necessary.
	Inverter parameterization.	Correct the parameterization.
Oil escapes.	Incorrect oil level for the mounting position being used.	Check the mounting position (Page 95) and the oil level (Page 67).
	Gearbox leaks.	Checking the gearbox for leaks (Page 83).
	Overpressure due to lack of venting.	Mount the venting as appropriate for the mounting position (Page 95).
	Overpressure due to soiled venting.	Clean the venting (Page 84).
	Shaft sealing rings defective.	Replace the shaft sealing rings.
	Cover / flange bolts loose.	Checking tightness of fastening bolts (Page 85). Continue to monitor the gearbox.
	Surface sealing defective (e.g. on cover, flange).	Reseal.
	Damage in transit (e.g. hairline cracks).	Check the gearbox for damage in transit.
Oil leak at the gearbox vent	Incorrect oil level for the mounting position used and / or incorrect venting position.	Check the venting position, the mounting position (Page 95) and the oil level (Page 67).
	Frequent cold starts during which the oil foams up.	Call Technical Support.
Gearbox overheats.	Motor fan cover and / or gearbox very dirty.	Clean the fan cover and surface of the geared motor (Page 84).
	Incorrect oil level for the mounting position being used.	Check the mounting position (Page 95) and the oil level (Page 67).
	Incorrect oil being used (e.g. incorrect viscosity).	Checking the oil quality (Page 71).
	Oil is too old.	Check the date of last oil change. If required, change the oil (Page 67).
	Excessive bearing play and / or bearing defective.	Check the bearing and replace if necessary.

Faults	Causes	Remedy
Output shaft does not turn when the motor is running.	Force flow interrupted by breakage in gearbox.	Call Technical Support.
Geared motor only starts with difficulty or not at all.	Incorrect oil level for the mounting position being used.	Check the mounting position (Page 95) and the oil level (Page 67).
	Incorrect oil being used (e.g. incorrect viscosity).	Checking the oil quality (Page 71).
	Excessive external load on the drive input and output.	Check the load against rated data (you might need to correct the belt tension, for example).
	Motor brake is not released.	Check circuit / connection of brake. Check brake for wear and readjust if necessary.
	Geared motor runs against backstop.	Change the direction of motor or backstop rotation.
Excessive play at drive input and output.	Flexible elements worn (e.g. on couplings).	Replace flexible elements.
	Positive connection disrupted by overload.	Call Technical Support.
Speed and torque drop.	Belt tension too low (for belt drive).	Check the belt tension and replace belt if necessary.

Service and maintenance

8.1 General notes about maintenance work



ATEX version gearboxes

All measures, checks, and their results must be documented by the operator and records kept in a safe place for 10 years.

! WARNING
Unintentional starting of the drive unit
Secure the drive unit to prevent it from being started up unintentionally.
Attach a warning notice to the start switch.

NOTICE
Improper maintenance
Only authorized qualified personnel may perform the maintenance and servicing. Only original parts supplied by Siemens AG may be installed.

Only qualified personnel may perform the inspection, maintenance and servicing work. Please observe the General information and safety notes (Page 7).

Table 8- 1 Maintenance measures

Remedy	Interval	Description of work
Monitor and check the geared motor for unusual noise, vibrations, and changes.	Daily; if possible, more frequently during operation.	Operation (Page 59)
Check the housing temperature.	After 3 hours, on the first day, thereafter monthly.	
Check the oil level.	After the first day, and then every 3,000 operating hours, or at the latest after 6 months.	Checking and changing lubricants (Page 67)
Check the oil level sensor.	Regularly and after oil changes.	Checking the oil level sensor (optional) (Page 84)
Check the oil quality.	Every 6 months.	Checking the oil quality (Page 71)

8.1 General notes about maintenance work

Remedy	Interval	Description of work
First oil change after commissioning.	After approximately 10,000 operating hours or at the latest after 2 years.	Checking and changing lubricants (Page 67)
Subsequent oil changes.	Every 2 years or 10,000 operating hours ¹⁾ .	
Visual inspection of the gearbox and shaft sealing ring for leaks.	After the first day, thereafter monthly.	Checking the gearbox for leaks (Page 83)
When required, replace the breather valve.	Once a year.	Replacing the vent valve (Page 84)
Clean the gearbox.	Depending on degree of soiling, at least every 6 months.	Cleaning the gearbox (Page 84)
Carry out a complete inspection of the geared motor.	Every 12 months.	Inspecting the gearbox (Page 85)
Check the friction clutch and adjust if necessary.	After 500 hours, thereafter once a year and after every blockage.	Observe the BA 2039 Operating Instructions.
Check the coupling.	For the first time after 3 months.	Please refer to the separate operating instructions.
Check that fastening bolts on gearboxes and add-on elements are securely tightened. Check that covers and plugs are securely fastened.	After 3 hours, and then every 2 years.	Checking tightness of fastening bolts (Page 85)
Change the roller bearing grease.	When the oil is changed.	Change the roller bearing grease (Page 76)
Replace the bearing.	-	Replace bearings (Page 82)
Check the rubber buffer of the torque arms.	Every 6 months.	Torque arms with shaft-mounted gearboxes (Page 48)
Check the hose of the oil expansion unit.	Check regularly; renew every 4 years at the latest.	Replacing the hose of the oil expansion unit (Page 86)
Lubricate the XLplus and VLplus heavy-duty bearing systems.	-	Lubrication of the XLplus and VLplus heavy-duty bearing systems (Page 80)

¹⁾ When using synthetic oils, the intervals can be doubled. The data specified is valid for an oil temperature of +80° C. See the figure titled "Guide values for oil change intervals" for the intervals for other temperatures.

8.2 Checking and changing lubricants

8.2.1 General safety notes

 **WARNING**

Danger of scalding from the hot oil emerging from the unit

Before starting any work wait until the oil has cooled down to below +30 °C.

 **WARNING**

Risk of slipping on oil

Remove any oil spillage immediately with an oil-binding agent in compliance with environmental requirements.

NOTICE

Damage to the gearbox caused by incorrect oil quantities

The oil quantity and the position of the sealing elements are determined by the mounting position.

After removing the oil level screw, the oil level may not be below the specified fill level.

NOTICE

Damage to the gearbox due to open oil holes

Dirt and damaging atmosphere can penetrate through open oil holes.

Close the gearbox immediately after checking the oil level or changing the oil.

Note

Information about oil

Refer to the rating plate for the type of oil, oil viscosity and quantity of oil required.

For oil compatibility, see Recommended lubricants (Page 79).

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level. An oil change is not required.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Note

Tandem gearbox - intermediate helical gearbox

- In a horizontal operating position the bulging part of the housing of the intermediate helical gearbox generally faces vertically downwards.
- The oil quantity is specified for every individual gearbox and is valid for the standard mounting position.
- Perform the following work for each individual gearbox:
 - Check the oil level.
On the main gearboxes D/Z, F, K it is not possible to check the oil level in mounting position M4. The oil level is above the oil level bore so that the bearings above it are lubricated.
 - Check the oil quality.
 - Change the oil.
 - Fill in oil and top it up.

Note

Gearbox in special mounting position

The gearbox is intended for a specific rotation angle and is delivered with the correct quantity of oil for this purpose.

It is not possible to check the oil level. You will find information regarding oil quantity and type of oil on the rating plate.

When draining the oil a higher residual quantity of oil may remain in the gearbox. When you carry out an oil change remove any residual oil.

8.2.2 Checking the oil level

NOTICE
The volume of gearbox oil changes with temperature If the temperature rises, the volume increases. Where temperature differences and filling quantities are significant, the volume difference can amount to several liters. The oil level must therefore be checked while still slightly warm, approximately 30 minutes after switching off the drive unit.

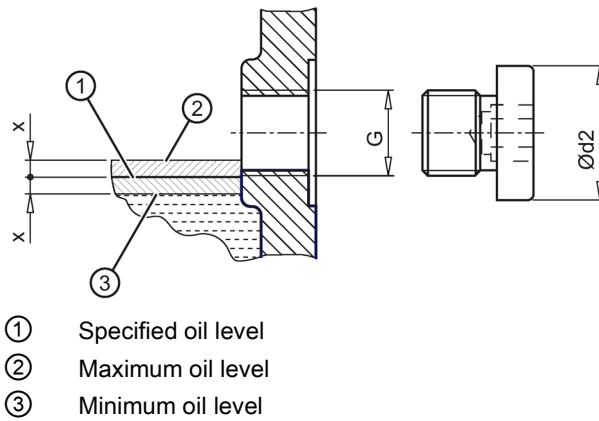


Figure 8-1 Oil level in the gearbox housing

Table 8-2 Minimum and maximum fill levels x

Oil level hole	Ød2	Fill level x	Tightening torque
	[mm]	[mm]	[Nm]
G 1/8"	14	2.5	10
G 1/4"	18	3	10
G 3/8"	22	4	25
G 3/4"	32	7	50

Procedure

1. Switch off the power supply to the drive unit.
 2. Unscrew the oil level screw, see Mounting positions (Page 95). Oil escapes if the maximum fill level is above the plug hole.
 3. Check the oil level. Observe the fill level x.
 4. Top up the oil level if necessary and check it again.
 5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
 6. After checking, seal the gearbox immediately using the sealing element.
- You have now checked the oil level in the gearbox housing.

8.2.3 Checking the oil level using the oil sight glass (optional)

If there is an oil sight glass to check the oil level ①, the oil must be visible in the center of the sight glass when the oil is cool. When the oil is hot, the oil level ① is above the center of the sight glass. The oil level ① of cold oil is below the center of the sight glass.

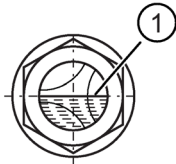


Figure 8-2 Oil level in the oil sight glass

Top up the oil level ① if necessary, and check it again.

8.2.4 Checking the oil level using the oil dipstick (optional)

In the M4 mounting position for ZF/EF helical gearboxes, the oil level can be checked with an oil dipstick.

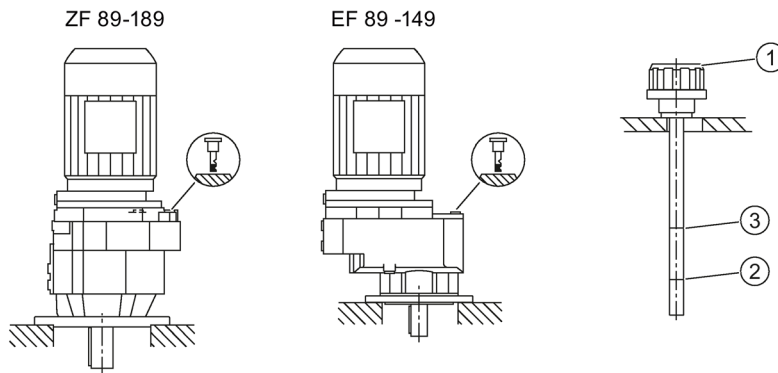


Figure 8-3 Checking the oil level using the oil dipstick

To check the oil level, push the oil dipstick ① into the hole but do not screw it in.

The oil level must be between the lower ② and upper ③ marks on the oil dipstick ①.

After checking, screw the oil dipstick ① in again hand-tight. The oil dipstick ① can remain screwed in during operation.

Rectify the oil level if necessary and check it again.

8.2.5 Checking the oil quality

Visible signs show effects on the oil. Fresh oil is clear to the eye, and has a typical smell and a specific product color. Clouding or a flocculent appearance indicates water and / or contamination. A dark or black color indicates residue, serious thermal decomposition or contamination.

Observe the symbols in the diagrams of the Mounting positions (Page 95):



Venting



Oil level

Procedure

1. Allow the geared motor to run for a short time. Wear and contaminant particles are visible in the oil shortly after shutting down.
2. Switch off the power supply to the drive unit.
3. Unscrew the sealing element at one of the points marked with the symbols listed above.
4. Remove some oil, using a suction pump and a flexible hose, for example.
5. Check the state of the sealing ring on the sealing element. When required, replace the sealing ring.
6. Seal the gearbox with the sealing element.
7. Check the oil for abnormalities. Change the oil immediately if you determine any abnormalities, see Changing the oil (Page 72).

You have now checked the oil quality.

8.2.6 Changing the oil

8.2.6.1 General safety notes for changing the oil

NOTICE

Impermissible mixing of oils leads to damage

Impermissible mixing of oils leads to:

- Darkening
- Sediment
- Foam formation
- Change of the viscosity or reduced corrosion protection
- Wear protection.

When changing oil of the same type, the residual volume of oil in the gearbox should be kept as low as possible. Generally speaking, a small residual volume will cause no particular problems.

Gear oils of different types and by different manufacturers must not be mixed. Have the manufacturer confirm that the new oil is compatible with the remaining volume of used oil.

If very different types of oil or oils with very different additives are changed, always flush out the gearbox with the new oil. When changing from mineral oil to polyglycol oil (PG) or vice versa, it is vital to flush the gearbox twice. All traces of old oil must be completely removed from the gearbox.

NOTICE

Contaminations of the oil impair the lubricity

Do not mix the gearbox oil with other substances.

Do not flush with paraffin or other solvents, as traces of these substances will always remain inside the gearbox.

Note

The oil must be warm because insufficient viscosity caused by oil that is too cold impairs correct emptying.

If necessary, run the gearbox for 15 to 30 minutes to become warm.

8.2.6.2 Draining the oil

Observe the symbols in the diagrams of the Mounting positions (Page 95):



Venting



Oil level




Oil drain

Procedure

1. Switch off the power supply to the drive unit.
2. Unscrew the vent plug.
3. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
4. Remove the oil drain plug. Drain all the oil into the receptacle.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After draining the oil, seal the gearbox immediately using the sealing element.

You have now drained the oil from the gearbox.

8.2.6.3 Flushing the gearbox when changing between incompatible oils

 WARNING
Impermissible mixing of oils leads to damage
Residual quantities of original oil can impair the specific properties of the new oil.
A flushing process is required with biodegradable and physiologically safe oils.
The residual corrosion protection oil must amount to no more than 1% of the operating oil volume.

Note

Polyglycol oil has a higher density than mineral oil. Therefore, it sinks down towards the oil drain and the mineral oil floats on top.

This makes the required complete draining of mineral oil from the gearbox extremely difficult.

Note

After the second flush, we recommend that an appropriate analysis institute checks the quality of the flushed fluid.

Observe the symbols in the diagrams of the Mounting positions (Page 95):



Venting



Oil drain

Procedure

1. After the oil has been drained, wipe the gearbox clean of any remaining mineral oil using a cloth.
2. Unscrew the vent plug.
3. Fill the gearbox with a flushing oil, using a filter (filter mesh max. 25 µm). For the flushing oil, use either the new oil or one that is compatible with the new oil and is less expensive.
4. Operate the gearbox for 15 to 30 minutes under a low load.
5. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
6. Remove the oil drain plug. Drain all the oil into the receptacle.
7. After flushing, immediately seal the gearbox using the sealing element.
8. Repeat this step for the second flushing.

You have now flushed the gearbox twice and can pour in the new oil.

8.2.6.4 Filling in oil

NOTICE

Mixing of different oils impairs the lubricity

When adding oil, use the same oil type and viscosity. If changing mutually incompatible oils, see Flushing the gearbox (Page 73).

Observe the symbols in the diagrams of the Mounting positions (Page 95):



Venting

Procedure

1. Unscrew the vent plug.
2. Fill the gearbox with fresh oil. Use a filler filter with mesh of max. 25 µm.
3. Check the oil level.
4. Top up the oil level if necessary and check it again.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After filling with oil, seal the gearbox immediately using the sealing element.

You have now filled up the gearbox with oil.

8.2.7 Topping up with oil

If the mounting position of the gearbox is changed or oil lost because of leakage, check the oil level. If you notice oil escaping, locate the leak, and seal the affected area. Top up and check the oil level.

At the time of going to print, the following types of oil are being used when the gearbox is filled for the first time:

- CLP ISO VG220: Fuchs Renolin CLP220
- CLP ISO PG VG220: Fuchs Renolin PG220
- CLP ISO PG VG460: Fuchs Renolin PG460
- CLP ISO PAO VG68: Fuchs Renolin Unisyn CLP68
- CLP ISO PAO VG220: Fuchs Renolin Unisyn XT220
- CLP ISO PAO VG460: Fuchs Renolin Unisyn CLP460
- CLP ISO E VG220: Fuchs Plantogear S220
- CLP ISO H1 VG100: Klüber Klübersynth UH1 6 100
- CLP ISO H1 VG460: Castrol Optileb GT 1800/460

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant must be shown on the rating plate.

8.2.8 Change the roller bearing grease

The roller bearings are lubricated in the factory with the greases listed in the table.

Renew the grease quantify for grease-lubricated bearings with each oil change.

Clean the bearing before filling it with fresh lubricant.

In the case of bearings on the output shaft or intermediate shafts, the grease quantity must fill 2/3, and in the case of bearings on the input side, 1/3 of the space between the rolling elements.

Table 8- 3 Roller-bearing and shaft-sealing-ring grease

Fields of application	Ambient temperature	Manufacturer	Type
Standard	-40 °C to +80 °C	Klüber	Petamo GHY 133 N
Foodstuff-compatible for the food industry	-30 °C to +40 °C	Castrol	Optileb GR UF 1 NSF H1
Biologically degradable, for agriculture, forestry and water industries	-35 °C to +40 °C	BP	Biogrease EP 2

8.2.9 Service life of the lubricants

Note

In case of ambient conditions deviating from normal conditions, e.g. high ambient temperatures, high relative humidity, aggressive ambient media, the intervals between changes should be shorter. In such cases, contact Technical Support for assistance in determining the individual lubricant change interval.

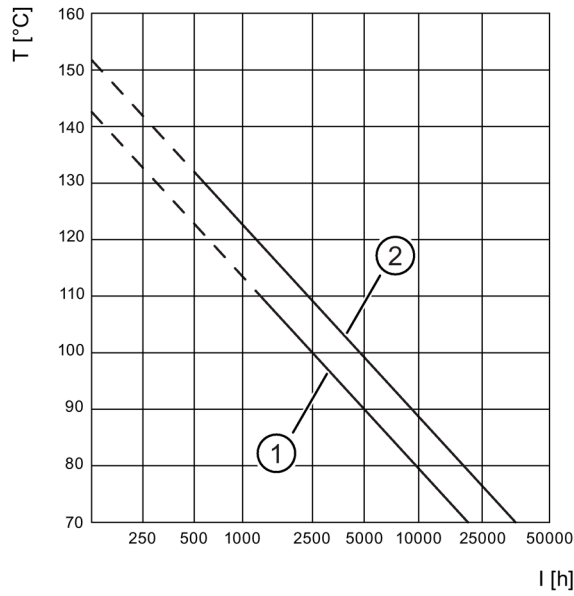
Note

Oil sump temperatures above +80 °C can reduce service life. A temperature increase by 10 K halves the service life by the amount as shown in the figure titled "Guide values for oil change intervals".

For a +80 °C oil sump temperature, the following service life can be expected when observing the properties specified by Siemens AG:

Table 8- 4 Service life of the oils

Type of oil	Service life
Mineral oil	10 000 operating hours or 2 years
Biodegradable oil	
Physiologically safe oil according to USDA-H1/-H2	
Synthetic oil	20 000 operating hours or 4 years



- ① Mineral oil
- ② Synthetic oil
- T Oil-bath steady-state temperature [°C]
- I Oil change interval in operating hours [h]

Figure 8-4 Guide values for oil change intervals

Grease service life of roller bearing greases

Roller bearings and the clearance in front are filled with sufficient grease.

Under approved operating conditions and ambient temperatures, no regreasing is required.

We recommend that the grease in the bearings is also renewed when the oil or shaft sealing rings are replaced.

8.2.10 Recommended lubricants

The released and recommended lubricants are listed in the table NT 7300 (<https://support.industry.siemens.com/cs/ww/en/view/109753864>).

 DANGER
<p>Used lubricants only have conditional approval</p> <p>The used lubricants are not or only conditionally approved for use in the foodstuff or pharmaceutical industry.</p> <p>Use only lubricants with USDA (United States Department of Agriculture) H1 / H2 approval for deployment in the foodstuff or pharmaceutical industry.</p>

<p>NOTICE</p> <p>Incorrect operating temperatures impair lubricity of the gearbox oil</p> <p>Operating temperatures outside the permitted range impair the lubricating property of the gearbox oil.</p> <p>Maximum permissible temperature for:</p> <ul style="list-style-type: none"> • Mineral oil +90 °C, for brief periods +100 °C • Polyglycols and polyalphaolefins +100 °C, for brief periods +110 °C • Synthetic esters +90 °C <p>The minimum permissible temperature for initial filling corresponds to the lowest ambient temperature specified on the rating plate.</p> <p>The oil used must be approved for use in the ambient temperature range given on the rating plate.</p> <p>When changing the oil, please observe the operating temperature range of the new oil as specified by the oil manufacturer.</p>
--

Note

As standard, the lubricants and shaft seals are harmonized and coordinated with one another corresponding to the prevailing operating conditions.

Contact Technical Support for:

- Change of the operating conditions
- Change in oil grade
- Deployment of new shaft seals.

Note

The lubricants used are not at all or only conditionally biodegradable. If biologically degradable lubricants are required, use only gearbox lubricants with the appropriate classification listed in the NT 7300 table.

Note

These recommendations are not a guarantee of the lubricant quality provided by your supplier. All lubricant manufacturers are responsible for the quality of their own products.

The oil viscosity is decisive for the oil selection (ISO VG class). The viscosity is specified on the rating plate of the gearbox. The viscosity class indicated applies for the contractually agreed operating conditions.

In the case of different operating conditions, please contact Technical Support.

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant is shown on the rating plate.

The oil quality must meet the gearbox lubricant requirements specified in the NT 7300 table. The Siemens warranty is otherwise null and void. We recommend the use of one of these gearbox lubricants. These gearbox oils are subject to constant testing and meet the specified requirements. It is possible that the recommended oils are removed or replaced by oils that have been further developed at a later point in time. We recommend that you regularly check as to whether the selected lubricating oil is still recommended by Siemens. Otherwise change the product.

8.3 Lubrication of the XLplus and VLplus heavy-duty bearing systems

The output-side bearing is greased depending on the frame size. Initial greasing has already been carried out.

In normal operating conditions and with low loads, the lubrication is sufficient for approximately 25,000 to 30,000 operating hours.

For higher loads due to speed and / or temperature, schedule regreasing at shorter intervals.

Regreasing intervals

Note

The relubrication interval of the bearing depends on the temperature and the load

For temperatures above +70° C, the regreasing interval must be reduced by half for each temperature increase of 15 K.

For moderate shock loading and vibration, the regreasing interval must be reduced by 20%.

For heavy loading, the regreasing interval must be reduced by half.

The regreasing interval is valid for a temperature of +70° C, measured on the surface of the housing in the vicinity of the bearing.

Regrease the bearing after the following number of operating hours.

Table 8- 5 Regreasing interval in operating hours [h]

Output speed n ₂	Operating hours for size				
	89	109	129	149	169
[rpm]	[h]				
≤ 30	29000	29000	29000	29000	18000
31 ... 50	29000	18000	18000	14000	14000
51 ... 100	14000	12000	12000	10000	9000
101 ... 150	10000	10000	9000	9000	7000
151 ... 250	9000	7000	7000	5000	5000
251 ... 400	7000	5000	5000	4000	4000

Roller bearing grease

NOTICE
<p>Impermissible mixing of roller bearing greases results in damage</p> <p>Residual quantities of original oil can impair the specific properties of the new oil.</p> <p>When regreasing, do not mix greases with a different soap base.</p> <p>For regreasing, use lithium-saponified roller bearing grease NLGI 3/2.</p>

Using a grease gun, inject the grease into the bearing point via the lubricating nipples provided.

The grease quantities listed in the table are guide values.

Table 8- 6 Grease quantity [g] for relubrication

Regreasing interval	Grease quantity for size				
	89	109	129	149	169
	[g]				
After 6 months	10	10	20	20	30
After several years without operation	28	33	46	68	95

Maintenance of the output-side bearing

Note

Change the grease filling of the roller bearing when you change the gear oil.

For refilling, use lithium-saponified roller bearing grease NLGI 3/2.

Procedure

1. Dismantle the output-side bearing unit.
2. Clean the bearing.
3. Fill the bearing with the new grease up to approximately 30% of the free bearing chamber.
4. Reassemble the bearing unit.

Maintenance interval after regreasing

After regreasing, the maintenance interval can be increased to the following number of operating hours.

Table 8- 7 Maintenance interval in operating hours [h] for relubrication

Output speed n ₂ [rpm]	Operating hours for size				
	89	109	129	149	169
≤ 30	80000	80000	80000	80000	50000
31 ... 50	80000	50000	50000	40000	40000
51 ... 100	40000	32000	32000	28000	25000
101 ... 150	28000	28000	25000	25000	20000
151 ... 250	25000	20000	20000	15000	15000
251 ... 400	20000	15000	15000	10000	10000

8.4 Replace bearings

The bearing service life depends greatly on the operating conditions and so cannot be calculated reliably. In the operating conditions specified by the operator, bearing life can be calculated and indicated on the rating plate. If no information is given, changes in vibration and noise pattern can serve as an indicator that an immediate bearing replacement is necessary.

8.5 Checking the gearbox for leaks



ATEX version gearboxes

Shaft sealing rings are subject to natural wear. The service life depends on the operating conditions.

Include the shaft sealing rings in periodic maintenance and servicing work on the system.

Note

From the inherent principle of operation, oil mist can escape from the vent valve or a labyrinth seal.

Oil or grease escaping in small quantities from the shaft sealing ring should be regarded as normal during the running-in phase of 24 hours operating time.

If the quantities escaping are significant or leaking continues after the running-in phase, the shaft sealing ring must be replaced to prevent consequential damage.

Table 8- 8 Description and measures

Status	Description	Measures	Notes
Film of moisture on the shaft sealing ring	Film of moisture as a result of the inherent principle of operation (apparent leakage)	Remove using a clean cloth and continue to observe.	This does not represent a fault; frequently, in the course of operation, the sealing ring dries off.
Leakage at the shaft sealing ring	Identifiable small trickle, formation of drops, also after the running-in phase	Replace the sealing ring, determine the possible cause of the sealing ring failure and rectify.	During the run-in period, the shaft sealing ring beds into the shaft. A visible track can be seen on the shaft. Optimum preconditions for a perfect seal are obtained after the run-in period.

8.6 Replacing the vent valve

To ensure correct functioning, renew the breather valve yearly.

When replacing, prevent dirt and damaging atmospheres from entering the gearbox.

If too much oil is contained in the gearbox, oil will escape from the breather valve. Correct the oil quantity and replace the breather valve.

8.7 Checking the oil level sensor (optional)

The oil level sensor indicates the oil level only when the gearbox is shut down.

Lower the oil level and fill it up again until the oil level sensor gives a switching signal.

Please refer to the separate operating instructions for the oil level sensor.

8.8 Cleaning the gearbox

NOTICE
Dust deposits cause higher housing temperatures
Dust deposits prevent heat radiation.
Keep the geared motor free from dirt and dust.

NOTICE
Cleaning with a high-pressure cleaning appliance
Water can penetrate into the geared motor. Seals can become damaged.
Do not use a high-pressure cleaning appliance to clean the geared motor.
Do not use tools with sharp edges.

Switch off the power supply to the drive unit before cleaning it.

8.9 Checking tightness of fastening bolts



ATEX version gearboxes

Loose parts can cause sparks through impact.
Entry of foreign bodies can cause sparks.

Note

Replace damaged headless bolts with new bolts of the same type and strength class.

Switch off the power supply to the drive unit. Check all fastening bolts for tightness using a torque wrench.

The general tolerance for the tightening torque is 10 %. The tightening torque is based on a friction coefficient of $\mu = 0.14$.

Table 8- 9 Tightening torques for fastening bolts

Thread size	Tightening torque for strength class		
	8.8	10.9	12.9
	[Nm]	[Nm]	[Nm]
M4	3	4	5
M5	6	9	10
M6	10	15	18
M8	25	35	41
M10	50	70	85
M12	90	120	145
M16	210	295	355
M20	450	580	690
M24	750	1 000	1 200
M30	1 500	2 000	2 400
M36	2 500	3 600	4 200

8.10 Inspecting the gearbox


Carry out a scheduled inspection of the gearbox once a year in accordance with the possible criteria listed in General notes about maintenance work (Page 65).

Check the gearbox in accordance with the criteria set out in General information and safety notes (Page 7).

Touch up damaged paintwork carefully.

8.11 Replacing the hose of the oil expansion unit

NOTICE
Hose with leaks The hose of the oil expansion unit is subject to natural wear. The service life depends on the operating conditions. Check the hose regularly for tears or leaks. Renew the hose every 4 years at the latest.

 WARNING
<p>Incorrect disposal of used oil</p> <p>Incorrect disposal of used oil is a threat to the environment and health.</p> <p>After use, oil must be taken to a used oil collection point. The addition of foreign substances such as solvents, brake and cooling fluid is prohibited.</p> <p>Avoid prolonged contact with the skin.</p>

Empty the used oil from the gearbox. The used oil must be collected, stored, transported and disposed of in accordance with regulations. Do not mix polyglycols with mineral oil. Dispose of polyglycols separately.

Please observe country-specific laws. Under German law, to allow optimal treatment of the oil (§4 VI Used Oil), oils with different disposal codes must not be mixed with one another.

Collect and dispose of used oil in accordance with regulations.

Remove oil spillages immediately with an oil-binding agent in compliance with environmental requirements.

Dispose of the housing parts, gears, shafts, and roller bearings of the geared motor as scrap metal.

Dispose of packaging material in accordance with regulations.

Table 9- 1 Disposal codes for gear oils

Type of oil	Designation	Disposal code
Mineral oil	CLP ISO VG220	13 02 05
Polyglycols	CLP ISO PG VG220, CLP ISO PG VG460, CLP ISO H1 VG100, CLP ISO H1 VG460	13 02 08
Poly-Alpha-Olefines	CLP ISO PAO VG68, CLP ISO PAO VG220, CLP ISO PAO VG460	13 02 06
Biologically degradable oils	CLP ISO E VG220	13 02 07

Technical data

10.1 Type designation

Table 10- 1 Example of the type designation structure

	Main gearbox				Intermediate helical gearbox		Input unit	
	F	D	F	89	- Z	39	-K4	(100)
Example:	F		F	89	- Z	39	-K4	(100)
Gearbox type	F							
Stage		D						
Type			F					
Size				89				
Stage					Z			
Size						39		
Input unit							K4	
(for motor size)								(100)

Table 10- 2 Type designation code

Gearbox type	
(-)	Helical gearbox
F	Parallel shaft gearbox
B	Bevel gearbox, two-stage
K	Bevel gearbox, three-stage
C	Helical worm gearbox
Stage	
(-)	
E	Single-stage
Z	Two-stage
D	Three-stage

10.1 Type designation

Type	
Shaft	
(-)	Solid shaft
A	Hollow shaft
Fixing	
(-)	Foot-mounted design
B	Foot / flange-mounted version
F	Flange-mounted design (A type)
Z	Housing flange (C type)
D	Torque arm
G	Flange (A type) opposite output shaft
Connection	
(-)	Parallel key
S	Shrink disk
T	Hollow shaft with splines
R	SIMOLOC assembly system
Special features	
W	Reduced-backlash version
Intermediate helical gearbox - transmission stage	
Z	Two-stage
D	Three-stage
Input unit	
K2	Coupling adapter with flexible coupling for fitting an IEC motor
K3	Coupling adapter with flexible coupling for fitting a NEMA motor
K4	Short adapter with plug-in connection for fitting an IEC motor
K5	Short adapter with plug-in connection for fitting a NEMA motor
KQ(S)	Coupling adapter for fitting a servomotor of the SIMOTICS S-1FK7/-1FT7 series
K8	Coupling adapter for fitting a servomotor of the SIMOTICS M-1PH8 series

10.2 General technical data

The most important technical data appears on the rating plate of the gearboxes and geared motors.

This data, together with the contractual agreements for the geared motors, determines the limits of intended use.

In the case of geared motors, a rating plate attached to the motor usually indicates the data for the entire drive.

In certain cases separate rating plates are attached to the gearbox and the motor.

SIEMENS FDU0412/8999999 nnn 2KJ3105-1EM22-2AV1-Z ZF59-LE90SG4E-L32/14N-IN SI04 IP55 30kg Tamb -15...+40°C K-ID: 1234567890 1.5L OIL CLP VG220 i: 28 50Hz n2: 49.3r/min 60Hz n2: 59.7r/min T2: 213Nm fB: 2.1 T2: 203Nm fb: 2.2 3~Mot. THCL.155(F) Δ 14Nm 230V ±10% AC 50Hz 230/400V ±10% D/Y 60Hz 460V ±10% Y 4.33/2.5A cosφ 0.78 2.2 A cosφ 0.78 1.1kW S1 IE2-81.4% 1425r/min 1.27kW S1 IE2-81.4% 1725r/min Mot. 1AV2090B 1LE1001-0EB0 SIEMENS AG, Bahnhofstr. 40, DE-72072 Tübingen		SIEMENS 1 IEC60034 CE M1 12 13 14 15 17 20 21 16 18 19 22 23 24 25 26 27 28 29 30 31 38 39 40 32 33 41 42 34 35 36 37 43 44 45 46 47 48 SIEMENS AG, Bahnhofstr. 40, DE-72072 Tübingen	
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Figure 10-1 Example of a SIMOGEAR rating plate

- 1 Data matrix code
- 2 Applied standard
- 3 Serial number
FDU = Siemens AG, Bahnhofstr. 40, 72072 Tübingen, Germany
- 4 CE marking or other marking, if required
- 5 Article number
- 6 Type designation
- 7 Mounting position
- 8 Degree of protection according to IEC 60034-5
- 9 Weight m [kg]
- 10 Ambient temperature
- 11 Customer ID
- 12 Oil quantity [l] main gearbox / intermediate gearbox
- 13 Type of oil
- 14 Oil viscosity ISO VG class according to DIN 51519 / ISO 3448
- 15 Total transmission ratio i

Frequency 1

- 16 Rated frequency f [Hz]
- 17 Gearbox output speed n_2 [rpm]
- 18 Geared motor output torque T_2 [Nm]
- 19 Service factor f_B

Frequency 2

- 20 Rated frequency f [Hz]
- 21 Gearbox output speed n_2 [rpm]
- 22 Geared motor output torque T_2 [Nm]
- 23 Service factor f_B

Motor and brake data

- 24 Phase number and type of current for the motor
- 25 Temperature class Th. Cl.
- 26 Symbols (IEC 60617-2): \square = brake
- 27 Rated braking torque T_{Br} [Nm]
- 28 Brake supply voltage U [V]



Frequency 1

- 29 Rated frequency f [Hz]
- 30 Rated voltage / range U [V]
- 31 Circuit, graphical symbols according to DIN EN 60617 Part 6 / IEC 60617-6
- 32 Rated current I_N [A]
- 33 Power factor $\cos \varphi$
- 34 Rated output P_N [kW]
- 35 Duty type
- 36 Efficiency class marking according to IEC 60034-30
- 37 Rated speed n_N [rpm]

Frequency 2

- 38 Rated frequency f [Hz]
- 39 Rated voltage/range U [V]
- 40 Circuit, graphical symbols according to DIN EN 60617 Part 6 / IEC 60617-6
- 41 Rated current I_N [A]
- 42 Power factor $\cos \varphi$
- 43 Rated output P_N [kW]
- 44 Duty type
- 45 Efficiency class marking according to IEC 60034-30
- 46 Rated speed n_N [rpm]
- 47 Motor series
- 48 Motor designation

Rating plate for ATEX version gearboxes

SIEMENS FDU0412/8999999 nnn 2KJ3105-1EM22-2AV1-Z ZF59-LE90SG4E-L32/14N-IN 30kg Tamb -15...+40°C K-ID: 1234567890 1.5L OIL CLP VG220 i: 28 50Hz n2: 49.3r/min 60Hz T2: 213Nm fB: 2.1 T2: 203Nm SIEMENS AG, Bahnhofstr. 40, DE-72072 Tübingen		  II 3G II 3D IEC60034 CE M1 Ex II 3G IIC ck T4 Ex II 3D ck 120°C	SIEMENS	1	2	3
4	5	6	7	8	11.1	
12	9	10	11.2	12	13	
13	14	15	16	17	18 21	
17	19	20 23	22	24	24	
SIEMENS AG, Bahnhofstr. 40, DE-72072 Tübingen						


- 1 Data matrix code
- 2  marking
- 3 Applied standard
- 4 Serial number
FDU = Siemens AG, Bahnhofstr. 40, 72072 Tübingen, Germany
- 5 CE marking or other marking, if required
- 6 Article number
- 7 Type designation - *S104 functional safety designation?*
- 8 Mounting position
- 9 Weight m [kg]
- 10 Ambient temperature
- 11.1 Gas explosion protection type
- 11.2 Dust explosion protection type
- 12 Customer ID
- 13 Oil quantity [l] main gearbox / intermediate gearbox
- 14 Type of oil
- 15 Oil viscosity ISO VG class according to DIN 51519 / ISO 3448
- 16 Total transmission ratio i
- Frequency 1
- 17 Rated frequency f [Hz]
- 18 Gearbox output speed n₂ [rpm]
- 19 Geared motor output torque T₂ [Nm]
- 20 Service factor f_B
- Frequency 2
- 21 Rated frequency f [Hz]
- 22 Gearbox output speed n₂ [rpm]
- 23 Geared motor output torque T₂ [Nm]
- 24 Service factor f_B

Figure 10-2 ATEX rating plate

10.3 Weight

The weight of the entire geared motor is given in the shipping papers.

If the weight exceeds 30 kg, the weight of the entire geared motor is indicated on the rating plate of the gearbox or geared motor.

Where there are several rating plates on one geared motor, the specification on the main gearbox is decisive.

The weight specification refers only to the product in the delivery state.

10.4 Sound energy level

SIMOGEAR geared motors have noise levels below the permissible noise levels defined for gearboxes in VDI guideline 2159 and for motors in IEC 60034-9. In conjunction with gearboxes, the motor noise values L_{pA} or L_{WA} increase on average by 3 dB (A).

The circumferential velocity of the motor pinion has a significant influence on the additional gearbox noise. As a consequence, higher speeds or lower ratios result in higher noise.

External noise

Noise not generated by the gearbox but emitted from it are not taken into consideration.

Noise emitted by the drive and driven machines or the base are also not taken into consideration. Even when the noise from the gearbox have been transferred there.

10.5 Mounting positions

10.5.1 General notes on mounting positions

Only operate the gearbox in the mounting position specified on the rating plate. This ensures that the correct quantity of lubricant is provided. The symbols are shown for the standard mounting position.

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Description of the symbols:



Venting



Oil level



Oil drain

A, B Position of insert shaft / solid shaft

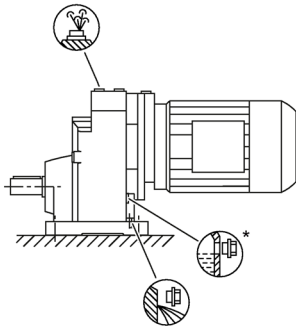
* On opposite side

② Two-stage gearbox

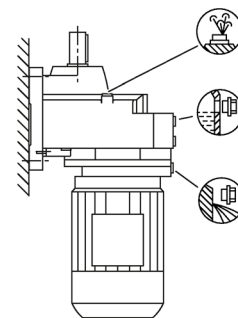
③ Three-stage gearbox

10.5.2 Single-stage helical gearboxes

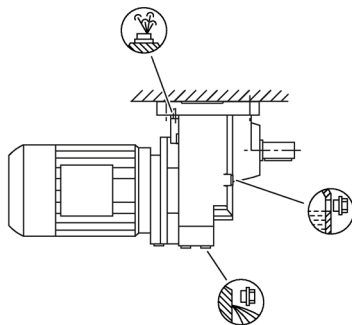
M1



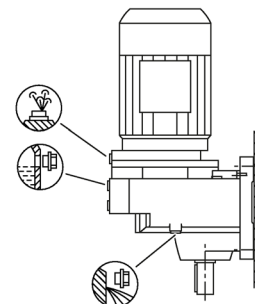
M2



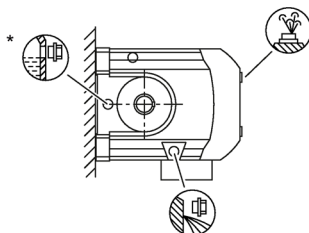
M3



M4



M5



M6

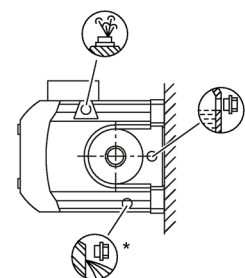
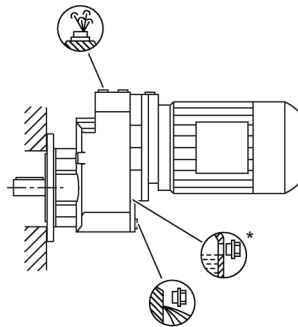
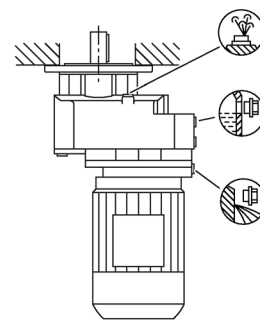


Figure 10-3 Mounting positions for helical gearbox E, foot-mounted design, sizes 39 - 149

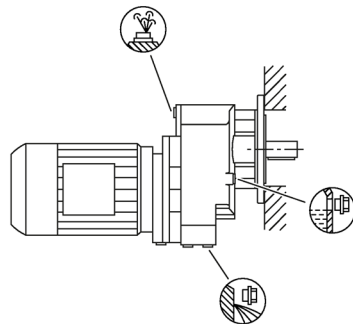
M1



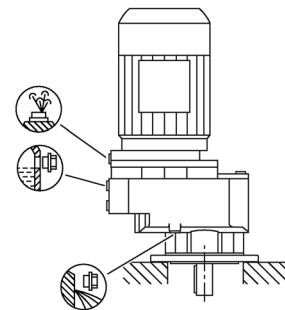
M2



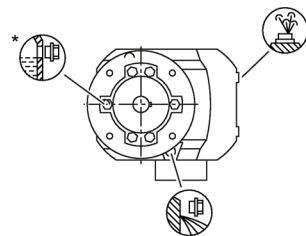
M3



M4



M5



M6

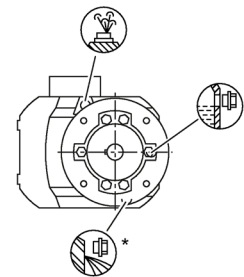
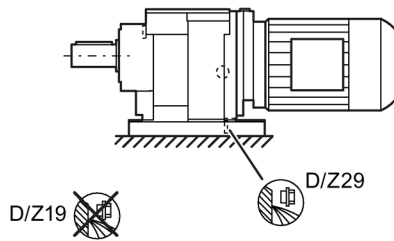


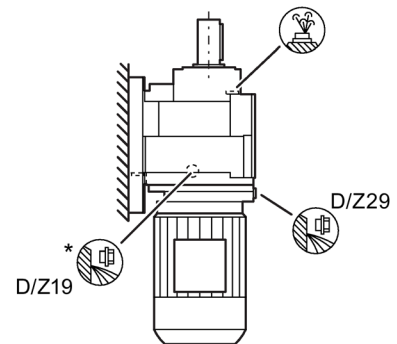
Figure 10-4 Mounting positions for helical gearbox EF/EZ, flange-mounted design, sizes 39 - 149

10.5.3 Two- and three-stage helical gearbox

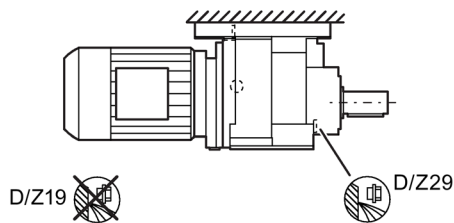
M1



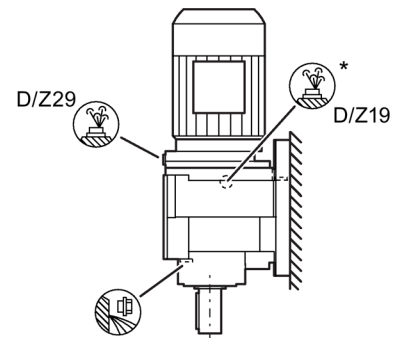
M2



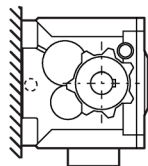
M3



M4



M5



M6

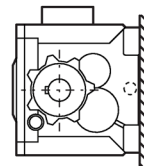
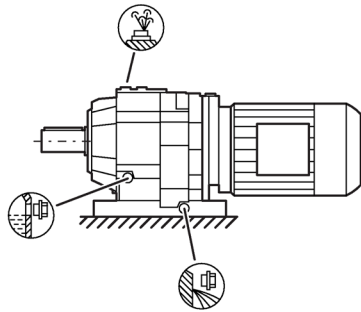
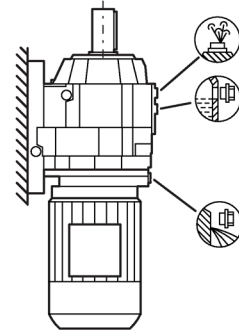


Figure 10-5 Mounting positions for helical gearbox D/Z foot-mounted design, sizes 19 - 29

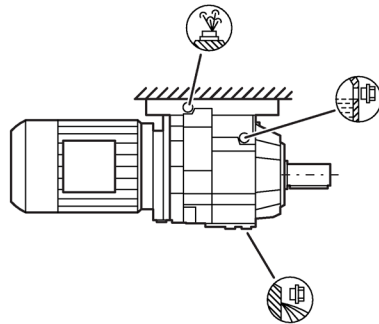
M1



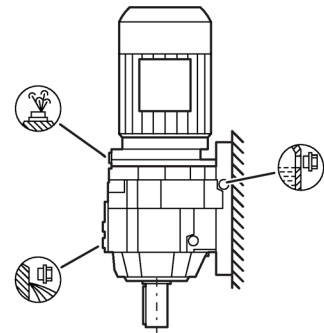
M2



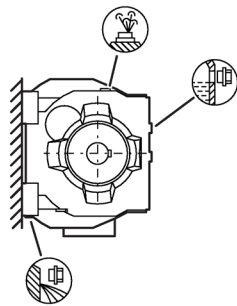
M3



M4



M5



M6

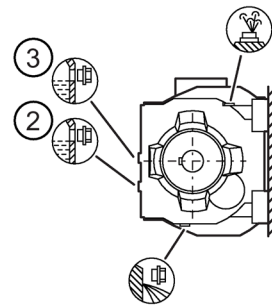
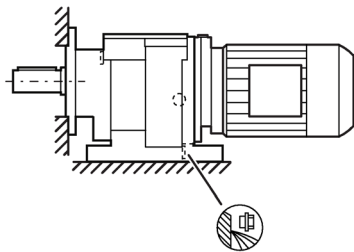


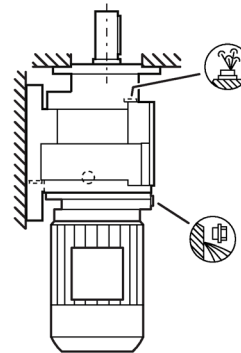
Figure 10-6 Mounting positions for helical gearbox D/Z foot-mounted design, sizes 39 - 189

10.5 Mounting positions

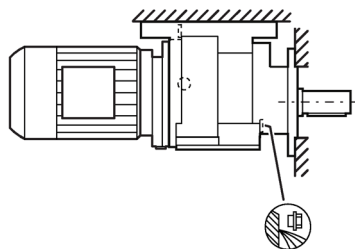
M1



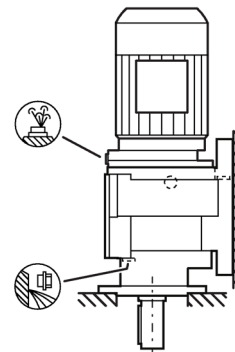
M2



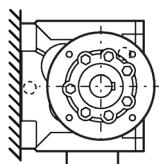
M3



M4



M5



M6

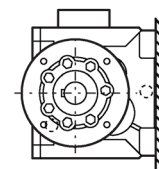
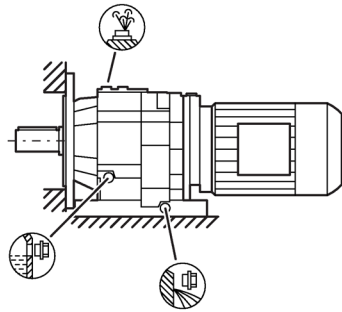
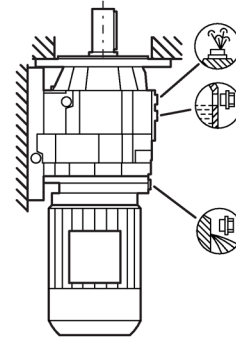


Figure 10-7 Mounting positions for helical gearbox DB/ZB foot / flange-mounted design, size 29

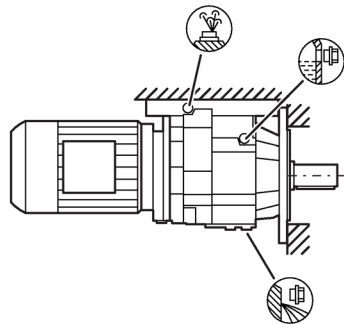
M1



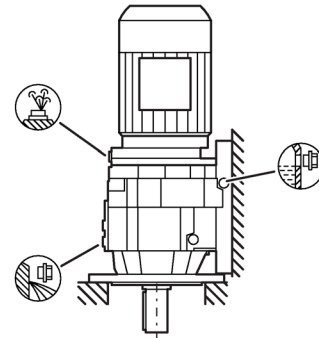
M2



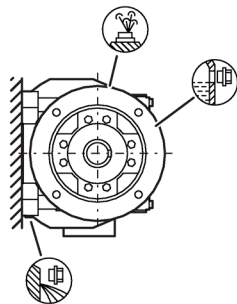
M3



M4



M5



M6

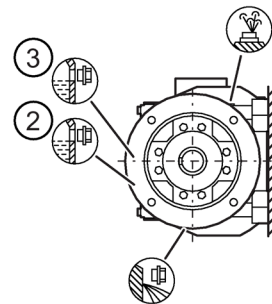
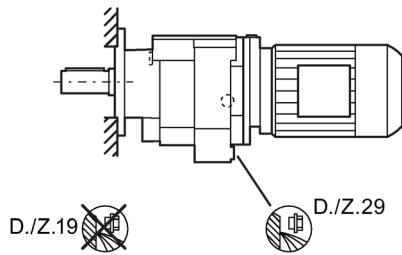


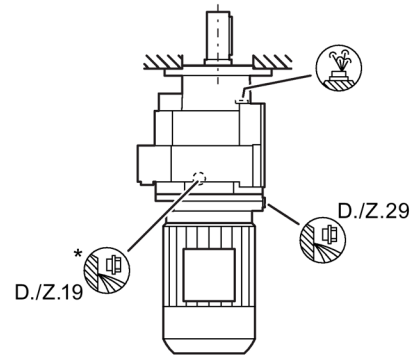
Figure 10-8 Mounting positions for helical gearbox DB/ZB foot / flange-mounted design, sizes 39 - 89

10.5 Mounting positions

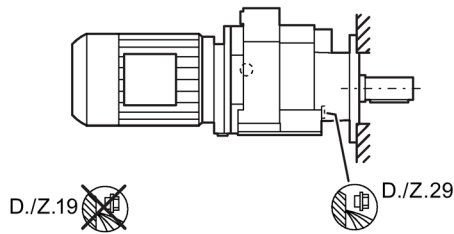
M1



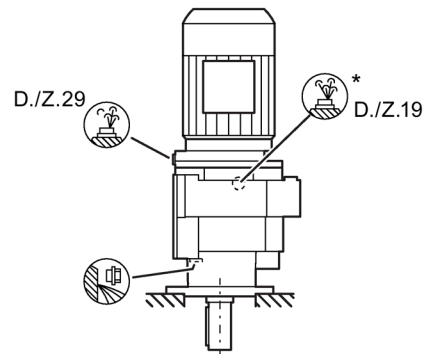
M2



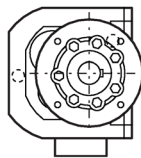
M3



M4



M5



M6

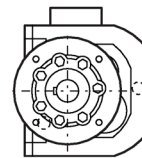
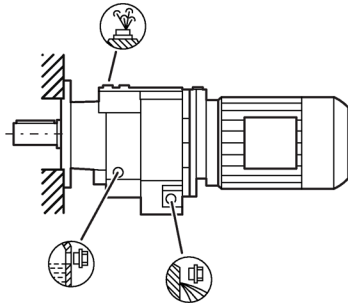
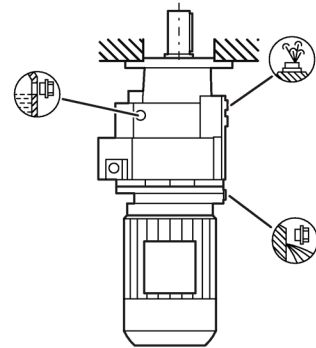


Figure 10-9 Mounting positions for helical gearbox DF/ZF flange-mounted design and DZ/ZZ with housing flange, sizes 19 - 29

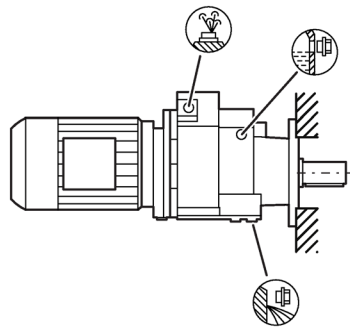
M1



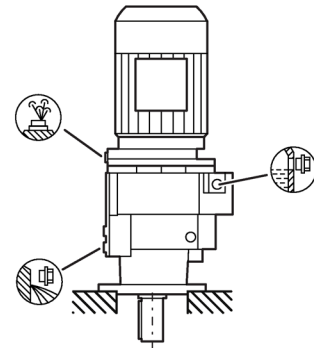
M2



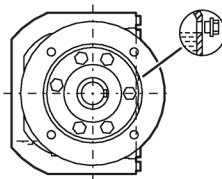
M3



M4



M5



M6

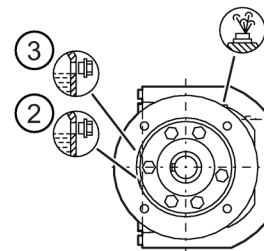
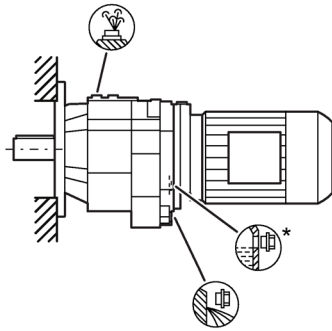
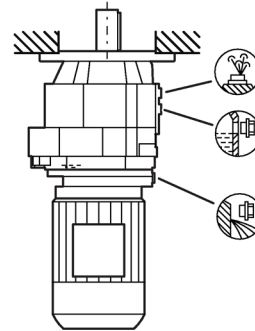


Figure 10-10 Mounting positions for helical gearbox DF/ZF flange-mounted design and DZ/ZZ with housing flange, size 39

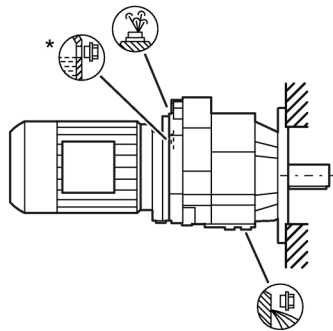
M1



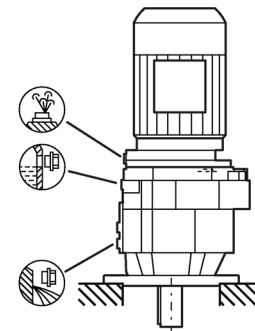
M2



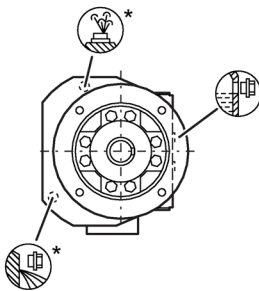
M3



M4



M5



M6

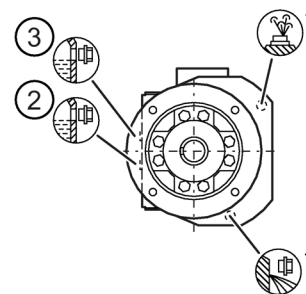
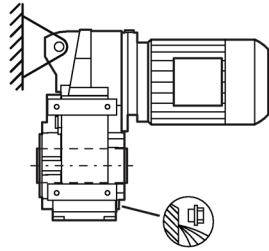


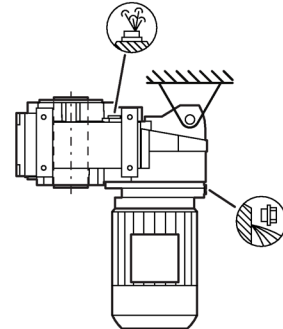
Figure 10-11 Mounting positions for helical gearbox DF/ZF flange-mounted design, sizes 49 - 189 and DZ/ZZ with housing flange, sizes 49 - 129

10.5.4 Parallel shaft gearbox

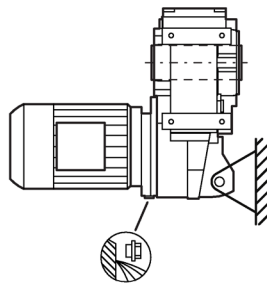
M1



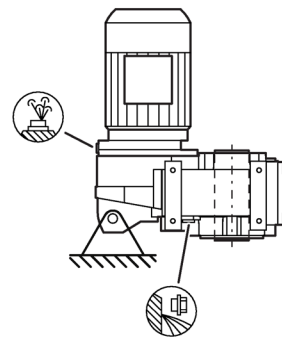
M2



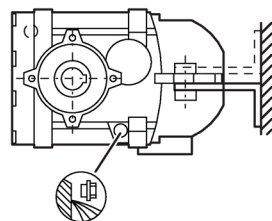
M3



M4



M5



M6

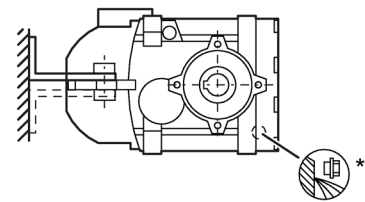
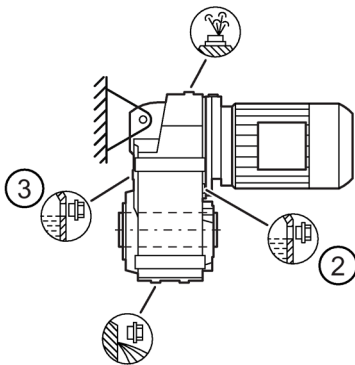
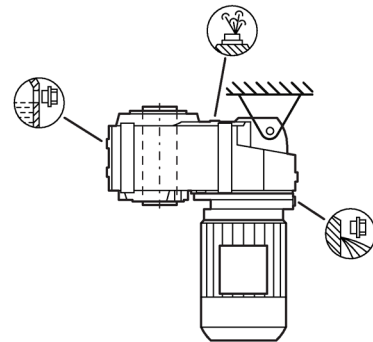


Figure 10-12 Mounting positions for parallel shaft gearbox F.AD shaft-mounted design, size 29

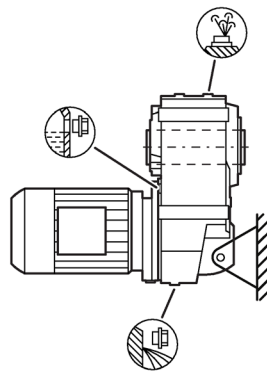
M1



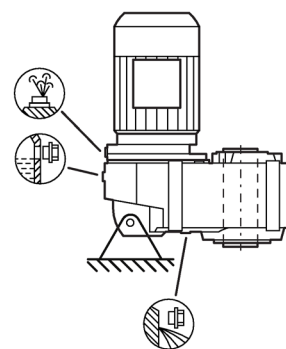
M2



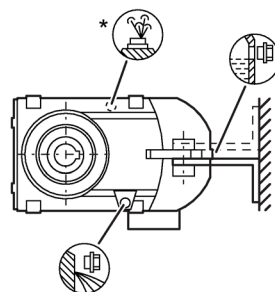
M3



M4



M5



M6

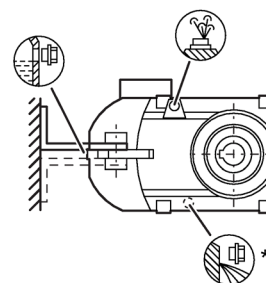
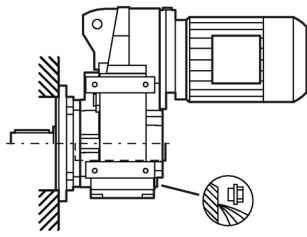
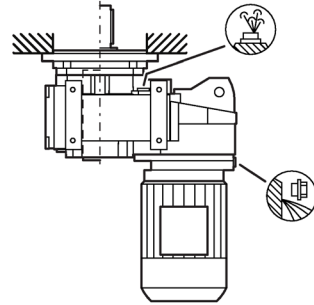


Figure 10-13 Mounting positions for parallel shaft gearbox F.AD shaft-mounted design, sizes 39 - 189

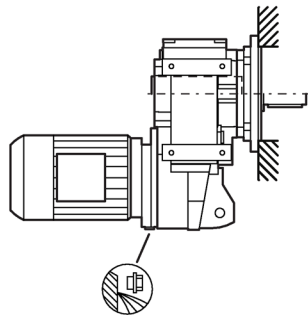
M1



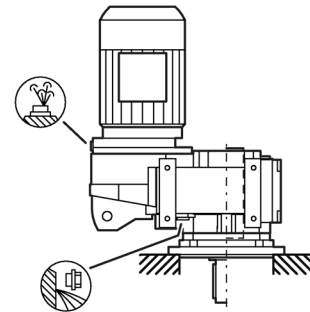
M2



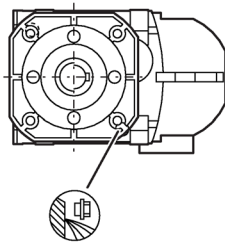
M3



M4



M5



M6

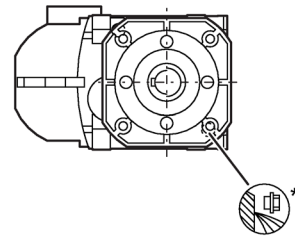
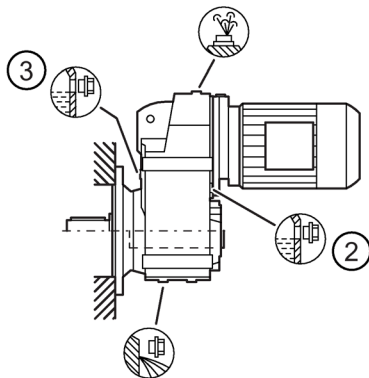
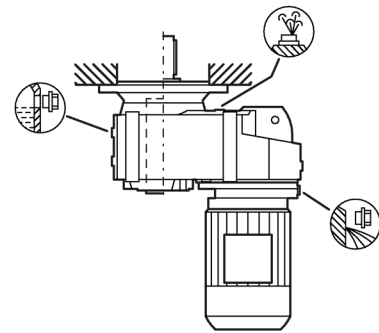


Figure 10-14 Mounting positions for parallel shaft gearbox F.F flange-mounted design and F.Z with housing flange, size 29

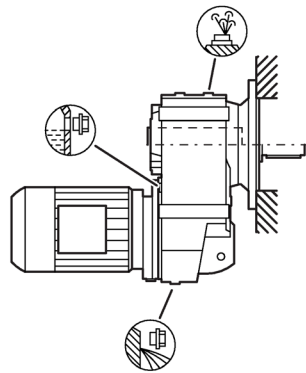
M1



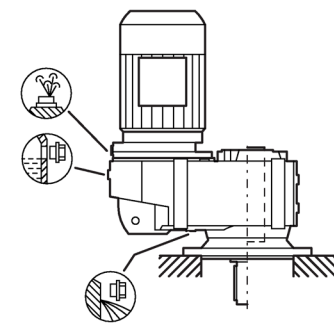
M2



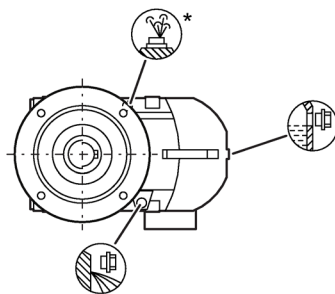
M3



M4



M5



M6

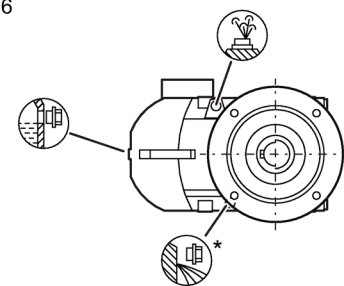
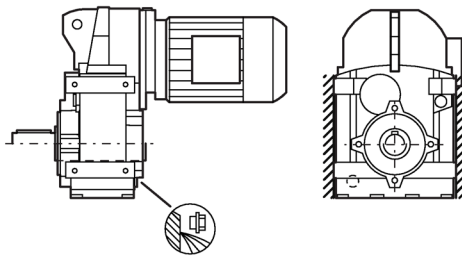
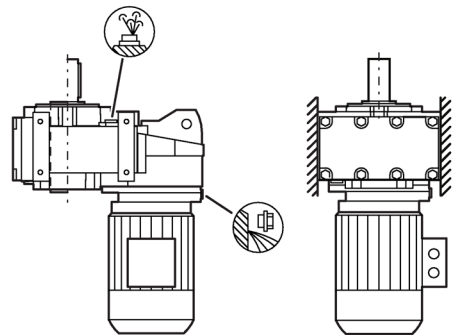


Figure 10-15 Mounting positions for parallel shaft gearbox F.F flange-mounted design and F.Z with housing flange, sizes 39 - 189

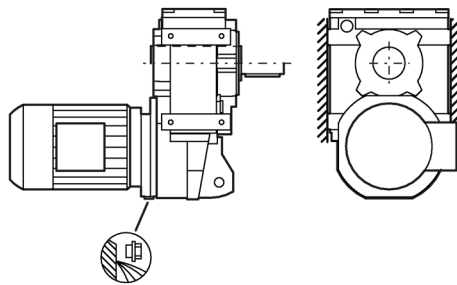
M1



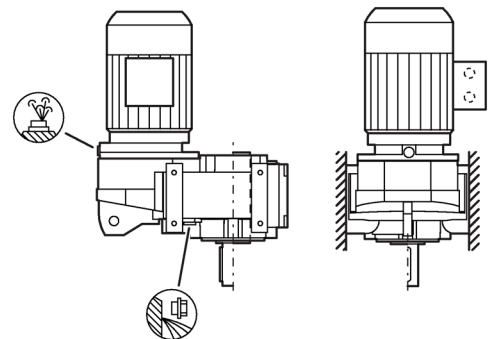
M2



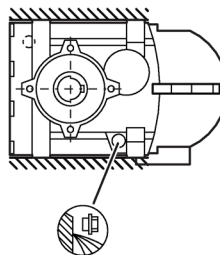
M3



M4



M5



M6

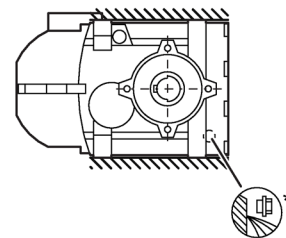


Figure 10-16 Mounting positions for parallel shaft gearbox F foot-mounted design, size 29

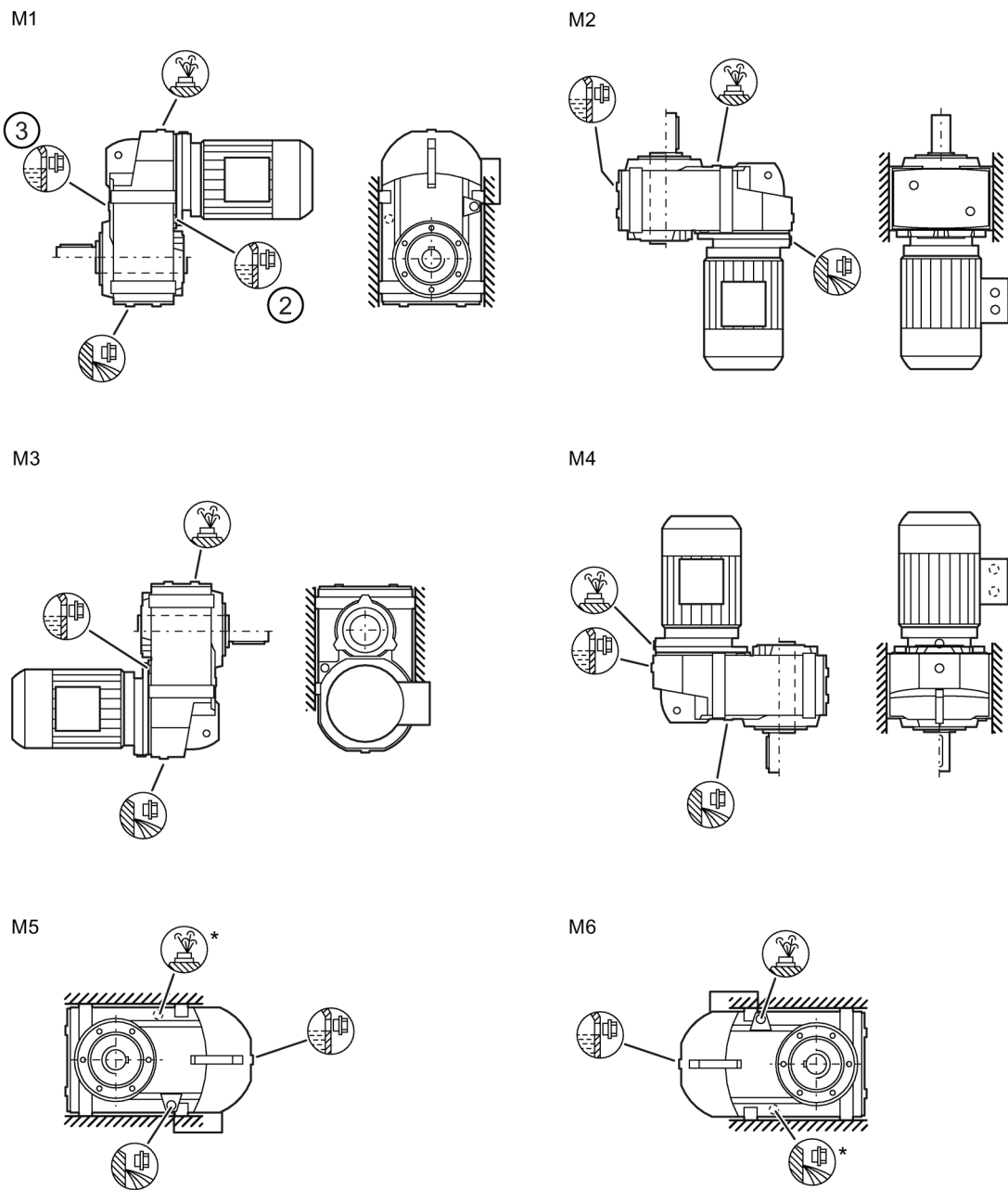


Figure 10-17 Mounting positions for parallel shaft gearbox F. foot-mounted design, sizes 39 - 189

10.5.5 Bevel gearbox

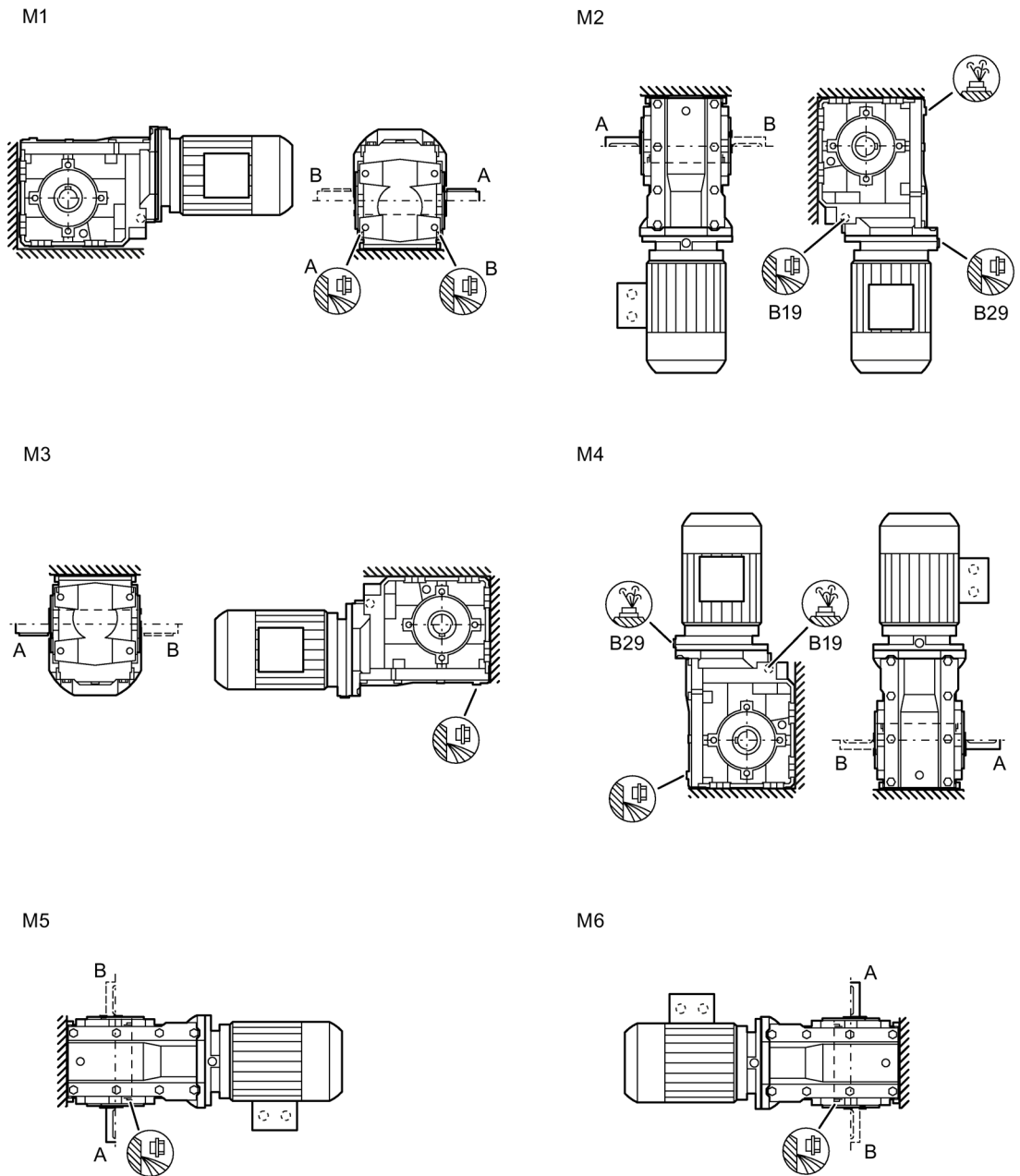


Figure 10-18 Mounting positions for bevel gearbox B foot-mounted design, sizes 19 - 29

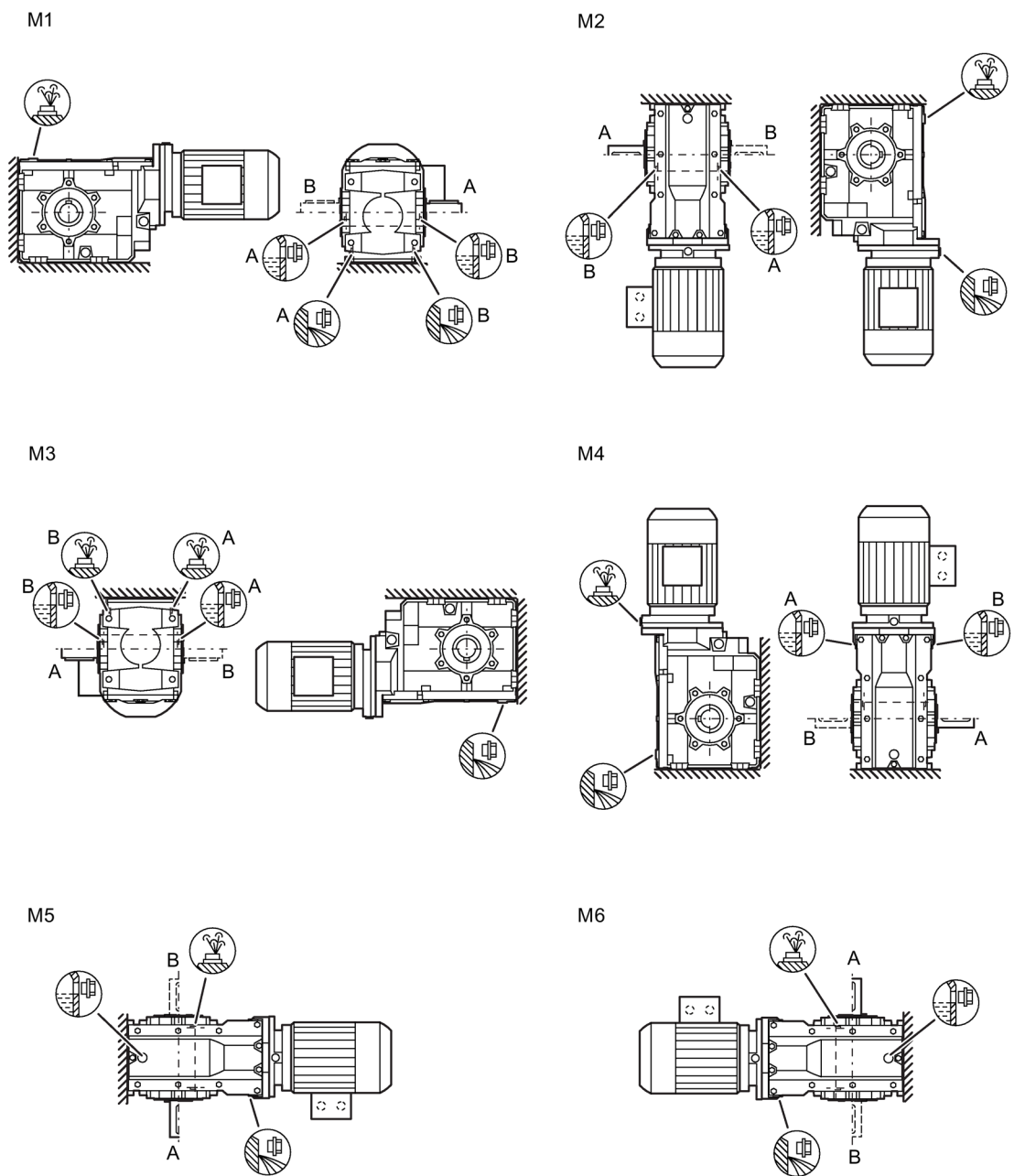
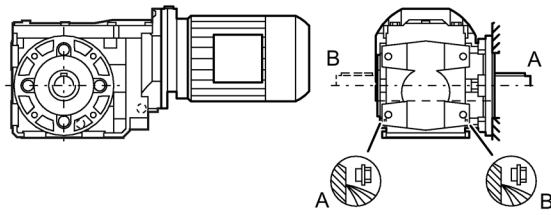
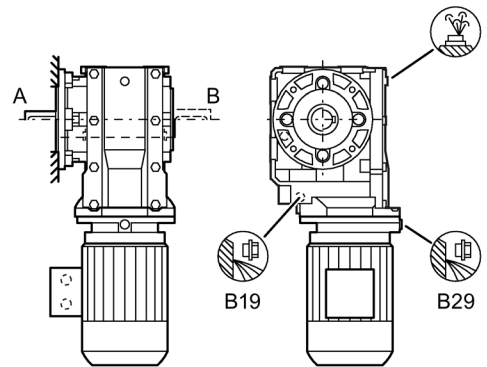


Figure 10-19 Mounting positions for bevel gearbox B foot-mounted design, sizes 39 - 49

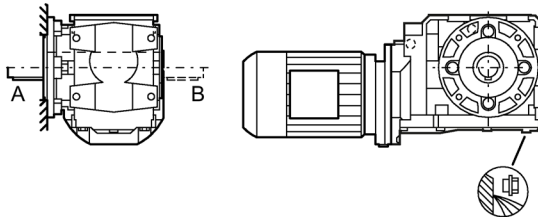
M1



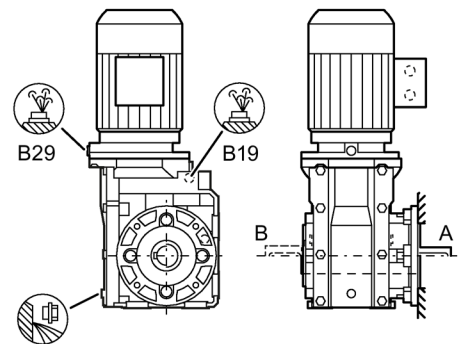
M2



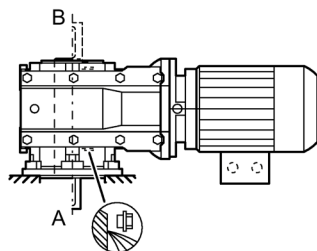
M3



M4



M5



M6

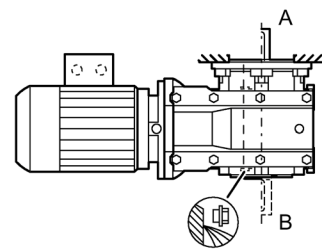
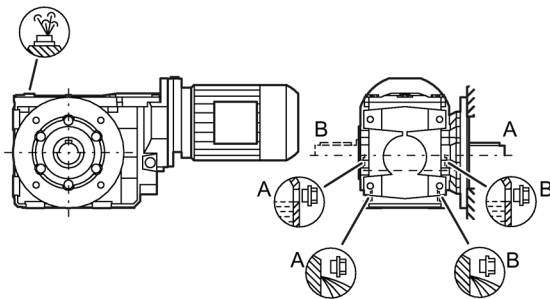
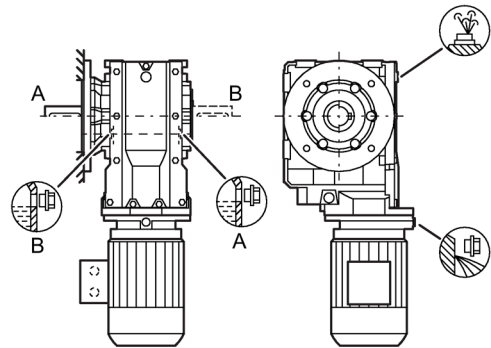


Figure 10-20 Mounting positions for bevel gearbox B.F flange-mounted design and B.Z with housing flange, sizes 19 - 29

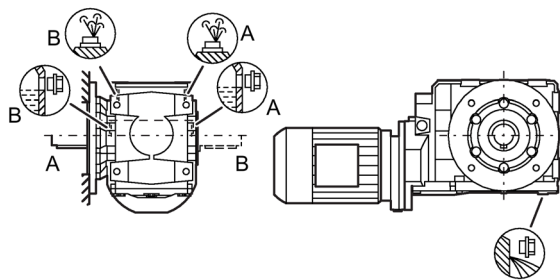
M1



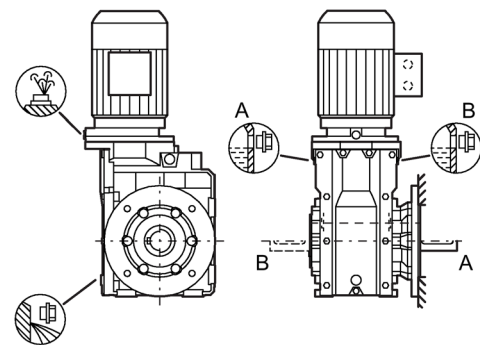
M2



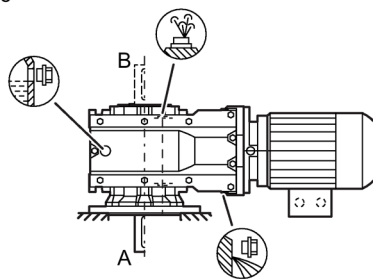
M3



M4



M5



M6

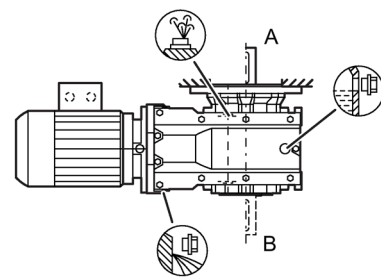


Figure 10-21 Mounting positions for bevel gearbox B.F flange-mounted design and B.Z with housing flange, sizes 39 - 49

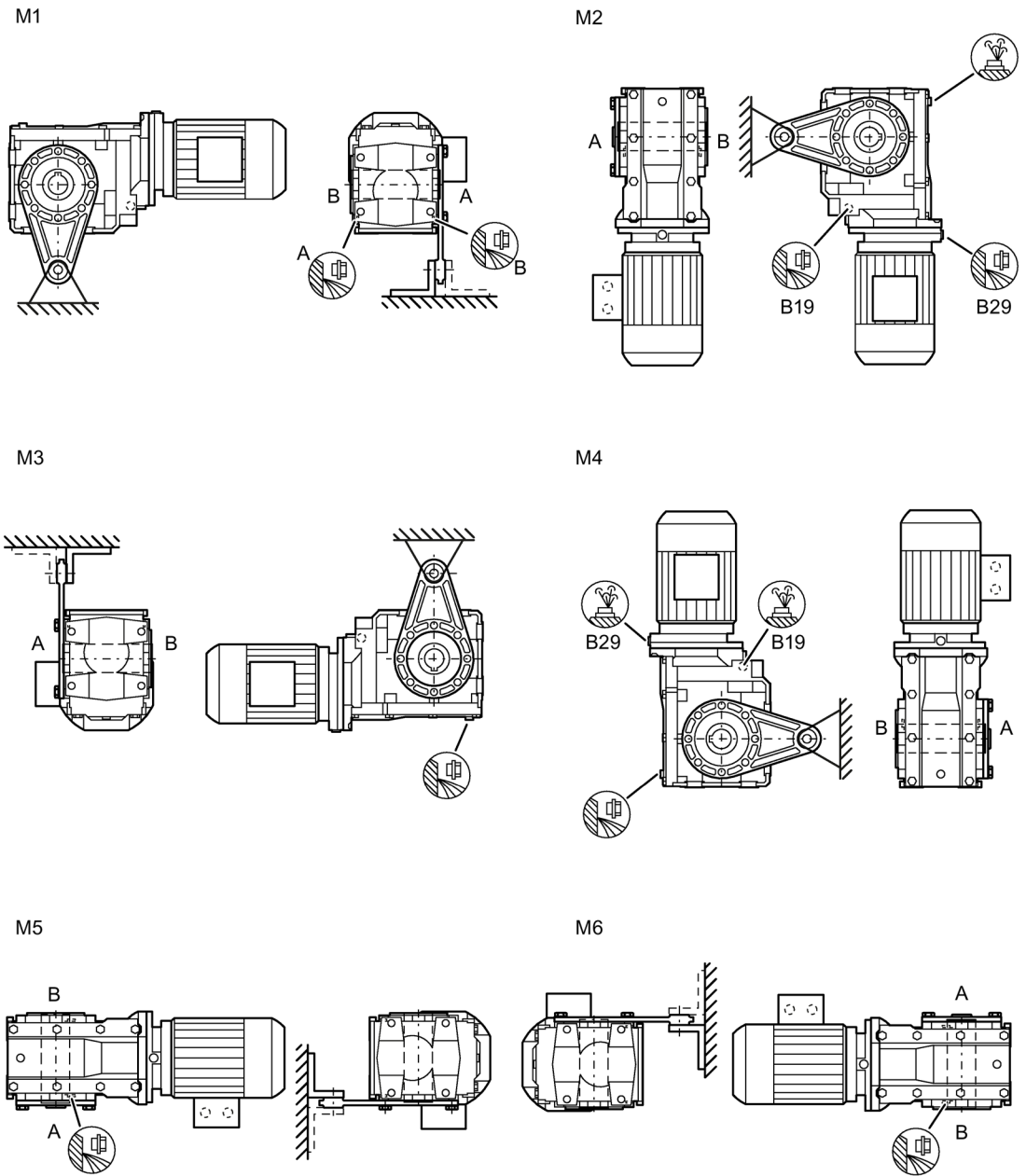


Figure 10-22 Mounting positions for bevel gearbox BAD shaft-mounted design, sizes 19 - 29

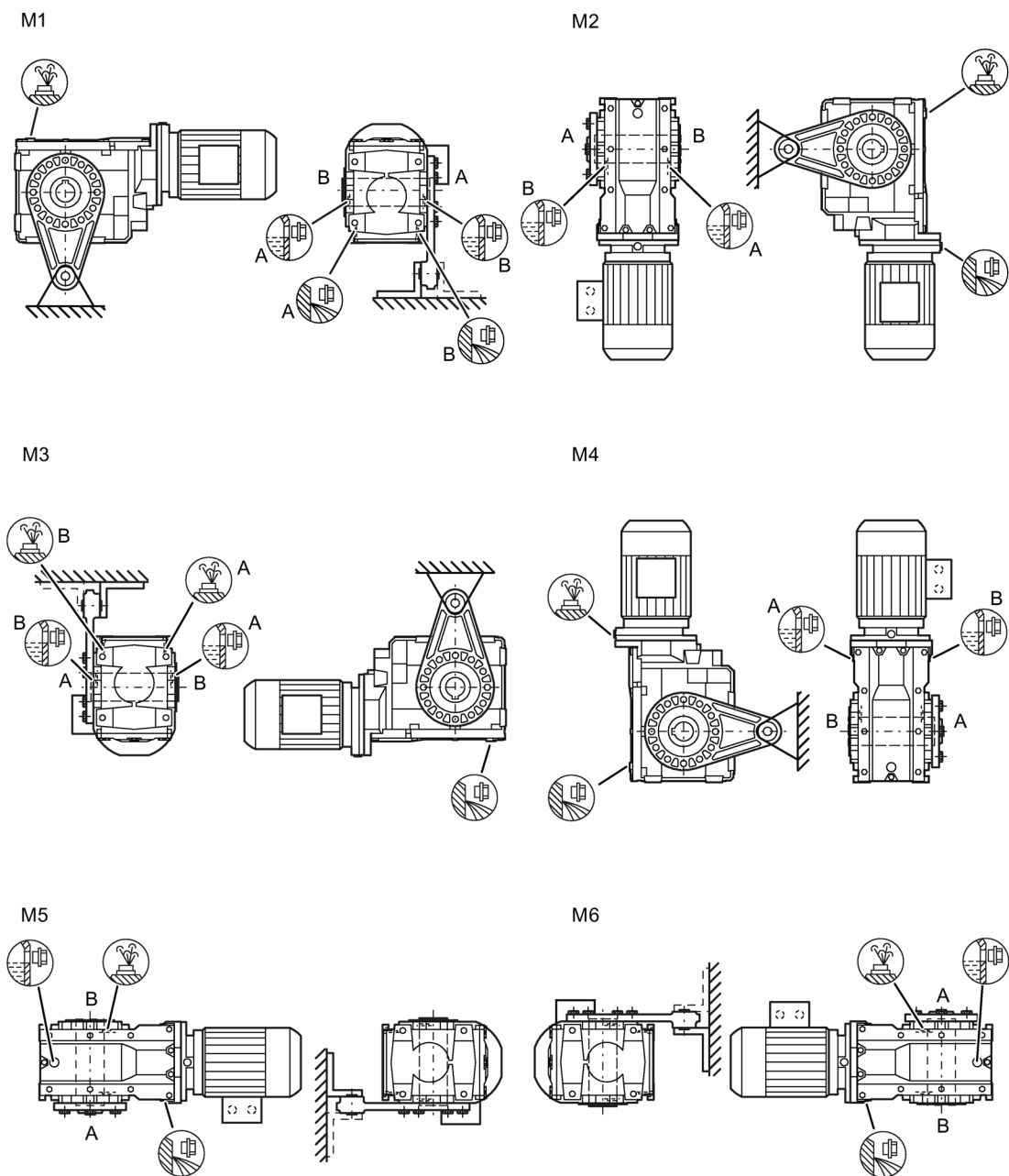


Figure 10-23 Mounting positions for bevel gearbox BAD shaft-mounted design, sizes 39 - 49

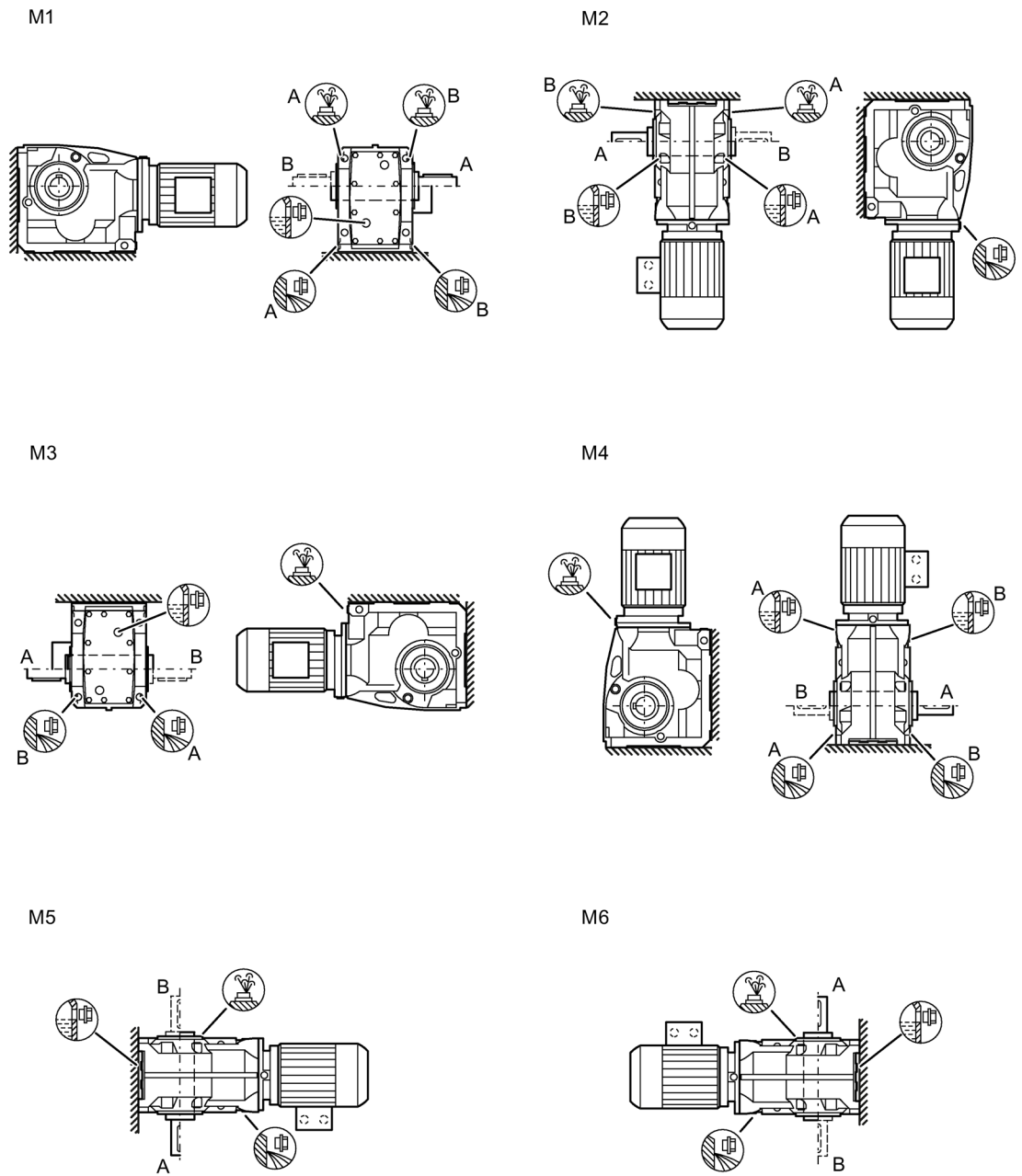


Figure 10-24 Mounting positions for bevel gearbox K. foot-mounted design, sizes 39 - 189

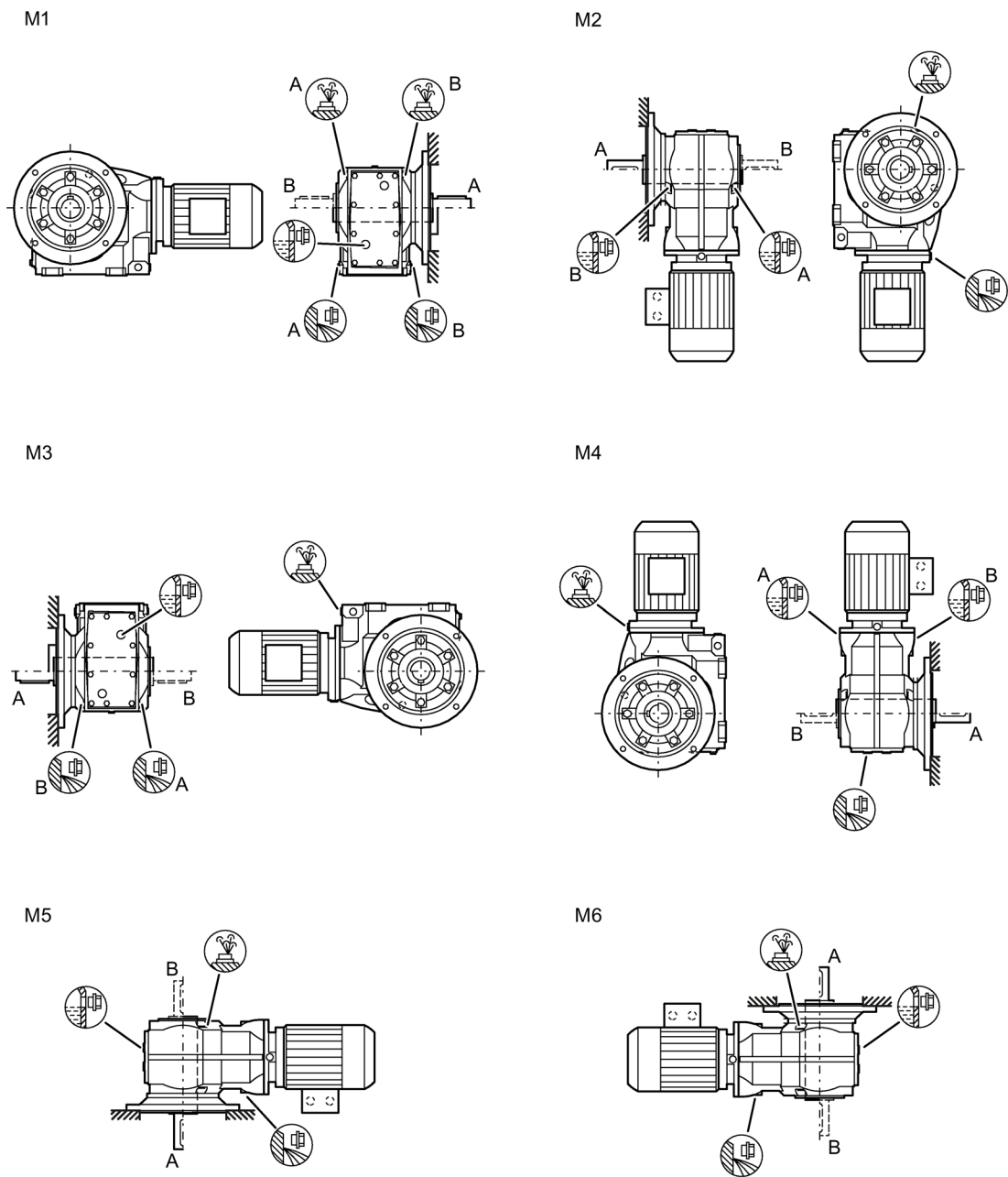


Figure 10-25 Mounting positions for bevel gearbox K.F flange-mounted design and KAZ with housing flange, sizes 39 - 189

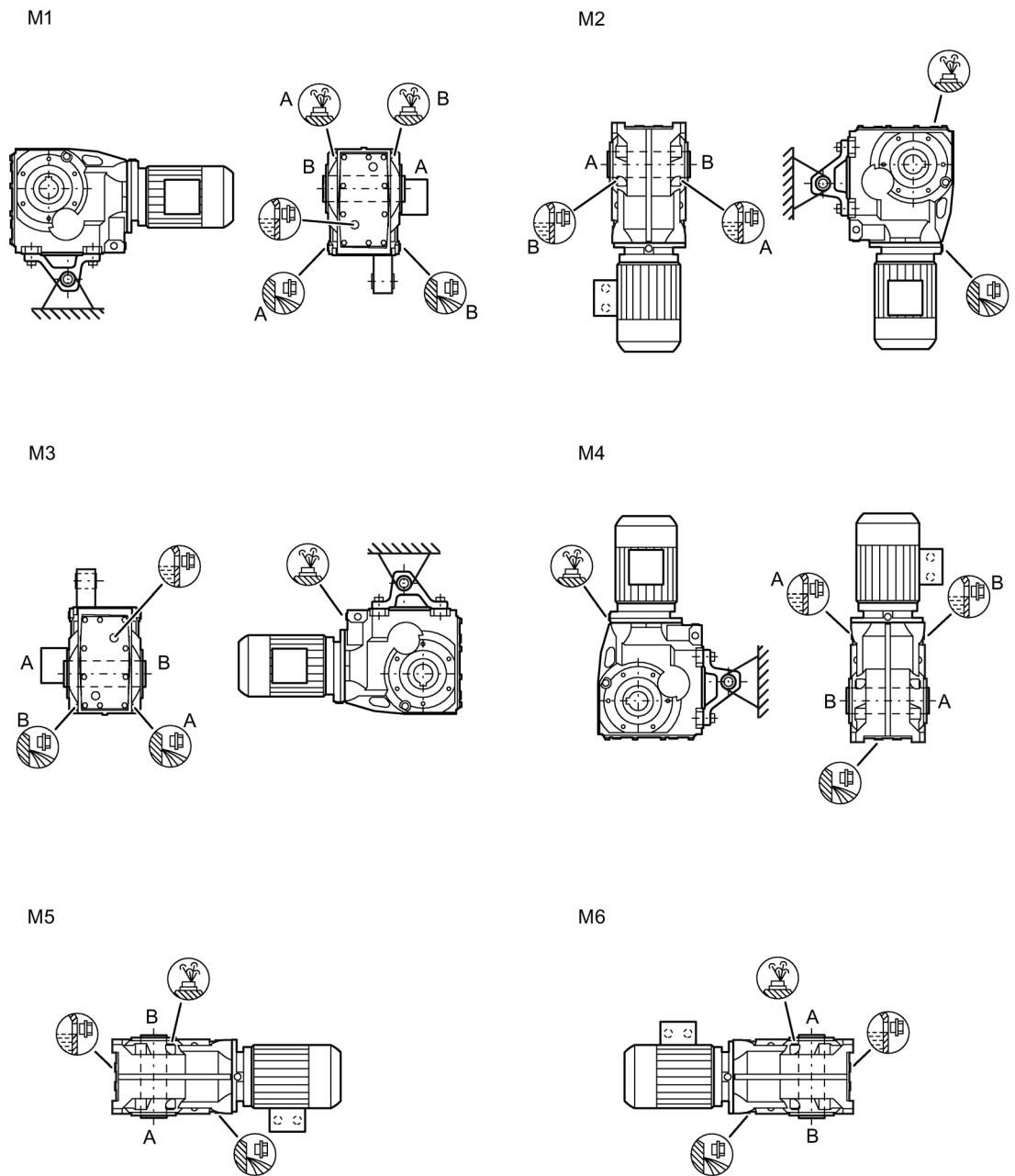


Figure 10-26 Mounting positions for bevel gearboxes KAD shaft-mounted design, sizes 39 - 189

10.5.6 Helical worm gearbox

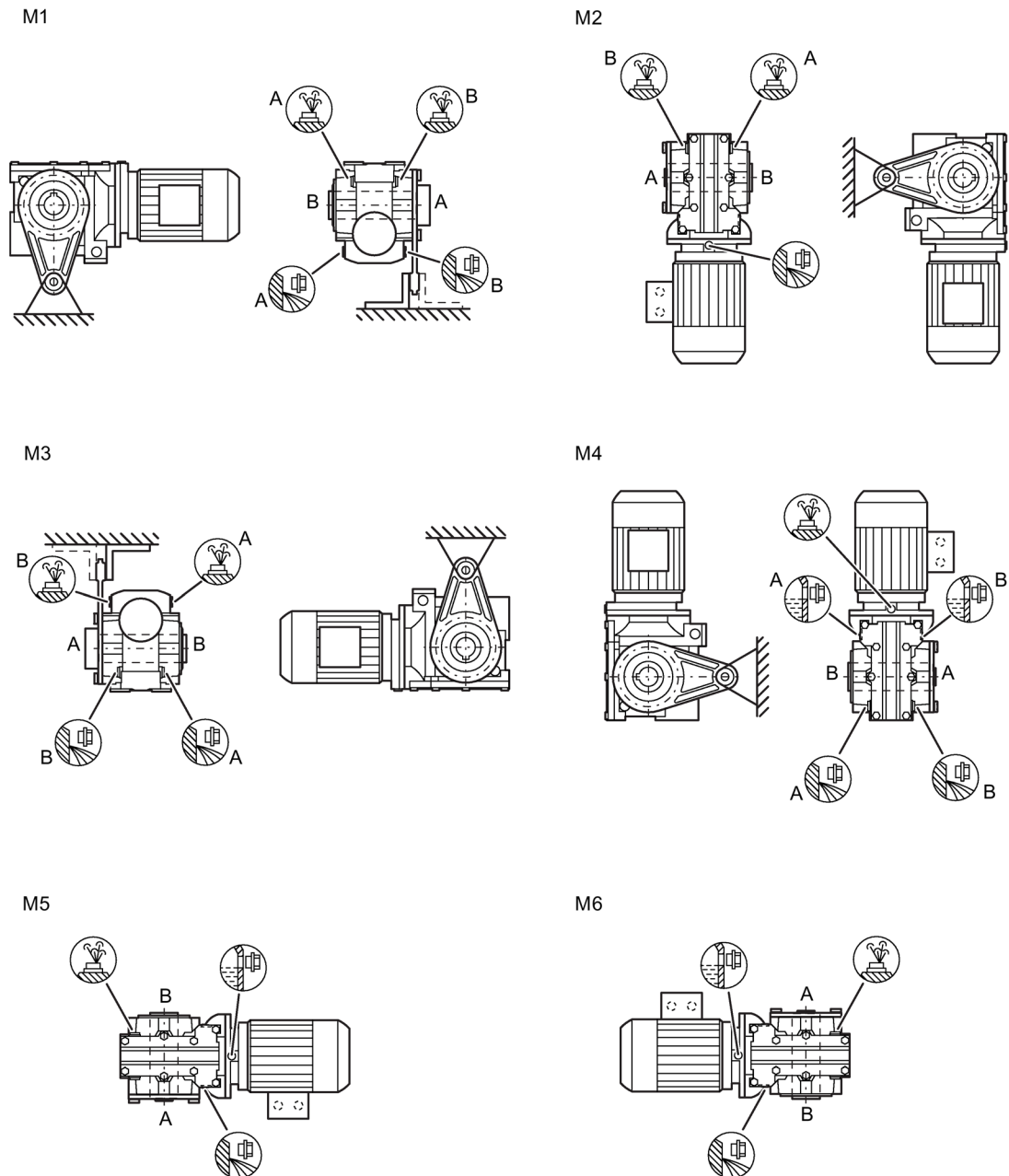


Figure 10-27 Mounting positions for helical worm gearbox CAD shaft-mounted design, size 29

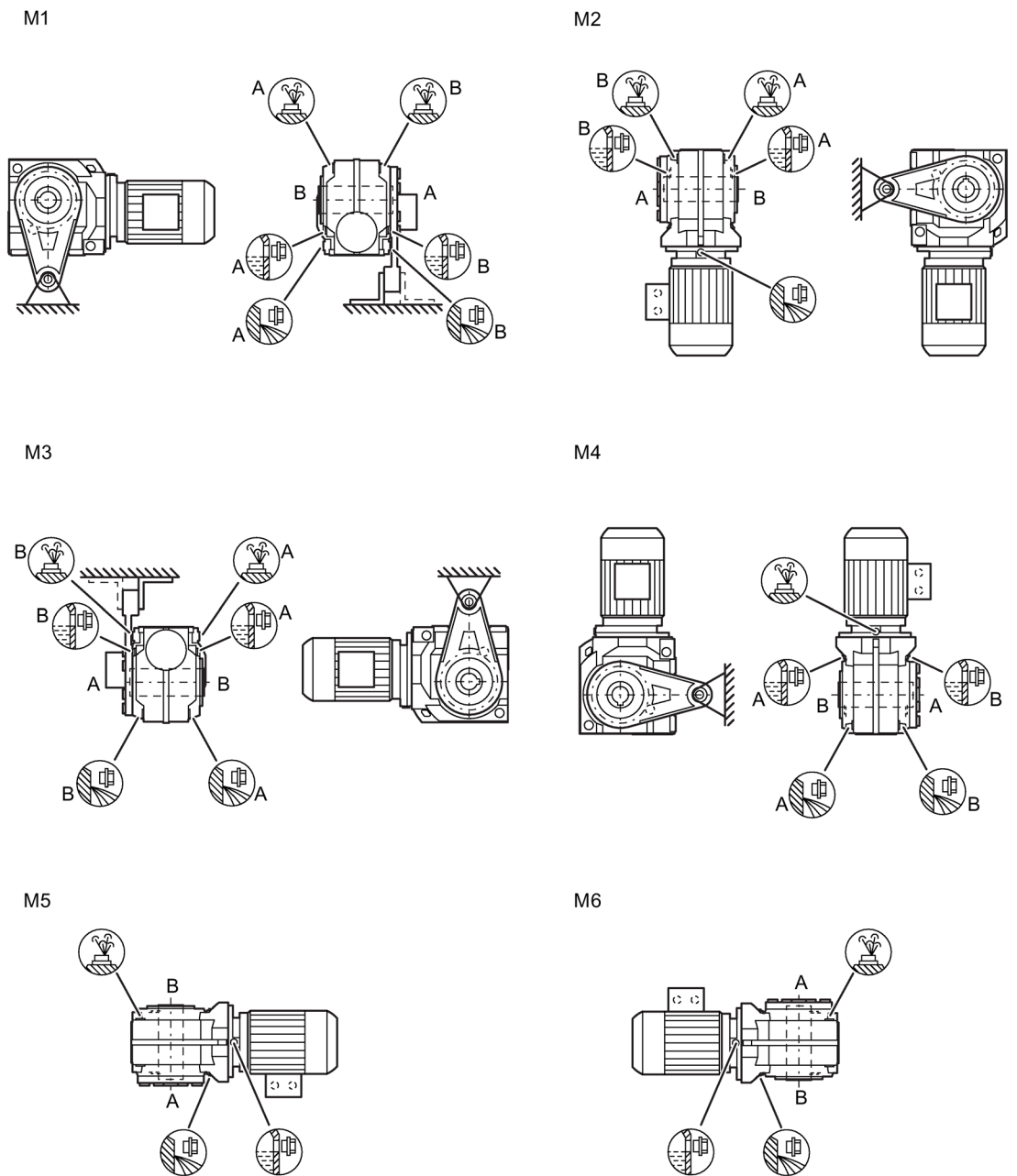
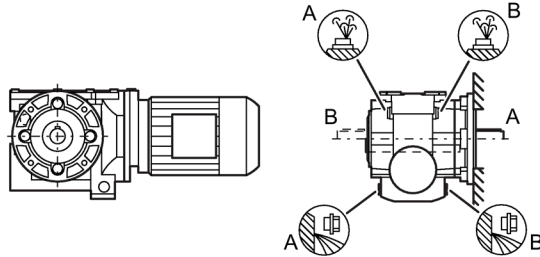
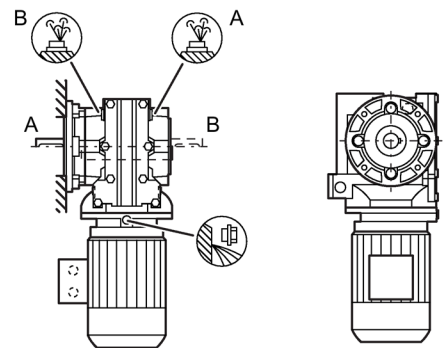


Figure 10-28 Mounting positions for helical worm gearbox CAD shaft-mounted design, sizes 39 - 89

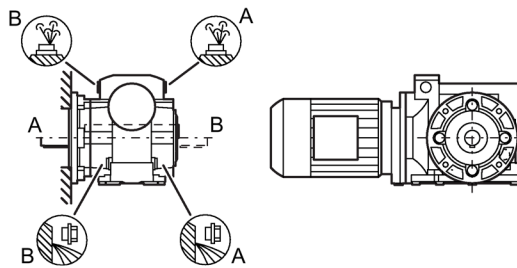
M1



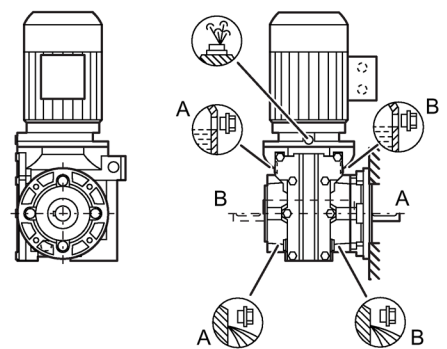
M2



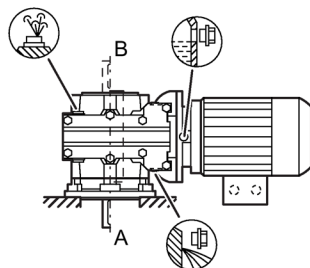
M3



M4



M5



M6

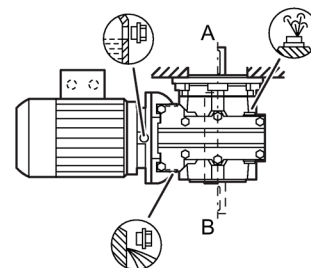


Figure 10-29 Mounting positions for helical worm gearbox CF flange-mounted design and CAZ housing flange, size 29

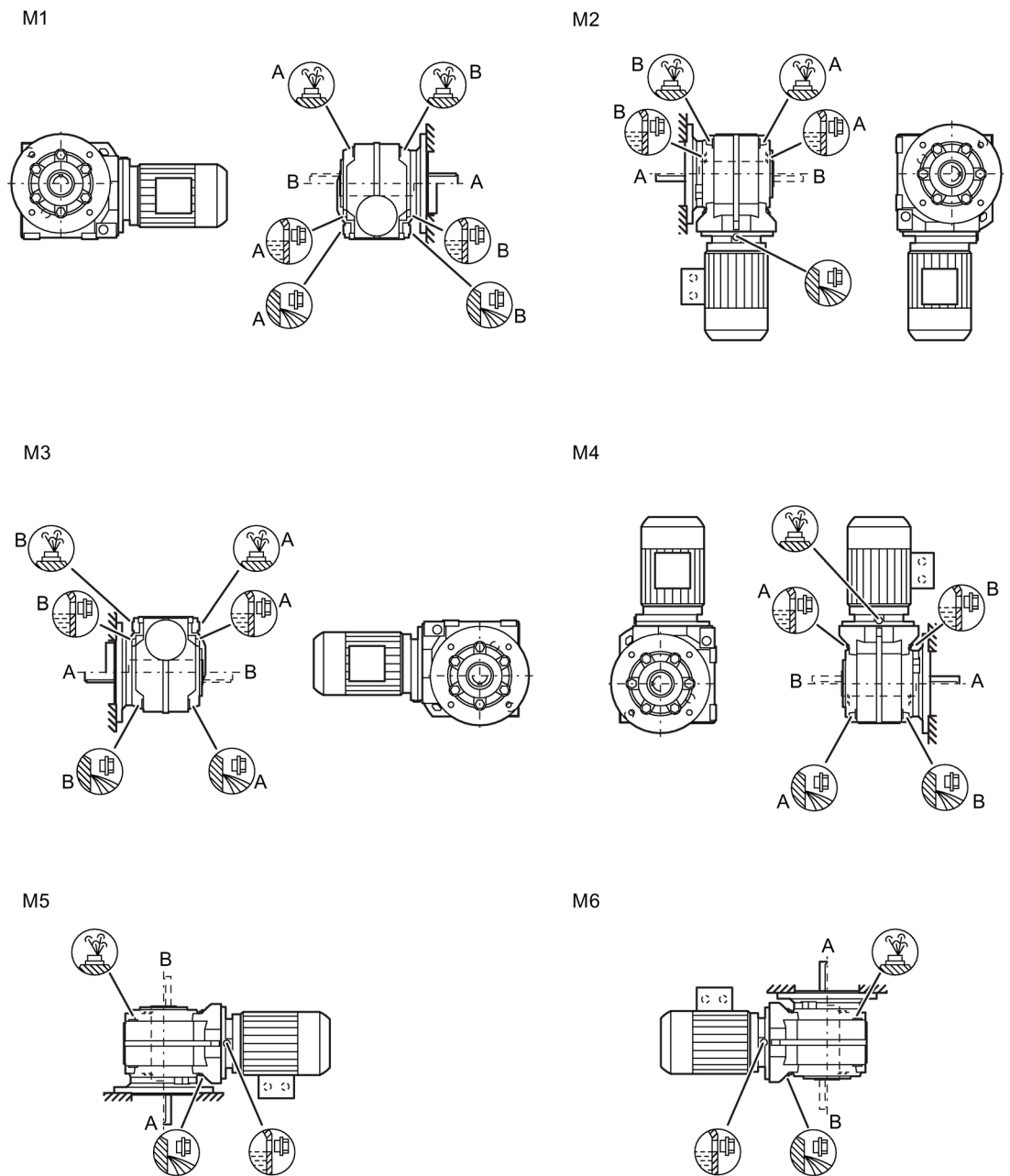
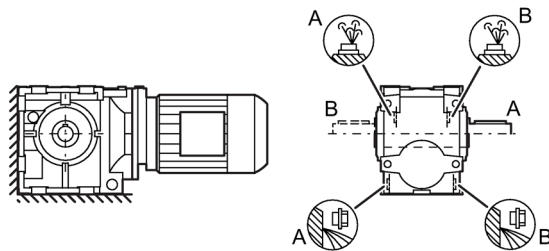
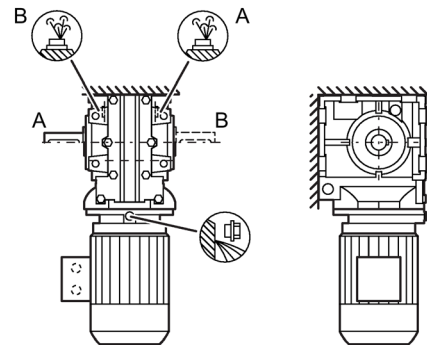


Figure 10-30 Mounting positions for helical worm gearbox CF flange-mounted design and CAZ housing flange, sizes 39 - 89

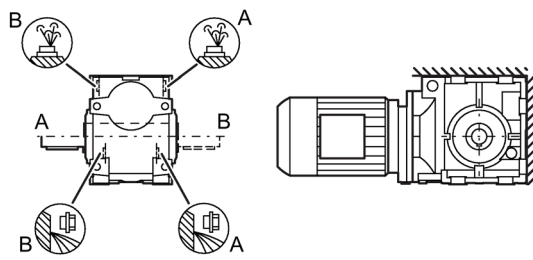
M1



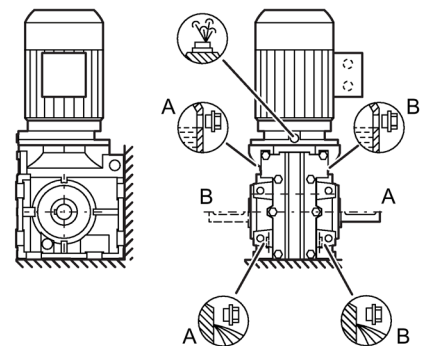
M2



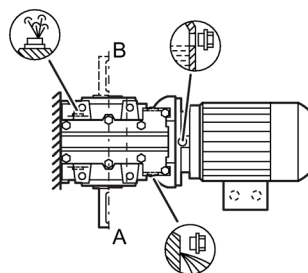
M3



M4



M5



M6

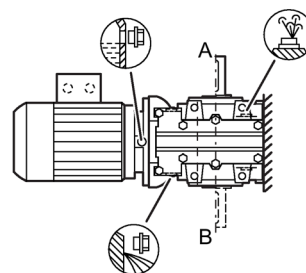


Figure 10-31 Mounting positions for helical worm gearbox C. foot-mounted design, size 29

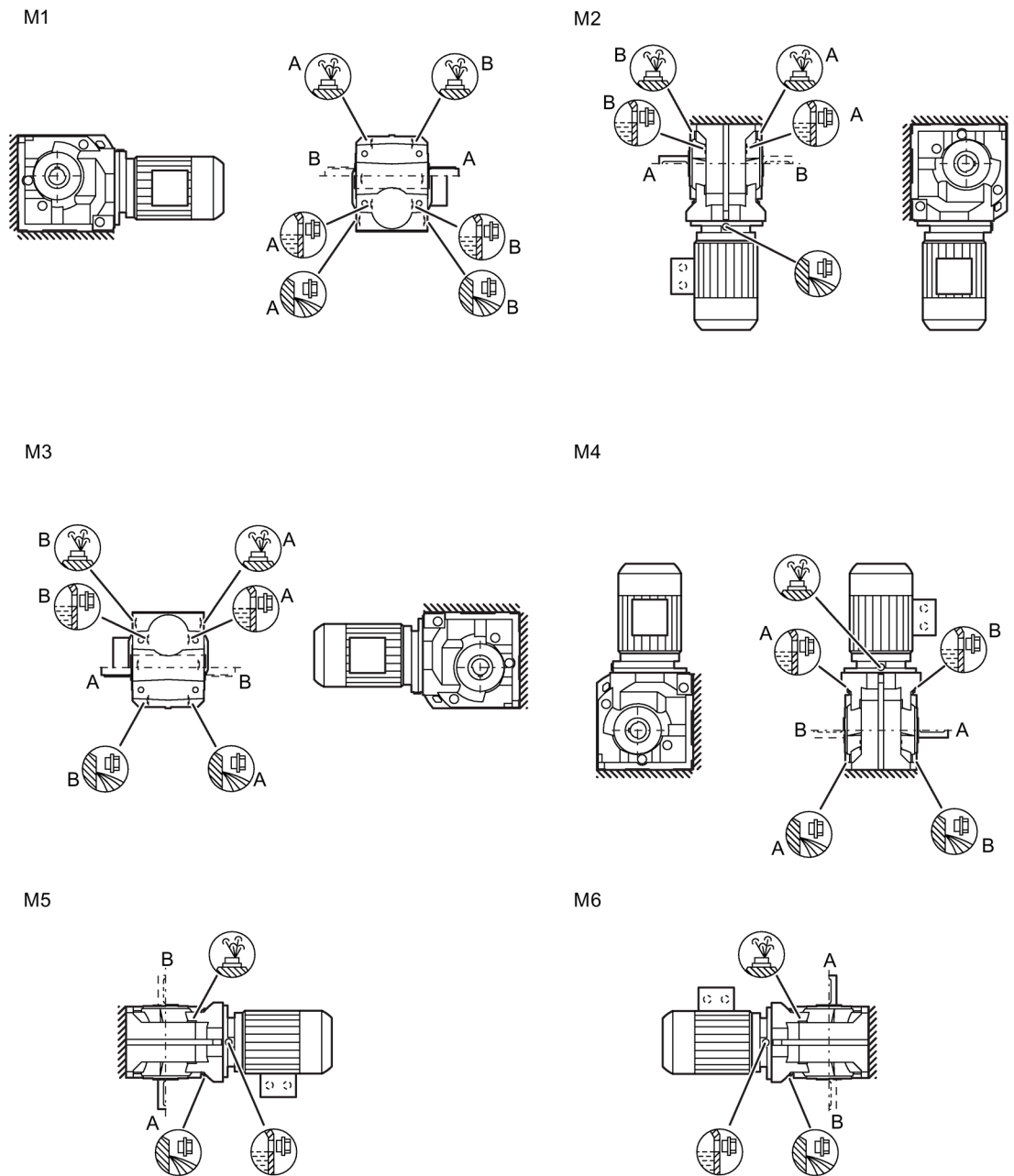


Figure 10-32 Mounting positions for helical worm gearbox C. foot-mounted design, sizes 39 - 89

10.5.7 Tandem gearboxes - Intermediate helical gearboxes

Only operate the gearbox in the mounting position specified on the rating plate. This ensures that the correct quantity of lubricant is provided. The symbols are shown for the standard mounting position.

Note

Horizontal operating position

In a horizontal operating position the bulging part of the housing of the intermediate helical gearbox generally faces vertically downwards.

Note

Helical gearbox size 19

The helical gearbox size 19 is lubricated for life. There is no opening to check the oil level.

In vertical mounting positions the gearbox is equipped with a breather valve.

Horizontal operating position

Vertical operating position

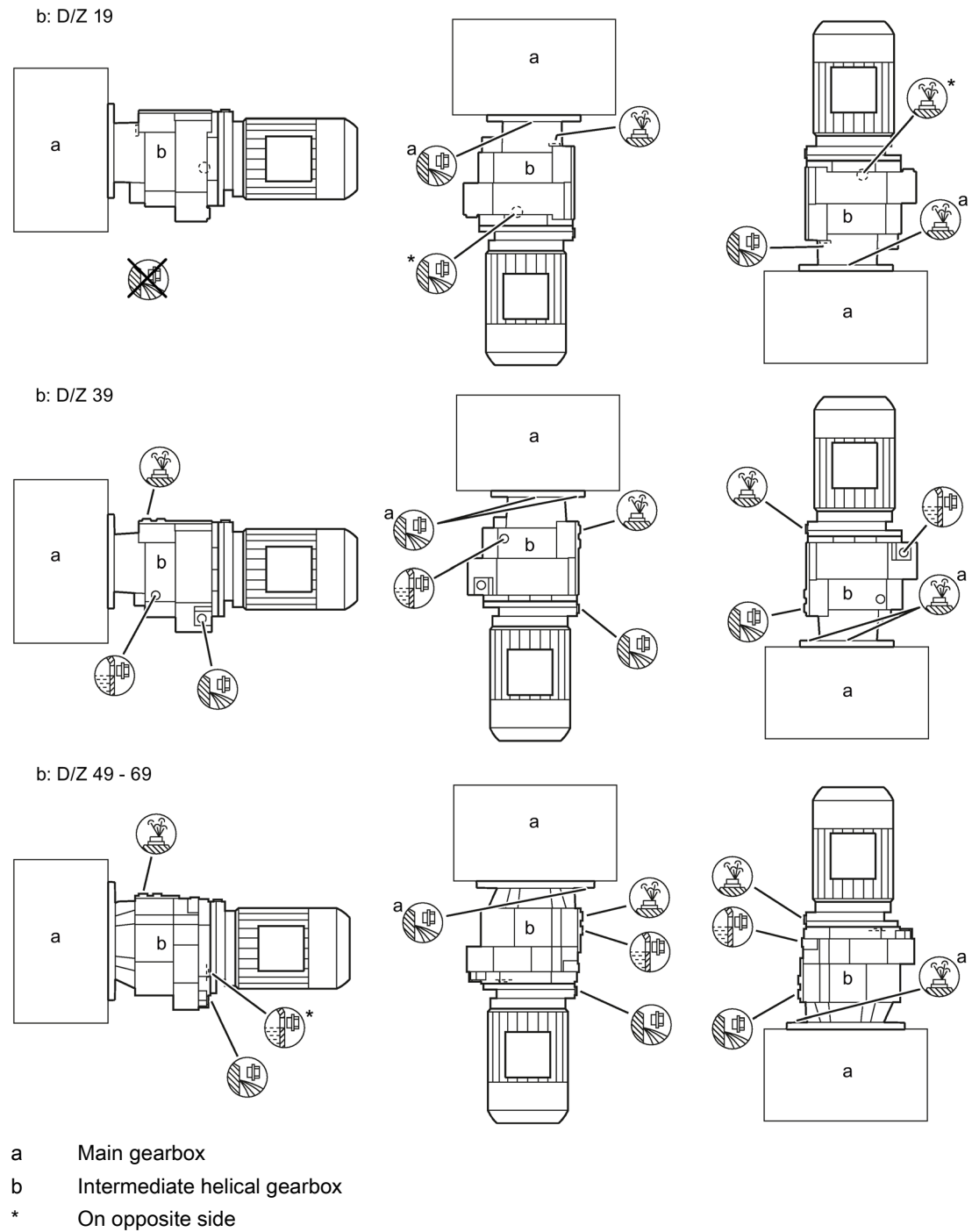


Figure 10-33 Operating position for tandem gearbox

10.6 Oil quantities

NOTICE
Damage to the gearbox caused by incorrect oil quantities
The oil quantities listed in the tables are guide values for changing the oil. They serve, for example, for lubricant storage and procurement.
The precise values depend on the number of stages and transmission ratio of the gearbox.
The specified oil quantities are valid for the standard mounting position.

Note

Tandem gearbox - intermediate helical gearbox

The oil quantity is specified for every individual gearbox and is valid for the standard mounting position.

Note

Gearbox in special mounting position

The gearbox is intended for a specific rotation angle and is delivered with the correct quantity of oil for this purpose.

You will find information regarding oil quantity and type of oil on the rating plate.

10.6.1 Helical gearbox

Table 10- 3 Oil quantities [l] for E, EZ, EF , sizes 39 - 149

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
E.39	0.2	0.5	0.4	0.7	0.45	0.45
E.49	0.4	1	0.95	1.5	1	0.95
E.69	0.6	1.9	1.6	2.5	1.7	1.7
E.89	0.9	3.7	2.5	4	3	2.9
E.109	1.4	6.6	6	6.9	5.3	5.1
E.129	2.2	10.7	6.6	9.5	7.7	7.5
E.149	3.8	16	10.3	15.5	12	11.6

Table 10- 4 Oil quantities [l] for D/Z, DB/ZB, DF/ZF, DZ/ZZ, sizes 19 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
D.19	0.15	0.45	0.45	0.45	0.4	0.3
D.29	0.15	0.65	0.45	0.5	0.55	0.4
D.39	0.25	0.9	0.8	0.85	0.8	0.7
D.49	0.55	1.8	1.8	1.7	1.7	1.2
D.59	0.45	1.9	1.9	1.8	1.8	1.2
D.69	0.6	2	2.4	2.3	2.2	1.5
D.79	1	3.5	3.7	3.6	3.4	2.3
D.89	2	6.5	6.2	6	6	4.2
D.109	2.9	11.3	11.3	10	9.8	7.3
D.129	5.6	17.9	18.5	17.7	16.9	12.1
D.149	9.1	30.5	28.5	28.5	26	20.5
D.169	12.9	45	45	43.5	40.5	33
D.189	17.9	65	77	77	59	59
Z.19	0.15	0.5	0.45	0.5	0.4	0.35
Z.29	0.2	0.7	0.45	0.6	0.55	0.3
Z.39	0.3	0.95	0.85	0.95	0.9	0.25
Z.49	0.55	1.9	1.9	1.9	1.8	0.65
Z.59	0.65	2	1.9	1.9	1.9	0.6
Z.69	0.65	2.1	2.6	2.6	2.3	0.85
Z.79	1.1	3.8	3.9	3.9	3.7	1.4
Z.89	2.2	6.9	6.7	6.7	6.6	2.4
Z.109	3	12	12.3	11.3	10.7	4.6
Z.129	6	19	19.9	19.9	18.4	7.5
Z.149	9.4	32	31.5	32.5	29	12.2
Z.169	13.6	47.5	49	49.5	45	17.9
Z.189	18.9	67	79	80	61	36.5

10.6.2 Parallel shaft gearbox

Table 10- 5 Oil quantities [l] for FD/Z, FD/ZZ, FD/ZA., FD/ZAF., FD/ZAZ., FD/ZAD., sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FD.29	0.6	0.8	0.35	0.6	0.45	0.45
FD.39	0.95	1.1	0.7	1.2	0.8	0.8
FD.49	2.1	2.3	1.5	2.3	1.5	1.5
FD.69	2.2	2.7	1.6	2.7	1.8	1.8
FD.79	3	3.8	2.7	3.9	2.6	2.7
FD.89	5.6	7.6	5.9	7.8	5.1	5.2
FD.109	9.5	13	9.2	11.8	8.5	8.5
FD.129	16.1	20	16.3	23.5	14.9	15
FD.149	24.5	32.5	23	34	21.5	22
FD.169	39	50	37	54	34.5	35.5
FD.189	64	74	48	77	51.5	52
FZ.29	0.6	0.9	0.4	0.7	0.5	0.45
FZ.39	0.95	1.3	0.8	1.4	0.9	0.85
FZ.49	1.6	2.5	1.6	2.5	1.6	1.6
FZ.69	2.2	2.8	1.6	2.9	1.9	1.9
FZ.79	2.8	4.1	2.9	4.2	2.7	2.9
FZ.89	4.9	7.7	5.9	8.4	5.2	5.5
FZ.109	9.1	13.7	9.4	13.1	9	9.3
FZ.129	15.6	21.5	16.7	25	15.6	16.3
FZ.149	23.5	34	24	37	22.5	24
FZ.169	38	54	37.5	59	36.5	38.5
FZ.189	57	77	50	80	52.5	54

Table 10- 6 Oil quantities [l] for FD/ZF, sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FDF29	0.6	0.8	0.35	0.6	0.45	0.45
FDF39	1	1.2	0.75	1.3	0.8	0.85
FDF49	2.2	2.3	1.5	2.4	1.6	1.5
FDF69	2.4	2.8	1.6	2.9	1.9	1.9
FDF79	3.1	3.9	2.7	4	2.7	2.6
FDF89	5.8	7.6	5.8	8	5.2	5.2
FDF109	9.7	13	9.2	12	8.6	8.6
FDF129	16.4	20	16.3	23.5	15.1	15.2
FDF149	25	32.5	23	35	22	22.5
FDF169	40.5	50	37	56	35.5	36.5
FDF189	66	74	48	79	53	53

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FZF29	0.6	0.9	0.4	0.7	0.5	0.45
FZF39	1	1.4	0.85	1.6	0.95	0.9
FZF49	1.8	2.4	1.5	2.6	1.6	1.6
FZF69	2.4	2.9	1.6	3.1	2	2
FZF79	2.9	4.2	2.9	4.3	2.9	2.8
FZF89	5.1	7.7	5.8	8.6	5.3	5.4
FZF109	9.2	13.7	9.4	13.3	9.1	9.4
FZF129	16	21.5	16.7	25.5	15.8	16.5
FZF149	24	34	24	38	23	24.5
FZF169	39.5	54	37.5	61	37.5	39.5
FZF189	60	77	50	82	53.5	55

10.6.3 Bevel gearbox

Table 10- 7 Oil quantities [l] for B., sizes 19 - 49

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
B.19	0.15	0.3	0.4	0.45	0.3	0.3
B.29	0.25	0.55	0.7	0.85	0.55	0.5
B.39	0.5	0.95	1.3	1.6	0.95	0.9
B.49	1	1.7	2.4	3.1	1.8	1.5

Table 10- 8 Oil quantities [l] for K, KA, KAS, KAT, sizes 39 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.35	0.85	1.1	1.2	0.85	0.9
K.49	0.55	1.4	1.8	1.9	1.5	1.6
K.69	0.75	2	2.5	2.7	2.2	2.2
K.79	1	2.2	2.9	3.4	2.7	2.5
K.89	1.9	4.5	6	6.8	5	5.3
K.109	3	7.2	9.2	10.5	7.1	7.5
K.129	6.2	13.4	16.6	19.5	13.2	13.6
K.149	9.3	21	28	33	21.5	22.5
K.169	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

10.6 Oil quantities

Table 10- 9 Oil quantities [l] for KZ, KAF., KAZ., KAD., sizes 39 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.4	0.9	1.2	1.3	0.95	0.95
K.49	0.65	1.5	1.9	2.2	1.6	1.6
K.69	0.85	2.1	2.8	3.2	2.4	2.5
K.79	1.1	2.4	3.1	3.7	2.5	2.7
K.89	2.2	4.7	6.2	7.3	5.3	5.6
K.109	3.7	7.4	9.6	11.7	7.6	8.2
K.129	6.5	13.5	17.5	20.5	13.8	14.2
K.149	9.6	21.5	29	34.5	22.5	23.5
K.169	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

Table 10- 10 Oil quantities [l] for KF, sizes 39 -189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
KF39	0.35	0.9	1.2	1.3	0.95	1
KF49	0.6	1.4	2	2.2	1.6	1.7
KF69	0.85	2	2.8	3.1	2.4	2.4
KF79	1.2	2.3	3.1	3.8	3	2.5
KF89	2.1	4.6	6.5	7.6	5.6	5.5
KF109	3.6	7.4	9.8	11.7	8.1	7.8
KF129	6.7	13.9	18.1	21.5	14.4	14.8
KF149	9.7	22	30.5	36	23	24
KF169	16.9	30.5	48.5	59.5	36.5	39
KF189	24.5	54	76	90	56	60

10.6.4 Helical worm gearbox

Table 10- 11 Oil quantities [l] for C, CA., CAS, CAT, sizes 29 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
C.29	0.15	0.5	0.6	0.55	0.35	0.4
C.39	0.3	1.1	0.95	1	0.55	0.6
C.49	0.55	1.8	1.7	1.8	1	1.1
C.69	0.75	2.6	2.6	2.9	1.6	1.7
C.89	1.2	4.2	4.8	5	2.8	2.9

Table 10- 12 Oil quantities [l] for CZ, CAF., CAZ., CAD., sizes 29 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
C.29	0.15	0.5	0.55	0.5	0.35	0.35
C.39	0.3	1.1	0.95	1	0.6	0.6
C.49	0.6	1.9	1.8	1.9	1.1	1.1
C.69	0.8	2.6	2.6	3	1.6	1.6
C.89	1.4	4.4	5	5.4	3	3

Table 10- 13 Oil quantities [l] for CF, sizes 29 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
CF29	0.15	0.5	0.55	0.5	0.35	0.35
CF39	0.3	1.2	1	1.1	0.65	0.65
CF49	0.6	2	1.9	2	1.2	1.2
CF69	0.8	2.6	2.6	3	1.6	1.6
CF89	1.4	4.4	5	5.4	3	3

10.6.5 Tandem gearbox - intermediate helical gearbox

10.6.5.1 Two- and three-stage helical gearboxes

Table 10- 14 Oil quantities [l] for D/Z, DB/ZB, DF/ZF, DZ/ZZ, sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
Z.29-Z19	0.2 + 0.15	0.7 + 0.5	0.45 + 0.15	0.6 + 0.5	0.55 + 0.15	0.3 + 0.15
Z.29-D19	0.2 + 0.15	0.7 + 0.45	0.45 + 0.15	0.6 + 0.45	0.55 + 0.15	0.3 + 0.15
D.29-D19	0.15 + 0.15	0.65 + 0.45	0.45 + 0.15	0.65 + 0.45	0.55 + 0.15	0.4 + 0.15
Z.39-Z19	0.3 + 0.15	0.95 + 0.5	0.85 + 0.15	0.95 + 0.5	0.9 + 0.15	0.25 + 0.15
Z.39-D19	0.3 + 0.15	0.95 + 0.45	0.85 + 0.15	0.95 + 0.45	0.9 + 0.15	0.25 + 0.15
D.39-D19	0.25 + 0.15	0.9 + 0.45	0.8 + 0.15	0.95 + 0.45	0.8 + 0.15	0.7 + 0.15
Z.49-Z19	0.55 + 0.15	1.9 + 0.5	1.9 + 0.15	2.3 + 0.5	1.8 + 0.15	0.65 + 0.15
Z.49-D19	0.55 + 0.15	1.9 + 0.45	1.9 + 0.15	2.3 + 0.45	1.8 + 0.15	0.65 + 0.15
D.49-Z19	0.55 + 0.15	1.8 + 0.5	1.8 + 0.15	2.1 + 0.5	1.7 + 0.15	1.2 + 0.15
D.49-D19	0.55 + 0.15	1.8 + 0.45	1.8 + 0.15	2.1 + 0.45	1.7 + 0.15	1.2 + 0.15
Z.59-Z19	0.65 + 0.15	2 + 0.5	1.9 + 0.15	2.3 + 0.5	1.9 + 0.15	0.6 + 0.15
Z.59-D19	0.65 + 0.15	2 + 0.45	1.9 + 0.15	2.3 + 0.45	1.9 + 0.15	0.6 + 0.15
D.59-Z19	0.45 + 0.15	1.9 + 0.5	1.9 + 0.15	2.1 + 0.5	1.8 + 0.15	1.2 + 0.15
D.59-D19	0.45 + 0.15	1.9 + 0.45	1.9 + 0.15	2.1 + 0.45	1.8 + 0.15	1.2 + 0.15
Z.69-Z19	0.65 + 0.15	2.1 + 0.5	2.6 + 0.15	2.9 + 0.5	2.3 + 0.15	0.85 + 0.15
Z.69-D19	0.65 + 0.15	2.1 + 0.45	2.6 + 0.15	2.9 + 0.45	2.3 + 0.15	0.85 + 0.15
D.69-Z19	0.6 + 0.15	2 + 0.5	2.4 + 0.15	2.7 + 0.5	2.2 + 0.15	1.5 + 0.15
D.69-D19	0.6 + 0.15	2 + 0.45	2.4 + 0.15	2.7 + 0.45	2.2 + 0.15	1.5 + 0.15
Z.79-Z39	1.1 + 0.3	3.8 + 0.95	3.9 + 0.3	4.5 + 1	3.7 + 0.3	1.4 + 0.3
Z.79-D39	1.1 + 0.25	3.8 + 0.9	3.9 + 0.25	4.5 + 0.9	3.7 + 0.25	1.4 + 0.25
D.79-D39	1 + 0.25	3.5 + 0.9	3.7 + 0.25	4.2 + 0.9	3.4 + 0.25	2.3 + 0.25
Z.89-Z39	2.2 + 0.3	6.9 + 0.95	6.7 + 0.3	7.7 + 1	6.6 + 0.3	2.4 + 0.3
Z.89-D39	2.2 + 0.25	6.9 + 0.9	6.7 + 0.25	7.7 + 0.9	6.6 + 0.25	2.4 + 0.25
D.89-Z39	2 + 0.3	6.5 + 0.95	6.2 + 0.3	7.2 + 1	6 + 0.3	4.2 + 0.3
D.89-D39	2 + 0.25	6.5 + 0.9	6.2 + 0.25	7.2 + 0.9	6 + 0.25	4.2 + 0.25
D.109-Z39	2.9 + 0.3	11.3 + 0.95	11.3 + 0.3	12.1 + 1	9.8 + 0.3	7.3 + 0.3
D.109-D39	2.9 + 0.25	11.3 + 0.9	11.3 + 0.25	12.1 + 0.9	9.8 + 0.25	7.3 + 0.25
D.129-Z49	5.6 + 0.55	17.9 + 1.9	18.5 + 0.55	22.5 + 2.1	16.9 + 0.55	12.1 + 0.55
D.129-D49	5.6 + 0.55	17.9 + 1.8	18.5 + 0.55	22.5 + 1.9	16.9 + 0.55	12.1 + 0.55
D.149-Z49	9.1 + 0.55	30.5 + 1.9	28.5 + 0.55	34 + 2.1	26 + 0.55	20.5 + 0.55
D.149-D49	9.1 + 0.55	30.5 + 1.8	28.5 + 0.55	34 + 1.9	26 + 0.55	20.5 + 0.55
D.169-Z69	12.9 + 0.65	45 + 2.1	45 + 0.65	54 + 2.95	40.5 + 0.65	33 + 0.65
D.169-D69	12.9 + 0.6	45 + 2	45 + 0.6	54 + 2.65	40.5 + 0.6	33 + 0.6
D.189-Z69	17.9 + 0.65	65 + 2.1	77 + 0.65	87 + 2.95	59 + 0.65	59 + 0.65
D.189-D69	17.9 + 0.6	65 + 2	77 + 0.6	87 + 2.65	59 + 0.6	59 + 0.6

10.6.5.2 Parallel shaft gearboxes

Table 10- 15 Oil quantities [l] for FD/Z, FD/ZZ, FD/ZA., FD/ZAF., FD/ZAZ., FD/ZAD., sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FZ.29-Z19	0.6 + 0.15	0.9 + 0.5	0.4 + 0.15	0.85 + 0.5	0.5 + 0.15	0.45 + 0.15
FZ.29-D19	0.6 + 0.15	0.9 + 0.45	0.4 + 0.15	0.85 + 0.45	0.5 + 0.15	0.45 + 0.15
FD.29-D19	0.6 + 0.15	0.8 + 0.45	0.35 + 0.15	0.75 + 0.45	0.45 + 0.15	0.45 + 0.15
FZ.39-Z19	0.95 + 0.15	1.3 + 0.5	0.8 + 0.15	1.6 + 0.5	0.9 + 0.15	0.85 + 0.15
FZ.39-D19	0.95 + 0.15	1.3 + 0.45	0.8 + 0.15	1.6 + 0.45	0.9 + 0.15	0.85 + 0.15
FD.39-D19	0.95 + 0.15	1.1 + 0.45	0.7 + 0.15	1.4 + 0.45	0.8 + 0.15	0.8 + 0.15
FZ.49-Z19	1.6 + 0.15	2.5 + 0.5	1.6 + 0.15	3 + 0.5	1.6 + 0.15	1.6 + 0.15
FZ.49-D19	1.6 + 0.15	2.5 + 0.45	1.6 + 0.15	3 + 0.45	1.6 + 0.15	1.6 + 0.15
FD.49-Z19	2.1 + 0.15	2.3 + 0.5	1.5 + 0.15	2.8 + 0.5	1.5 + 0.15	1.5 + 0.15
FD.49-D19	2.1 + 0.15	2.3 + 0.45	1.5 + 0.15	2.8 + 0.45	1.5 + 0.15	1.5 + 0.15
FZ.69-Z19	2.2 + 0.15	2.8 + 0.5	1.6 + 0.15	3.4 + 0.5	1.9 + 0.15	1.9 + 0.15
FZ.69-D19	2.2 + 0.15	2.8 + 0.45	1.6 + 0.15	3.4 + 0.45	1.9 + 0.15	1.9 + 0.15
FD.69-Z19	2.2 + 0.15	2.7 + 0.5	1.6 + 0.15	3.2 + 0.5	1.8 + 0.15	1.8 + 0.15
FD.69-D19	2.2 + 0.15	2.7 + 0.45	1.6 + 0.15	3.2 + 0.45	1.8 + 0.15	1.8 + 0.15
FZ.79-Z39	2.8 + 0.3	4.1 + 0.95	2.9 + 0.3	4.9 + 1	2.7 + 0.3	2.9 + 0.3
FZ.79-D39	2.8 + 0.25	4.1 + 0.9	2.9 + 0.25	4.9 + 0.9	2.7 + 0.25	2.9 + 0.25
FD.79-D39	3 + 0.25	3.8 + 0.9	2.7 + 0.25	4.6 + 0.9	2.6 + 0.25	2.7 + 0.25
FZ.89-Z39	4.9 + 0.3	7.7 + 0.95	5.9 + 0.3	9.6 + 1	5.2 + 0.3	5.5 + 0.3
FZ.89-D39	4.9 + 0.25	7.7 + 0.9	5.9 + 0.25	9.6 + 0.9	5.2 + 0.25	5.5 + 0.25
FD.89-Z39	5.6 + 0.3	7.6 + 0.95	5.9 + 0.3	9 + 1	5.1 + 0.3	5.2 + 0.3
FD.89-D39	5.6 + 0.25	7.6 + 0.9	5.9 + 0.25	9 + 0.9	5.1 + 0.25	5.2 + 0.25
FD.109-Z39	9.5 + 0.3	13 + 0.95	9.2 + 0.3	14.8 + 1	8.5 + 0.3	8.5 + 0.3
FD.109-D39	9.5 + 0.25	13 + 0.9	9.2 + 0.25	14.8 + 0.9	8.5 + 0.25	8.5 + 0.25
FD.129-Z49	16.1 + 0.55	20 + 1.9	16.3 + 0.55	28 + 2.1	14.9 + 0.55	15 + 0.55
FD.129-D49	16.1 + 0.55	20 + 1.8	16.3 + 0.55	28 + 1.9	14.9 + 0.55	15 + 0.55
FD.149-Z49	24.5 + 0.55	32.5 + 1.9	23 + 0.55	41 + 2.1	21.5 + 0.55	22 + 0.55
FD.149-D49	24.5 + 0.55	32.5 + 1.8	23 + 0.55	41 + 1.9	21.5 + 0.55	22 + 0.55
FD.169-Z69	39 + 0.65	50 + 2.1	37 + 0.65	66 + 2.95	34.5 + 0.65	35.5 + 0.65
FD.169-D69	39 + 0.6	50 + 2	37 + 0.6	66 + 2.65	34.5 + 0.6	35.5 + 0.6
FD.189-Z69	64 + 0.65	74 + 2.1	48 + 0.65	93 + 2.95	51.5 + 0.65	52 + 0.65
FD.189-D69	64 + 0.6	74 + 2	48 + 0.6	93 + 2.65	51.5 + 0.6	52 + 0.6

10.6 Oil quantities

Table 10- 16 Oil quantities [l] for FD/ZF, sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FZF29-Z19	0.6 + 0.15	0.9 + 0.5	0.4 + 0.15	0.85 + 0.5	0.5 + 0.15	0.45 + 0.15
FZF29-D19	0.6 + 0.15	0.9 + 0.45	0.4 + 0.15	0.85 + 0.45	0.5 + 0.15	0.45 + 0.15
FDF29-D19	0.6 + 0.15	0.8 + 0.45	0.35 + 0.15	0.75 + 0.45	0.45 + 0.15	0.45 + 0.15
FZF39-Z19	1 + 0.15	1.4 + 0.5	0.85 + 0.15	1.8 + 0.5	0.95 + 0.15	0.9 + 0.15
FZF39-D19	1 + 0.15	1.4 + 0.45	0.85 + 0.15	1.8 + 0.45	0.95 + 0.15	0.9 + 0.15
FDF39-D19	1 + 0.15	1.2 + 0.45	0.75 + 0.15	1.5 + 0.45	0.8 + 0.15	0.85 + 0.15
FZF49-Z19	1.8 + 0.15	2.4 + 0.5	1.5 + 0.15	3.2 + 0.5	1.6 + 0.15	1.6 + 0.15
FZF49-D19	1.8 + 0.15	2.4 + 0.45	1.5 + 0.15	3.2 + 0.45	1.6 + 0.15	1.6 + 0.15
FDF49-Z19	2.2 + 0.15	2.3 + 0.5	1.5 + 0.15	3 + 0.5	1.6 + 0.15	1.5 + 0.15
FDF49-D19	2.2 + 0.15	2.3 + 0.45	1.5 + 0.15	3 + 0.45	1.6 + 0.15	1.5 + 0.15
FZF69-Z19	2.4 + 0.15	2.9 + 0.5	1.6 + 0.15	3.6 + 0.5	2 + 0.15	2 + 0.15
FZF69-D19	2.4 + 0.15	2.9 + 0.45	1.6 + 0.15	3.6 + 0.45	2 + 0.15	2 + 0.15
FDF69-Z19	2.4 + 0.15	2.8 + 0.5	1.6 + 0.15	3.4 + 0.5	1.9 + 0.15	1.9 + 0.15
FDF69-D19	2.4 + 0.15	2.8 + 0.45	1.6 + 0.15	3.4 + 0.45	1.9 + 0.15	1.9 + 0.15
FZF79-Z39	2.9 + 0.3	4.2 + 0.95	2.9 + 0.3	5 + 1	2.9 + 0.3	2.8 + 0.3
FZF79-D39	2.9 + 0.25	4.2 + 0.9	2.9 + 0.25	5 + 0.9	2.9 + 0.25	2.8 + 0.25
FDF79-D39	3.1 + 0.25	3.9 + 0.9	2.7 + 0.25	4.7 + 0.9	2.7 + 0.25	2.6 + 0.25
FZF89-Z39	5.1 + 0.3	7.7 + 0.95	5.8 + 0.3	9.8 + 1	5.3 + 0.3	5.4 + 0.3
FZF89-D39	5.1 + 0.25	7.7 + 0.9	5.8 + 0.25	9.8 + 0.9	5.3 + 0.25	5.4 + 0.25
FDF89-Z39	5.8 + 0.3	7.6 + 0.95	5.8 + 0.3	9.2 + 1	5.2 + 0.3	5.2 + 0.3
FDF89-D39	5.8 + 0.25	7.6 + 0.9	5.8 + 0.25	9.2 + 0.9	5.2 + 0.25	5.2 + 0.25
FDF109-Z39	9.7 + 0.3	13 + 0.95	9.2 + 0.3	15 + 1	8.6 + 0.3	8.6 + 0.3
FDF109-D39	9.7 + 0.25	13 + 0.9	9.2 + 0.25	15 + 0.9	8.6 + 0.25	8.6 + 0.25
FDF129-Z49	16.4 + 0.55	20 + 1.9	16.3 + 0.55	28.5 + 2.1	15.1 + 0.55	15.2 + 0.55
FDF129-D49	16.4 + 0.55	20 + 1.8	16.3 + 0.55	28.5 + 1.9	15.1 + 0.55	15.2 + 0.55
FDF149-Z49	25 + 0.55	32.5 + 1.9	23 + 0.55	41.5 + 2.1	22 + 0.55	22.5 + 0.55
FDF149-D49	25 + 0.55	32.5 + 1.8	23 + 0.55	41.5 + 1.9	22 + 0.55	22.5 + 0.55
FDF169-Z69	40.5 + 0.65	50 + 2.1	37 + 0.65	68 + 2.95	35.5 + 0.65	36.5 + 0.65
FDF169-D69	40.5 + 0.6	50 + 2	37 + 0.6	68 + 2.65	35.5 + 0.6	36.5 + 0.6
FDF189-Z69	66 + 0.65	74 + 2.1	48 + 0.65	95 + 2.95	53 + 0.65	53 + 0.65
FDF189-D69	66 + 0.6	74 + 2	48 + 0.6	95 + 2.65	53 + 0.6	53 + 0.6

10.6.5.3 Bevel gearbox

Table 10- 17 Oil quantities [l] for K, KA, KAS, KAT, sizes 39 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
K.39-Z19	0.35 + 0.15	0.85 + 0.5	1.1 + 0.15	1.3 + 0.5	0.85 + 0.15	0.9 + 0.15
K.49-Z19	0.55 + 0.15	1.4 + 0.5	1.8 + 0.15	2.2 + 0.5	1.5 + 0.15	1.6 + 0.15
K.69-Z19	0.75 + 0.15	2 + 0.5	2.5 + 0.15	3 + 0.5	2.2 + 0.15	2.2 + 0.15
K.79-Z39	1 + 0.3	2.2 + 0.95	2.9 + 0.3	3.7 + 1	2.7 + 0.3	2.5 + 0.3
K.89-Z39	1.9 + 0.3	4.5 + 0.95	6 + 0.3	7.3 + 1	5 + 0.3	5.3 + 0.3
K.109-Z39	3 + 0.3	7.2 + 0.95	9.2 + 0.3	11.6 + 1	7.1 + 0.3	7.5 + 0.3
K.129-Z49	6.2 + 0.55	13.4 + 1.9	16.6 + 0.55	21.5 + 2.1	13.2 + 0.55	13.6 + 0.55
K.149-Z49	9.3 + 0.55	21 + 1.9	28 + 0.55	36 + 2.1	21.5 + 0.55	22.5 + 0.55
K.169-Z69	17 + 0.65	31 + 2.1	47 + 0.65	63 + 2.95	35.5 + 0.65	38.5 + 0.65
K.189-Z69	24.5 + 0.65	53 + 2.1	73 + 0.65	94 + 2.95	53.5 + 0.65	59 + 0.65
K.39-D19	0.35 + 0.15	0.85 + 0.45	1.1 + 0.15	1.3 + 0.45	0.85 + 0.15	0.9 + 0.15
K.49-D19	0.55 + 0.15	1.4 + 0.45	1.8 + 0.15	2.2 + 0.45	1.5 + 0.15	1.6 + 0.15
K.69-D19	0.75 + 0.15	2 + 0.45	2.5 + 0.15	3 + 0.45	2.2 + 0.15	2.2 + 0.15
K.79-D39	1 + 0.25	2.2 + 0.9	2.9 + 0.25	3.7 + 0.9	2.7 + 0.25	2.5 + 0.25
K.89-D39	1.9 + 0.25	4.5 + 0.9	6 + 0.25	7.3 + 0.9	5 + 0.25	5.3 + 0.25
K.109-D39	3 + 0.25	7.2 + 0.9	9.2 + 0.25	11.6 + 0.9	7.1 + 0.25	7.5 + 0.25
K.129-D49	6.2 + 0.55	13.4 + 1.8	16.6 + 0.55	21.5 + 1.9	13.2 + 0.55	13.6 + 0.55
K.149-D49	9.3 + 0.55	21 + 1.8	28 + 0.55	36 + 1.9	21.5 + 0.55	22.5 + 0.55
K.169-D69	17 + 0.6	31 + 2	47 + 0.6	63 + 2.65	35.5 + 0.6	38.5 + 0.6
K.189-D69	24.5 + 0.6	53 + 2	73 + 0.6	94 + 2.65	53.5 + 0.6	59 + 0.6

Table 10- 18 Oil quantities [l] for KZ, KAF., KAZ., KAD., sizes 39 - 189

Type	Type of construction					
	M1	M2	M3	M4	M5	M6
K.39-Z19	0.4 + 0.15	0.9 + 0.5	1.2 + 0.15	1.4 + 0.5	0.95 + 0.15	0.95 + 0.15
K.49-Z19	0.65 + 0.15	1.5 + 0.5	1.9 + 0.15	2.4 + 0.5	1.6 + 0.15	1.6 + 0.15
K.69-Z19	0.85 + 0.15	2.1 + 0.5	2.8 + 0.15	3.4 + 0.5	2.4 + 0.15	2.5 + 0.15
K.79-Z39	1.1 + 0.3	2.4 + 0.95	3.1 + 0.3	4 + 1	2.5 + 0.3	2.7 + 0.3
K.89-Z39	2.2 + 0.3	4.7 + 0.95	6.2 + 0.3	7.8 + 1	5.3 + 0.3	5.6 + 0.3
K.109-Z39	3.7 + 0.3	7.4 + 0.95	9.6 + 0.3	12.8 + 1	7.6 + 0.3	8.2 + 0.3
K.129-Z49	6.5 + 0.55	13.5 + 1.9	17.5 + 0.55	23 + 2.1	13.8 + 0.55	14.2 + 0.55
K.149-Z49	9.6 + 0.55	21.5 + 1.9	29 + 0.55	37.5 + 2.1	22.5 + 0.55	23.5 + 0.55
K.169-Z69	17 + 0.65	31 + 2.1	47 + 0.65	63 + 2.95	35.5 + 0.65	38.5 + 0.65
K.189-Z69	24.5 + 0.65	53 + 2.1	73 + 0.65	94 + 2.95	53.5 + 0.65	59 + 0.65

10.6 Oil quantities

Type	Type of construction					
	M1	M2	M3	M4	M5	M6
K.39-D19	0.4 + 0.15	0.9 + 0.45	1.2 + 0.15	1.4 + 0.45	0.95 + 0.15	0.95 + 0.15
K.49-D19	0.65 + 0.15	1.5 + 0.45	1.9 + 0.15	2.4 + 0.45	1.6 + 0.15	1.6 + 0.15
K.69-D19	0.85 + 0.15	2.1 + 0.45	2.8 + 0.15	3.4 + 0.45	2.4 + 0.15	2.5 + 0.15
K.79-D39	1.1 + 0.25	2.4 + 0.9	3.1 + 0.25	4 + 0.9	2.5 + 0.25	2.7 + 0.25
K.89-D39	2.2 + 0.25	4.7 + 0.9	6.2 + 0.25	7.8 + 0.9	5.3 + 0.25	5.6 + 0.25
K.109-D39	3.7 + 0.25	7.4 + 0.9	9.6 + 0.25	12.8 + 0.9	7.6 + 0.25	8.2 + 0.25
K.129-D49	6.5 + 0.55	13.5 + 1.8	17.5 + 0.55	23 + 1.9	13.8 + 0.55	14.2 + 0.55
K.149-D49	9.6 + 0.55	21.5 + 1.8	29 + 0.55	37.5 + 1.9	22.5 + 0.55	23.5 + 0.55
K.169-D69	17 + 0.6	31 + 2	47 + 0.6	63 + 2.65	35.5 + 0.6	38.5 + 0.6
K.189-D69	24.5 + 0.6	53 + 2	73 + 0.6	94 + 2.65	53.5 + 0.6	59 + 0.6

Table 10- 19 Oil quantities [l] for KF, sizes 39 - 189

Type	Type of construction					
	M1	M2	M3	M4	M5	M6
KF39-Z19	0.35 + 0.15	0.9 + 0.5	1.2 + 0.15	1.5 + 0.5	0.95 + 0.15	1 + 0.15
KF49-Z19	0.6 + 0.15	1.4 + 0.5	2 + 0.15	2.4 + 0.5	1.6 + 0.15	1.7 + 0.15
KF69-Z19	0.85 + 0.15	2 + 0.5	2.8 + 0.15	3.4 + 0.5	2.4 + 0.15	2.4 + 0.15
KF79-Z39	1.2 + 0.3	2.3 + 0.95	3.1 + 0.3	4.1 + 1	3 + 0.3	2.5 + 0.3
KF89-Z39	2.1 + 0.3	4.6 + 0.95	6.5 + 0.3	8 + 1	5.6 + 0.3	5.5 + 0.3
KF109-Z39	3.6 + 0.3	7.4 + 0.95	9.8 + 0.3	12.8 + 1	8.1 + 0.3	7.8 + 0.3
KF129-Z49	6.7 + 0.55	13.9 + 1.9	18.1 + 0.55	24 + 2.1	14.4 + 0.55	14.8 + 0.55
KF149-Z49	9.7 + 0.55	22 + 1.9	30.5 + 0.55	39 + 2.1	23 + 0.55	24 + 0.55
KF169-Z69	16.9 + 0.65	30.5 + 2.1	48.5 + 0.65	64 + 2.95	36.5 + 0.65	39 + 0.65
KF189-Z69	24.5 + 0.65	54 + 2.1	76 + 0.65	98 + 2.95	56 + 0.65	60 + 0.65
KF39-Z19	0.35 + 0.15	0.9 + 0.45	1.2 + 0.15	1.5 + 0.45	0.95 + 0.15	1 + 0.15
KF49-Z19	0.6 + 0.15	1.4 + 0.45	2 + 0.15	2.4 + 0.45	1.6 + 0.15	1.7 + 0.15
KF69-Z19	0.85 + 0.15	2 + 0.45	2.8 + 0.15	3.4 + 0.45	2.4 + 0.15	2.4 + 0.15
KF79-Z39	1.2 + 0.25	2.3 + 0.9	3.1 + 0.25	4.1 + 0.9	3 + 0.25	2.5 + 0.25
KF89-Z39	2.1 + 0.25	4.6 + 0.9	6.5 + 0.25	8 + 0.9	5.6 + 0.25	5.5 + 0.25
KF109-Z39	3.6 + 0.25	7.4 + 0.9	9.8 + 0.25	12.8 + 0.9	8.1 + 0.25	7.8 + 0.25
KF129-Z49	6.7 + 0.55	13.9 + 1.8	18.1 + 0.55	24 + 1.9	14.4 + 0.55	14.8 + 0.55
KF149-Z49	9.7 + 0.55	22 + 1.8	30.5 + 0.55	39 + 1.9	23 + 0.55	24 + 0.55
KF169-Z69	16.9 + 0.6	30.5 + 2	48.5 + 0.6	64 + 2.65	36.5 + 0.6	39 + 0.6
KF189-D69	24.5 + 0.6	54 + 2	76 + 0.6	98 + 2.65	56 + 0.6	60 + 0.6

10.6.5.4 Helical worm gearboxes

Table 10- 20 Oil quantities [l] for C, CA., CAS, CAT, sizes 39 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
C.39-Z19	0.3 + 0.15	1.1 + 0.5	0.95 + 0.15	1 + 0.5	0.55 + 0.15	0.6 + 0.15
C.49-Z19	0.55 + 0.15	1.8 + 0.5	1.7 + 0.15	1.8 + 0.5	1 + 0.15	1.1 + 0.15
C.69-Z19	0.75 + 0.15	2.6 + 0.5	2.6 + 0.15	2.9 + 0.5	1.6 + 0.15	1.7 + 0.15
C.89-Z39	1.2 + 0.3	4.2 + 0.95	4.8 + 0.3	5 + 1	2.8 + 0.3	2.9 + 0.3
C.39-D19	0.3 + 0.15	1.1 + 0.45	0.95 + 0.15	1 + 0.45	0.55 + 0.15	0.6 + 0.15
C.49-D19	0.55 + 0.15	1.8 + 0.45	1.7 + 0.15	1.8 + 0.45	1 + 0.15	1.1 + 0.15
C.69-D19	0.75 + 0.15	2.6 + 0.45	2.6 + 0.15	2.9 + 0.45	1.6 + 0.15	1.7 + 0.15
C.89-D39	1.2 + 0.25	4.2 + 0.9	4.8 + 0.25	5 + 0.9	2.8 + 0.25	2.9 + 0.25

Table 10- 21 Oil quantities [l] for CZ, CAF., CAZ., CAD., sizes 39 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
C.39-Z19	0.3 + 0.15	1.1 + 0.5	0.95 + 0.15	1 + 0.5	0.6 + 0.15	0.6 + 0.15
C.49-Z19	0.6 + 0.15	1.9 + 0.5	1.8 + 0.15	1.9 + 0.5	1.1 + 0.15	1.1 + 0.15
C.69-Z19	0.8 + 0.15	2.6 + 0.5	2.6 + 0.15	3 + 0.5	1.6 + 0.15	1.6 + 0.15
C.89-Z39	1.4 + 0.3	4.4 + 0.95	5 + 0.3	5.4 + 1	3 + 0.3	3 + 0.3
C.39-D19	0.3 + 0.15	1.1 + 0.45	0.95 + 0.15	1 + 0.45	0.6 + 0.15	0.6 + 0.15
C.49-D19	0.6 + 0.15	1.9 + 0.45	1.8 + 0.15	1.9 + 0.45	1.1 + 0.15	1.1 + 0.15
C.69-D19	0.8 + 0.15	2.6 + 0.45	2.6 + 0.15	3 + 0.45	1.6 + 0.15	1.6 + 0.15
C.89-D39	1.4 + 0.25	4.4 + 0.9	5 + 0.25	5.4 + 0.9	3 + 0.25	3 + 0.25

Table 10- 22 Oil quantities [l] for CF, sizes 39 - 89

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
CF39-Z19	0.3 + 0.15	1.2 + 0.5	1 + 0.15	1.1 + 0.5	0.65 + 0.15	0.65 + 0.15
CF49-Z19	0.6 + 0.15	2 + 0.5	1.9 + 0.15	2 + 0.5	1.2 + 0.15	1.2 + 0.15
CF69-Z19	0.8 + 0.15	2.6 + 0.5	2.6 + 0.15	3 + 0.5	1.6 + 0.15	1.6 + 0.15
CF89-Z39	1.4 + 0.3	4.4 + 0.95	5 + 0.3	5.4 + 1	3 + 0.3	3 + 0.3
CF39-D19	0.3 + 0.15	1.2 + 0.45	1 + 0.15	1.1 + 0.45	0.65 + 0.15	0.65 + 0.15
CF49-D19	0.6 + 0.15	2 + 0.45	1.9 + 0.15	2 + 0.45	1.2 + 0.15	1.2 + 0.15
CF69-D19	0.8 + 0.15	2.6 + 0.45	2.6 + 0.15	3 + 0.45	1.6 + 0.15	1.6 + 0.15
CF89-D39	1.4 + 0.25	4.4 + 0.9	5 + 0.25	5.4 + 0.9	3 + 0.25	3 + 0.25

Spare parts

11.1 Stocking of spare parts

By stocking the most important spare and wearing parts on site, you can ensure that the gearbox or geared motor is ready for use at any time.

<p>NOTICE</p> <p>Safety impairment caused by inferior products</p> <p>The installation and / or use of inferior products can have a negative impact on the design characteristics of the geared motor and might consequently impair the active and / or passive safety features of the machine.</p> <p>Siemens AG states explicitly that only spare parts and accessories supplied by Siemens have been tested and approved by Siemens.</p> <p>If you do not use original spare parts and original accessories, Siemens AG excludes every liability and warranty.</p> <p>Siemens AG accepts the warranty only for original spare parts.</p>

Note that special manufacturing and delivery specifications often apply to individual components. All spare parts offered by Siemens AG are state-of-the-art and conform to the latest legal regulations.

Please state the following data when ordering spare parts:

- Serial number shown on the rating plate ③
- Type designation shown on the rating plate ⑥
- Part number
 - 4-digit item number from the spare parts list
 - 6-digit object number
 - 7-digit article number
 - 14-digit material number
- Quantity

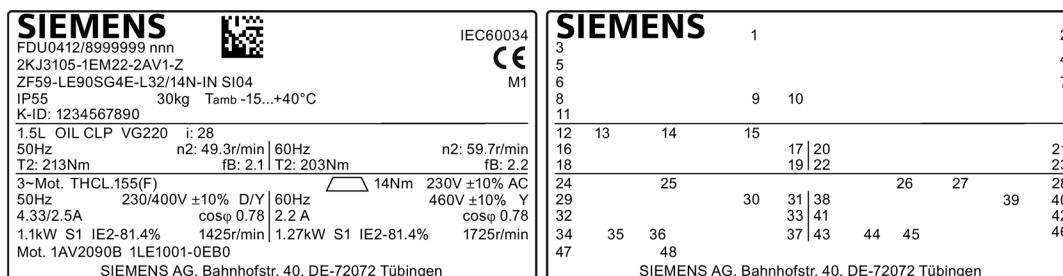
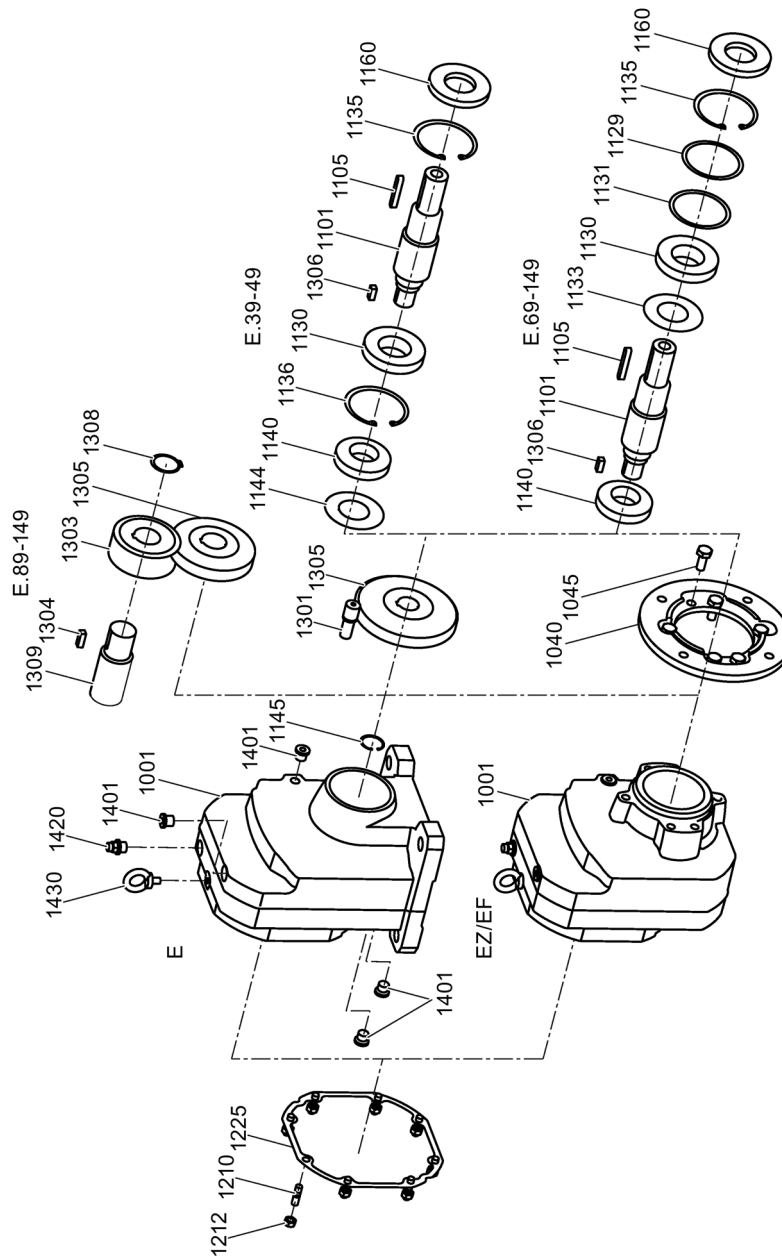


Figure 11-1 Example of a SIMOGEAR rating plate

For motors with their own rating plate, the spare parts documentation in the original operating instructions applies.

11.2 Lists of spare parts

11.2.1 Helical gearbox E, sizes 39 - 149



1001	Gearbox housing	1160	Shaft sealing ring
1040	Output flange	1210	Bolt
1045	Bolt	1212	Nut
1101	Output shaft	1225	Seal
1105	Parallel key	1301	Plug-in pinion
1129	Supporting disk	1303	Slip-on pinion
1130	Bearing	1304	Parallel key
1131	Shim	1305	Helical gear
1133	NILOS ring	1306	Parallel key
1135	Locking ring	1308	Locking ring
1136	Locking ring	1309	Seal
1140	Bearing	1401	Screw plug
1144	Supporting disk / shim	1420	Vent filter
1145	Locking ring	1430	Eyebolt

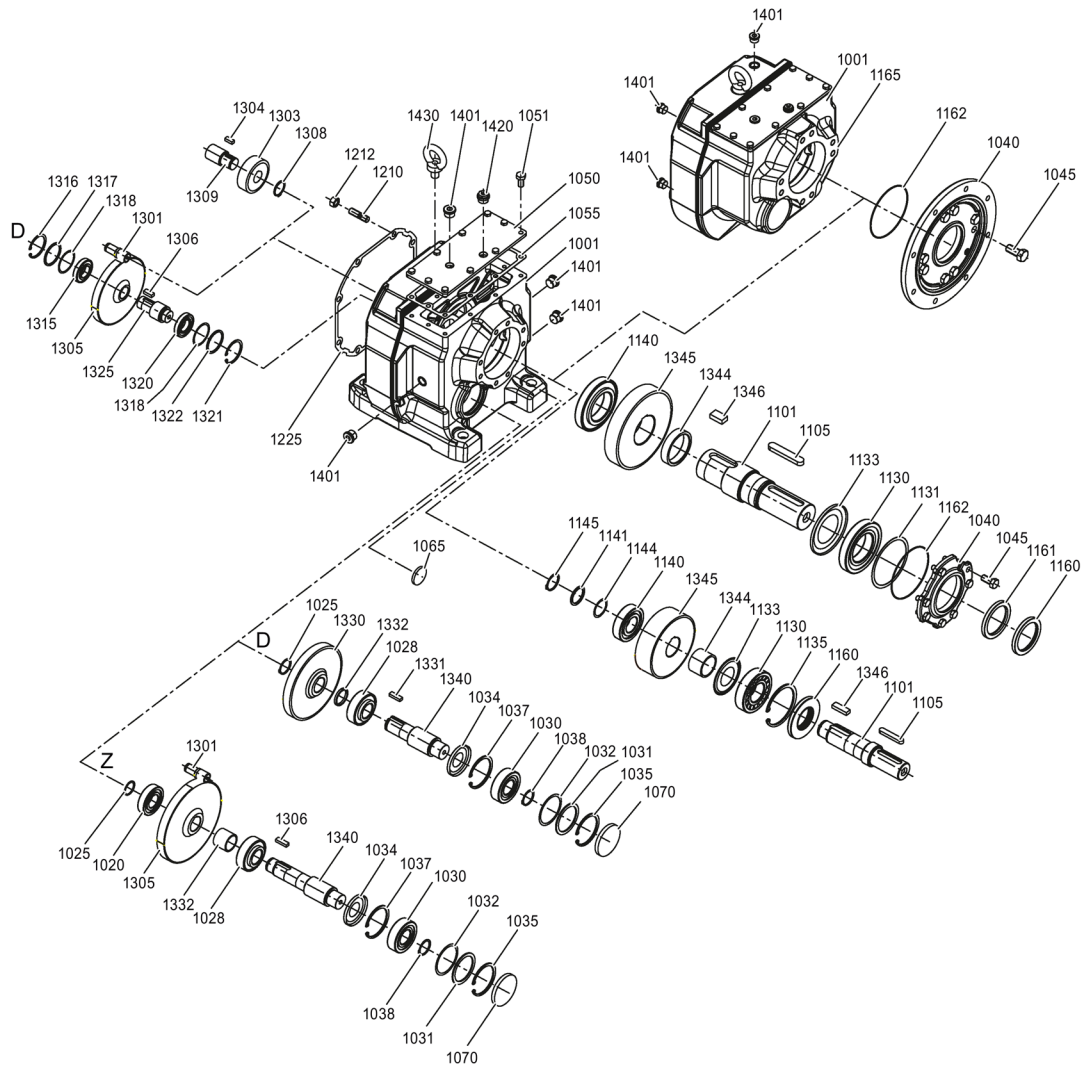
Figure 11-2 Helical gearbox E, sizes 39 - 149

11.2.2 Helical gearbox D / Z, sizes 19 - 189

Note

For gearbox sizes 19 and 29, we recommend that Siemens AG replaces the gearbox if service is required.

Parts subject to wear are available on request.



1001	Gearbox housing	1309	Seal
1020	Bearing	1315	Bearing
1025	Locking ring	1316	Locking ring
1028	Bearing	1317	Supporting disk
1030	Bearing	1318	Supporting disk
1031	Supporting disk	1320	Bearing
1032	Shim	1321	Locking ring
1034	NILOS ring	1322	Supporting disk
1035	Locking ring	1325	Pinion shaft
1037	Locking ring	1330	Helical
1038	Locking ring	1331	Parallel key
1040	Output flange	1332	Bush / locking ring
1045	Bolt	1340	Pinion shaft
1050	Housing cover	1344	Spacer / bush
1051	Bolt	1345	Helical
1055	Seal	1346	Parallel key
1065	Sealing cap	1401	Screw plug
1070	Sealing cap	1420	Vent filter
1101	Output shaft	1430	Eyebolt
1105	Parallel key		
1130	Bearing		
1131	Shim		
1133	NILOS ring		
1135	Locking ring		
1140	Bearing		
1141	Supporting disk / shim		
1144	Supporting disk / shim		
1145	Locking ring		
1160	Shaft sealing ring		
1161	Shaft sealing ring		
1162	O ring		
1165	Seal		
1210	Bolt		
1212	Nut		
1225	Seal		
1301	Plug-in pinion		
1303	Slip-on pinion		
1304	Parallel key		
1305	Helical		
1306	Parallel key		
1308	Locking ring		

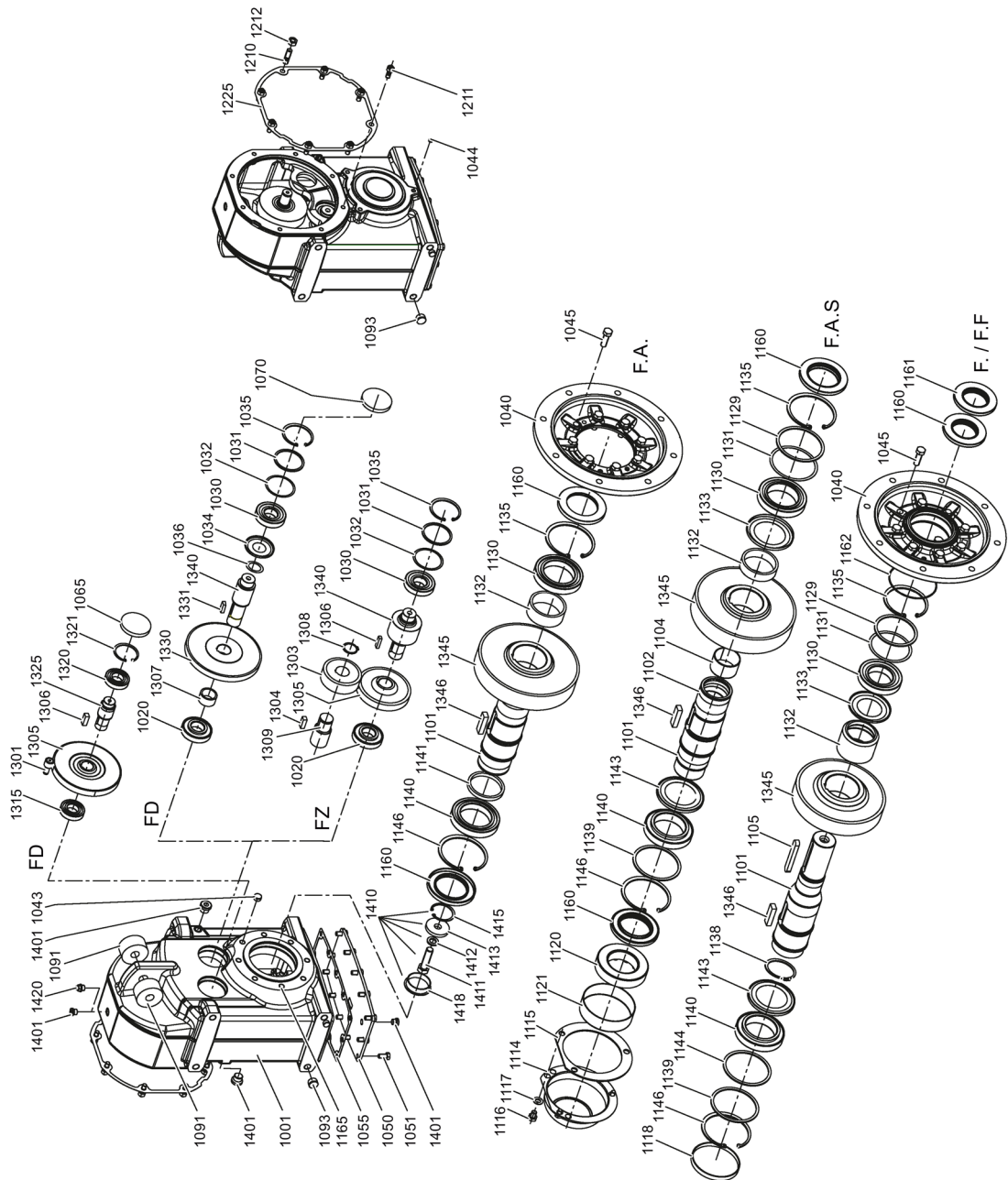
Figure 11-3 Helical gearbox D / Z, sizes 19 - 189

11.2.3 Parallel shaft gearbox F, sizes 29 - 189

Note

For gearbox size 29, we recommend that Siemens AG replaces the gearbox if service is required.

Parts subject to wear are available on request.



1001	Gearbox housing	1143	NILOS ring
1020	Bearing	1144	Supporting disk/shim
1030	Bearing	1146	Locking ring
1031	Supporting disk	1160	Shaft sealing ring
1032	Shim	1161	Shaft sealing ring
1034	NILOS ring	1162	O ring
1035	Locking ring	1165	Seal
1036	Shim	1210	Bolt
1040	Output flange	1211	Screw lock
1043	Plug	1212	Nut
1044	Plug	1225	Seal
1045	Bolt	1301	Plug-in pinion
1050	Housing cover	1303	Slip-on pinion
1051	Bolt	1304	Parallel key
1055	Seal	1305	Helical
1065	Sealing cap	1306	Parallel key
1070	Sealing cap	1307	Spacer / bush
1091	Rubber bush	1308	Locking ring
1093	Plug	1309	Seal
1101	Output shaft	1315	Bearing
1102	Bushing	1320	Bearing
1104	Seal	1321	Locking ring
1105	Parallel key	1325	Pinion shaft
1114	Cover NDE	1330	Helical
1115	Seal	1331	Parallel key
1116	Bolt	1340	Pinion shaft
1117	Screw retainer	1345	Helical
1118	Plug / sealing cap	1346	Parallel key
1120	Shrink disk	1401	Screw plug
1121	Protective cap	1410	Mounting accessories
1129	Supporting disk	1411	Bolt
1130	Bearing	1412	Locking ring
1131	Shim	1413	Disk
1132	Bushing	1415	Locking ring
1133	NILOS ring	1418	Sealing cap
1135	Locking ring	1420	Vent filter
1138	Locking ring		
1139	Supporting disk		
1140	Bearing		
1141	Supporting disk/shim		

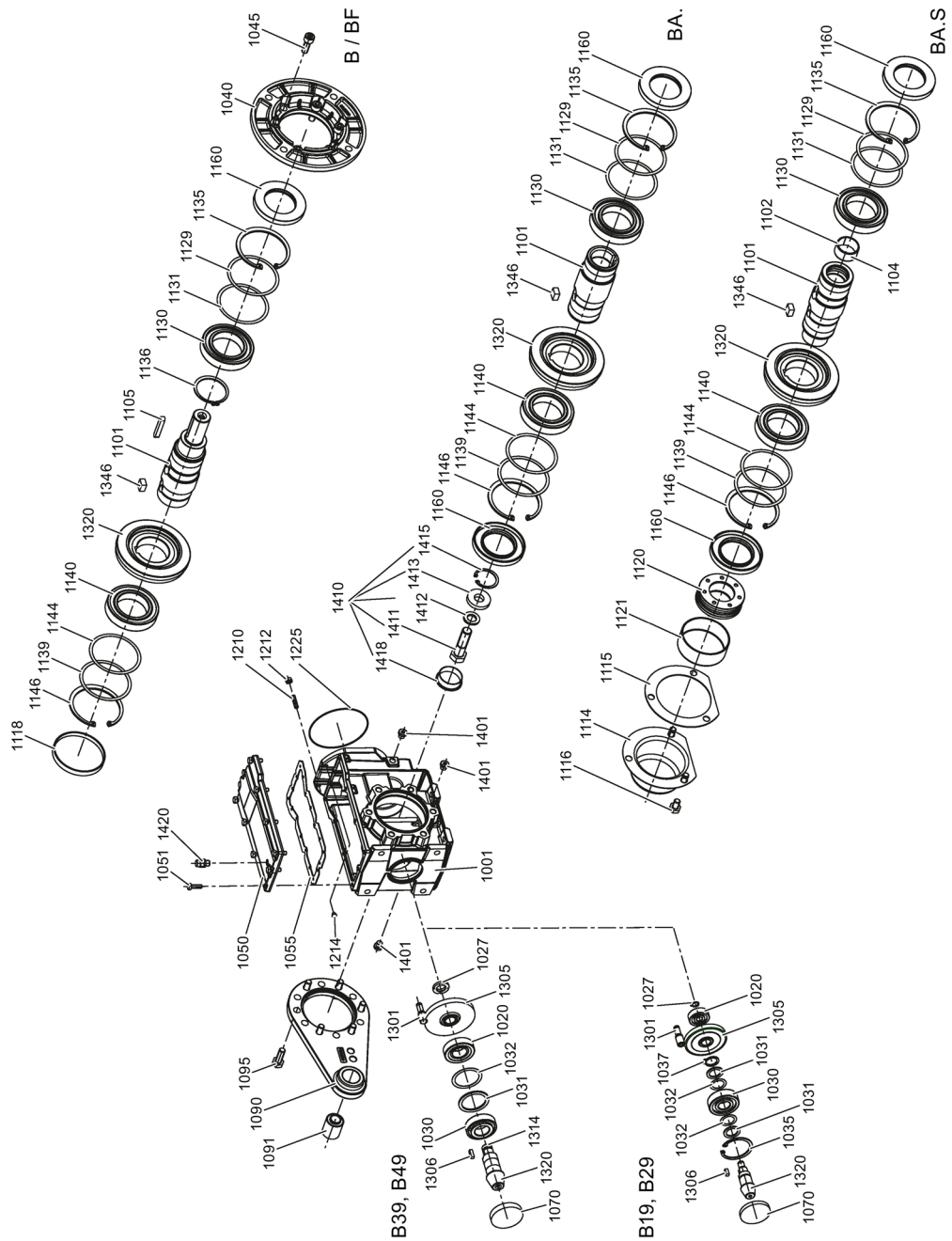
Figure 11-4 Parallel-shaft gearbox F, sizes 29-189

11.2.4 Bevel gearbox B, sizes 19 - 49

Note

For gearbox sizes 19 and 29, we recommend that Siemens AG replaces the gearbox if service is required.

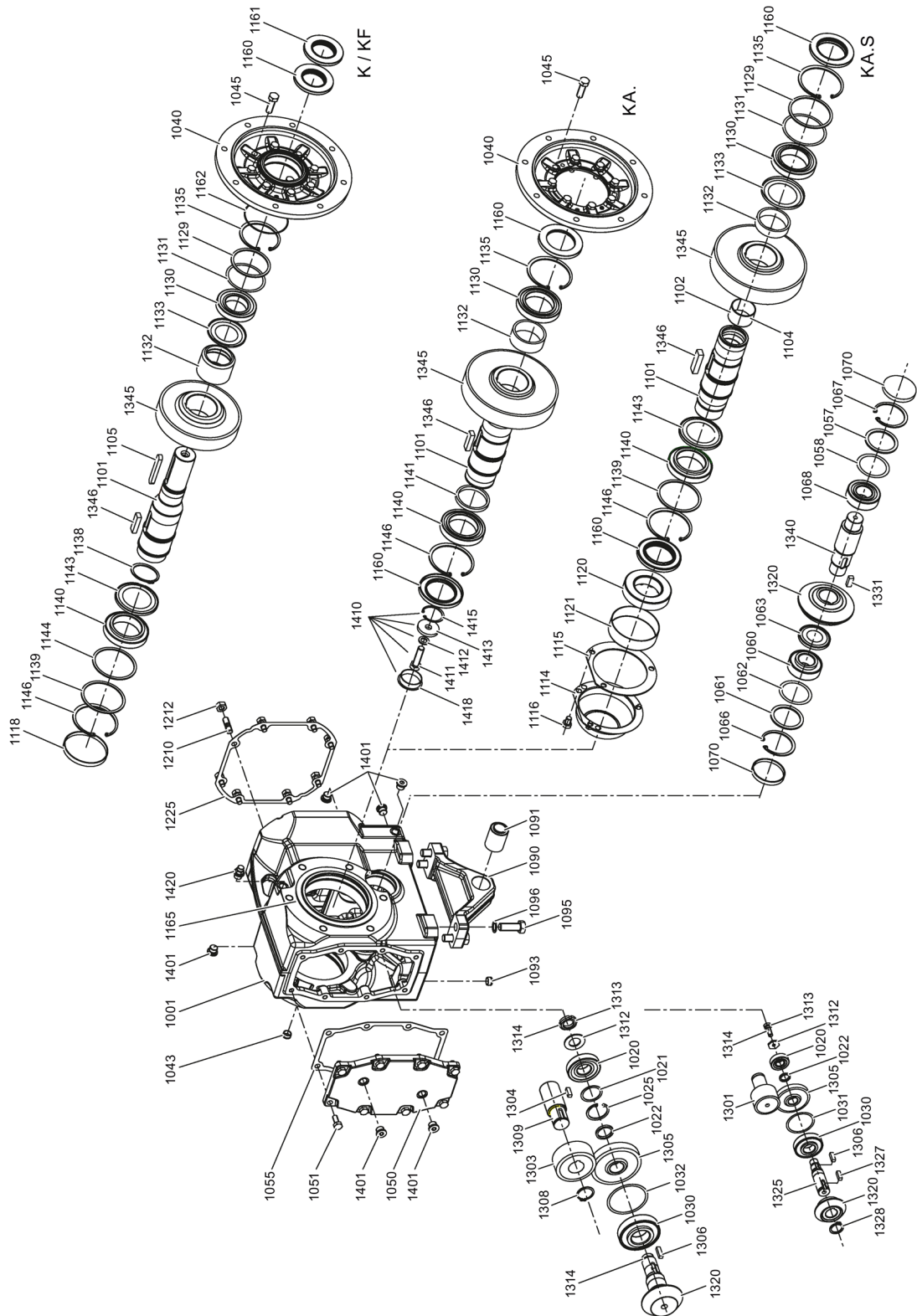
Parts subject to wear are available on request.



1001	Gearbox housing	1225	Seal
1020	Bearing	1301	Plug-in pinion
1027	Locking ring / nut	1305	Helical
1030	Bearing	1306	Parallel key
1031	Supporting disk	1314	Screw lock
1032	Shim	1320	Bevel gear pair
1035	Locking ring	1346	Parallel key
1037	Locking ring	1401	Screw plug
1040	Output flange	1410	Mounting accessories
1045	Bolt	1411	Bolt
1050	Housing cover	1412	Locking ring
1051	Bolt	1413	Disk
1055	Seal	1415	Locking ring
1070	Sealing cap	1418	Sealing cap
1090	Torque arm	1420	Vent filter
1091	Rubber bush		
1095	Bolt		
1101	Output shaft		
1102	Bushing		
1104	Seal		
1105	Parallel key		
1114	Cover NDE		
1115	Seal		
1116	Bolt		
1118	Plug / sealing cap		
1120	Shrink disk		
1121	Protective cap		
1129	Supporting disk		
1130	Bearing		
1131	Shim		
1135	Locking ring		
1136	Locking ring		
1139	Supporting disk		
1140	Bearing		
1144	Supporting disk / shim		
1146	Locking ring		
1160	Shaft sealing ring		
1210	Bolt		
1212	Nut		
1214	Plug		

Figure 11-5 Bevel gearbox B, sizes 19 - 49

11.2.5 Bevel gearbox K, sizes 39 - 189



1001	Gearbox housing	1133	NILOS ring
1020	Bearing	1135	Locking ring
1021	Supporting disk/shim	1138	Locking ring
1022	Supporting disk/shim	1139	Supporting disk
1025	Locking ring	1140	Bearing
1030	Bearing	1141	Supporting disk/shim
1031	Supporting disk	1143	NILOS ring
1032	Shim	1144	Supporting disk/shim
1040	Output flange	1146	Locking ring
1043	Plug	1160	Shaft sealing ring
1045	Bolt	1161	Shaft sealing ring
1050	Housing cover	1162	O ring
1051	Bolt	1165	Seal
1055	Seal	1210	Bolt
1057	Supporting disk	1212	Nut
1058	Shim	1225	Seal
1060	Tapered roller bearing	1301	Plug-in pinion
1061	Supporting disk	1303	Slip-on pinion
1062	Shim	1304	Parallel key
1063	NILOS ring	1305	Helical
1066	Locking ring	1306	Parallel key
1067	Locking ring	1308	Locking ring
1068	Tapered roller bearing	1309	Seal
1070	Sealing cap	1312	Disk
1090	Torque arm	1313	Bolt/nut
1091	Rubber bush	1314	Screw lock
1093	Plug	1320	Bevel gear pair
1095	Bolt	1325	Pinion shaft
1096	Screw lock	1327	Parallel key
1101	Output shaft	1328	Locking ring
1102	Bushing	1331	Parallel key
1104	Seal	1340	Pinion shaft
1105	Parallel key	1345	Helical
1114	Cover NDE	1346	Parallel key
1115	Seal	1401	Screw plug
1116	Bolt	1410	Mounting accessories
1118	Plug / sealing cap	1411	Bolt
1120	Shrink disk	1412	Locking ring
1121	Protective cap	1413	Disk
1129	Supporting disk	1415	Locking ring
1130	Bearing	1418	Sealing cap
1131	Shim	1420	Vent filter
1132	Supporting disk/shim		

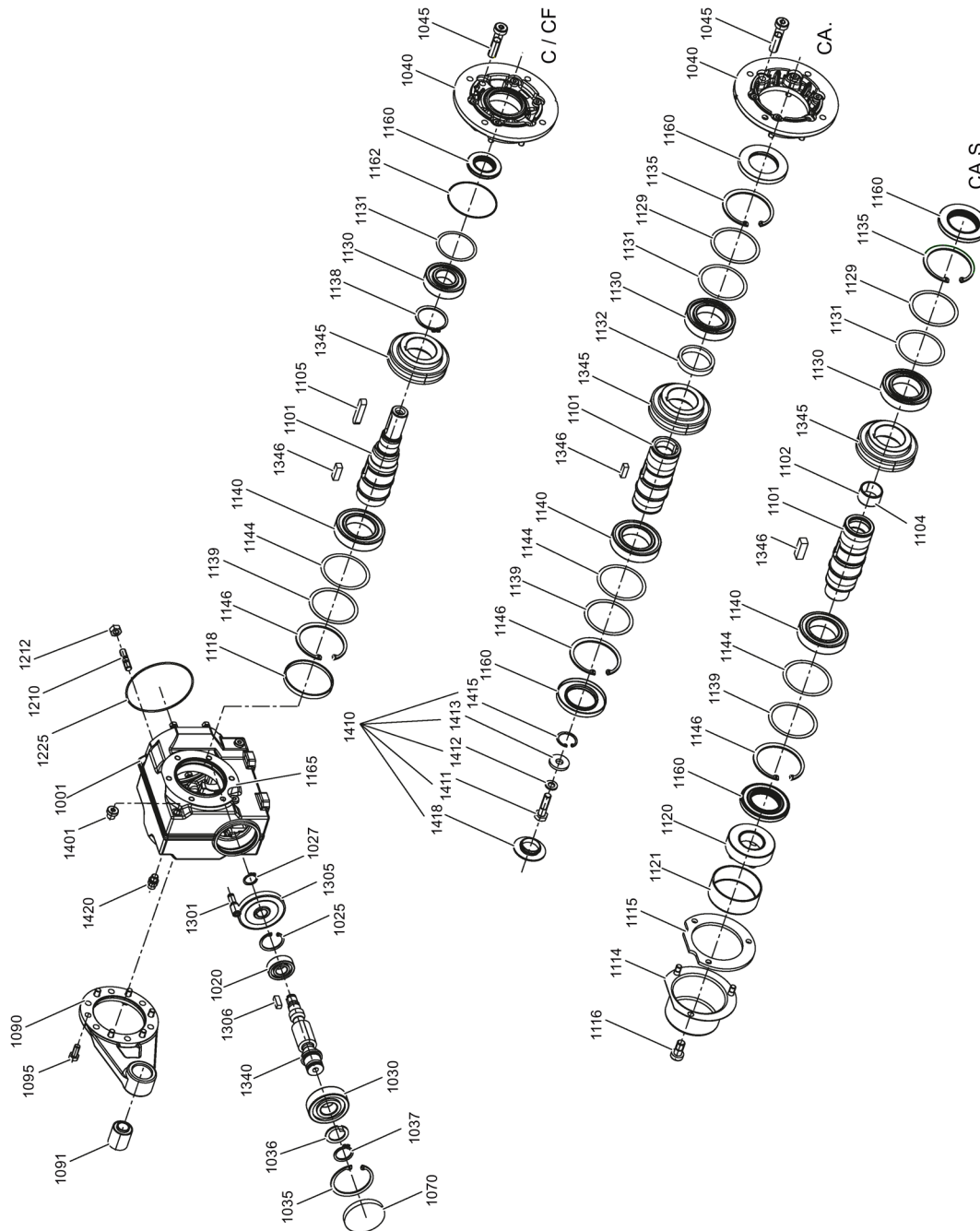
Figure 11-6 Bevel gearbox K, sizes 39 - 189

11.2.6 Helical worm gearbox C, sizes 29 - 89

Note

For gearbox size 29, we recommend that Siemens AG replaces the gearbox if service is required.

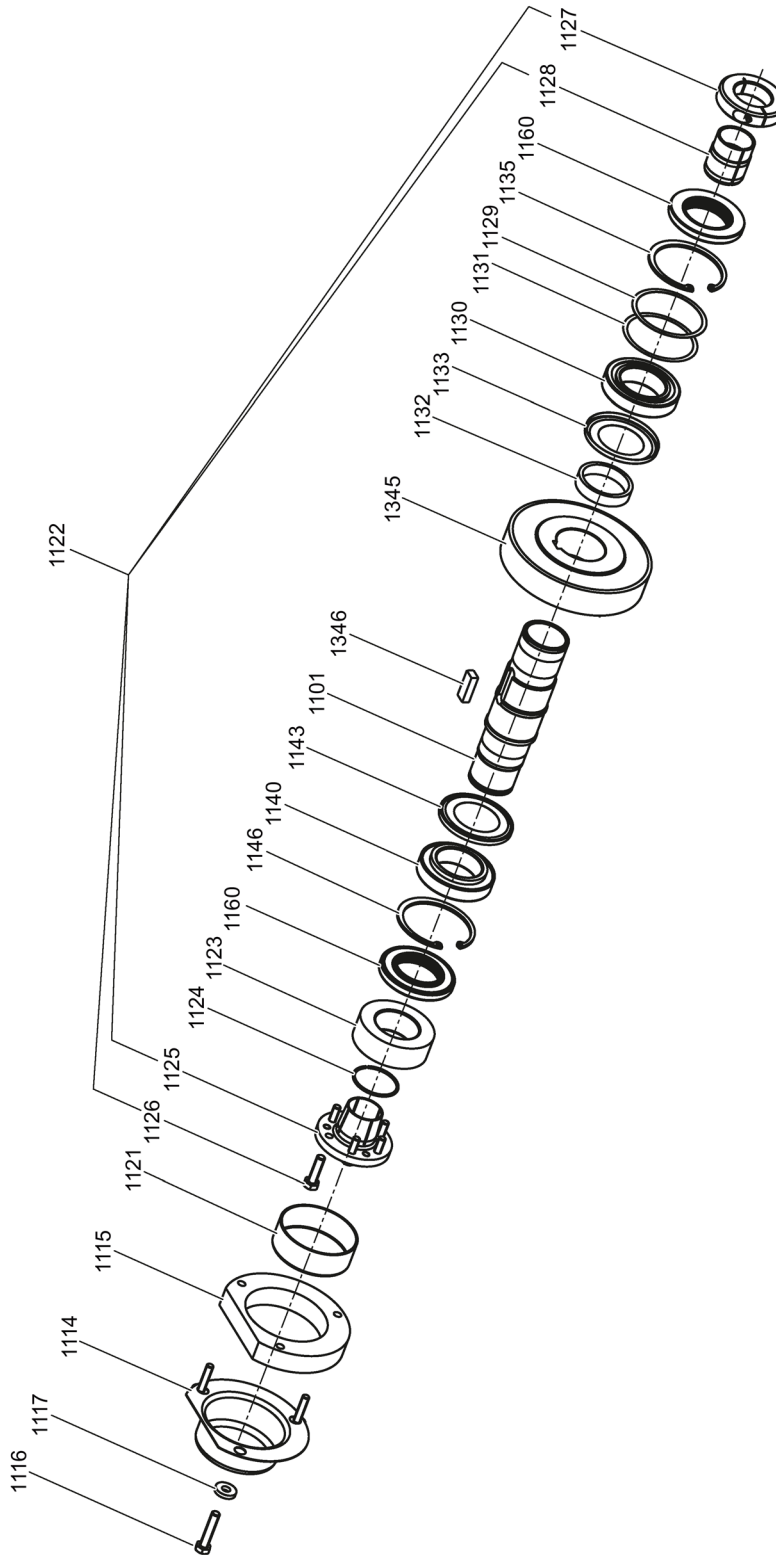
Parts subject to wear are available on request.



1001	Gearbox housing	1301	Plug-in pinion
1020	Bearing	1305	Helical
1025	Locking ring	1306	Parallel key
1027	Locking ring	1340	Pinion shaft
1030	Bearing	1345	Helical
1035	Locking ring	1346	Parallel key
1036	Supporting disk / shim	1401	Screw plug
1037	Locking ring	1410	Mounting accessories
1040	Output flange	1411	Bolt
1045	Bolt	1412	Locking ring
1070	Sealing cap	1413	Disk
1090	Torque arm	1415	Locking ring
1091	Rubber bush	1418	Sealing cap
1095	Bolt	1420	Vent filter
1101	Output shaft		
1102	Bushing		
1104	Seal		
1105	Parallel key		
1114	Cover NDE		
1115	Seal		
1116	Bolt		
1118	Plug / sealing cap		
1120	Shrink disk		
1121	Protective cap		
1129	Supporting disk		
1130	Bearing		
1131	Shim		
1132	Supporting disk / shim		
1135	Locking ring		
1138	Locking ring		
1139	Supporting disk		
1140	Bearing		
1144	Shim		
1146	Locking ring		
1160	Shaft sealing ring		
1162	O ring		
1165	Seal		
1210	Bolt		
1212	Nut		
1225	Seal		

Figure 11-7 Helical worm gearbox C, sizes 29 - 89

11.2.7 SIMOLOC assembly system, sizes 29 - 89



- 1101 Output shaft
- 1114 Cover NDE
- 1115 Seal
- 1116 Bolt
- 1117 Screw lock
- 1121 Protective cap
- 1122 SIMOLOC mounting kit
- 1123 Thrust collar
- 1124 Snap ring
- 1125 Tapered bushing
- 1126 Bolt
- 1127 Clamping ring
- 1128 Bushing
- 1129 Supporting disk
- 1130 Bearing
- 1131 Shim
- 1132 Bushing
- 1133 NILOS ring
- 1135 Locking ring
- 1140 Bearing
- 1143 NILOS ring
- 1146 Locking ring
- 1160 Shaft sealing ring
- 1345 Helical
- 1346 Parallel key

Figure 11-8 SIMOLOC assembly system, sizes 29 - 89

11.2.8 XLplus and VLplus heavy-duty bearing systems, sizes 89-169

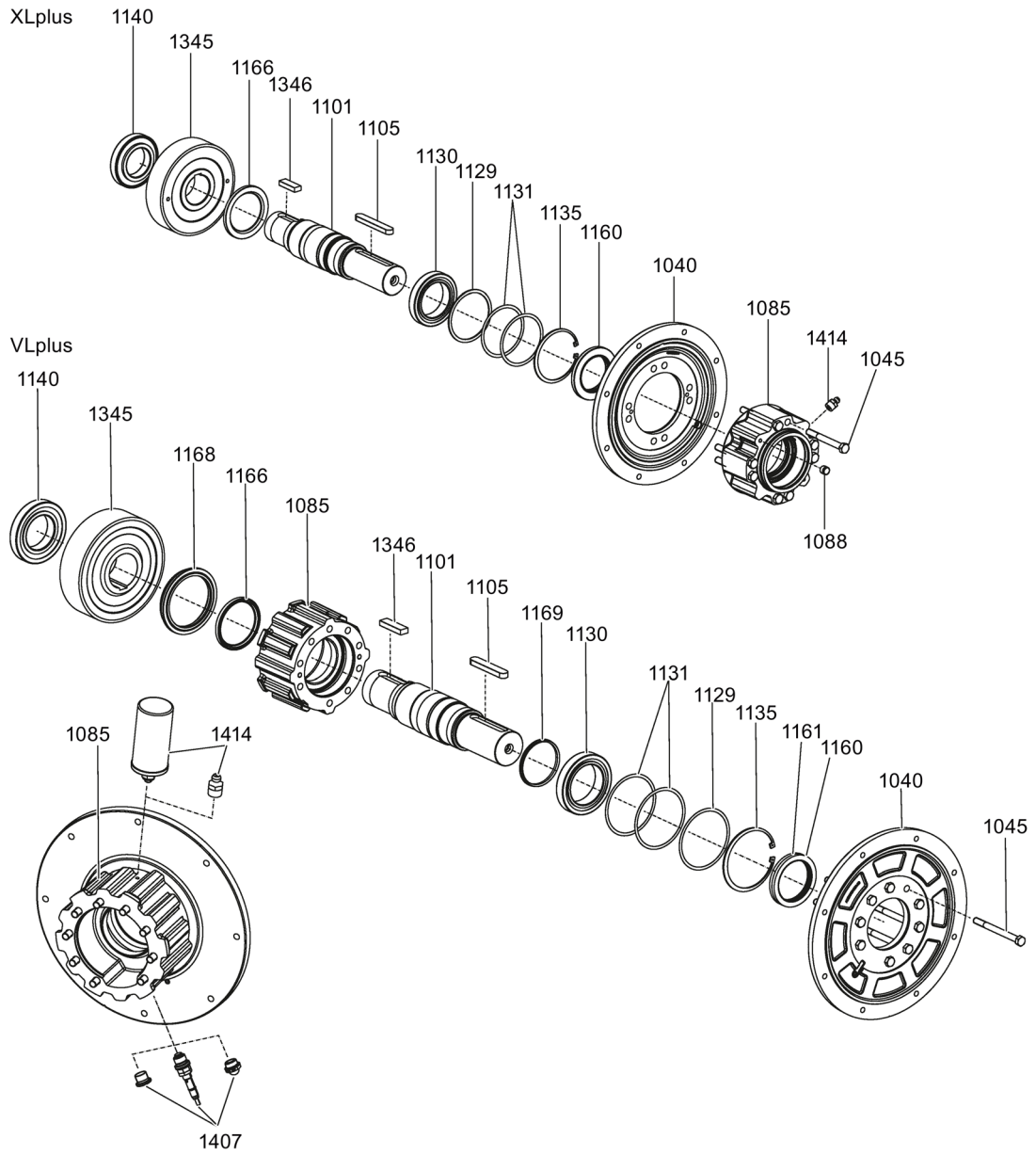


Figure 11-9 XLplus and VLplus helical gearboxes

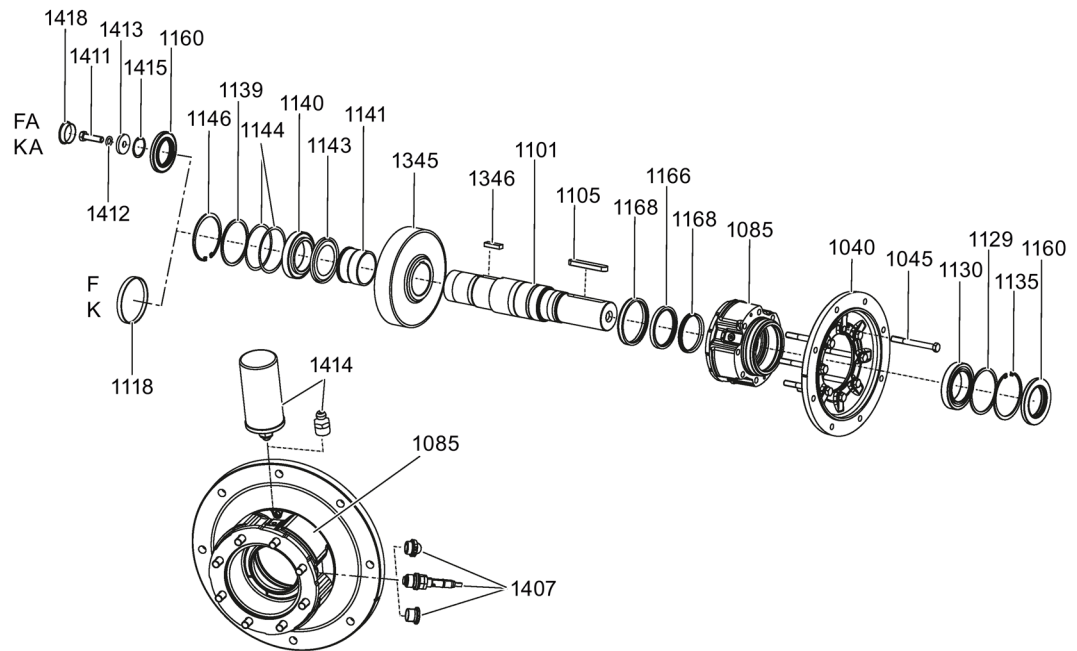


Figure 11-10 VLplus parallel-shaft gearboxes and bevel gearboxes

Spare parts list for XLplus and VLplus heavy-duty bearing systems

1040	Output flange	1146	Locking ring
1045	Bolt	1160	Shaft sealing ring
1085	Adapter	1161	Shaft sealing ring
1088	Plug	1166	Shaft sealing ring
1101	Output shaft	1168	Ring
1105	Parallel key	1169	Axial seal
1118	Plug / sealing cap	1345	Helical
1129	Supporting disk	1346	Parallel key
1130	Bearing	1407	Screw plug / oil sight glass / oil sensor
1131	Shim	1411	Bolt
1135	Locking ring	1412	Locking ring
1139	Supporting disk	1413	Disk
1140	Bearing	1414	Screw plug / automatic regreasing device
1141	Supporting disk/shim	1415	Locking ring
1143	NILOS ring	1418	Sealing cap
1144	Supporting disk/shim		

Declaration of incorporation, declaration of conformity

12

12.1 Declaration of incorporation

Document No. A5E36963968AC

Declaration of Incorporation according to Directive 2006/42/EC Annex II 1 B.

Manufacturer: Siemens AG
Division Digital Factory DF MC

Address: Bahnhofstraße 40, 72072 Tübingen, Germany

Product designation: SIMOGEAR gearboxes with adapter K

- Single-stage helical gearboxes E. 39 - 149
- Three- and two-stage helical gearboxes D./Z. 19 - 189
- Parallel-shaft gearboxes F. 29 - 189
- Bevel gearboxes B. 19 - 49, K. 39 - 189
- Helical worm gearboxes C. 29 - 89

The designated product is an incomplete machine in the sense of Article 2 g of Directive 2006/42/EC. It is designed exclusively for incorporation into another machine or for assembly with one or more other machines.

The following essential safety and health requirements of Directive 2006/42/EC, Annex I, are applied for the incomplete machine specified above and are complied with. The risks not relevant for the product are not listed.

- 1.1.1, 1.1.2, 1.1.3, 1.1.5 • 1.2.4.4, 1.2.6 • 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.6, 1.3.8.1
- 1.4.1, 1.4.2, 1.4.2.1 • 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.5.13, 1.5.15
- 1.6.1, 1.6.2 • 1.7.1, 1.7.1.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2, 1.7.4.3

When developing and manufacturing the above designated product, the following standards and specifications were applied: EN ISO 12100-1: 2011

The special technical documents according to Annex VII, B of the Directive 2006/42/EC were generated and will be provided to the appropriate authorities when justifiably requested in an electronic form.

The named person for compiling the technical documents:
Georg Böing, Head of Research & Development

Before the final product is commissioned, in which the incomplete machine described here is to be incorporated, it must be ensured that this is in conformance with Directive 2006/42/EC.

Tübingen, July 1, 2017

Georg Böing
Head of Research & Development

Florian Hanisch
Vice President Lead Factory Simogear

12.2 EU Declaration of Conformity DIN EN 80079-36

Document No. A5E43968284AA

Manufacturer: Siemens AG
Division Digital Factory DF MC
Address: Bahnhofstraße 40, 72072 Tübingen, Germany
Product designation: SIMOGEAR gearbox series
Gearbox types: E, Z, D, F, B, K, C
Sizes: 19 - 189
Adapter for gearbox: K









The designated product complies with the regulations of the following European Directive:

Directive 2014/34/EU, OJ L 96/309 of March 29, 2014 of the European Parliament and of the Council of February 26, 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

Conformance with the regulations laid down in these Directives is proven by fully complying with the following standards:

- DIN EN 1127-1: 2011
- DIN EN 80079-37: 2016
- DIN EN 60079-0: 2014
- DIN EN 80079-36: 2016
- DIN EN 80079-34: 2012
- DIN EN 15198: 2007

Explosion protection type for equipment group II of categories 2 and 3:

-  II 2G Ex h IIB T4 Gb
-  II 2G Ex h IIC T4 Gb
-  II 2D Ex h IIIB T120° C Db
-  II 2D Ex h IIIC T120° C Db
-  II 3G Ex h IIB T4 Gc
-  II 3G Ex h IIC T4 Gc
-  II 3D Ex h IIIB T120° C Dc
-  II 3D Ex h IIIC T120° C Dc

The specific marking of the gearbox is noted on the rating plate.

The technical documentation for Category 2 gearboxes has been subjected to a voluntary validation. The documentation has been filed with the designated body under No. 0123, TÜV SÜD PRODUCT SERVICE GmbH, Ridlerstraße 65, 80339 München, Germany.

Tübingen, January 22, 2018

Georg Böing
Head of Research & Development

Florian Hanisch
Vice President Lead Factory Simogear

12.3 EU declaration of conformity motors for direct mounting DIN EN 80079-36

Document No. A5E43968682AA

Manufacturer: Siemens AG
Division Digital Factory DF MC
Address: Bahnhofstraße 40, 72072 Tübingen, Germany
Product designation: SIMOGEAR gearbox series
Gearbox types: E, Z, D, F, B, K, C
Sizes: 29 - 189
Motors for direct mounting: 1MB1. Sizes 80 – 180


The designated product complies with the regulations of the following European Directive:

Directive 2014/34/EU, OJ L 96/309 of March 29, 2014 of the European Parliament and of the Council of February 26, 2014 on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

Conformance with the regulations laid down in these Directives is proven by fully complying with the following standards:

- DIN EN 1127-1: 2011
- DIN EN 80079-37: 2016
- DIN EN 60079-0: 2014
- DIN EN 80079-36: 2016
- DIN EN 80079-34: 2012
- DIN EN 15198: 2007

Explosion protection type for equipment group II of categories 2 and 3:

-  II 3G Ex h IIB T4 Gc
-  II 3D Ex h IIIB T120° C Dc
-  II 3G Ex h IIC T4 Gc
-  II 3D Ex h IIIC T120° C Dc

The specific marking of the gearbox is noted on the rating plate.

The technical documentation for Category 2 gearboxes has been subjected to a voluntary validation. The documentation has been filed with the designated body under No. 0123, TÜV SÜD PRODUCT SERVICE GmbH, Ridlerstraße 65, 80339 München, Germany.

Tübingen, January 22, 2018

Georg Böing
Head of Research & Development

Florian Hanisch
Vice President Lead Factory Simogear

Declaration of incorporation, declaration of conformity

*12.3 EU declaration of conformity motors for direct mounting
DIN EN 80079-36*

Your suggestions

Dear Customer,

Our products are the result of knowledge, ideas, suggestions. Because you have made a major contribution to this information,

YOUR ideas and suggestions are important. Please forward us your knowledge.

Send the completed following preprinted form to:

Siemens AG, Quality Management, Bahnhofstr. 40, 72072 Tübingen, Germany or to the e-mail address: sales-smg.aud@siemens.com

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Phone:	
E-Mail:	
Product	
Current situation	
Change	
This advantage results	

We appreciate your contribution.

Further information

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