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TECHNICAL DATA LIST

K230F 11596 + 11597

KRØLL CRANES A/S

HOIST	MANUFAC	TYPE	SERIAL NO.	kW	RPM	RATIO	QTY	P/N
MOTOR WITH BRAKE	Siemens	1LP9207	E1509/5428379_02 001 E1509/5428379_02 002	42.5	1750	-	1	15.00050916
GEAR	Bonfiglioli	A90	4197677 01 4196220 01	-	-	1:55.03	1	17.00063202

SLEWING	MANUFAC	TYPE	SERIAL NO.	kW	RPM	RATIO	QTY	P/N
MOTOR without encoder	Siemens	1LA7113-4AA11-Z		11.5	2850	-	1	15.00050889
MOTOR with encoder	Siemens	1LA7113-4AA11-Z		11.5	2850	-	1	15.00050890
BRAKE	Krøll Cranes A/S	K-Brake 180V	-	-	-	-	2	16.00045720
GEAR	Bonfiglioli	309L4HZ	SK 1500863X	-	-	1:465	2	17.00057190
SLEWING RING	Rothe Erde	061.50.1390.203.49.1502		-	-	-	1	37.00037277

TROLLEY	MANUFAC	TYPE	SERIAL NO.	kW	RPM	RATIO	QTY	P/N
MOTOR WITH BRAKE	Siemens	1LP7113		6		-	1	15.00050891
GEAR	Bonfiglioli	A55	4194676 0X		-	1:40.303	1	17.00063214

SIEMENS



SIMOTICS Low-voltage motors

GP, SD, DP

1LA, 1LE, 1LF, 1LG, 1LP, 1PC, 1PF, 1PK, 1PP, 1PQ, 2KG

Compact Operating Instructions

Ausgabe

02/2013

SIEMENS

SIMOTICS GP, SD, DP

Low-voltage motors

Compact Operating Instructions

1 Introduction

1.1 Information for the reader

Explanation of the icons



Note for 1LE1, 1MB1, 1PC1, 1PC3 machines



Note for 1LE1, 1PC1 and 1PC3 machines, frame sizes 80 and 90 with central terminal box locking

2 Safety notes

2.1 Information for those responsible for the plant or system

This electric machine has been designed and built in accordance with the specifications contained in Directive 2006/95/EC ("Low-Voltage Directive") and is intended for use in industrial plants. Please observe the country-specific regulations when using the electric machine outside the European Community.

Follow the local and industry-specific safety and setup regulations.

The persons responsible for the plant must ensure the following:

- Planning and configuration work and all work carried out on and with the machine is only to be done by qualified personnel.
- The operating instructions must always be available for all work.

- The technical data as well as the specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- The specific setup and safety regulations as well as regulations on the use of personal protective equipment are observed.

Note

Use the services and support provided by the appropriate Service Center for planning, installation, commissioning, and servicing work.

In the individual chapters of this document, you will find safety instructions that must be obeyed absolutely, for your own safety, to protect other people and to avoid damage to property.

Observe the following safety instructions for all activities on and with the machine.

2.2 The five safety rules:

For your personal safety and to prevent material damage when carrying out any work, always observe the safety 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 the system.
Disconnect the auxiliary circuits, for example anti-condensation heating
2. Prevent reconnection.
3. Make sure that the equipment is at zero voltage
4. Ground and short-circuit
5. Cover or isolate nearby components that are still live.

To energize the system, apply the measures in reverse order.

2.3 Qualified personnel

All work at the machine must be carried out by qualified personnel only. For the purpose of this documentation, qualified personnel is taken to mean people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the machine by the appropriate person responsible.

2.4 The safe use of electrical machines



! WARNING

Live parts

Electrical machines contain live parts.

Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

- Only remove covers in compliance with the applicable regulations.
- Operate the machines properly.
- Perform regular maintenance on the machine.



! WARNING

Rotating parts

Electrical machines contain dangerous rotating parts.

Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

- Only remove covers in compliance with the applicable regulations.
- Operate the machines properly.
- Perform regular maintenance on the machine.
- Secure free-standing shaft extensions.



! WARNING

Hot surfaces

Electrical machines have hot surfaces.

Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

- Allow the machine to cool down before starting any work on it.
- Only remove covers in compliance with the applicable regulations.
- Operate the machines properly.

3 Description

3.1 Language versions on the Internet

Language versions can be found on the Internet

Internet page: <http://www.siemens.com/motors>

If you require additional language versions, please contact the Siemens Service Center.

Intended use of the machines

These machines are intended for industrial installations. They comply with the harmonized standards of the series EN / IEC 60034 (VDE 0530). Their use in hazardous areas is forbidden unless the marking on the rating plate expressly permits this operation. If other/more wide-ranging demands (e.g. protection so that they cannot be touched by children) are made in special cases – i.e. use in non-industrial installations – these conditions must have been complied with in the plant or system itself when the motors are installed.

Note

Machine directive

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. The system may not be commissioned until confirmation has been given that the final product is in conformance with this directive (observe EN 60204-1!).

Forced ventilation (optional): Cooling IC 416 in accordance with EN / IEC 60034-6



WARNING

Hot surfaces

Operating the machine without external fan results in overheating. This may result in personal injury and material damage.

Never commission the machine without an external fan.

Cooling that does not depend on the speed is achieved by means of a separately driven fan wheel (forced ventilation). Forced ventilation does not depend on the operating state of the machine.

The fan wheel for the external flow of cooling air is powered by an independent module and is enclosed by the fan cover.

3.2 Degree of protection

The degree of protection the machines feature is stated on the rating plate. They can be installed in dusty or humid environments.



! WARNING

Dangerous voltage

Condensation drain holes (optional)

Inserting objects into the condensation drain holes can damage the winding and can result in death, serious injury and damage to property!

Note the following to maintain the degree of protection:

- Switch off the machine so that it is in a no-voltage condition, before you open the condensation drain holes.
- Close the condensation drain holes (e.g. using T-plugs) before commissioning the machine.

Note

Storage

If the machines are used or stored outdoors, we recommend keeping them under a shelter or an additional cover.

- Avoid exposing them to direct, intense solar radiation, rain, snow, ice, or dust for extended periods.
- If necessary, please consult us or seek advice regarding technical issues.

Environmental requirements

The machines are suitable for operation in tropical climates.

Guide value for the standard version 60 % relative humidity at an ambient temperature of (T_{amb}) 40 °C.

Ambient temperature: -20 °C to +40 °C

Installation altitude: ≤ 1000 m

Air with normal oxygen content, usually 21 % (V/V)

If the environmental requirements are different from the details listed here, then the values on the rating plate will apply.

4 Preparing for use

WARNING

Use lifting eyes

The machine must only be transported and lifted using the lifting eyes, in a position that is appropriate for its type of construction. Otherwise, it could fall over or slip in the lifting tackle.

This can result in death, serious injury, or material damage.

- Use all the lifting eyes on the machine.
- Any eyes that are screwed in must be tightly fastened.
- Eyebolts must be screwed in right up to their supporting surface.
- If necessary, use suitable, sufficiently-sized transport equipment such as lifting straps (EN1492-1) and lashing straps (EN12195-2).

WARNING

Suspended transport

If several items of transport material are used for fastening, two straps must be able to carry the whole load.

- Use additional, suitable means of support for transport and during installation.
- Secure the support equipment to prevent it from slipping.

Storage time

Turn the shafts 1x every year to avoid bearing brinelling. Prolonged storage periods reduce the useful life of the bearing grease (aging).

Open bearings

- For open bearings e.g. 1Z, check the state of the bearing grease over 12 months.
- Replace the grease if it can be identified that the grease has lost oil content or has become dirty (ingress of condensation leads to consistency changes of the grease).

Closed bearings

- For closed bearings, replace the DE and NDE bearings after a storage time of 48 months

5 Mounting, installation

5.1 Safety instructions



WARNING

Hot surfaces

Electrical machines have hot surfaces.

Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the machines are not handled, operated, or maintained properly.

- Allow the machine to cool down before starting any work on it.
- Only remove covers in compliance with the applicable regulations.
- Operate the machines properly.

It must be ensured that parts (cables etc.) do not come into contact with the machine enclosure.

NOTICE

Before start-up, please check that

- the customer has set the correct direction of rotation of the machine - e.g. by decoupling from the driven machine - by taking appropriate measures!
- there are no temperature-sensitive parts (cables etc.), which are in contact with the machine enclosure.
- condensation drain holes are always located at the lowest point of the motor!

Note

Please note the technical data on the rating plates on the machine enclosure.

5.2 Electromagnetic compatibility

Note

If the torque levels are very unequal (e.g. when a reciprocating compressor is being driven), a non-sinusoidal machine current will be induced whose harmonics can have an impermissible effect on the supply system and cause impermissible interference emissions as a result.

Note**Converter**

- If operated with a frequency converter, the emitted interference varies in strength, depending on the design of the converter (type, interference suppression measures, manufacturer).
- Prevent the limit values stipulated by EN / IEC 61000-6-3 for the drive system (consisting of the machine and converter) from being exceeded.
- You must observe the EMC information from the manufacturer of the converter.
- The most effective method of shielding is to conductively connect a shielded machine supply cable to the metal terminal box of the machine (with a metal screw connection) over a large surface area.
- On machines with integrated sensors (e.g. PTC thermistors), disturbance voltages caused by the converter may occur on the sensor cable.

5.3 Balancing



Safety precautions

- The general touch protection measures for drive output elements must be observed.
- Output elements may only be attached or withdrawn using the correct equipment.
- The feather keys are only secured against falling out during shipping. If you commission a machine without an output element, the feather keys must be secured to prevent them from being thrown out.

The rotors are balanced dynamically. The balancing quality corresponds to vibration severity grade "A" for the complete machine as standard. The optional vibration severity grade "B" is indicated on the rating plate.

The declaration regarding the type of featherkey for balancing is generally marked on the rating plate and optionally on the face of the shaft end.

Designation:

- As a standard measure, balancing is carried out dynamically with a half featherkey (code "H") in accordance with ISO 8821.
- "F" means balancing with a whole featherkey (optional version).
- "N" means balancing without a featherkey (optional version).

Note

Measures conforming to ISO 10816 must be taken in order to compensate any offset between electrical machines and driven machines.

The foundation must be designed according to DIN 4024.

5.4 Alignment and fastening

General

When aligning and fastening the machine, please bear the following in mind:

- The machine must be level.
- Feet and flanges must be fastened securely.
- Alignment must be precise in the case of direct coupling.
- Fastening surfaces must be clean
- Look out for any damage to paint; this must be rectified immediately and correctly.
- Look out for traces of anti-corrosion protection agents; these must be removed using mineral turpentine.
- Look out for installation-related resonances with the rotating frequency and double line frequency; these must be prevented.
- Listen for unusual noises when turning the rotor manually.
- Check the direction of rotation with the machine decoupled.
- Avoid using rigid coupling measures.

Flatness of the supporting surfaces for conventional motors

Frame size (FS)	Flatness mm
≤ 132	0.10
160	0.15
≥ 180	0.20

6 Electrical connection



! WARNING

Note the following safety information before connecting-up the machine:

- Only qualified and trained personnel should carry out work on the machine while it is stationary.
- Disconnect the machine from the power supply and take measures to prevent it being reconnected. This also applies to auxiliary circuits, e.g. anti-condensation heating.
- Check that the machine really is in a no-voltage condition.
- Establish a safe protective conductor connection before starting any work.
- If the incoming power supply system displays any deviations from the rated values in terms of voltage, frequency, curve form or symmetry, such deviations will increase the temperature and influence electromagnetic compatibility.



! WARNING

Line supply with non-grounded neutral point

Operating the machine on a line supply system with a non-grounded neutral point is only permitted over short time intervals that occur rarely, e.g. the time leading to a fault being eliminated (ground fault of a cable, EN 60034-1).

6.1 Terminal box

6.1.1 Instructions for terminal boxes



! DANGER

Dangerous voltage

Electric machines contain hazardous voltages.

If the machine is not de-energized and brought into a no-voltage condition, death or serious injury will occur.

When work is carried out on the machine with the terminal box open, it must not be electrically connected!

NOTICE

Damage to property

Note the following information to avoid damage to the terminal box.

- Make sure that the components inside the terminal box e.g. terminal board and cable connections) are not damaged!
- It must be ensured that there are no foreign bodies, dirt or moisture in the terminal box.
Cable entries into the terminal box according to DIN 42925.
- Close any additional open cable entries with O-rings or suitable flat gaskets, the terminal box itself must be sealed so that it is dust and water tight using the original seal.
- Please observe the tightening torques for cable glands and other screws.
- When performing a test run, secure the feather keys without output elements.

Note

The terminal box must be sealed so that dust and water cannot enter.



⚠ WARNING

Dangerous voltage

Loosening the safety torx screw can result in death, serious injury or material damage!

Do not loosen the safety torx screw with respect to the center terminal, as this ensures a conductive connection between the grounding conductor and frame!

NOTICE

Serious damage to the machine

Failure to observe these measures will result in serious damage to the machine!

- Do not rotate the terminal box unless the connection cables have not yet been laid.
- If you release the safety torx screw to both sides of the outer connecting terminals, this can destroy the machine!
- Remove the three large snap hooks on the terminal board before rotating the terminal box. Keep the snap hooks pressed while rotating the terminal box and use a screwdriver to re-engage when finished.

6.1.2 Optional terminal board (star or delta circuit)



NOTICE

Arcing at the optional terminal board can destroy the machine

Failure to observe this information can result in destruction of the machine as a result of arcing.

To change the operating mode, always press the jumper fully into the base of the slot and use the red locking lever to ensure that it is engaged.

6.1.3 Protruding connection cables



WARNING

Short-circuit hazard

During disassembly and particularly when installing the cover plate, make sure that the connection cables are not clamped between enclosure parts and the cover plate.



CAUTION

It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal base of the machine enclosure.

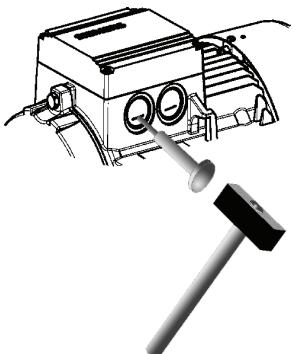
- Use O-rings or suitable flat gaskets to seal entries in cover plates (DIN 42925) and other open entries.
- Seal the terminal base of the machine enclosure using the original seal of the cover plate to prevent dust and water from entering.
- Please observe the tightening torques for cable glands and other screws.
- When performing a test run, secure the feather keys without output elements.

6.1.4 Knockout openings

Note

Knockout openings

- Knockout openings in the terminal box must be knocked out using appropriate methods.
- Take care not to damage the terminal box or its interior components (the terminal board, cable connections, and so on).



6.1.5 Installation and routing



NOTICE

Damage to terminal board

Observe the following measures to prevent damage to the terminal board:

- Remove the screw-type connections (EN 50262) only when the terminal box is closed.
- Tighten the screw-type connections to rated torque value only when the terminal box is closed.
- Tighten the screw-type connections only finger tight when the terminal box is open.
- Make sure that the three large snap hooks are engaged when tightening the screw-type connections!

6.2 Tightening torques

6.2.1 Cable glands

Note

Take care not to damage the cable jacket.

Tightening torques must be adapted to suit the type of cable jacket material in use.

You should refer to the table in order to find the correct tightening torque for any metal and plastic cable glands that are to be mounted directly on the machine, as well as for any other screw-type connections (such as adapters).

Table 6-1 Tightening torques for cable glands

	Metal ± 10% Nm	Plastic ± 10% Nm	Clamping range in mm		O ring Cord Ø mm	
			Standard -30 °C ... 100 °C	Ex -30 °C ... 90 °C		
M 12 x 1,5	8	1,5	3,0 ... 7,0	-		
M 16 x 1,5	10	2	4,5 ... 10,0	6,0 ... 10,0		
M 20 x 1,5	12	4	7,0 ... 13,0	6,0 ... 12,0	2	
M 25 x 1,5			9,0 ... 17,0	10,0 ... 16,0		
M 32 x 1,5	18	6	11,0 ... 21,0	13,0 ... 20,0	2	
M 40 x 1,5			19,0 ... 28,0	20,0 ... 26,0		
M 50 x 1,5	20		26,0 ... 35,0	25,0 ... 31,0		
M 63 x 1,5			34,0 ... 45,0	-		

6.2.2 Terminal boxes, end shields, grounding conductors, sheet metal fan covers

Note

The specified tightening torques are applicable unless other values are indicated.

Table 6-2 Tightening torques for screws on the terminal box, end shields, screw-type grounding conductor connections

	Thread Ø		M 4	M 5	M 6	M 8	M 10	M 12	M 16	M20
	Nm	min	2	3.5	6	16	28	46	110	225
		max	3	5	9	24	42	70	165	340



Table 6-3 Tightening torques for self-tapping screws on the terminal box, end shields, screw-type grounding conductor connections, sheet metal fan covers

	Thread Ø		M 4	M 5	M 6
	Nm	min	4	7.5	12.5
		Max.	5	9.5	15.5

6.3 General information on conductor connection

Cross-sections that can be connected depending on the size of the terminal (possibly reduced due to size of cable entries)



WARNING

Short-circuit hazard

Electric machines contain hazardous voltages.

If the appropriate precautions are not taken, death or serious physical injury can occur.

- Do not lay connection cables over the central dome of the terminal board.
- Observe the opening direction and the mounting position of the cover washers on the terminal board.

6.4 General information on connecting the grounding conductor

Note

The machine's grounding conductor cross-section must comply with EN / IEC 60034-1.

Please also observe installation regulations such as those specified in EN / IEC 60204-1..

6.5 Connection to the converter



CAUTION

The standard insulation system is designed so that operation on the converter is possible for supply voltages up to 500 V +10% in motorized operation. Use a special insulation system or adopt special measures, e.g. output filter, for higher voltages.



NOTICE

Machines must always be connected to frequency converters using shielded machine supply cables. The most effective method of shielding is to conductively connect the cable to the metal terminal box of the machine (with metal screw connections) over a large surface area.

Note

EMC

Please observe the section containing instructions on ensuring electromagnetic compatibility.

See the list of additional operating instructions: Further documents (Page 64)

6.6 Final checks

Before closing the terminal box/terminal base of the machine enclosure, check the following:

- Establish the electrical connections in the terminal box in accordance with the details in the sections above and tighten with the correct torque.
- The clearances between non-insulated parts have been maintained:
 ≥ 5.5 mm to 690 V, ≥ 8 mm to 1000 V.
- Avoid protruding wire ends!
- In order not to damage the cable insulation, freely arrange the connecting cables.
- Connect the machine corresponding to the specified direction of rotation.
- Keep the inside of the terminal box clean and free from trimmed-off ends of wire.
- Ensure that all seals and sealing surfaces are undamaged and clean.
- Correctly and professionally close unused openings in the terminal boxes.
- The pressure relief device is undamaged (depending on the type of terminal box, this involves either cast-in slots or an overpressure diaphragm). Only repair damage after prior consultation with the person responsible for the safety of the equipment and use only original parts.

7 Commissioning

7.1 Insulation resistance



WARNING

Working on electrical power installations

Only appropriately trained personnel may carry out this work.

Before starting commissioning, install all covers that are designed to prevent active or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling.



WARNING

Hazardous voltage at the terminals

Dangerous voltages are sometimes present on the terminals during and immediately after measurement of the winding insulation resistance.

Contact with these can result in death, serious injury or material damage.

If any power cables are connected, check to make sure line supply voltage cannot be connected. Once you have measured the insulation resistance, discharge the winding by connecting to the ground potential.

Checking the insulation resistance

NOTICE

The insulation resistance needs to be checked prior to start-up and again after any extended periods of storage or periods during which the equipment is not in operation. Before you begin measuring the insulation resistance, please read the operating manual for the insulation resistance meter you are going to use.

Disconnect any main-circuit cables that are connected to the terminals before measuring the insulation resistance.

Note

If the critical insulation resistance is less than or equal to this value, the windings must be dried or, if the fan is removed, cleaned thoroughly and dried.

Please note that the insulation resistance of dried, clean windings is lower than that of warm windings. The insulation resistance can only be properly assessed after conversion to the reference temperature of 25 °C.

Note

If the measured value is close to the critical value, you must check the insulation resistance at suitably frequent intervals.

Measuring the insulation resistance

1. Before you begin measuring the insulation resistance, please read the operating manual for the insulation resistance meter you are going to use.
2. Disconnect any main circuit cables from the terminals before measuring the insulation resistance.
3. Where possible, measure the insulation resistance of the winding with respect to the motor enclosure when the winding temperature is between 20 ... 30 °C. Different insulation resistance values apply for other temperatures.
4. When measuring, wait until the final resistance value is reached. This is reached after approximately one minute. Then read off the insulation resistance.

Limit values of the stator winding insulation resistance

The following table indicates the measuring circuit voltage and the limit values for the minimum insulation resistance and the critical insulation resistance of the stator winding.

Table 7-1 Insulation resistance of the stator unwinding at 25 °C

	Rated voltage $U_{\text{rated}} < 2 \text{ kV}$
Measuring circuit voltage	500 V
Minimum insulation resistance for new, cleaned or repaired windings	10 MΩ
Critical specific insulation resistance after a long operating time	0,5 MΩ / kV

Note the following:

- If the measurements are performed at winding temperatures $\neq 25 \text{ }^{\circ}\text{C}$, convert the measured value to the reference temperature of 25 °C in order to be able to compare the values with the table above.
 - The insulation resistance halves every time the temperature rises by 10 K.
 - The resistance doubles every time the temperature falls by 10 K.
- Dry, new windings have a typical insulation resistance of more than 100 ... 2000 MΩ depending on the winding size, design and rated voltage. An

insulation resistance value close to the minimum value could be due to moisture and/or dirt accumulation.

- During operation, the insulation resistance of the windings can fall to the critical insulation resistance due to ambient and operational influences. The critical insulation resistance value for a winding temperature of 25 °C can be calculated by multiplying the rated voltage (kV) by the specific critical resistance value (0,5 MΩ / kV).

Example:

Critical resistance for rated voltage $U_N = 690 \text{ V}$:

$$690 \text{ V} \times 0,5 \text{ M}\Omega / \text{kV} = 0,345 \text{ M}\Omega$$

Note

Critical insulation resistance reached or fallen below

If the critical insulation resistance is reached or fallen below, this can result in damage to the insulation or voltage flashovers.

- Contact your Siemens Service Center.
- If the measured value is close to the critical value, you must check the insulation resistance at suitably frequent intervals.

Measures before commissioning

Once the system has been correctly installed, you should check the following prior to commissioning:

- The machine has been assembled and aligned correctly.
- The machine has been connected so that it rotates in the direction specified.
- The operating conditions match the data specified on the rating plate.
- The bearings have been lubricated as appropriate for the version used. Rolling-contact bearing machines which have been in storage for more than 24 months have been relubricated.
- Any supplementary machine monitoring equipment has been connected correctly and is functioning as it should.
- For versions with bearing thermometers, the bearing temperatures must be checked during the machine's first period of operation. The warning and shutdown values are set on the monitoring device.
- Appropriately configured control and speed monitoring functions ensure that the machine cannot exceed the permissible speeds specified on the rating plate.

- The output elements have the correct settings for their type (e.g. alignment and balancing of couplings, belt forces in the case of a belt drive, tooth forces and tooth face clearance in the case of toothed-wheel power output, radial and axial clearance in the case of coupled shafts).
- The minimum insulation resistance and minimum clearance values have been adhered to.
- The grounding and equipotential bonding connections have been established correctly.
- All fixing screws, connection elements, and electrical connections have been tightened to the specified torques.
- Lifting eyes that were screwed in have been removed following installation or secured to prevent them becoming loose.
- The rotor can turn without coming into contact with the stator.
- All touch protection measures for both moving and live parts have been implemented.
- In cases where the shaft extension is not being used and is, therefore, exposed, it has been covered and the feather key has been secured to prevent it from being thrown out.
- If being used, the external fan is ready for operation and connected so that it rotates in the direction specified.
- The flow of cooling air is not obstructed.
- If a brake is being used, it is functioning correctly.
- The specified mechanical limit speed n_{\max} is adhered to.

If the design of the machine requires the converter to be assigned in a particular way, the relevant information will be provided on the rating plate or an additional label.

Note

It may be necessary to perform additional checks and tests in accordance with the specific situation on site.

8 Operation

Switching on the machine with anti-condensation heating (optional)



CAUTION

Before switching on, always make sure that the (optional) anti-condensation heating is switched off.

Machine operation



WARNING

Line supply with non-grounded neutral point

Operating the machine on a line supply system with a non-grounded neutral point is only permitted over short time intervals that occur rarely, e.g. the time leading to a fault being eliminated (ground fault of a cable, EN / IEC 60034-1).



WARNING

Do not remove covers when the motor is running

Rotating or live parts are dangerous. Death, serious injury, or material damage can result if the required covers are removed.

- De-energize the machine and bring it into a no voltage condition before removing any covers.
- Ensure that any covers, which are designed to prevent active or rotating parts from being touched, which are necessary to ensure correct air guidance and thus effective cooling, or which guarantee the degree of protection of the machine, remain closed during operation.



CAUTION

The surfaces of the machines can reach high temperatures, which can lead to burns if touched.

NOTICE

Minimum load for cylindrical roller bearings

Be sure to comply with the minimum radial load of 30% of the cylindrical roller bearings in accordance with catalog data.

**WARNING****Faults during operation**

Deviations from conditions during normal operation, such as an increase in power consumption, temperatures or vibrations, unusual noises or odors, tripping of monitoring devices, etc., indicate that the machine is not functioning properly. This can cause faults which can result in eventual or immediate death, severe injury or material damage.

- Immediately inform the maintenance personnel.
- If you are in doubt, immediately switch off the machine, being sure to observe the system-specific safety conditions.

NOTICE**Risk of corrosion due to condensation**

When changing machines and/or ambient temperatures, air humidity can condense within the machines.

- If available, remove the screw plugs to drain the water depending on the ambient and operating conditions.
- Reinsert them afterwards.

If the machine is equipped with drainage plugs, the water can drain away automatically.

**WARNING****Machines with textile fan covers**

The machine fan is not completely protected against contact.

The customer must put suitable measures in place, e.g. housings or protective grating, to prevent manual intervention.

8.1 Stoppages

Overview

If the machine remains out of service for an extended period of time (> 1 month), it should be commissioned regularly (around once a month) or, at the very least, the rotor should be turned. Please refer to the instructions in the section titled "Switching on" before recommissioning the machine. If a rotor locking device has been fitted to the machine, you must remove it before the rotor starts to turn.

NOTICE

If the machine is to be out of service for a period in excess of 12 months, you must take suitable anti-corrosion, mothballing, packaging, and drying measures.

Switching on the anti-condensation heater

If an anti-condensation heater is provided, switch it on during the machine stoppages.

Taking the machine out of service

For details of measures that need to be implemented, please refer to Section Preparing for use (Page 39).

Lubricating before recommissioning**NOTICE**

The machine must be relubricated during commissioning if it has been out of service for more than 1 year, in order to ensure that the grease is distributed throughout the bearings. The shaft must rotate for the grease to be distributed. Please observe the information on the lubricant plate if carrying out relubrication using relubrication equipment.

See also the section titled "Application planning - Bearing lifetime".

9 Maintenance



! WARNING

Safety instructions

- Before starting work on the machines, make sure that the plant or system has been disconnected in a manner that is compliant with the appropriate specifications and regulations.
- In addition to the main currents, make sure that supplementary and auxiliary circuits, particularly in heating devices, are also disconnected.
- Certain parts of the machine may reach temperatures above 50 °C. Physical contact with the machine could result in burn injuries! Check the temperature of parts before touching them.
- When carrying out cleaning using compressed air, make sure that appropriate methods of extracting fumes are in place and that personal protective gear such as gloves, goggles, face masks, or similar are worn.
- If you are using chemical cleaning agents, observe the instructions and any warnings provided in the relevant safety data sheet. Chemical agents must be compatible with the machine's components, especially if these contain plastics.

Note

Operation characteristics can vary widely. For this reason, only general maintenance intervals can be specified here.

9.1 Maintenance

9.1.1 Regreasing (optional)

General

As a standard feature, the machines have rolling-contact bearings which are permanently lubricated with grease (UNIREX N3, made by ESSO). A regreasing device is possible as an option. In this case, you can find information about relubrication intervals, quantities and types of grease, and, if required, additional data on the rating plate or lubricant plate.

Note

Do not mix different types of grease!

Prolonged storage periods reduce the useful life of the bearing grease. Check the condition of the grease if the equipment has been in storage for more than 12 months. If the grease is found to have lost oil content or to be contaminated, the machine must be immediately relubricated before commissioning. For information on permanently-greased bearings, please refer to the section titled Bearings (Page 60).

Note**Regreasing**

1. Clean the grease nipples at the drive end and non-drive end.
2. Press in the type and quantity of grease specified (see rating/lubricant plate data).
 - Please observe the information on the rating and lubricant plates.
 - Regreasing should be carried out when the machine is running (max. 3600 rpm)!

The bearing temperature rises sharply at first, then drops to the normal value again when the excess grease is displaced out of the bearing.

9.1.2 Cleaning

Cleaning the greasing channels and used grease chambers

The used grease collects outside each bearing in the used grease chamber of the outer bearing cap. When replacing bearings, remove the used grease.

Note

You have to separate the active parts of the bearings to replace the grease that is in the greasing channel.

Cleaning the cooling air passages

Regularly clean the cooling air passages through which the ambient air flows, e.g. using dry compressed air.

Note

Never direct compressed air in the direction of the shaft outlet or machine openings.

In the case of machines with textile fan covers, regularly remove fluff balls, fabric remnants, and similar types of contamination (particularly at the air passage opening between the fan cover and cooling fins of the machine enclosure) to ensure that the cooling air can flow without obstruction.

Note

The frequency of the cleaning intervals depends on the local degree of contamination.

⚠️ WARNING

Particularly when carrying out cleaning using compressed air, make sure you use suitable extraction equipment and wear personal protective gear (safety goggles, respiratory filter, etc.).

9.2 Repair

9.2.1 Instructions for repair

Qualified personnel

Only appropriately qualified persons should be deployed to commission and operate equipment. Qualified persons, as far as the safety instructions specified in this manual are concerned, are those who have the necessary authorization to commission, ground and identify/tag equipment, systems and circuits in accordance with the relevant safety standards.

Instructions relevant to safety

⚠️ WARNING

Before you begin working on the three-phase machine, in particular before you open the covers of active parts, make sure that the three-phase machine or system is properly isolated from the supply.

Note

If it is necessary to transport the machine, carefully observe the information provided in Chapter Preparing for use !

9.2.2 Bearings



Take the bearing used up to frame size 90 only for special versions, and generally for frame size 100 and higher from the rating plate.

Bearing lifetime

Prolonged storage periods reduce the useful lifetime of the bearing grease. In the case of permanently lubricated bearings, this leads to a shorter bearing lifetime. Bearing or grease replacement is recommended after a storage time of 12 months, for longer than four years, replace the bearings or grease.

Replacing bearings

Recommended interval after which bearings are to be replaced under normal operating conditions:

Table 9-1 Bearing replacement intervals

Ambient temperature	Principle of operation	Bearing replacement intervals
40° C	Horizontal coupling operation	40 000 h
40° C	With axial and radial forces	20 000 h

Note

Special operating conditions

Examples of factors that can reduce operating hours are vertical machine installation, high vibrational and impact loads, frequent reversing, higher ambient temperature, higher speeds, etc.

Note

- Do not reuse bearings that have been removed.
 - Remove any existing contaminated old grease from the bearing shield!
 - Replace old grease with new grease!
 - Replace the shaft seals when the bearings are replaced.
 - Lightly grease the contact surfaces of the sealing lips!
-

9.2.3 Dismantling

Note

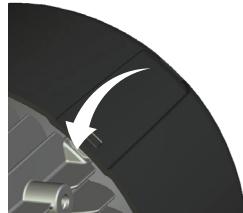
Before commencing disassembly, you should mark how each of the fastening elements has been assigned, as well as how internal connections are arranged, for re-assembly purposes.

Fan

Take care not to damage the snapping mechanisms on fans that are equipped with these. To ensure this, the fans should be heated to a temperature of approximately 50 °C around the area of the hub. If any damage is caused, request new parts.

Fan cover

- Carefully lever the snap openings on the cover out of the snap-in lugs one after the other; do not apply the lever directly under the web (risk of breakage).
- Do not damage the snap mechanisms. If any damage is caused, request new parts.



Canopy; incremental encoder under the canopy



Loosen the fixing screws on the external surface of the protective cover.

Under no circumstances should the spacing bolts or the mounting bracket be disassembled or forcibly separated from each other or the cover. Forcibly removing or separating can destroy the distance bolts, the connecting elements of the mounting bracket or the fan cover.

9.2.4 Installation

Note

Avoid damaging the windings protruding out of the stator enclosure when fitting the end shield.

10 Spare parts

General

In addition to the exact part designation, please specify the machine type and the serial number in all orders for spare parts and repair parts.

A Appendix

A.1 SIEMENS Service Center

Details regarding the design of this electrical machine and the permissible operating conditions are described in these instructions.

Field service visits and spare parts

If you wish to request a field service call or order spare parts, please contact your local Siemens sales office. This office will contact the responsible service center on your behalf. You can find your local contact partner here.

Technical queries or additional information

If you have any technical queries or you require additional information, please contact the Siemens Service Center.

Please have the following machine data ready:

- Machine type
- Serial number

You can find this data on the rating plate of the machine.

Service numbers

Table A-1 Siemens Service Center contact details

Time zone	Telephone	Fax	Internet
Europe / Africa	+49 911 895 7222	+49 911 895 7223	http://www.siemens.com/automation/support-request (http://www.siemens.de/automation/support-request)
Americas	+1 423 262 2522	+1 423 262 2200	mailto:techsupport.sea@siemens.com
Asia / Pacific	+86 1064 757 575	+86 1064 747 474	mailto:support.asia.automation@siemens.com

A.2 Further documents

These operating instructions can also be obtained at the following Internet site:

<http://www.siemens.com/motors>

General Documentation

1.517.30777.30.000	1XP8001 encoder
5 610 00000,02 000	Operating_Instructions_Simotics GP, SD, DP, XP
5 610 00000,02 001	Operating_Instructions_Compact_Simotics GP, SD, DP
5 610 00000,02 002	Operating_Instructions_Compact_Simotics XP
5 610 00002,09 000	Incremental encoder 1XP8012-1x
5 610 00002,09 001	Incremental encoder 1XP8012-2x
5 610 70000,02 015	External fan
5 610 70000,10 020	Spring-loaded brake

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG

Standard motors
56100000002001, 02/2013

INDUSTRY PROCESS
AND AUTOMATION SOLUTIONS

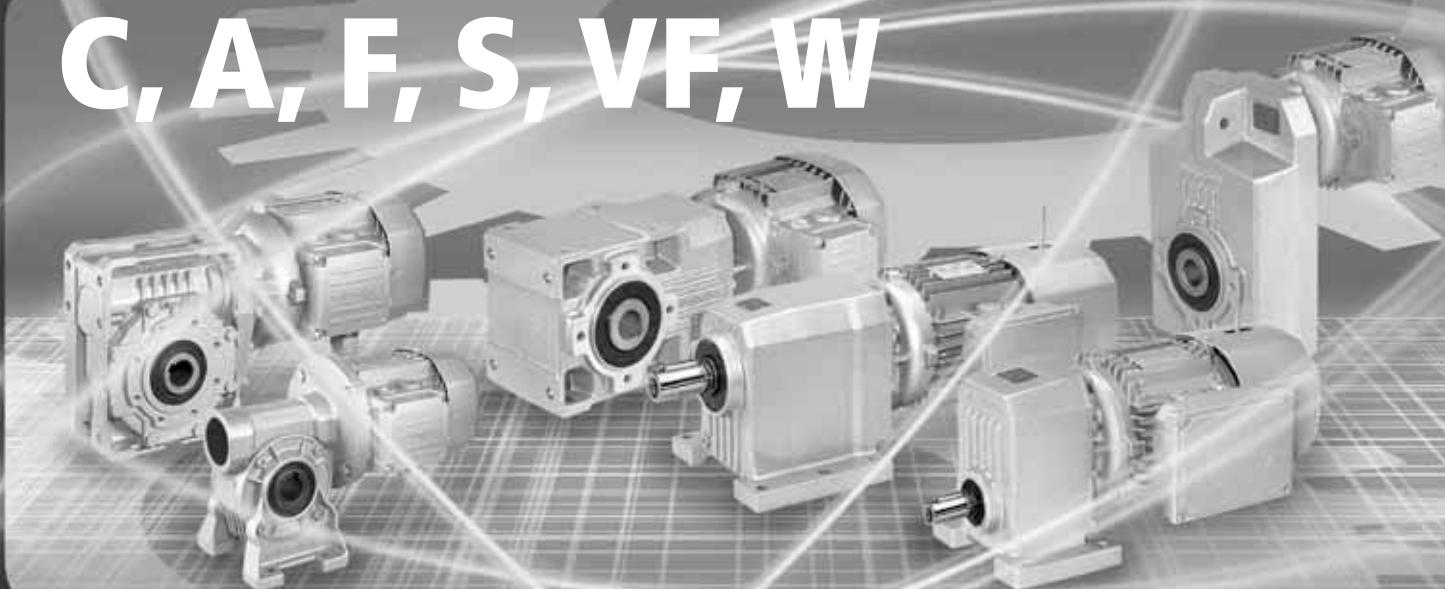


BONFIGLIOLI
RIDUTTORI

Installation, use and service manual



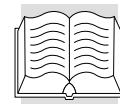
C, A, F, S, VF, W



ATEX
INCLUDED



BONFIGLIOLI



INSTALLATION, USE AND SERVICE MANUAL



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Revisions

Refer to page 50 for the catalogue revision index. Visit www.bonfiglioli.com to search for catalogues with up-to-date revisions.



1.0 - GENERAL INFORMATION

1.1 - PURPOSE OF THE MANUAL

This manual has been compiled by the Manufacturer to provide information on the safe transport, handling, installation, maintenance, repair, disassembly and dismantling of the gear units.

All purchasing and design criteria is provided in the Sales Catalogue. Apart from adhering to established engineering practices, the information given in this manual must be carefully read and applied rigorously.

The information regarding the electric motor that can be found matching the speed reducer is supplied with the owner's manual relevant to the specific electric motor.

Failure to adhere to the information provided herein may result in risk to personal health and safety, and may incur economic damages.

This information, provided in the original language (Italian) of the Manufacturer, may also be made available in other languages to meet legal and/or commercial requirements.

The documentation must be stored by a person with the correct authority and must always be made available for consultation.

In case of loss or damage, replacement documentation must be requested directly from the Manufacturer, quoting the code of this manual.

The manual reflects the state of the art at the time of commercialisation of the gear unit.

The Manufacturer reserves the right to modify, supplement and improve the manual, without the present publication being for that reason considered inadequate.

Particularly significant sections of the manual and important specifications are highlighted by symbols whose meanings are given below.

SYMBOLS:

DANGER - WARNING



This symbol indicates situations of serious danger which, if ignored, may result in serious risks to the health and safety of personnel.

CAUTION - ATTENTION



This symbol indicates the need to adopt specific precautions to avoid risks to the health and safety of personnel and possible economic damages.

IMPORTANT



This symbol indicates important technical information.

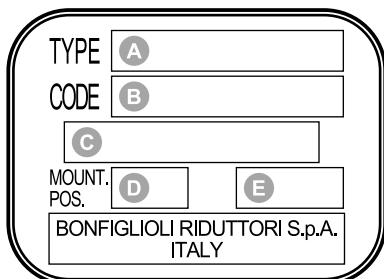
	<p>The instructions indicated on a yellow background next to these symbols refer exclusively to equipment conforming to the "ATEX" Directive 94/9/EC. The operations highlighted by these symbols must be carried out by qualified professionals specially trained in the safety requirements for zones characterised by potentially explosive atmospheres. Failure to observe these instructions may result in serious risks to personal and environmental safety</p>
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1.2 - EQUIPMENT IDENTIFICATION

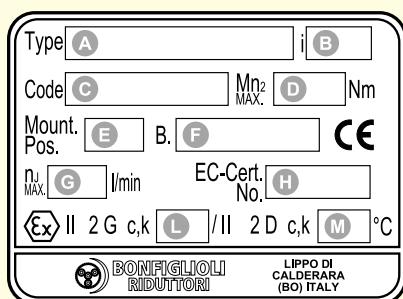
The gear unit bears the following nameplate. The nameplate bears all references and indispensable safety instructions. The gear unit's identifying code is explained in the Sales Catalogue. If the gear unit is supplied complete with electric motor (garmotor), all information regarding the motor itself is supplied in the motor manual.

Nameplate data



- A** Gear unit type.
- B** Product code.
- C** Month / Year of manufacture.
- D** Mounting position.
- E** Gear ratio.

Nameplate for ATEX-specified gear units:



- A** Gear unit type.
- B** Gear ratio.
- C** Product code.
- D** Transmissible torque at $n_1=1400$ rpm [Nm].
- E** Mounting position.
- F** Month / Year of manufacture.
- G** Maximum drive speed.
- H** Certification Nr.
- L** Temperature class, or maximum surface temperature.
- M** Maximum surface temperature.

CE - ExMark

- Environmental limits (ambient temperature range between - 20°C and + 40°C).
- Maximum surface temperature: temperature class **T4** for 2G and **130°C** for 2D. Some types of gear unit, shown in the catalogue, are exceptions to this rule and are marked temperature class **T3** for 2G or **160°C** for 2G and 2D.
- Certifying agency with whom the technical file has been deposited.

Readability of the nameplate

The nameplate and the information thereon must be readable at all times and consequently cleaned from time to time.

Should the nameplate wear and/or become damaged so as to affect its readability or that of even one of the items of information thereon, the User must request a new nameplate from the Manufacturer, quoting the information given in this manual, and replace the old one.



1.3 - GLOSSARY AND TERMINOLOGY

Some of the frequently occurring terms used in this manual are described below so as to unequivocally define their meaning.

Routine maintenance: the set of operations required for maintaining the functionality and efficiency of the gear unit. These operations are usually scheduled by the Manufacturer, who defines the qualifications required and tasks in question.

Non-routine maintenance: the set of operations required for maintaining the functionality and efficiency of the gear unit. These operations are not scheduled by the Manufacturer and must be done by an expert maintenance technician.

Expert maintenance technician: an authorised technician selected by means of having the qualifications, skills and mechanical and electrical training to do repairs and non-routine maintenance work on the gear unit.

Overhaul: an overhaul consists in the replacement of bearings and/or other mechanical components which have worn to such an extent as to compromise the operation of the gear unit. The overhaul also includes verification of the condition of all gear unit components (keys, seals, gaskets, vents, etc.). If any such components are damaged they must be replaced and the reason for the damage identified.

1.4 - REQUESTING TECHNICAL ASSISTANCE

For any technical service needs, contact the Manufacturer's sales network, quoting the information on the unit's nameplate, the approximate hours of service and the type of defect.

1.5 - MANUFACTURER'S LIABILITY

The Manufacturer declines all liability for cases of:

- use of the gear unit in violation of local laws on safety and accident prevention at work.
- incorrect installation, disregard or incorrect application of the instructions provided in this manual.
- incorrect or defective power supply (garmotors).
- modifications or tampering.
- work done on the unit by unqualified or unsuitable persons.

The safety of the gear unit also depends on scrupulous observance of the instructions given in this manual, in particular:

- always operate the unit within its operating limits.
- diligently observe the routine maintenance schedule.
- only authorise trained operators to inspect and service the unit.
- use only original spare parts.



- the configurations given in the gear unit catalogue are the only ones permitted.
- do not attempt to use the unit contrary to the instructions supplied.
- the instructions given in this manual do not substitute but summarise the provisions of applicable safety legislation.



2.0 - TECHNICAL INFORMATION

2.1 - GEAR UNIT DESCRIPTION

The gear unit has been designed and constructed for integration, if required, driven by an electric motor, into an assembly of interlocking parts or mechanisms as part of a specific application.

Depending on the requirements of the application, the gear unit can be supplied in a variety of executions and configurations. It is capable of satisfying a range of specific requirements in the mechanical, chemical, agricultural and food industries, etc.

BONFIGLIOLI RIDUTTORI supplies a range of accessories and optionals to make their products as versatile as possible. For further technical information and descriptions, refer to the Sales Catalogue.

The User is responsible for using the products recommended for installation and maintenance of BONFIGLIOLI gear units in an appropriate manner and in accordance with instructions.

	SAFETY SPECIFICATIONS FOR ATEX SPECIFIED GEAR UNITS
	<ul style="list-style-type: none">use of synthetic lubricants only (oil and grease)VITON® seal ringsthread locker on all external boltsvent caps with anti-intrusion valvedouble oil seals on series C gear units, and oil seals with dust traps on all other typescomponents and products operable at above the maximum rated operating temperatureno metal moving parts external to the gear unitno plastic parts capable of building up electrostatic chargeirreversible temperature indicator supplied along with each unitfor installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme of all surfaces and recesses to avoid a build up of dust of more than 5 mm in depthto prevent dust build-ups in difficult to access areas, the units are equipped with a variety of seals in proximity to the couplings of moving parts, mounting flanges and external threaded holes.

2.2 - CONFORMITY TO STANDARDS

All gear units or gearmotors (when supplied complete with electric motor) are designed in compliance with the provisions of all applicable Essential Health and Safety Requirements, "Machinery Directive" 98/37/EC and, if requested, can be supplied complete with Manufacturer's Declaration – Annex IIB as provided by said directive.

The electric motors of all BONFIGLIOLI RIDUTTORI gearmotors conform to the provisions of Low Voltage Directive 73/23/EEC and Electromagnetic Compatibility Directive 89/336/EEC.

	Furthermore, if specified for use in potentially explosive atmospheres, the gear units are designed and constructed to conform with the Essential Health and Safety Requirements (EHSR) of Annex II of ATEX Directive 94/9/EC and conform to the following classification:
	<ul style="list-style-type: none">Equipment group: II.Class: Gas 2G – Dust 2D.Zone: Gas 1 – Dust 21.Maximum surface temperature: temperature class T4 for 2G and 130°C for 2D. Some types of gear units, given in the catalogue, are exceptions to this rule and are marked temperature class T3 for 2G or 160°C for 2G and 2D.



2.3 - OPERATING LIMITS AND CONDITIONS



Modification of the gearbox configuration or mounting position is only permitted if previously authorised by the BONFIGLIOLI RIDUTTORI technical service.



Failure to obtain said authorisation voids the ATEX certification.

Ambient conditions

- Ambient temperature: min. - 20°C; max. + 40°C.
- Do not use the gear unit, if not explicitly intended for the purpose, in a potentially explosive atmosphere or where the use of explosion-proof equipment is specified.



The nameplate data on the maximum surface temperature, refer to measurements made in normal ambient and installation conditions. Even minimal variations to said conditions (e.g. smaller mounting cabinet) could have a significant impact on the build up of heat.



- Lighting



If the unit is to be serviced in a poorly lit area, use additional lamps and ensure that the work is done in compliance with applicable safety legislation.

- Noise - Vibration

During operational testing at the Manufacturer's premises, the acoustic pressure measured under full load at a distance of 1 m from the unit and 1.6 m above ground level without vibration was less than 85 dB(A).

The vibrations produced by the gear unit do not constitute a health risk for personnel. Excessive vibration may be the result of a fault and should be immediately reported and eliminated.



3.0 - SAFETY INFORMATION

3.1 - SAFETY STANDARDS

- Carefully read the instructions given in this manual and those posted directly on the gear unit, especially those regarding safety.
- Persons charged with working on the gear unit at any time in its service life must be trained specifically for the purpose with special abilities and experience in this area as well as being equipped with the appropriate tools and individual safety equipment (as per Legislative Decree 626/94). Failure to meet these requirements constitutes a risk to personal health and safety.
- Use the gear unit only for the applications envisaged by the Manufacturer. Improper use can result in risks to personal health and safety and economic damages.



The applications defined by the Manufacturer are those industrial applications for which the gear unit has been developed.

- Keep the gear unit at its maximum efficiency by following the routine maintenance schedule. Good maintenance enables the unit to operate at maximum performance over a long service life in compliance with safety regulations.
- When working on the unit in areas which are difficult to access or hazardous, ensure that adequate safety precautions have been taken for the operator and others in compliance with the provisions of law on health and safety at work.
- All maintenance, inspection and repairs must only be done by an expert maintenance technician fully familiar with the attendant hazards. It is, therefore, essential to implement operating procedures which address potential hazards and their prevention for the entire machine. The expert maintenance technician must always work with extreme caution in full compliance with applicable safety standards.



If the gear unit is to be serviced in a potentially explosive atmosphere, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning.



Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc.).

- During operation wear only the apparel and safety equipment indicated in the User instructions provided by the Manufacturer or laid down by applicable laws on safety at work.
- Replace worn components with original spare parts. Use the lubricants (oil and grease) recommended by the Manufacturer.
- Do not dump polluting materials into the environment. Dispose of all such materials as stipulated by applicable legislation.
- After replacing lubricants clean the gear unit's surfaces and the walk-on surfaces around the work area.



4.0 - HANDLING AND TRANSPORT

4.1 - PACKAGING

The standard packaging, when supplied and unless otherwise agreed, is not proofed against rainfall and is intended for shipping by ground and not sea, and for environments which are under cover and not humid. The material can be stored in suitable conditions for a period of two years under cover at a temperature between -15°C and $+50^{\circ}\text{C}$ at a relative humidity not in excess of 80%. Storage in all other conditions requires specific packaging.

In order to facilitate handling, heavy packages can be loaded on pallets.

The most frequent types of packaging are shown in the figures below.

- Wooden crate for miscellaneous products shipped by sea.



- Carton pallet packaging for single products and kits.

Horizontal packaging



Vertical packaging



On receipt of the gear unit, check that the delivery item corresponds to the purchase order and that it is not damaged or faulty in any way. Refer any nonconformity to your BONFIGLIOLI RIDUTTORI dealer.

Dispose of packaging materials as laid down by the provisions of law.



4.2 - HANDLING INSTRUCTIONS

Handle packages as per the Manufacturer's instructions and those marked on the packages themselves. Since the weight and shape of packages may make manual handling unfeasible, special equipment must be used to avoid damage and injury. Persons authorised for this purpose must be trained and experienced in the work in question to safeguard his safety and that of all other persons involved.

⚠ The person authorised to handle the product must take all necessary precautions to safeguard his safety and that of all other persons involved.

4.2.1 - Moving packages

- Prepare a suitable, delimited area with a level floor or surface for unloading the packages.
- Prepare the equipment required for handling the package. The lifting and handling equipment used (e.g. crane or lift truck) must have adequate capacity for the weight and size of the load, taking into account its attachment points and centre of gravity. If required, this information is indicated on the package itself. Harness heavy packages with chains, belts and steel ropes after checking that they are capable of sustaining the weight of the load, which is generally specified.
- When handling the load keep it level to avoid instability and/or tipping.

4.2.2 - Moving the equipment

⚠ 1 All the following operations must be done with due care and caution and without sudden movements.

- Identify the attachment points for lifting the gear unit. Refer to Annex 4 of this manual for this information.
- Prepare the gear unit for lifting by attaching straps, hooks, shackles etc. to its attachment points, or alternatively, use a pallet for moving the load. If using a crane, first lift the gear unit vertically out of its packaging.
- If using a lift truck or pallet truck, remove the packaging and fit the truck's forks at the indicated positions.
- First lift the load very slowly to check that it is stable.
- Move the gear unit to the unloading area and lower it gently into position, taking care not to cause sudden oscillations while moving it.

⚠ If the gear unit is coupled to an electric motor, do not use the eyebolts on the motor for lifting the entire load, unless this is expressly indicated.



4.3 - STORAGE

Some recommendations for storing the gear unit are indicated below.

1. Do not store the unit in excessively humid conditions or where it is exposed to the weather (do not store outdoors).
2. Do not place the gear unit directly on the ground.
3. Place the gear unit on a stable base and make sure that it is not subjected to accidental displacement.
4. Store the packaged gear unit (if allowed) in accordance with the instructions on the packaging itself.

If the gear unit is stored for more than 6 months, the following **additional** precautions must be taken:

5. Cover all machined external surfaces with a rustproofing product such as Shell Ensis or equivalent product with similar properties and application range.
6. Fill the unit with lubricating oil.

	<p>SAFETY PRECAUTIONS to be taken when returning the gear unit to service after storage.</p> <p>The output shafts and external surfaces must be thoroughly cleaned of all rustproofing product, contaminants and other impurities (use a standard commercial solvent). Do this outside any explosion hazard area.</p> <p>The solvent must not touch the seal rings as this can damage them and render them ineffective.</p> <p>If the oil or protective material used during storage is not compatible with the synthetic oil used during the machine's operation, the interior of the unit must be thoroughly cleaned before filling with the operating oil.</p> <p>The service life of bearing grease is reduced if the unit is stored for more than 1 year. The bearing grease must be synthetic.</p>
--	---



5.0 - INSTALLATION

5.1 - INSTALLING THE GEAR UNIT

⚠ The entire installation process must be planned based on the general design of the machine. The person authorised to do the work must, if necessary, implement a safety plan to safeguard all persons directly involved and rigorously apply all applicable legislation.

If a gearmotor is going to be installed, please consult the owner's manual of the electric motor on beforehand.

1. Thoroughly clean all packaging materials and protective product residue from the gear unit. Pay particular attention to the coupling surfaces.
2. Check that the data on the nameplate corresponds to that which is specified on the order.
3. Ensure that the structure to which the gear unit is to be mounted is sufficiently robust and rigid to support its weight and operating stresses.
4. Check that the machine on which the gear unit is to be installed is switched off and cannot be accidentally switched on again.
5. Check that all coupling surfaces are flat.
6. Check that the shaft/shaft or shaft/bore are perfectly aligned for coupling.
7. Fit suitable guards to protect against the external moving parts of the gear unit.
8. If the work environment is corrosive for the gear unit or any of its parts, take the special precautions required for aggressive environments. In this case, contact the BONFIGLIOLI RIDUTTORI sales service.
9. We recommend applying a protective paste to all couplings between the gear unit/motor and other parts (Klüüberpaste 46 MR 401 or equivalent product with similar properties and application range) to ensure optimal coupling and protection against fretting corrosion.
10. To ensure effective coupling, the driven shafts should be machined to the tolerances given in tables (A16), (A17), (A18), (A19), (A20) and (A21) in Annex 3 of this Manual.
11. In case of installation outdoors and when fitted with an electric motor, protect the latter from direct sunlight and the weather by means of guards or a casing. Also make sure that the assembly is properly ventilated.

Now proceed with the installation as follows:

1. Place the gear unit in the vicinity of the installation area.
2. Mount the gear unit and secure it to the structure at the points provided. The gear unit should be secured to the structure through all mounting points on the mount specified (feet or flange).
3. Locate the closed plug used for transportation (usually red) and replace it with the vented plug provided.
4. Tighten down the mounting bolts and check that the oil plugs are screwed down to the torque given in table (A0).



(A0)

Bolt size	Tightening torque [Nm] +5% /-10%	
	Bolt class	
	8.8	10.9
M4	3	3.8
M5	5.9	8.0
M6	10.3	13.0
M8	25.5	32
M10	50	64
M12	87.3	110
M14	138.3	180
M16	210.9	275
M18	306	390
M20	432	540
M22	592	720
M24	744	930
M27	1100	1400
M30	1500	1850

Cap/vent thread	Pitch	Tightening torque [Nm]
1/8"	28	5
1/4"	19	7
3/8"	19	7
1/2"	14	14
3/4"	14	14
1"	11	25

5. Charge the gear unit with oil or top it up with reference to the method in which gear units of the type covered by this manual are filled in the factory. The standard charge of synthetic life-time lubricant is as follows:

(A1)

C 05	C 11	C 21	C 31	C 35	C 41	C 51	C 61	C 70	C 80	C 90	C 100
A 10	A 20	A 30	A 41	A 50	A 60	A 70	A 80	A 90			
F 10	F 20	F 30	F 40	F 50	F 60	F 70	F 80	F 90			
S 10	S 20	S 30	S 40	S 50							
VF 27	VF 30	VF 44	VF 49	VF 130	VF 150	VF 185	VF 210	VF 250			
W 63	W 75	W 86	W 110								



Life-time lubrication.



Life-time lubrication with ATEX-specified unit only.

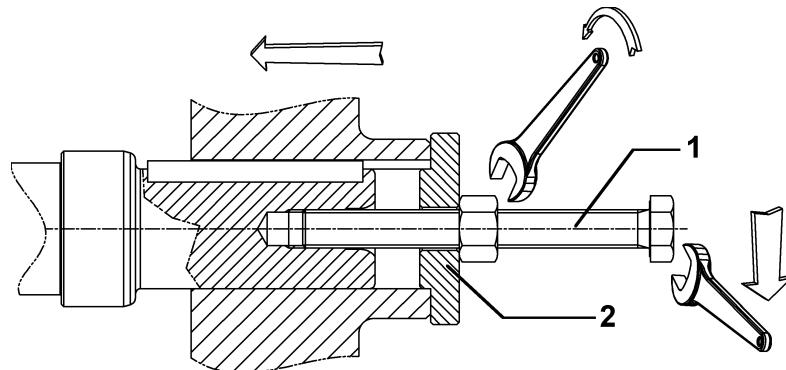
 	<p>Helical in-line gear units C 11, C 21 and C 31 are not equipped with service plugs for direct oil level checks.</p> <p>Bevel helical gear units A 10, A 20 and A 30 are not equipped with service plugs for direct oil level checks in mounting positions B6 and B7 only.</p> <p>For these types of gear units, refer to Annex 1 of this Manual.</p> <p>Before installing, check the unit as follows:</p> <ol style="list-style-type: none"> 1. Place the gear unit in the mounting position indicated for the gear unit in question in Annex 1. Wait 10 minutes for the oil level to stabilise inside the gear unit's casing. 2. Insert a dipstick through the hole shown in drawing (S4) or (S5) and measure the distance between the oil level and the exterior of the casing. This value must be compared with the values in mm given in Annex 1, tables (A7) and (A8), depending on the mounting position for the gear unit in question. 3. If the measurement gives a higher value than that prescribed, top up the oil to the correct level as indicated in the catalogue. <p>For all other types of gear unit the oil level must be checked via the oil plug (spill type) using the tool (out of scope for supply) described in Annex 1.</p> <p>For the first charge and subsequent top ups, only use the recommended oils.</p>
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 	<p>Installation of gear units classified under Directive 94/9/EC</p> <ul style="list-style-type: none"> • Category 2D gear units must be installed in compliance with the provisions of standards EN 1127-1 and EN 50281-1-2. The installer must, therefore, be fully informed and trained for this application. • The installation technician must be aware of the ATEX class of the installation area, as well as the risks associated with the presence of a potentially explosive atmosphere, with particular attention to explosion and fire hazards, and thereby adopt the necessary safety precautions. • All maintenance, assembly and disassembly work must be done outside the explosion hazard area by trained personnel. • Check that all accessory components (cables, joints, cable glands, cooling units, etc.) comply with the Essential Health and Safety Requirements of the ATEX directives. Handle them with extreme care to avoid altering their characteristics. • Remove the bolts sealing the threaded holes if provided for securing the gear unit. Do not damage the coupling surfaces. • When assembling gear units with a torque arm, make sure that during operation, the metal parts which move relative to each other do not come into contact. If necessary, insert non-metal anti-friction elements in compliance with Directive 94/9/EC. • Do not connect any object with electrical resistance greater than $10^9 \Omega$ to the product. • Install guards to prevent the hazardous accumulation of dust and liquids on the seals of the solid shafts and to protect them mechanically. • In case of installation of the gearmotor in a vertically downward orientation, the electric motor must be equipped with a drip cover. • The output shaft and any pulleys or other transmission components must be perfectly aligned. • Only install the gear unit in the motor execution and mounting position specified on the order. Shaft-mounted gear units can be installed with a tolerance relative to the theoretical plane of installation of $\pm 5^\circ$. • If the gear unit is supplied without lubricant it must be installed as such and only filled with lubricant thereafter. • Secure the gear unit to a flat, vibration-free surface capable of bearing the torsional stresses it produces in operation. Make sure not to deform the contact surfaces, mounting feet and/or flanges by overtightening the bolts. • Use bolts of quality no lower than 8.8 for mounting the gear unit, and for heavy-duty installations use 10.9 bolts. For the tightening torque refer to table (A0). To prevent bolts from unscrewing, apply a thin film of Loctite 510, or equivalent, on threads of all bolts used to assemble the gear unit onto the structure and/or to the electric motor. • Make sure that the radial/thrust loads and operating torques do not exceed those specified for the unit. • The vent caps and oil level caps must be easy to access for inspection. • Clean the gear unit thoroughly after installation.
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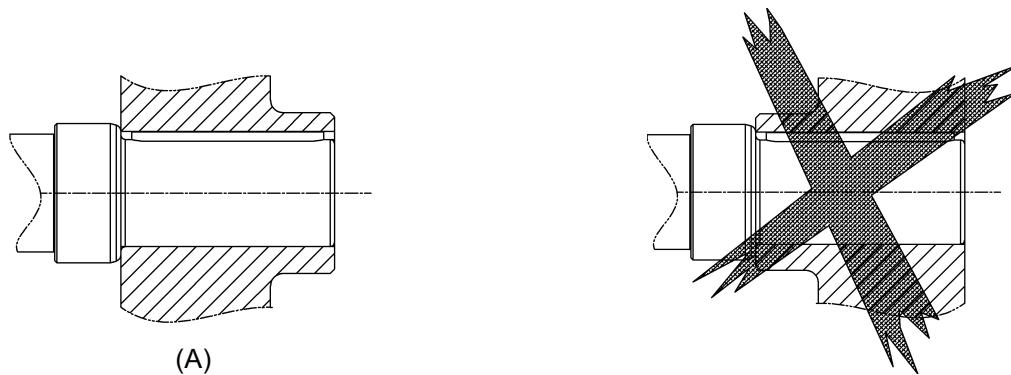
5.1.1 - Gear units with solid output shaft

 For mounting external parts do not use hammers or other tools which might damage the gear unit's shafts or bearings. Instead, proceed as indicated in the diagram below:



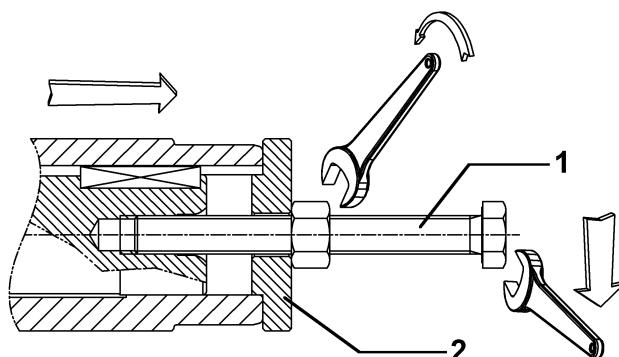
Bolt (1) and spacer (2) are to be supplied by customer.

To minimise the loads on the shaft bearings, when mounting transmission elements with asymmetrical hubs, the preferred layout is shown in diagram (A) below:



5.1.2 - Gear units with hollow output shaft

To facilitate mounting hollow shaft gear units onto the machine's driven shaft, proceed as indicated in the diagram below. Also refer to Annex 3 of this Manual for dimension information on customer's shaft.



The bolt (1) and spacer (2) are to be supplied by customer.

5.1.3 - Gear units with shrink disk

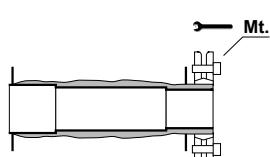
Series A and F gear units may be specified with a shrink disk for coupling onto the driven shaft. When installing a unit of this type, proceed as follows:

1. Loosen the locking bolts gradually and in sequence and remove the entire shrink disk.
2. Clean and carefully degrease the coupling surface between the gear unit's output shaft and the customer shaft.

⚠ Do not use molybdenum bisulphide or any other grease which would affect the friction coefficient of the coupling surfaces and reduce the performance of the shrink disk.

3. Fit the gear unit onto the machine sliding its output shaft onto the driven shaft.
4. Fit the shrink disk to the gear unit shaft.
5. Fully tighten down the shrink disk bolts gradually following a circular sequence using a torque wrench. This operation usually must be repeated several times to reach the tightening torque **Mt** specified in the table below:

(A2)

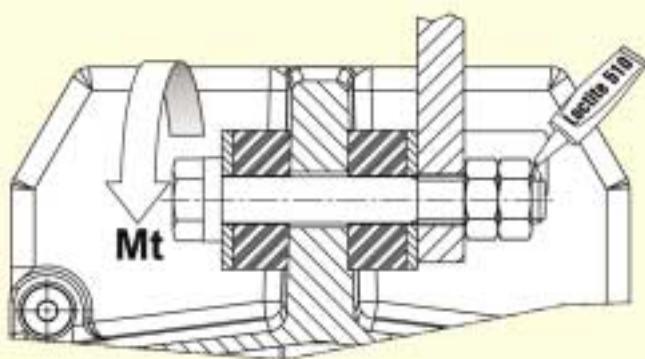
		 Mt.	A 10	A 20	A 30	A 41	A 50	A 60	A 70	A 80	A 90
			Mt [Nm]	14.5	14.5	14.5	14.5	35	35	69	69
		F 10	F 20	F 30	F 40	F 50	F 60	F 70	F 80	F 90	
		Mt [Nm]	8.5	14.5	14.5	14.5	14.5	35	35	69	69

5.1.4 - Shaft mounted gear units series F

Anchoring the torque arm

Use the original vibration-damping kit to ensure optimal operation of the assembly, as it is specifically designed and constructed, along with the gear unit, for operation in explosion hazard areas.

Failure to use the original accessory on gear units classified under 94/9/EC voids the ATEX certification.



	Mt [Nm]
F 10	10
F 20	10
F 30	20
F 40	20
F 50	50
F 60	50

The torque arm shown in the diagram is to be supplied by customer.



5.2 - INSTALLING AN IEC-STANDARD FLANGED MOTOR

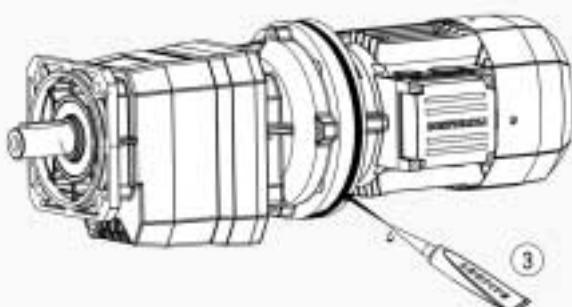
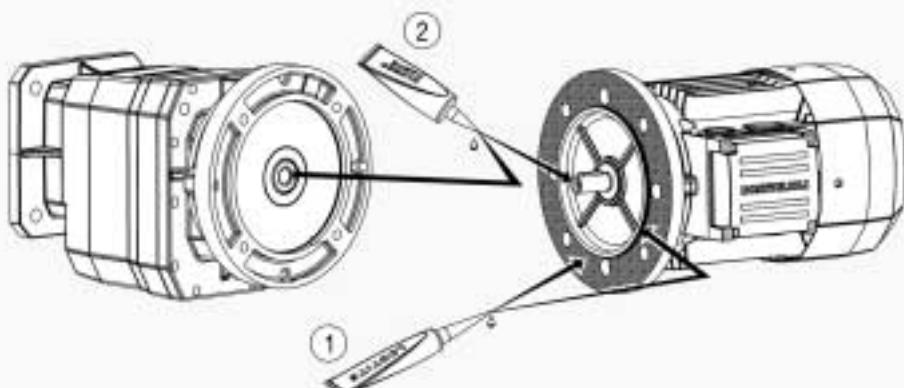
Further to all the precautions indicated above, when installing a IEC-flange mount electric motor the following precautions must also be observed:

- Do not force the coupling and do not use inappropriate tools during assembly. Take care not to damage the flat and/or cylindrical coupling surfaces.
- Do not force the shaft with large radial and/or thrust loads.
- To facilitate assembly, use a lubricating synthetic oil paste such as Klüberpaste 46 MR 401 or equivalent product with similar properties and application range.
- Tighten down all motor/gear unit mounting bolts to their prescribed torque. For the tightening torques, refer to table (A0).

When the gear unit is mounted to an IEC electric motor, proceed as follows:

- Apply a layer of sealant (Loctite 510 or equivalent product with similar properties and application range) to the motor/gear unit mounting flanges, spigot and frontal coupling surfaces as shown in diagram (S1).

(S1)



1 - Apply "Loctite 510" to both the flange surface and spigot.

2 - Apply "Klüberpaste 46MR401" to the input shaft bore and motor shaft.

3 - Use "Loctite 5366" to seal the area of contact between the gear unit and motor, taking care to fill in any gaps between the two flanges (e.g. disassembly slots).

- After mounting the motor, apply a layer of sealant (Loctite 5366 or equivalent product with similar properties and application range) around the edges of the flanges so as to close any gaps between their surfaces.
- If the gearbox is of the flanged type, the User must take similar precautions to prevent dust deposits forming in the gaps between the flanges or in the vicinity of the couplings.



6.0 - TESTING THE GEAR UNIT

The gear unit has been factory tested by the Manufacturer.

Before starting the unit, check that:

- The machine incorporating the gear unit complies with the provisions of the "Machinery Directive" 98/37/EC and any other applicable safety legislation.
- The gear unit's mounting position in the installation corresponds to that prescribed and indicated on the nameplate.
- The electrical power supply and control systems are suitable and operational as stipulated in standard EN 60204-1, and grounded as per standard EN 50014.
- The motor power supply corresponds to that prescribed and is within $\pm 5\%$ of the rated value.
- The oil level is as prescribed and that there are no leaks from the caps or gaskets.
- The unit does not run noisily or with excessive vibration.

	<p>Before starting up the unit, check and ensure that:</p> <ul style="list-style-type: none">• Assembly is not carried out in a potentially explosive atmosphere (oil, acid, gas, vapour or radiation) and that there is no dust deposits thicker than 5 mm on the gear unit.• During service the gear unit is sufficiently ventilated and that it is not subject to radiation from external heat sources.• During service the cooling air does not exceed 40 °C.• The oil level, drain and vent plugs are all easily accessible.• All accessories of any type mounted onto the gear unit are ATEX compliant.• Gear units with hollow shafts, with or without shrink disk, have been correctly mounted.• The gear unit is thoroughly cleaned after installation.• All guards installed to prevent accidental contact between operators and the gear unit's moving parts or seals, are effective.
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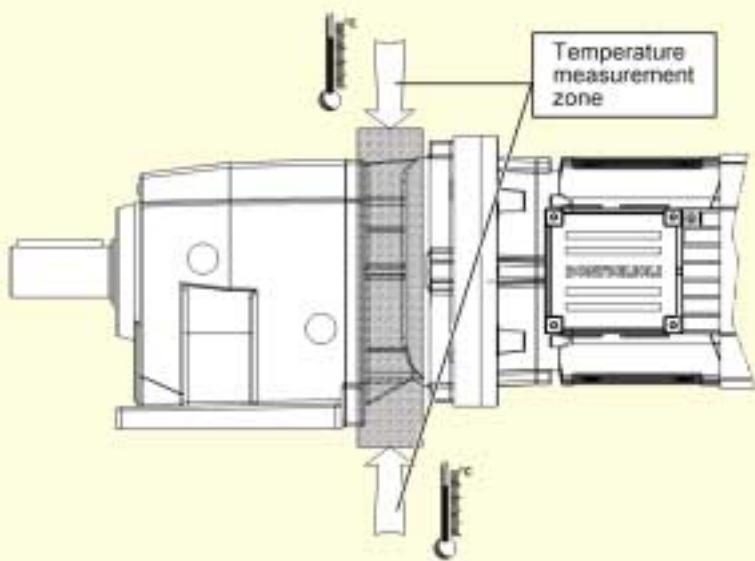


Measuring the gear unit's surface temperature

- The gear unit's maximum surface temperature depends on the motor speed, gear ratio and motor execution and must never exceed 130 °C (160 °C if so specified on the nameplate).
- The nameplate specifications regarding the maximum surface temperature, refer to measurements made in normal ambient and installation conditions. Even minimal variations to said conditions (e.g. smaller mounting cabinet) could have a significant impact on the build up of heat.
- When commissioning the gear unit, the surface temperature must be measured in the same operating conditions as for the final application.

The surface temperature must be measured at the coupling between the gear unit and motor, and at the points which are most shielded from the motor's fan cooling.

(S2)



IMPORTANT:

The maximum surface temperature is reached after 3 hours' operation at full load. The temperature measured in these conditions must not differ (ΔT) from the ambient temperature by more than the following values:

(A3)

	ΔT [°C]
C 11...C 61	75
A 10...A 60	75
F 10...F 60	75
VF 44, VF 49	75
W 63...W 86	75
W 110	90

Should the temperature differential exceed these values, stop the gear unit at once and contact the BONFIGLIOLI RIDUTTORI technical service.

- If the temperature differential is within the above values, wait for the gear unit to cool down and then install the temperature indicator supplied with the gear unit at the point of maximum temperature.

Example:



- At the same time, check for excessive running noise and vibration.

 	<ul style="list-style-type: none">Provided all the above checks have been passed and that all other instructions in this manual have been strictly observed, an electric motor with ATEX rating equal or greater than that of the gear unit may be installed, thus forming a gearmotor which itself complies with the provisions of Directive 94/9/EC. <p>If, on the other hand, the installation of the motor to the gear unit requires actions other than those prescribed in this Manual and/or one or more of the manual's prescriptions has not been satisfied, the User shall be responsible for analysing the risks attendant on this particular motor/gear unit combination. The risk analysis is in any case mandatory if the motor is driven through an inverter.</p> <p>Only in this way, and subject to certification by the assembler, shall the assembly, including the gear unit itself, be compliant with the requirements of Directive 94/9/EC.</p>
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7.0 - USING THE EQUIPMENT

Before putting the gear unit into service, the User must ensure that the plant in which it is installed complies with all applicable directives, especially those regarding health and safety at work.

- 
- The gear unit may not be used in areas and environments:
- with highly corrosive and/or abrasive vapours, smoke or dust
 - in direct contact with loose food products.

- 
- Danger zones and exposed persons:
- The danger zone of the gear unit is the protrusion of the shaft which constitutes a hazard for exposed persons in direct contact with it (crushing, cutting, trapping). In particular, when the gear unit is operating in automatic mode and in an accessible area, the shaft must be protected by a guard.



8.0 - MAINTENANCE



Maintenance and replacement work must be done by expert maintenance technicians trained in the observance of applicable laws on health and safety at work and the special ambient problems attendant on the installation.



Before doing any work on the unit, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning (due to suspended loads or similar external factors).

Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc.).

- Before doing any maintenance work, activate all safety equipment and, if necessary, inform persons working in the vicinity. In particular, mark off the area around the unit and prevent access to any equipment which, if activated, might be the cause of unexpected health and safety hazards.
- Replace worn components with original spare parts only.
- Use the lubricants (oil and grease) recommended by the Manufacturer.
- When working on the gear unit always replace gaskets and seals with new original ones.
- If a bearing requires replacement, it is good practice to also replace the other bearing supporting the same shaft.
- We recommend replacing the lubricating oil after all maintenance work.

The above instructions are aimed at ensuring efficient and safe operation of the gear unit.

The Manufacturer declines all liability for injury and damage to components due to the use of non-original spare parts and non-routine work which modifies the safety requirements without the express prior authorisation of the Manufacturer.

Refer to the specific spare parts catalogue when ordering spare parts for the gear unit.



Do not dump polluting liquids, worn parts and maintenance waste into the environment. Dispose of all such materials as stipulated by applicable legislation.



- Observe the routine inspection and maintenance schedule to ensure suitable operating conditions and the effective explosion protection of the unit.
- Always apply fresh Loctite 510 paste or equivalent product with similar properties and application range to all disassembled threads.
- Before servicing or repairing internal components, allow the gear unit to cool down completely before opening the casing so as to avoid burns from parts which are still hot.
- Make sure, on completion of maintenance work, that all safety measures and equipment have been applied and reset.
- Clean the gear unit thoroughly after maintenance work and repairs.
- On completion of maintenance work, tighten all vent, filler and level plugs to their specified torque (table A0).
- On completion of any maintenance work, all seals must be refitted and sealed as prescribed. On gear units with double seal rings, the cavity between the two rings must be packed with synthetic grease (Fluorocarbon gel 880 ITP or equivalent product with similar properties and application range) before assembly.
- Regardless of the type of gear unit, whenever a seal ring is replaced its lips should be smeared with a thin layer of grease (Fluorocarbon gel 880 ITP or equivalent product with similar properties and application range) before assembly.
- Use only original spare parts for repairs.





8.1 - ROUTINE MAINTENANCE



Keep the gear unit at its maximum efficiency by following the routine maintenance schedule specified by the Manufacturer.

Good maintenance enables the unit to operate at its maximum performance over a long service life in compliance with safety regulations.

Frequency	Component	Type of work	Operation
1000 h	External seals and gaskets	Check oil level Check for leaks by eye	Maintain or replace components as required
3000 h	For gear units with torque arm: polymer bushings	Check for cracks/ageing	Replace if no longer fully effective
5000 h	Gear unit seals and gaskets	Inspect carefully for wear/ageing of external seals.	Replace if aged/worn

Depending on the temperature reached by the lubricant, it should be replaced at the intervals indicated in table (A4) below:

(A4)

Oil temperature t [°C]	Hours
$t < 65$	25000
$65 \leq t < 80$	15000
$80 \leq t \leq 95$	12500

For installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme for all surfaces and recesses to avoid build up of dust more than 5 mm in depth.

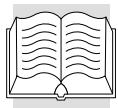
Every 1000 h of operation or after 6 months:

- Measure the surface temperature of the coupling between the gear unit and motor, at the points most shielded from the motor's fan cooling. The maximum temperature must not differ (ΔT) from the ambient temperature by more than the following values, nor may this differential be exceeded during operation.



(A3)

	ΔT [°C]
C 11...C 61	75
A 10...A 60	75
F 10...F 60	75
VF 44, VF 49	75
W 63...W 86	75
W 110	90



Check the condition of the temperature indicator previously installed on the gear unit during commissioning.

Example:



Limit temperature exceeded



Limit temperature NOT exceeded

Also check that the temperature is not excessive around the gear unit's bearings.

- Check the oil levels with reference to the tables and diagrams given in Annexes 1 and 2.
- Check that there are no signs of lubricant leaks near to the gear unit.
- **If any anomalies are found, identify their cause, repair the unit accordingly and top up the lubricant before putting the gear unit back into service.**

Every 3000 h of operation:

- For gear units with torque arm, check that the polymer bushings are not aged or damaged. If they are at all compromised, replace with original spare parts.

Every 5000 h of operation:

- Change the synthetic oil and bearing grease if the gear unit is not life-time lubricated.
- Replace all externally accessible seal rings unless this has already been done as a result of problems occurring before the scheduled maintenance deadline.



Every 5000 h of operation at rated torque:

(The minimum overhaul interval indicated here may increase considerably depending on actual conditions of service; see table (A5)).

- Overhaul the gear unit, unless this has already been done as a result of problems occurring before the specified deadline.

(An overhaul involves the replacement of bearings and/or other mechanical components which have worn to such an extent as to compromise the operation of the gear unit).

(A5)

$\frac{M_{n2}}{M_{r2}}$	Interval hours
1.0	5000
1.25	10000
1.5	17000
1.75	27000
2.0	40000

M_{n2} = nominal torque at output shaft

M_{r2} = required torque at output shaft

8.2 - LUBRICANTS

Before putting the gear unit into service, check the oil level. This must be done with the gear unit in the mounting position in which it will be used in the application. If necessary, if or top up the lubricant to the filling mark on the level cap which may be transparent or of the spill type.



Life-time lubricated gear units which are not subject to external contamination do not normally require periodic lubricant changes.



Do not mix oils of different nature or specifications and check that the oil is highly resistant to foaming and is EP rated.

If the same type of oil as that already in use is not available, drain the gear unit completely and flush its interior thoroughly with a light solvent before refilling with a new lubricant.

8.3 - OIL CHANGE

1. Place an adequate container under the drain plug.
2. Remove the filler and drain plugs and allow the oil to drain out.



The oil will drain better if it is warm.

3. Wait for a few minutes until all the oil has drained out, then screw the drain plug back on with a new gasket.
4. Fill the gear unit with the new oil (in its actual mounting position) to the centre of the level plug.
5. Tighten down the filler plug after fitting a new gasket.



The gear unit may be supplied with or without lubricant, as specified by the User. The quantity of oil to be filled is specified in the Sales Catalogue. This specification is, however, approximate, and reference must always be made to the centre of the level plug, the placement of which depends on the mounting position specified in the order.



Lubricants, solvents and detergents are toxic/harmful to health:

- they may cause irritation in direct contact with the skin
- they may cause intoxication if inhaled
- they can be fatal if swallowed.

Handle them with care using suitable individual safety equipment. Do not dump into the environment and dispose of in compliance with applicable legislation.



If a leak is found, identify the cause of the fault, repair it and refill with lubricant before operating the gear unit.



8.4 - RECOMMENDED/PERMITTED OILS

OILS AND GREASES COMPATIBLE with Atex-certified gear units

Greases:

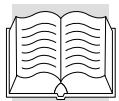
- Klüber Asonic GHY 72 (for bearings)
- Shell TVX Compound B (for greased gear trains)
- Shell Tivela GL 00 (alternative for greased gear trains)
- Klüberpaste 46 MR 401 (to facilitate coupling of cylindrical parts)
- ITP Fluorocarbon gel 880 (for greasing contact seals)



Oils (as alternatives to Shell Tivela Oil S 320):

- Shell: Tivela Oil SC320
- Aral: Degol GS 320
- IP: Telium Oil VSF 320 (o Agip)
- Klüber: Klübersynth GH 6 320
- Total: Carter SY 320
- Mobil: Glygoyle HE 320





		C	S	F	A	A	VF	VF_R	VF_L	VF-EP	V	VR	
		11...100	10...50	10...90	70...90	10...60	W	W_R	W_L	W-EP	0.25-0.5	1...10	0.25...10
	Tivela S 220												
	Tivela S 320												
	Tivela S 460												
	Donax TX												
	Donax TA												
	Cassida Fluid WG 460	F	F	F	F	F	F	F	F	F			
	Cassida Fluid HF 46										F	F	
	TVX Compound B							G					G
	Telium VSF 220												
	Telium VSF 320												
	Spartan EP 220												
	Spartan EP 320												
	Klübersynth GH 6 220												
	Klübersynth GH 6 320												
	Klübersynth UH1 6-460	F	F	F	F	F	F	F	F	F			
	Glygoyle HE 320												
	Glygoyle HE 460												
	Mobilgear SHC XMP 220												
	Mobilgear SHC XMP 320												
	Mobil SHC 630												
	Mobil SHC 632												
	DTE FM 460												
	Alphasyn PG 220												
	Alphasyn PG 320												
	Carter SY 220												
	Carter SY 320												
	Carter SY 460												
	Degol GS 220												
	Degol GS 320												
	Degol PAS 220												
	Synlube CLP 220												
	Synlube CLP 320												
	Renoling PG 220												
	Renoling PG 320												

G = Grease

Recommended

F = Food grade

Permitted



8.5 - CHECKING EFFICIENCY

- Remove dust deposits from the gear unit and motor casings.
- Check that noise at constant load does not vary. Excessive vibration or noise can indicate wear of the gear train or failure of a bearing.
- Check the power absorption and voltage against the nominal values given on the motor's nameplate.
- Check the wear of linings on the brake motor (if used) and, if necessary, adjust the gap.
- Check for lubricant leaks from the gaskets/seals, caps and casings.
- Check all bolted couplings for wear, deformation or corrosion and tighten them down fully without overtightening.

8.6 - CLEANING

Clean all dust and process waste off the gear unit. Do not use solvents or other products which are incompatible with the construction material and do not direct high-pressure jets of water at the gear unit.

8.7 - PAINT COATING

In the factory, the cast-iron casing of the gear unit is magnetised and sprayed with polyester heat-setting resin which is then baked on. Aluminium casings are not paint coated.

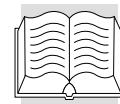
Table (A6) shows in colour the types and gear frame sizes of gear units which are generally painted.

(A6)

C 05	C 11	C 21	C 31	C 35	C 41	C 51	C 61	C 70	C 80	C 90	C 100
A 10	A 20	A 30	A 41	A 50	A 60	A 70	A 80	A 90			
F 10	F 20	F 30	F 40	F 50	F 60	F 70	F 80	F 90			
S 10	S 20	S 30	S 40	S 50							
VF 27	VF 30	VF 44	VF 49	VF 130	VF 150	VF 185	VF 210	VF 250			
W 63	W 75	W 86	W 110								



If the gear unit is to be painted, tape the nameplate and seal rings to prevent contact with solvent.



9.0 - REPLACING PARTS

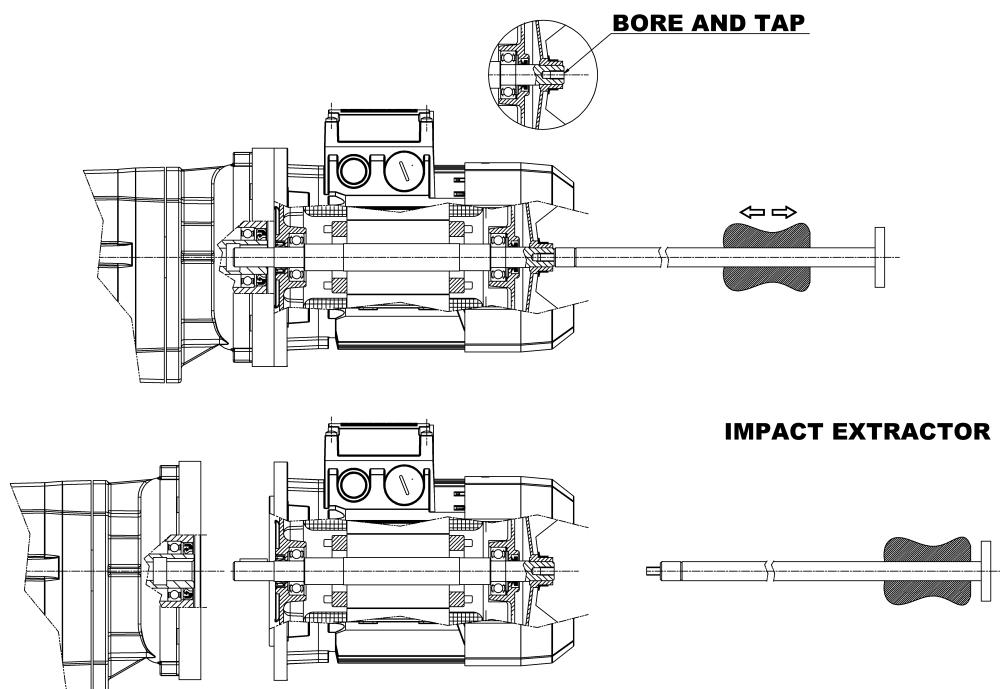
- Do not hesitate to replace parts and/or components if they are not able to guarantee safe and reliable operation.
- Never improvise repairs.
- The use of non-original spare parts not only voids the warranty but can compromise gear unit operation.

9.1 - TAKING APART OF THE IEC-STANDARD FLANGED MOTOR

If, during operation, the coupling area of the motor and gear unit has not rusted significantly, it should be possible to remove the motor without applying excessive force.

If, on the other hand, it proves difficult to remove the motor, do not use screwdrivers or levers to apply force as this can damage the flanges and coupling surfaces, but proceed as indicated below.

(S3)



1. Drill and thread the motor shaft (fan side).
2. Screw an impact extractor tool into the tap.
3. Undo the screws fixing the motor to the gear unit.
4. Remove the motor by means of the inertial force of the extractor.

9.2 - SCRAPPING THE GEAR UNIT

This must only be done by operators trained in the observance of applicable laws on health and safety at work.

Do not dump non-biodegradable products, lubricants and non-ferrous materials (rubber, PVC, resins, etc.) into the environment. Dispose of all such materials as stipulated by applicable environmental protection legislation.



Do not attempt to re-use parts or components which appear to be in good condition after they have been checked and/or replaced by qualified personnel and declared unsuitable for use.



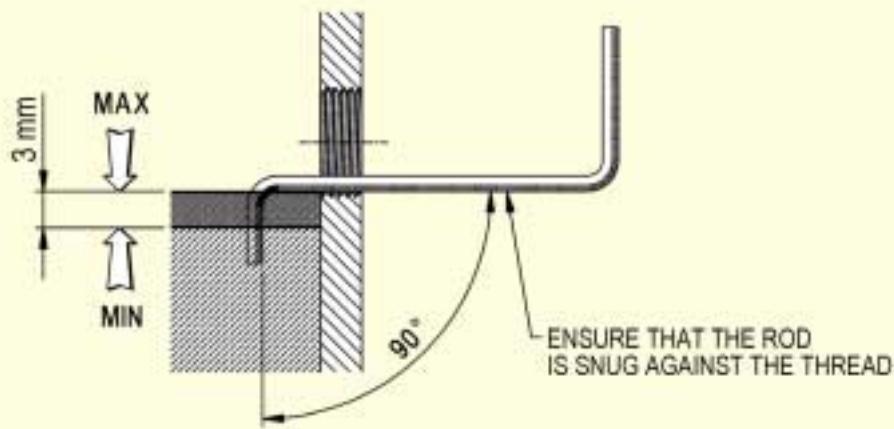
10.0 - TROUBLESHOOTING

The following information is intended to serve as an aid in identifying and correcting defects and faults. In some cases, such problems may be caused by the plant or machine onto which the gear unit is assembled, and hence, the cause and eventual solution can be found in the Manufacturer's technical documentation for the machine/plant in question.

PROBLEM	CAUSE	SOLUTION
Bearing temperature too high	Oil level too low	Top up oil level
	Oil too old	Replace oil
	Defective bearings	Contact authorised workshop
Operating temperature too high	Oil level too high	Check oil level
	Oil too old	Replace oil
	Impurities in oil	Replace oil
Abnormal running noise	Gears damaged	Contact authorised workshop
	Bearing axial backlash too high	Contact authorised workshop
	Bearings defective or worn	Contact authorised workshop
	Service load too high	Correct service load to nominal values given in Sales Catalogue
	Impurities in oil	Replace oil
Abnormal noise at gear unit mounting	Mounting bolts loose	Tighten down to specified torque
	Mounting bolts worn	Replace bolts
Oil leaks	Oil level too high	Check oil level
	Casing/coupling seals inadequate	Contact authorised workshop
	Gaskets worn	Contact authorised workshop
Gear unit does not run or runs with difficulty	Oil viscosity too high	Replace oil (see table of recommended lubricants)
	Oil level too high	Check oil level
	Service load too high	Redesign drive for actual service load
Output shaft does not turn with motor running	Gears damaged	Contact authorised workshop

ANNEX 1 - CHECKING OIL LEVEL ON ATEX-SPECIFIED GEAR UNITS

Gear units are normally supplied with a yellow oil level plug of the spill type. To check the oil level, first identify the yellow level plug. Remove the plug and insert a bar of the right size for the hole and of the shape shown in the figure below. If the level is more than 3 mm below the overflow level, top up and check the reason for the drop in oil level.

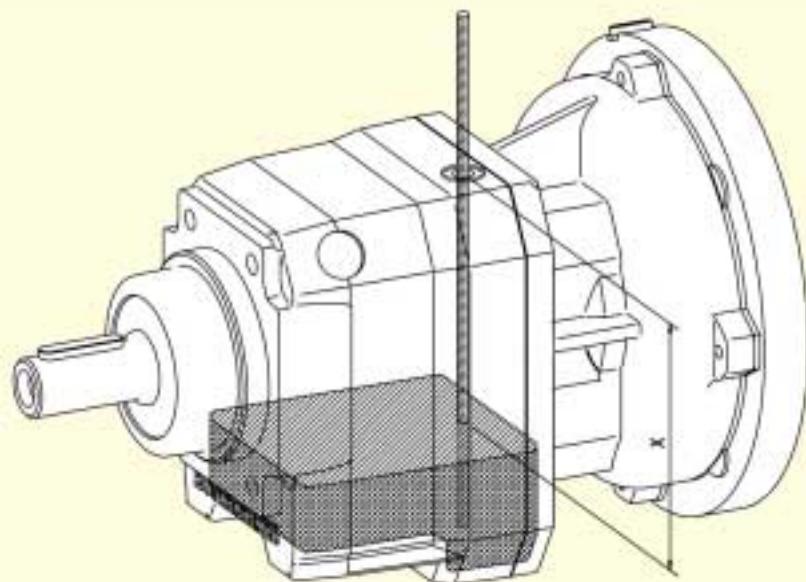


Helical in-line gear units C11, C21 and C31 (all mounting positions) and bevel helical gear units A10, A20 and A30 in mounting positions B6 and B7 only do not feature a level plug. The oil level must therefore be checked, not as described above, but via a hole provided for the purpose in the manner described hereafter.



Helical in-line gear units C 11, C 21, C 31

(S4)



(A7)

	P						F						U-UF					
	B3	B6	B7	B8	V5	V6	B5	B51	B53	B52	V1	V3	B5	B51	B53	B52	V1	V3
C 11 2_P63-P71	70	70	70	70	70	45	70	70	70	70	60	30	70	70	70	70	60	30
C 11 2_P80...P112	75	75	75	75	75	45	75	75	75	75	70	30	75	75	75	75	70	30
C 21 2_P63-P71, HS	70	70	70	70	70	40	70	70	70	70	70	45	70	70	70	70	70	45
C 21 2_P80...P112	75	75	75	75	75	40	75	75	75	75	75	45	75	75	75	75	75	45
C 21 3_P63-P71	50	50	50	50	50	30	50	50	50	50	50	30	50	50	50	50	50	30
C 21 3_P80...P112	55	55	55	55	55	30	55	55	55	55	55	30	55	55	55	55	55	30
C 31 2_P63...P112, HS	65	65	65	65	60	60	65	65	65	65	55	55	65	65	65	65	55	55
C 31 3_P63...P112	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55

Values in the table are given in mm.

To check the oil level, proceed as follows:

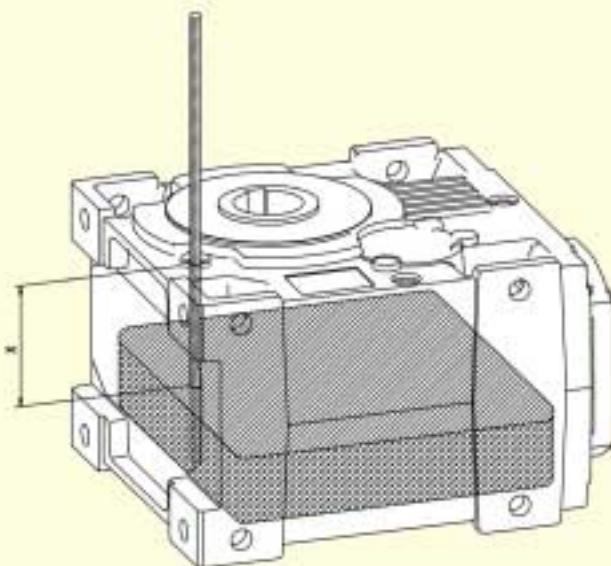
1. Place the gear unit in the mounting position as shown in diagram (S4).
2. Insert a dipstick through the yellow service cap (on top of the gear unit) until it touches the floor of the casing. Mark the level of the upper surface of the casing on the dipstick in this position.
3. Extract the dipstick and measure the distance X shown in diagram (S4) above.
4. The value X must be **less than** the value given in table (A7).



Bevel helical gear units A 10, A 20 and A 30 - Mounting positions B6 and B7



(S5)



(A8)

	B6	B7
A 10_P63...P112	30	30
A 20_P63...P112, HS	25	25
A 30_P63...P112, HS	30	30

Values in the table are given in mm

To check the oil level, proceed as follows:

1. Place the gear unit in the mounting position as shown in diagram (S5).
2. Insert a dipstick through the yellow service cap (on top of the gear unit) until it touches the floor of the casing. Mark the level of the upper surface of the casing on the dipstick in this position.
3. Extract the dipstick and measure the distance **X** shown in diagram (S5) above.
4. The value **X** must be **less than** the value given in table (A8).



ANNEX 2 - LUBRICANT FILL QUANTITY

Helical in-line gear units, series C:

(A9)

	oil [l]																	
	P						F						U - UF					
	B3	B6	B7	B8	V5	V6	B5	B51	B53	B52	V1	V3	B5	B51	B53	B52	V1	V3
C 05 2	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-	-	-	-	-	-
C 11 2	0.45	0.45	0.45	0.45	0.50	0.60	0.40	0.40	0.50	0.50	0.50	0.60	0.40	0.40	0.50	0.50	0.50	0.60
C 21 2	0.80	0.80	0.80	0.80	0.85	1.1	0.75	0.75	0.75	0.75	0.80	1.0	0.75	0.75	0.75	0.75	0.80	1.0
C 21 3	1.2	1.2	1.2	1.2	1.3	1.4	1.2	1.2	1.2	1.2	1.3	1.4	1.2	1.2	1.2	1.2	1.3	1.4
C 31 2	1.4	1.4	1.4	1.4	1.5	1.5	1.3	1.3	1.3	1.3	1.5	1.5	1.3	1.3	1.3	1.3	1.5	1.5
C 31 3	1.6	1.6	1.6	1.6	1.8	1.8	1.6	1.6	1.6	1.6	1.8	1.8	1.6	1.6	1.6	1.6	1.8	1.8
C 35 2	1.6	1.5	1.5	1.3	2.1	2.4	-	-	-	-	-	-	1.6	1.5	1.5	1.3	2.1	2.4
C 35 3	1.5	1.4	1.5	1.3	2.0	2.3	-	-	-	-	-	-	1.5	1.4	1.5	1.3	2.0	2.3
C 35 4	2.3	2.1	2.3	2.1	2.7	3.1	-	-	-	-	-	-	2.3	2.1	2.3	2.1	2.7	3.1
C 41 2	2.2	2.0	2.1	1.9	2.7	3.4	-	-	-	-	-	-	2.2	2.0	2.1	1.9	2.7	3.4
C 41 3	2.1	1.9	2.1	1.9	2.6	3.2	-	-	-	-	-	-	2.1	1.9	2.1	1.9	2.6	3.2
C 41 4	2.8	2.6	2.8	2.6	3.5	3.9	-	-	-	-	-	-	2.8	2.6	2.8	2.6	3.5	3.9
C 51 2	3.1	3.0	3.1	3.0	4.3	5.0	-	-	-	-	-	-	3.1	3.0	3.1	3.0	4.3	5.0
C 51 3	3.0	2.8	3.1	3.0	4.1	4.9	-	-	-	-	-	-	3.0	2.8	3.1	3.0	4.1	4.9
C 51 4	4.3	4.1	4.4	4.2	5.4	6.1	-	-	-	-	-	-	4.3	4.1	4.4	4.2	5.4	6.1
C 61 2	4.2	4.0	4.2	4.1	6.0	6.7	-	-	-	-	-	-	4.2	4.0	4.2	4.1	6.0	6.7
C 61 3	4.2	4.0	4.2	4.1	6.0	6.7	-	-	-	-	-	-	4.2	4.0	4.2	4.1	6.0	6.7
C 61 4	6.1	5.9	6.1	6.0	7.9	8.6	-	-	-	-	-	-	6.1	5.9	6.1	6.0	7.9	8.6
C 70 2	6.5	8.5	8.5	7.5	11	7.5	6.5	8.5	8.5	7.5	11	7.5	-	-	-	-	-	-
C 70 3	6.5	8.5	8.5	7.5	11	7.5	6.5	8.5	8.5	7.5	11	7.5	-	-	-	-	-	-
C 70 4	6.5	8.5	8.5	7.5	11	8.0	6.5	8.5	8.5	7.5	11	7.5	-	-	-	-	-	-
C 80 2	11	14	14	13	18	13	11	14	14	13	18	13	-	-	-	-	-	-
C 80 3	11	14	14	13	18	13	11	14	14	13	18	13	-	-	-	-	-	-
C 80 4	11	14	14	13	18	13	11	14	14	13	18	13	-	-	-	-	-	-
C 90 2	19	25	25	22	31	22	19	25	25	22	31	22	-	-	-	-	-	-
C 90 3	19	25	25	22	31	22	19	25	25	22	31	22	-	-	-	-	-	-
C 90 4	19	25	25	22	31	22	19	25	25	22	31	22	-	-	-	-	-	-
C 100 2	27	37	37	33	45	33	27	37	37	33	45	33	-	-	-	-	-	-
C 100 3	27	37	37	33	45	33	27	37	37	33	45	33	-	-	-	-	-	-
C 100 4	27	37	37	33	45	33	27	37	37	33	45	33	-	-	-	-	-	-

Life-time lubricated gear units.

Life-time lubricated gear units only in combination with ATEX variants.

Lubricant is not factory filled.



Bevel helical gear units, series A:

(A10)

	oil [l]					
	B3	B6	B7	B8	VA	VB
A 10 2	1.4	1.4	1.4	1.4	1.4	1.4
A 20 2	2.3	2.3	2.3	2.3	2.3	2.3
A 20 3	2.6	2.6	2.6	2.6	2.6	2.6
A 30 2	3.2	3.2	3.2	3.2	3.2	3.2
A 30 3	3.6	3.6	3.6	3.6	3.6	3.6
A 41 2	4.0	4.1	4.1	4.7	5.2	4.4
A 41 3	4.0	4.0	4.0	4.7	6.1	3.9
A 50 2	4.9	8.1	4.7	8.4	11	9.2
A 50 3	5.1	8.1	4.7	8.4	11	9.2
A 50 4	6.3	8.2	5.3	8.3	13	9.1
A 60 2	6.8	8.1	12	15	18	15
A 60 3	6.8	8.1	12	15	18	15
A 60 4	7.2	11	7.4	16	19	14
A 70 3	10	14	10	15	20	14
A 70 4	13	14	10	15	23	14
A 80 3	15	22	15	26	35	22
A 80 4	20	22	15	26	39	22
A 90 3	31	35	37	44	66	39
A 90 4	41	35	37	44	73	39

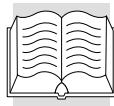
(A11)

	oil [l]					
	B3	B6	B7	B8	VA	VB
A 10 2	0.80	see Annex 1	see Annex 1	1.2	1.2	1.1
A 20 2	1.2			1.7	1.8	1.5
A 20 3	1.5			1.7	2.4	1.6
A 30 2	1.8			2.3	2.6	2.1
A 30 3	2.3			2.4	3.5	2.3
A 41 2	4.0	4.1	4.1	4.7	5.2	4.4
A 41 3	4.0	4.0	4.0	4.7	6.1	3.9
A 50 2	4.9	8.1	4.7	8.4	11	9.2
A 50 3	5.1	8.1	4.7	8.4	11	9.2
A 50 4	6.3	8.2	5.3	8.3	13	9.1
A 60 2	6.8	8.1	12	15	18	15
A 60 3	6.8	8.1	12	15	18	15
A 60 4	7.2	11	7.4	16	19	14



Life-time lubricated gear units.

Lubricant is not factory filled.



Shaft-mounted gear units, series F:

(A12)

	[l]					
	H1	H2	H3	H4	H5	H6
F 10 2	0.95	0.95	0.95	0.95	0.95	0.95
F 20 2	1.4	1.4	1.4	1.4	1.4	1.4
F 20 3	1.8	1.8	1.8	1.8	1.8	1.8
F 30 2	2.6	2.1	1.5	2.1	2.9	2.1
F 30 3	2.6	2.1	1.5	2.1	2.9	2.1
F 30 4	2.9	2.4	1.7	2.4	3.2	2.4
F 40 2	5.0	3.9	4.0	3.1	5.1	4.0
F 40 3	5.0	3.9	4.0	3.1	5.1	4.0
F 40 4	5.3	4.3	4.3	3.3	5.5	4.4
F 50 2	9.2	6.7	7.6	4.7	9.2	6.7
F 50 3	9.2	6.7	7.6	4.7	9.2	6.7
F 50 4	9.7	7.4	8.1	5.1	9.9	7.4
F 60 3	14	10	7.4	10	14	10
F 60 4	15	12	8.0	11	15	11
F 70 3	23	20	9.7	16	24	19
F 70 4	23	20	9.7	16	27	19
F 80 3	40	34	16	29	42	31
F 80 4	40	34	16	29	48	31
F 90 3	71	59	32	49	76	55
F 90 4	71	59	32	49	86	55

(A13)

	[l]					
	H1	H2	H3	H4	H5	H6
F 10 2	1.2	1.3	0.70	0.80	0.80	1.1
F 20 2	2.0	1.7	0.90	1.3	1.2	1.7
F 20 3	2.3	1.8	1.2	1.5	1.8	1.8
F 30 2	2.6	2.6	1.5	1.7	2.5	2.6
F 30 3	2.5	2.5	1.5	1.6	2.4	2.5
F 30 4	3.0	2.7	1.9	2.0	3.3	2.7
F 40 2	5.5	4.4	4.5	3.6	5.6	4.9
F 40 3	5.5	4.4	4.5	3.6	5.6	4.9
F 40 4	5.3	4.3	4.3	3.3	5.5	4.4
F 50 2	9.7	7.2	8.1	5.2	9.7	7.6
F 50 3	9.7	7.2	8.1	5.2	9.7	7.6
F 50 4	9.7	7.4	8.1	5.1	9.9	7.4
F 60 3	14	11	7.9	11	15	11
F 60 4	15	12	8.0	11	15	11



Life-time lubricated gear units.

Lubricant is not factory filled.



Worm gear units, series VF:

(A14)

			oil [l]					
			B3	B6	B7	B8	V5	V6
VF 27	N - A - V - F	HS - P(IEC)	0.025	0.025	0.025	0.025	0.025	0.025
VF 30	N - A - V - F - P	HS - P(IEC)	0.045	0.045	0.045	0.045	0.045	0.045
VF 44	N - A - V - F - FA - P	HS - P(IEC)	0.075	0.075	0.075	0.075	0.075	0.075
VFR 44	N - A - V - F - FA - P	P(IEC)	0.050	0.050	0.050	0.050	0.050	0.050
VF 49	N - A - V - F - FA - P	HS - P(IEC)	0.12	0.12	0.12	0.12	0.12	0.12
VFR 49	N - A - V - F - FA - P	HS - P(IEC)	0.065	0.065	0.065	0.065	0.065	0.065
VF 130	N	HS - P(IEC)	2.3	2.5	2.5	3.0	3.2	3.4
VFR 130	N	HS - P(IEC)	0.70	0.50	0.50	0.40	0.40	0.50
VF 130	V	HS - P(IEC)	3.4	2.5	2.5	3.1	3.0	2.5
VFR 130	V	HS - P(IEC)	0.50	0.50	0.50	0.40	0.40	0.70
VF 130	A - F - FC - FR - P	HS	3.9	2.5	2.5	2.3	3.3	3.3
VF 130	A - F - FC - FR - P	P(IEC)	3.0	2.5	2.5	2.3	3.3	3.3
VFR 130	A - F - FC - FR - P	HS - P(IEC)	0.40	0.50	0.50	0.70	0.40	0.50
VF 150	N	HS - P(IEC)	3.0	3.5	3.5	4.3	3.8	4.0
VFR 150	N	HS - P(IEC)	1.0	0.80	0.80	0.60	0.40	1.0
VF 150	V	HS - P(IEC)	4.0	3.5	3.5	3.6	4.3	3.0
VFR 150	V	HS - P(IEC)	1.0	0.80	0.80	0.40	0.60	1.0
VF 150	A - F - FC - FR - P	HS	4.5	3.5	3.5	3.0	3.9	3.9
VF 150	A - F - FC - FR - P	P(IEC)	4.3	3.5	3.5	3.0	3.9	3.9
VFR 150	A - F - FC - FR - P	HS - P(IEC)	0.60	0.80	0.80	1.0	0.40	1.0
VF 185	N	HS - P(IEC)	5.0	5.5	5.5	7.8	6.6	6.8
VFR 185	N	HS - P(IEC)	1.0	0.80	0.80	0.60	0.40	1.0
VF 185	V	HS - P(IEC)	6.8	5.5	5.5	6.4	7.8	5.4
VFR 185	V	HS - P(IEC)	1.0	0.80	0.80	0.40	0.60	1.0
VF 185	A - F - FC - FR - P	HS	9.6	5.5	5.5	5.0	6.7	6.7
VF 185	A - F - FC - FR - P	P(IEC)	7.8	5.5	5.5	5.0	6.7	6.7
VFR 185	A - F - FC - FR - P	HS - P(IEC)	0.60	0.80	0.80	1.0	0.40	1.0
VF 210	N	HS - P(IEC)	7.5	9.5	9.5	7.3	9.2	9.0
VFR 210	N	HS - P(IEC)	1.3	1.1	1.1	0.80	0.70	1.3
VF 210	V	HS - P(IEC)	8.9	9.5	9.5	7.3	11	8.0
VFR 210	V	HS - P(IEC)	1.3	1.1	1.1	0.60	0.90	1.3
VF 210	A - F - FC - FR - P	HS	15	9.5	9.5	7.5	9.4	8.9
VF 210	A - F - FC - FR - P	P(IEC)	11	9.5	9.5	7.5	9.4	8.9
VFR 210	A - F - FC - FR - P	HS - P(IEC)	0.80	1.1	1.1	1.3	0.70	1.3
VF 250	N	HS - P(IEC)	11	17	17	11	17	17
VFR 250	N	HS - P(IEC)	1.3	1.1	1.1	0.80	0.70	1.3
VF 250	V	HS - P(IEC)	17	17	17	11	23	11
VFR 250	V	HS - P(IEC)	1.3	1.1	1.1	0.60	0.90	1.3
VF 250	A - F - FC - FR - P	HS	28	17	17	11	18	17
VF 250	A - F - FC - FR - P	P(IEC)	23	17	17	11	18	17
VFR 250	A - F - FC - FR - P	HS - P(IEC)	0.80	1.1	1.1	1.3	0.70	1.3

VF permanent lubrication.

VFR permanent lubrication.

For VFR units the lubricant charge refers only to the additional helical reduction.



Worm gear units, series W:

(A15)

			oil [I]							
				B3	B6	B7	B8	V5	V6	R
W 63	i = 7, 10, 12, 15			0.31	0.31	0.31	0.31	0.31	0.31	0.15
	i = 19, 24, 30, 38, 45, 64, 80, 100			0.38	0.38	0.38	0.38	0.38	0.38	
W 75	i = 7, 10, 15			0.48	0.48	0.48	0.48	0.48	0.48	0.25
	i = 30, 40			0.52	0.52	0.52	0.52	0.52	0.52	
	i = 20, 25, 50, 60, 80, 100			0.56	0.56	0.56	0.56	0.56	0.56	
W 86	i = 7, 10, 15			0.64	0.64	0.64	0.64	0.64	0.64	0.25
	i = 30			0.73	0.73	0.73	0.73	0.73	0.73	
	i = 20, 23, 40, 46, 56, 64, 80, 100			0.90	0.90	0.90	0.90	0.90	0.90	
				B3	B6	B7	B8	V5	V6	R
W 110	P80...P132	-	-	1.5	1.7	1.7	1.9	1.7	1.6	0.40
	-	M2 – M3	-	1.5	1.7	1.7	1.9	1.7	1.6	
	-	-	7 ≤ i ≤ 15	1.5	1.7	1.7	1.9	1.7	1.6	
			20 ≤ i ≤ 100	2.7	1.7	1.7	1.9	1.7	1.6	

Life-time lubricated gear units.

Life-time lubricated gear units only in combination with ATEX variants.

Lubricant is not factory filled.

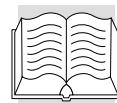
Single-stage helical gear units, series S:

(A16)

	oil [I]											
	P						F					
	B3	B6	B7	B8	V5	V6	B5	B51	B52	B53	V1	V3
S 10 1	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
S 20 1	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
S 30 1	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
S 40 1	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
S 50 1	1.7	2.2	2.2	3.0	3.0	2.0	1.7	1.7	1.7	1.7	3.0	2.0

Life-time lubricated gear units.

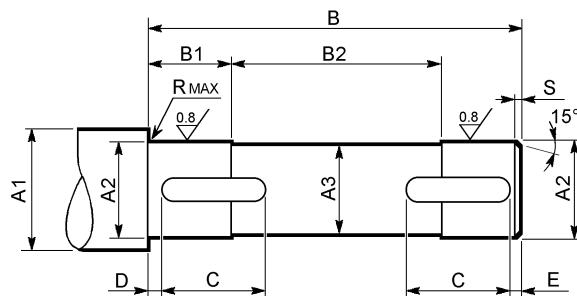
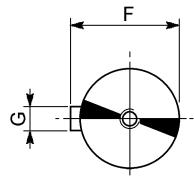
Lubricant is not factory filled.



ANNEX 3 - CUSTOMER'S SHAFT

Series A

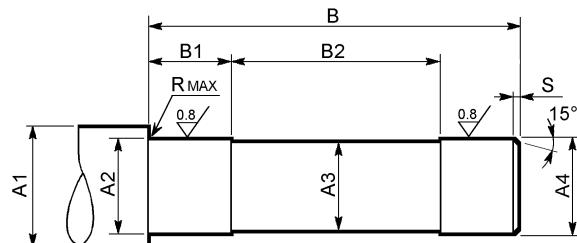
**NH
UH**



(A17)

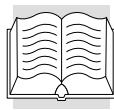
	A1	A2	A3	B	B1	B2	C	D	E	F	G	R	S	UNI 6604
A 10	≥ 35	30 h7	29	118	16	87	20	2	2	33	8 h9	0.5	1.5	8x7x20 A
	≥ 30	25 h7	24	118	16	87	20	2	2	28	8 h9	0.5	1.5	8x7x20 A
A 20	≥ 42	35 h7	34	138	20	98	20	2	2	38	10 h9	0.5	1.5	10x8x20 A
	≥ 35	30 h7	29	138	20	98	25	2	2	33	8 h9	0.5	1.5	8x7x25 A
A 30	≥ 47	40 h7	39	158	23	112	30	2	2	43	12 h9	0.5	1.5	12x8x30 A
	≥ 42	35 h7	34	158	23	112	30	2	2	38	10 h9	0.5	1.5	10x8x30 A
A 41	≥ 52	45 h7	44	184	28	128	45	2.5	2.5	49.5	14 h9	1	2	14x9x45 A
	≥ 47	40 h7	39	184	28	128	50	2.5	2.5	43	12 h9	1	2	12x8x50 A
A 50	≥ 63	55 h7	54	226	37.5	151	55	2.5	2.5	59	16 h9	1	2	16x10x55 A
	≥ 57	50 h7	49	226	37.5	151	65	2.5	2.5	53.5	14 h9	1	2	14x9x65 A
A 60	≥ 78	70 h7	69	248	48	152	70	2.5	2.5	74.5	20 h9	2.5	2	20x12x70 A
	≥ 68	60 h7	59	248	48	152	80	2.5	2.5	64	18 h9	2.5	2	18x11x80 A
A 70	≥ 89	80 h7	79	303	58	187	90	3	3	85	22 h9	2.5	2.5	22x14x90 A
	≥ 78	70 h7	69	303	58	187	110	3	3	74.5	20 h9	2.5	2.5	20x12x110 A
A 80	≥ 99	90 h7	89	358	78	202	120	3	3	95	25 h9	2.5	2.5	25x14x120 A
	≥ 89	80 h7	79	358	78	202	130	3	3	85	22 h9	2.5	2.5	22x14x130 A
A 90	≥ 111	100 h7	99	408	78	252	160	3	3	106	28 h9	2.5	2.5	28x16x160 A
	≥ 99	90 h7	89	408	78	252	190	3	3	95	25 h9	2.5	2.5	25x14x190 A

US

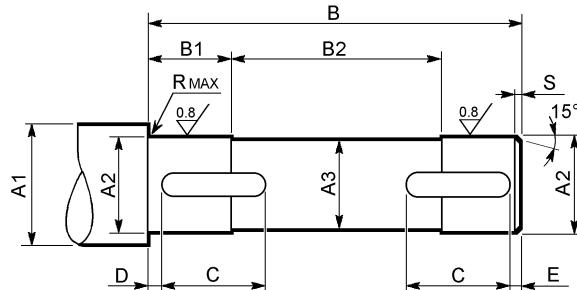
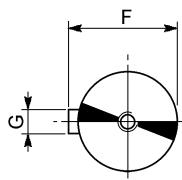


(A18)

	A1	A2	A3	A4	B	B1	B2	R	S
A 10	≥ 42	32 h7	29	30 h6	147.5	34	77.5	0.5	1.5
A 20	≥ 48	37 h7	34	35 h6	170	40	89	0.5	1.5
A 30	≥ 54	42 h7	39	40 h6	191.5	48	95.5	0.5	1.5
A 41	> 60	47 h7	44	45 h6	222	53	117	1	2
A 50	≥ 72	57 h7	54	55 g6	264	46	156	1	2
A 60	≥ 90	72 h7	69	70 g6	293	48	178	2.5	2.5
A 70	≥ 104	82 h7	79	80 g6	352.5	90	172.5	2.5	2.5
A 80	≥ 114	92 h7	89	90 g6	416	100	216	2.5	2.5
A 90	≥ 126	102 h7	99	100 g6	469	78	321	2.5	2.5

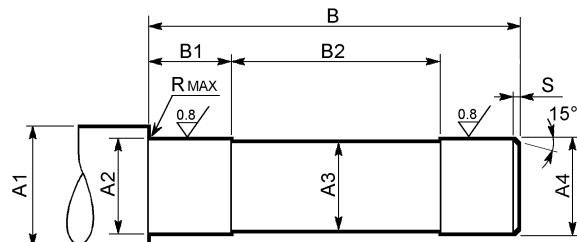


Series F



(A19)

	A1	A2	A3	B	B1	B2	C	D	E	F	G	R	S	UNI 6604
F 10	≥ 35	30 h7	29	79	15.5	48	20	2	2	33	8 h9	0.5	1.5	8x7x20 A
	≥ 30	25 h7	24	79	15.5	48	20	2	2	28	8 h9	0.5	1.5	8x7x20 A
F 20	≥ 42	35 h7	34	99	18	63	22	2	2	38	10 h9	0.5	1.5	10x8x22 A
	≥ 35	30 h7	29	99	18	63	22	2	2	33	8 h9	0.5	1.5	8x7x22 A
F 30	≥ 47	40 h7	39	104	28	48	30	2	2	43	12 h9	0.5	1.5	12x8x30 A
	≥ 42	35 h7	34	104	28	48	30	2	2	38	10 h9	0.5	1.5	10x8x30 A
F 40	≥ 52	45 h7	44	118	27.5	63	45	2.5	2.5	49.5	14 h9	1	2.0	14x9x45 A
	≥ 47	40 h7	39	118	27.5	63	45	2.5	2.5	43	12 h9	1	2.0	12x8x45 A
F 50	≥ 63	55 h7	54	139	33	73	50	2.5	2.5	59	16 h9	1	2.0	16x10x50 A
	≥ 57	50 h7	49	139	33	73	50	2.5	2.5	53.5	14 h9	1	2.0	14x9x50 A
F 60	≥ 78	70 h7	69	180	38	104	70	2.5	2.5	74.5	20 h9	1	2.0	20x12x70 A
	≥ 68	60 h7	59	180	38	104	70	2.5	2.5	64	18 h9	1	2.0	18x11x70 A
F 70	≥ 89	80 h7	79	229	58	113	75	3	3	85	22 h9	2.5	2.5	22x14x75 A
	≥ 78	70 h7	69	229	58	113	75	3	3	74.5	20 h9	2.5	2.5	20x12x75 A
F 80	≥ 99	90 h7	89	272	78	116	100	3	3	95	25 h9	2.5	2.5	25x14x100 A
	≥ 89	80 h7	79	272	78	116	100	3	3	85	22 h9	2.5	2.5	22x14x100 A
F 90	≥ 111	100 h7	99	333	87.5	158	110	3	3	106	28 h9	2.5	2.5	28x16x110 A
	≥ 99	90 h7	89	333	87.5	158	110	3	3	95	25 h9	2.5	2.5	25x14x110 A

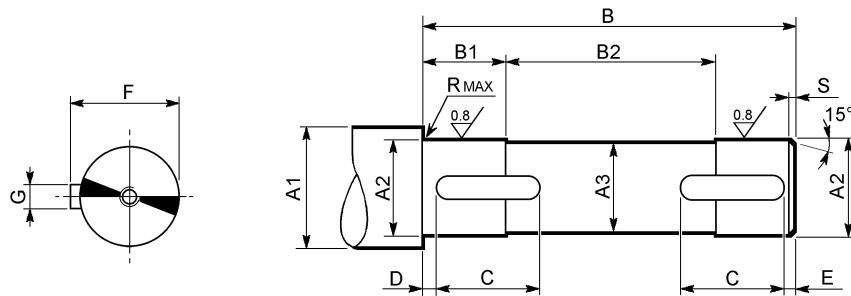


(A20)

	A1	A2	A3	A4	B	B1	B2	R	S
F 10	≥ 36	27 h7	24	25 h6	138	34	70	0.5	1.5
F 20	≥ 42	32 h7	29	30 h6	160	38	84	0.5	1.5
F 30	≥ 50	38 h7	35	36 h6	155	40	73	1	2
F 40	≥ 58	44 h7	41	42 h6	177	46.5	82	1	2
F 50	≥ 68	54 h7	51	52 g6	201	48	91	1	2
F 60	≥ 84	67 h7	64	65 g6	248	53	133	1.5	2
F 70	≥ 104	82 h7	79	80 g6	308	78	140	2.5	2.5
F 80	≥ 114	92 h7	89	90 g6	365	88	177	2.5	2.5
F 90	≥ 126	102 h7	99	100 g6	429.5	98	221.5	2.5	2.5



Series VF and W

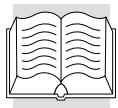


(A21)

	A1	A2	A3	B	B1	B2	C	D	E	F	G	R	S	UNI 6604
VF 30	≥ 19	14 f7	13	53	18.5	16	40	6.5	6.5	16	5 h9	0.5	1.5	5x5x40 A
VF 44	≥ 23	18 f7	17	62	22.5	17	50	6	6	20.5	6 h9	0.5	1.5	6x6x50 A
VF 49	≥ 30	25 f7	24	80	20.5	39	20	2	2	28	8 h9	1	1.5	8x7x20 A
VF 130	≥ 52	45 f7	44	163	50.5	62	60	2.5	2.5	49.5	14 h9	2.5	2	14x9x60 A
VF 150	≥ 57	50 f7	49	173	53	67	70	2.5	2.5	53.5	14 h9	2.5	2	14x9x70 A
VF 185	≥ 68	60 f7	59	188	63	62	80	2.5	2.5	64	18 h9	2.5	2	18x11x80 A
VF 210	≥ 99	90 f7	89	258	83	92	80	3	3	95	25 h9	2.5	2.5	25x14x80 A
VF 250	≥ 121	110 h7	109	318	83	152	80	3	3	116	28 h9	2.5	2.5	28x16x80 A

(A22)

	A1	A2	A3	B	B1	B2	C	D	E	F	G	R	S	UNI 6604
W 63	≥ 30	25	24	118	38	42	35	2	2	28	8 h9	1	1.5	8x7x35 A
W 75	≥ 35	28	27	125	38	49	40	2	2	31	8 h9	1	1.5	8x7x40 A
	≥ 35	30	29	125	38	49	40	2	2	33	8 h9	1	1.5	8x7x40 A
W 86	≥ 42	35	34	138	43	52	40	2	2	38	10 h9	1.5	1.5	10x8x40 A
W 110	≥ 48	42	41	153	43	67	50	2.5	2.5	45	12 h9	1.5	2	12x8x50 A



ANNEX 4 - LIFTING



When lifting, use accessories such as eyebolts, snap hooks, screw clamps, straps, ropes, hooks etc. which are certified and adequate for the load.

The weight of the product to be lifted is given in the Sales Catalogue.

The method of attachment for the products covered by this Manual are detailed below according to the various product series, sizes and configurations.

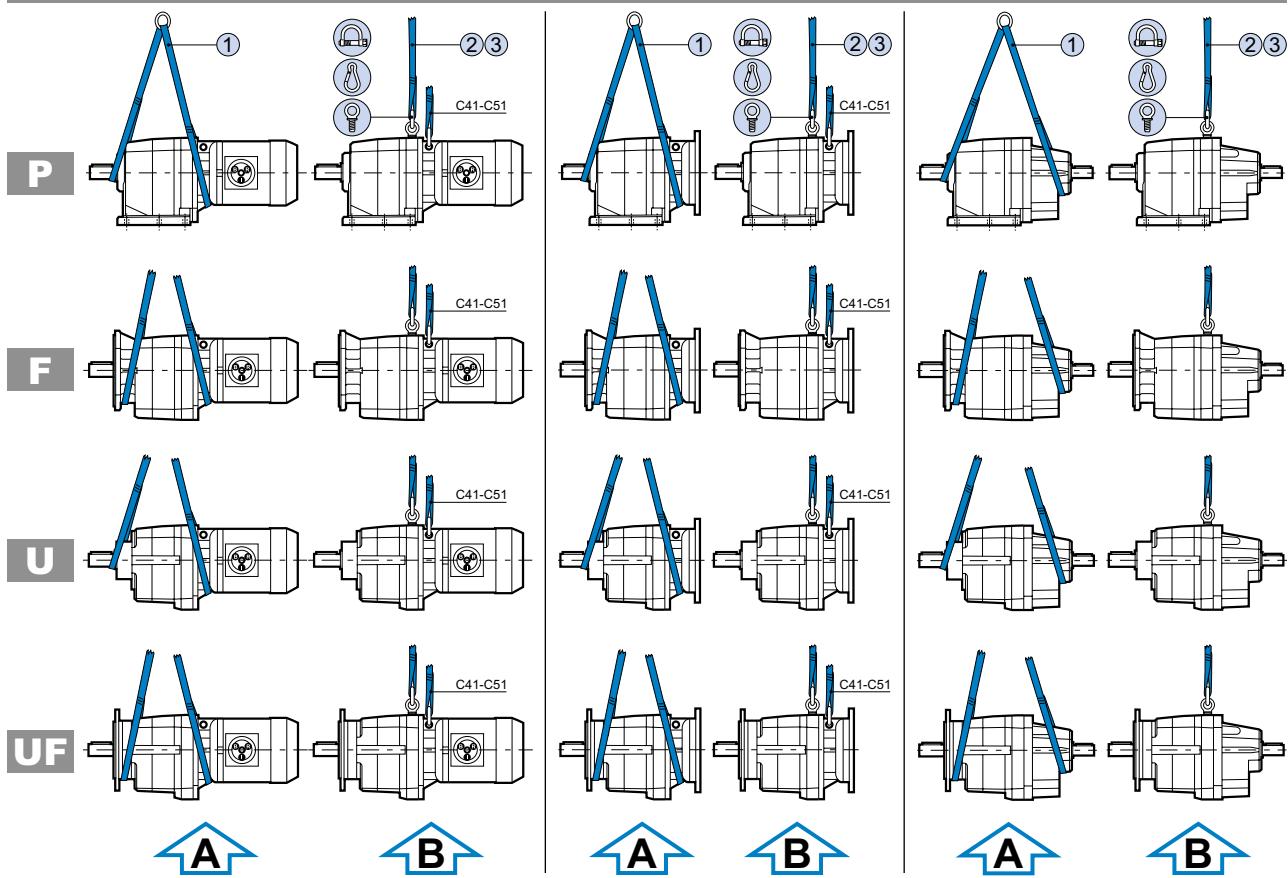
The most suitable type of solution for safely lifting and handling each is indicated below.

Symbols:

Lifting method	Manual	Through mechanical equipment	
Symbol	M	A	B
Approximate weight	≤ 15 Kg	> 15 Kg	
Instruction	—	Recommended method for positioning	Recommended method for handling and positioning
Warning	—	The load may be unstable	The load may sway or oscillate.
Solution	—	Slide the lifting ring to align it with the load's centre of gravity as shown in the diagrams below Lock the ropes under the ring with a cable clamp or similar device so as to prevent them sliding, and lift the load Observe all precautions regarding the handling of loads	Stabilise the moving load by hand. Observe all precautions regarding the handling of loads

The load must not be allowed to sway or oscillate by more than 15° in any direction when being lifted. If the oscillation exceeds this limit, stop and repeat the lifting operation as instructed.

Series C



	M05	M1	M2	M3	M4	M5		
C 05	M		—	—	—	—	—	—
C 11	M		A	—	—	—	M	M
C 21	M		A	—	—	—	M	M
C 31	M		A	—	—	—	M	M
C 35			A	—	—	—	A	A
C 41			A - B			—	A - B	A - B
C 51	—		A - B		—	—	A - B	A - B
C 61	—		A - B		A	A - B	A - B	A - B
C 70	—		A - B		A	A - B	A - B	A - B
C 80	—		A - B		A	A - B	A - B	A - B
C 90	—		A - B		A	A - B	A - B	A - B
C 100	—		A - B		A	A - B	A - B	A - B

① Ring harness

Screw clamp
(use with harness)

M Lift manually
(weight $\leq 15 \text{ kg}$)

MAX Maximum permissible tilt during handling: 15°

② Rope and hooks

Snap hook
(use with rope)

A Lift as per diagram A

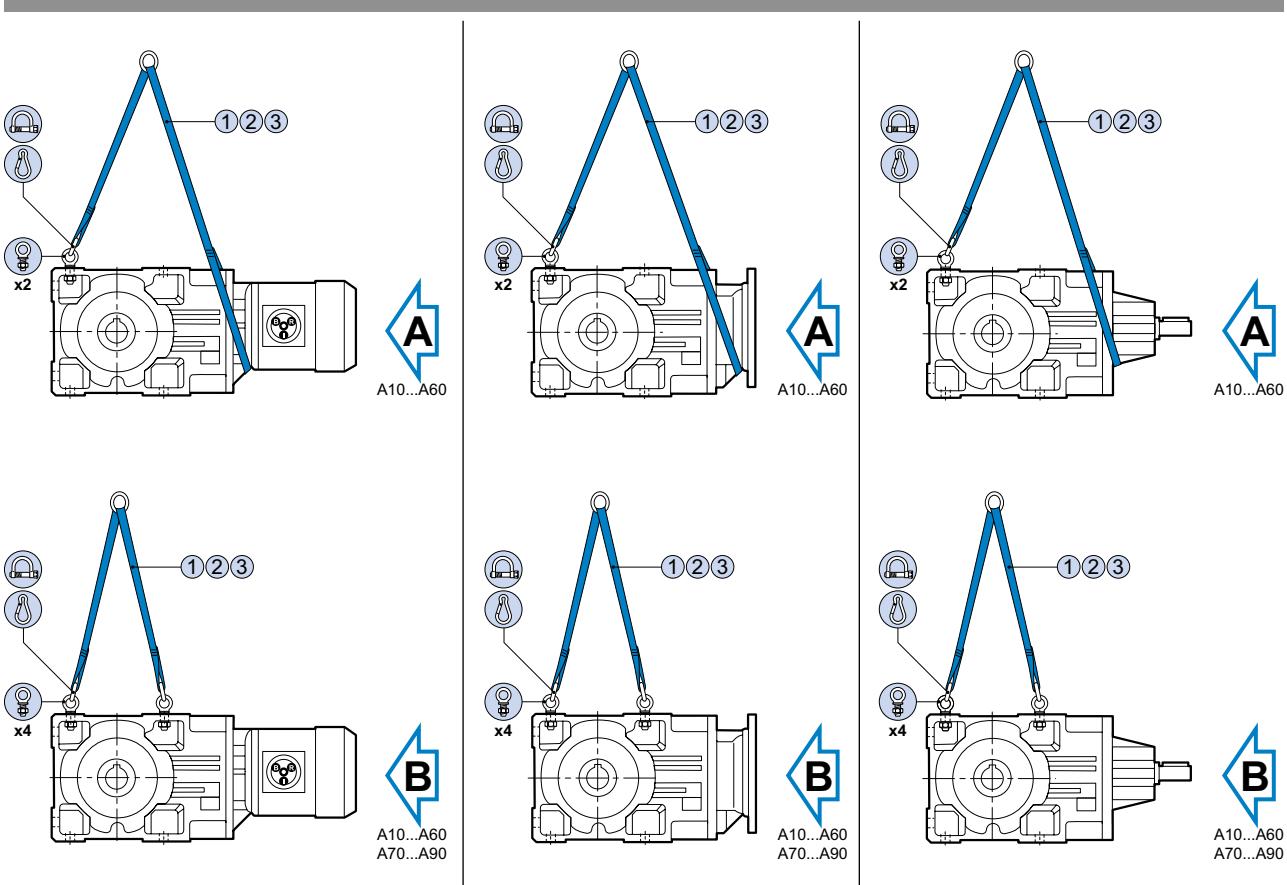
③ Open harness
with eyelets

Eyebolt (already fitted
to gear units C50...C100)

B Lift as per diagram B



Series A



	M05 M1 M2 M3 M4 M5						IEC	
A 10	M		A	—	—		M	M
A 20	A - B			—	—	M (P63...P90) A - B (P100...P112)	M	
A 30	A			—	—			
A 41	A - B			—		A - B	A - B	
A 50	—	A - B			—	A - B	A - B	
A 60	—	B				A - B	A - B	
A 70	—	B				B	B	
A 80	—	B				B	B	
A 90	—	B				B	B	

Reccomended:

solution A for positioning; solution B for positioning and handling.

① Ring harness

Screw clamp (use with harness)

M Lift manually (weight ≤ 15 kg)

Maximum permissible tilt during handling: 15°

② Rope and hooks

Snap hook (use with rope)

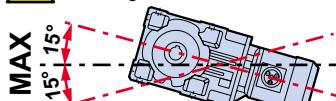
A Lift as per diagram A

MAX 15°

③ Open harness with eyelets

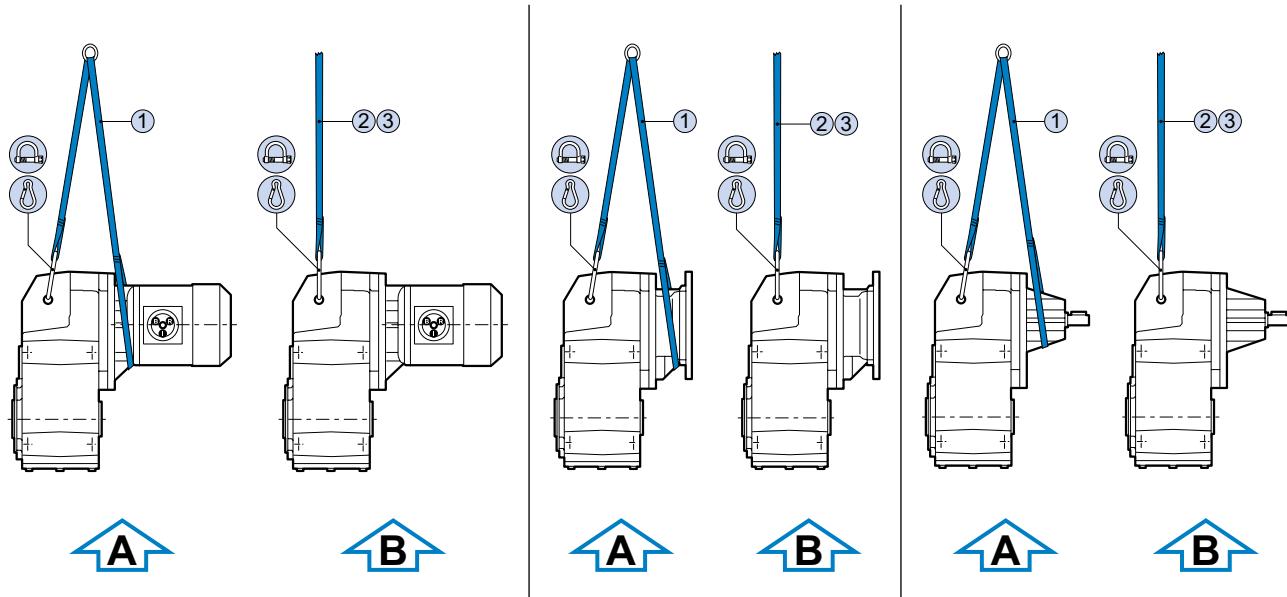
Eyebolt

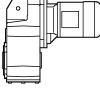
B Lift as per diagram B





Series F



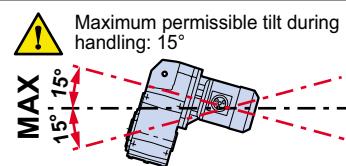
	 M05 M1 M2 M3 M4 M5							
F 10	M		A - B		—	—	M	M
F 20	A - B			—	—	M (P63...P90)	M	
	—	—	(P100...P112)	A - B				
F 30	A			—	—	A	A	
F 40	A - B			—		A - B	A - B	
F 50	—	A - B		—		A - B	A - B	
F 60	—	A - B			—	A - B	A - B	
F 70	—	A - B			—	A - B	A - B	
F 80	—	A - B			—	A - B	A - B	
F 90	—	A - B			—	A - B	A - B	

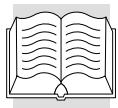
Reccomended:
solution A for positioning; solution B for positioning and handling.

- ① Ring harness
- ② Rope and hooks
- ③ Open harness with eyelets

-  Screw clamp (use with harness)
-  Snap hook (use with rope)

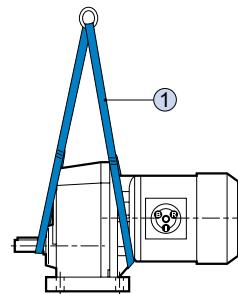
- M** Lift manually (weight ≤ 15 kg)
- A** Lift as per diagram A
- B** Lift as per diagram B



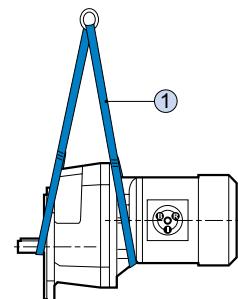


Series S

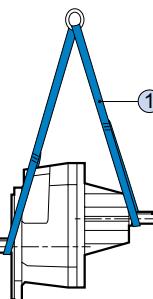
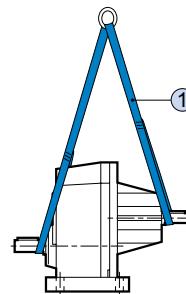
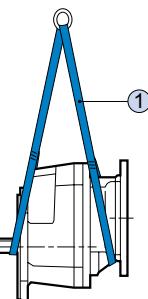
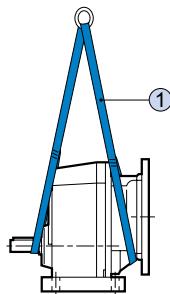
P



F



A



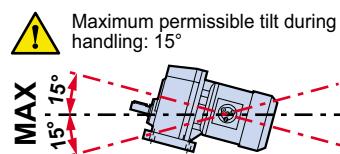
	M05	M1	M2	M3	M4	IEC	
S 10 1	M		A	—	M	M	
S 20 1	M		A	—	M	M	
S 30 1	M		A	—	M	M	
S 40 1			A		A	A	
S 50 1			A		A	A	

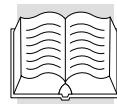
Reccomended:
solution A for positioning.

① Ring harness

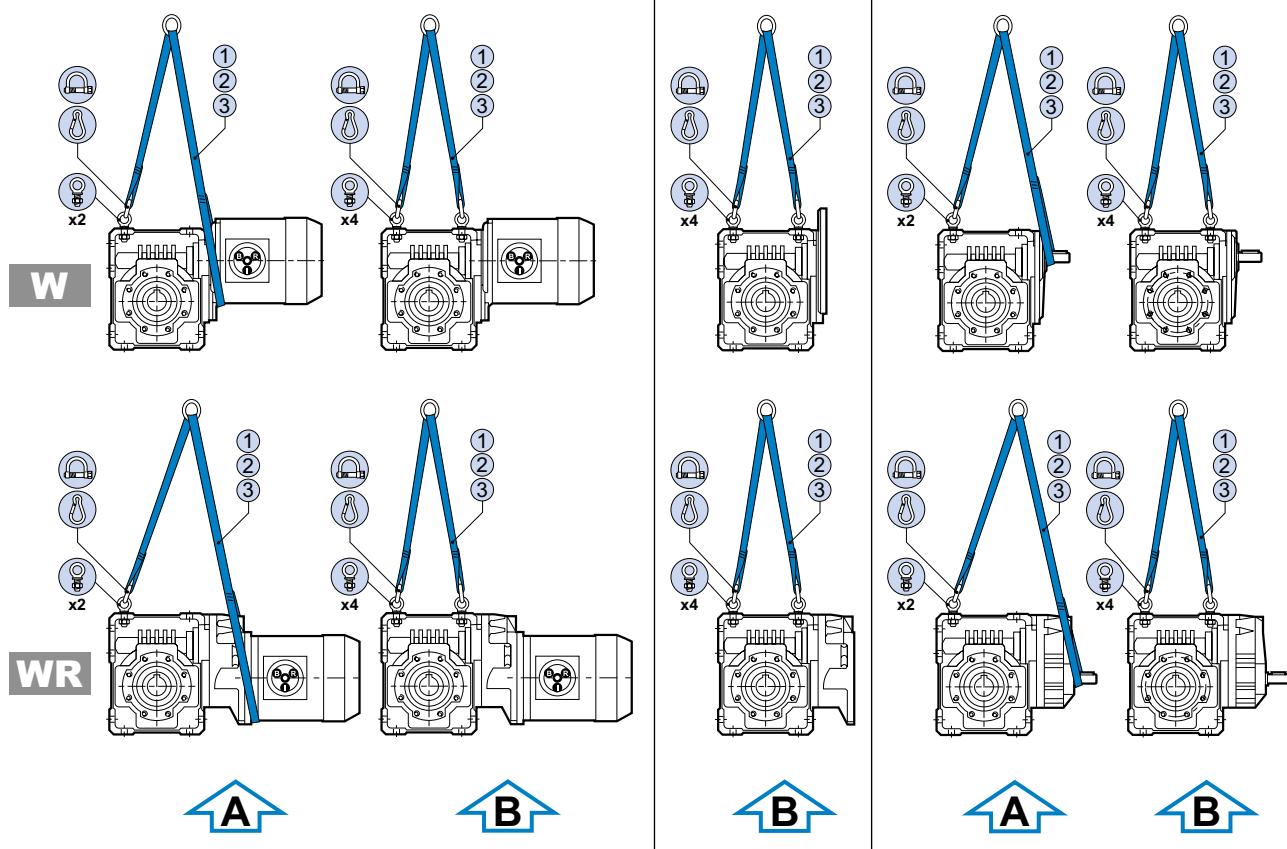
M Lift manually
(weight \leq 15 kg)

A Lift as per diagram A





Series W



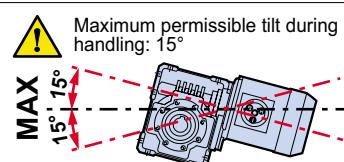
W 63	WR 63	M	M	M
W 75	WR 75	A - B	M	M
W 86	WR 86	A - B	M	M
W 110	WR 110	A - B	B	A - B

Reccomended:
solution A for positioning; solution B for positioning and handling.

- ① Ring harness
- ② Rope and hooks
- ③ Open harness with eyelets

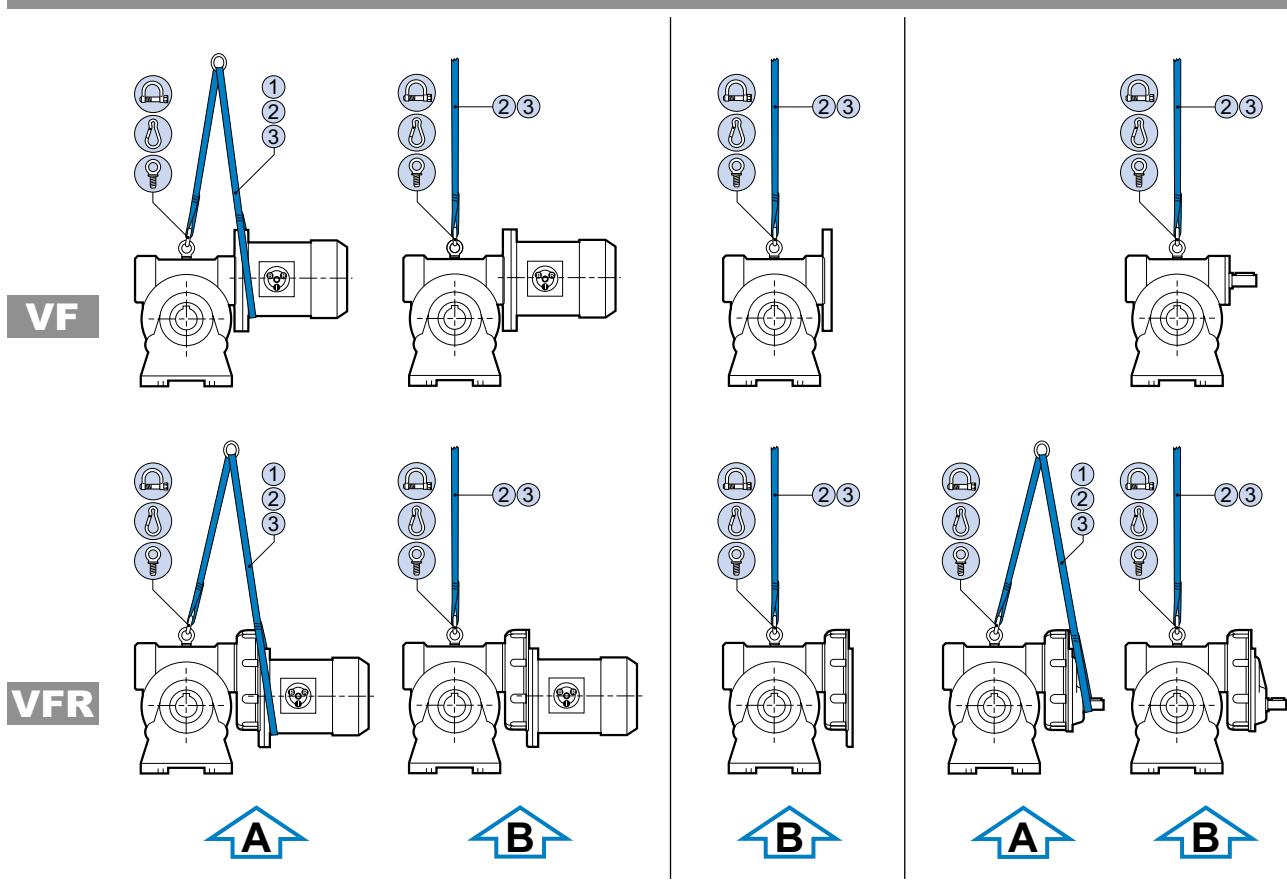
- Screw clamp (use with harness)
- Snap hook (use with rope)
- Eyebolt

- M** Lift manually (weight ≤ 15 kg)
- A** Lift as per diagram A
- B** Lift as per diagram B





Series VF



VF 30			
VF 44 VFR 44			M
VF 49 VFR 49			
VF 130 VFR 130	A - B		
VF 150 VFR 150		A - B	
VF 185 VFR 185			A - B
VF 210 VFR 210			
VF 250 VFR 250			

Reccomended:

solution A for positioning; solution B for positioning and handling.

(1) Ring harness

Screw clamp
(use with harness)

(2) Rope and hooks

Snap hook
(use with rope)

(3) Open harness
with eyelets

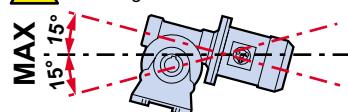
Eyebolt (already fitted
to gear units VF130...VF250)

M Lift manually
(weight \leq 15 kg)

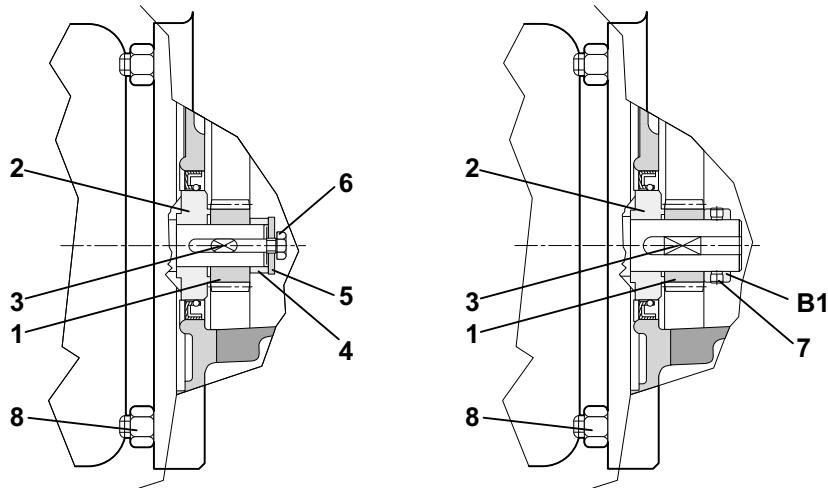
A Lift as per diagram A

B Lift as per diagram B

MAX Maximum permissible tilt during
handling: 15°



ANNEX 5 - INSTALLING THE MOTOR ON TYPE VFR WORM GEAR UNITS



- 1) Thoroughly clean and degrease the motor shaft and pinion (1) and bushing (2) coupling surfaces.
- 2) Check the motor shaft tolerance meets the following specifications:

Shaft diameter - Ø [mm]	Tolerance
11 - 28	j6
38 - 48	k6

- 3) Preheat the bushing (2) and pinion (1) to 80-100 °C.
- 4) Quickly fit, the bushing (2), key (3) and pinion (1), in succession, to the motor shaft.
When fitting the bushing (2), ensure that the chamfered side is facing the operator.
To facilitate mounting, lightly press on the parts being fitted (e.g. with a tubular drift). Make sure that the reaction force in this case is supported at the opposite end of the shaft, and not by the fan cover.
After this procedure the pinion (1) should be snug against the bushing (2).
- 5) Lock the assembly with the spacer (4) and washer (5) by tightening down the bolt (6) or, for configurations which have this option, fit the stop bushing (B1) and tighten down the two grub screws (7) while holding it snug against the pinion (1); see figure on the right.
- 6) Lubricate the seal ring lips with a film of grease.
- 7) For type VFR 49 units, which are lubricated for life and, hence, do not have a service plug, fill with the quantity of lubricant specified in the corresponding chapter of the catalogue dealing with lubrication of VFR units.
- 8) Hold the motor firmly and, holding it in alignment, mount it to the flange of the additional helical reduction casing. Take the greatest care to avoid denting the pinion or gear wheel teeth.
- 9) With the motor and gear unit flanges in contact, fully tighten down the mounting bolts (8) gradually and in a cross-wise pattern.
- 10) For units VFR 110 to VFR 250 the lubricant must be changed periodically.
The lubricant charge (fil) for these gear units is given in the VF catalogue. Check that the correct level has been reached via the sight glass, with the gear unit in its specified mounting position. Top up as necessary.



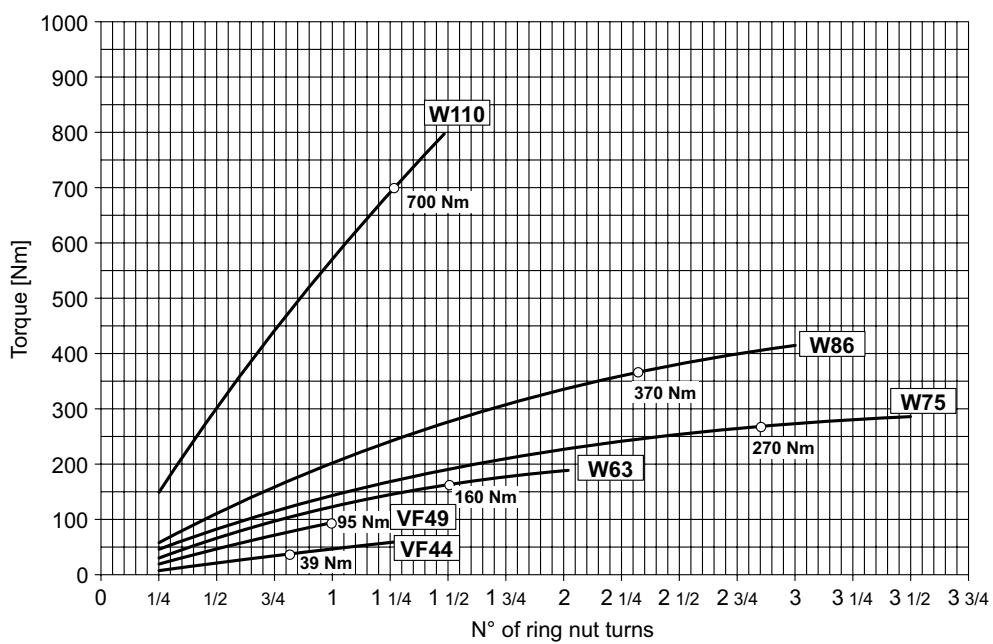
ANNEX 6 - CALIBRATING THE TORQUE LIMITER SLIP TORQUE

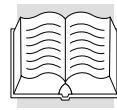
The torque limiter is an optional device available for worm gear units of the following types: VF 44L, VF 49L, W 63L, W 75L, W 86L and W 110L.

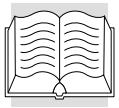
The device is factory calibrated to a slip torque which coincides with the nominal torque M_{n2} [$n_1 = 1400$] for the gear unit in question.

This is achieved as follows. The same operations, with exclusion of step (2), allow the User to calibrate the limiter to a torque different to that set in the factory.

1. The calibration ring nut is screwed in until the disk springs are loaded to the point that they cannot be turned freely by hand.
2. A centre punch is used to make two corresponding reference marks at the same angular position on the ring nut and the protruding section of the output shaft. This reference position is the starting point from which all further turns of the ring nut are counted, and thus, the torque calibration is measured.
3. The ring nut is now screwed in by the fractions of a turn which correspond to the nominal torque M_{n2} for the gear unit in question. The reference in this case is given by the diagram below, which is also to be used for any new settings required over time.







INDEX OF REVISIONS (R)

R3

35

Corrected oil quantities for gear units VF 150.

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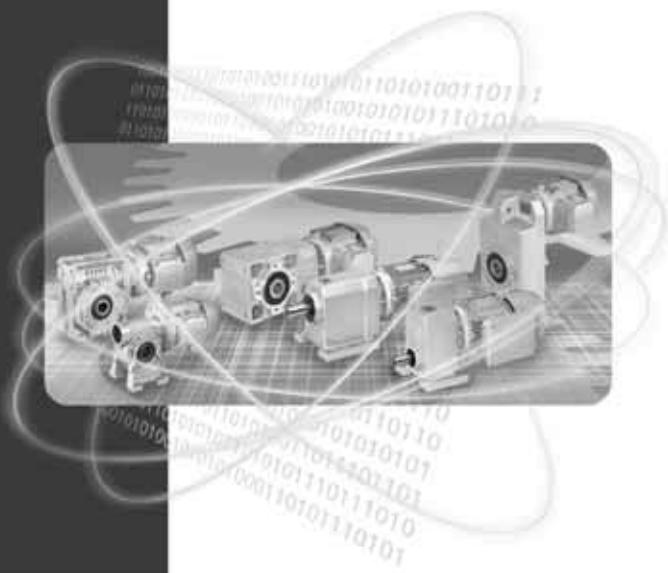
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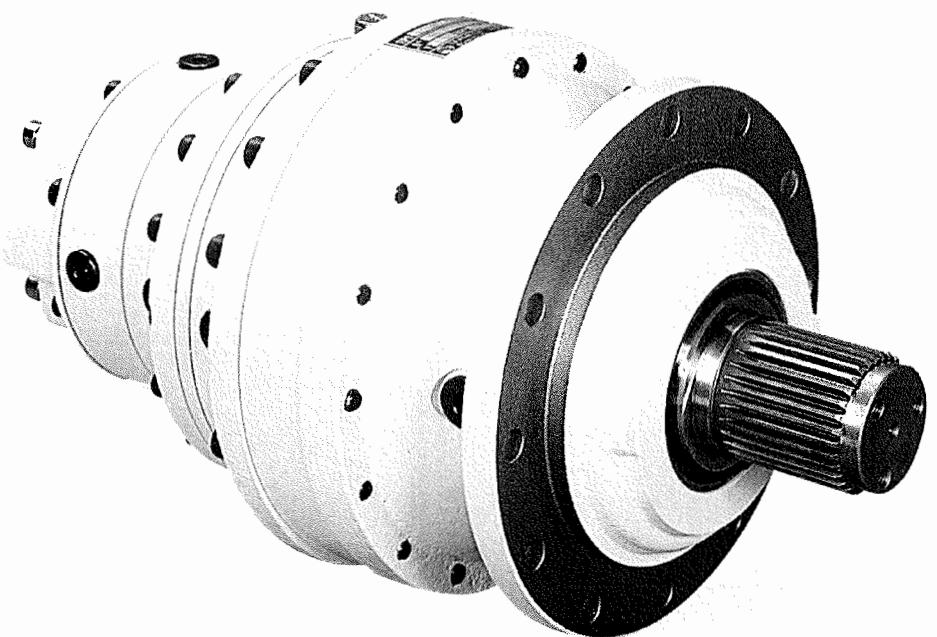
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300 series

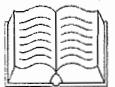
Installation,
use and service manual

ATEX INCLUDED



Bonfiglioli

power, control and green solutions



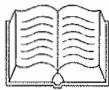
USE, INSTALLATION AND MAINTENANCE MANUAL



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Revisions

The catalogue revision list is given on page 42. The most recent versions of the catalogue are available at www.bonfiglioli.com.



1.0 - GENERAL INFORMATION

1.1 - PURPOSE OF THE MANUAL

This Manufacturer's manual provides information regarding the safe transport, handling, installation, maintenance, repair, disassembly and dismantling of the gear unit.

All information for users and designers is given in the Sales Catalogue. As well as adhering to established engineering practices, the information given in this manual must be read carefully and rigorously applied.

Failure to observe the information provided herein may result in risks to personal health and safety, as well as economic damages.

This information, provided in the Manufacturer's original language (Italian), is also available in other languages to meet legal and commercial requirements.

The documentation must be stored by a person charged to do so in a suitable location so as to be always available in good condition for consultation.

In case of loss or damage, replacement documentation must be requested directly from the Manufacturer, quoting the code of this manual.

This manual reflects the state of the art at the time of commercialisation of the gear unit.

The Manufacturer reserves the right to modify, supplement and improve the manual, without the present publication being for that reason considered inadequate.

Particularly significant sections of the manual and important specifications are highlighted by symbols whose meanings are explained below.

SYMBOLS:



DANGER - WARNING

This symbol indicates situations of danger, which if ignored, may result in serious injury to the operator.



CAUTION - ATTENTION

This symbol indicates the need to adopt specific precautions to avoid personal injury and damage, as well as economic damages.



IMPORTANT

This symbol indicates important technical information.



Instructions marked by these symbols and highlighted in yellow, apply exclusively to equipment complying with "ATEX" Directive 94/9/EC.

The operations identified by these symbols must be executed by professionally qualified operators specially trained in the safety precautions required for working in potentially explosive atmospheres.

Failure to observe these instructions may result in serious safety and environmental risks.



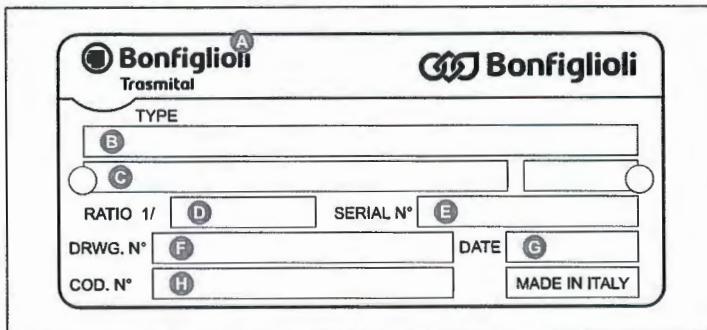
1.2 - PRODUCT IDENTIFICATION

The information identifying the product is shown on its nameplate. Gearmotors are equipped with two nameplates; one on the gear unit which bears the gear unit data, and one on the motor (electric or hydraulic), bearing the motor data.

The drawing below illustrates the layout of the data.

The gear unit's identifying code is explained in the Sales Catalogue. If the gear unit is supplied fitted with an electric motor (garmotor), all information regarding the motor is supplied in the motor manual.

Nameplate data



- (A) Manufacturer
- (B) Product identification
- (C) Bonfiglioli Trasmittal product code
- (D) Reduction ratio
- (E) Serial number
- (F) Installation drawing code.
- (G) Date of manufacture
- (H) Client product code

Supplementary nameplate on ATEX-specified gear units



Readability of the nameplate

The nameplate and the information on it must be readable and, consequently must be cleaned from time to time.

Quote the nameplate data in all communications with the manufacturer, for example, when requesting spare parts, information and assistance.



1.3 - GLOSSARY AND TERMINOLOGY

Some of the frequently occurring terms used in this manual are described below to unequivocally define their meaning.

Routine maintenance

The set of operations required to preserve the functionality and efficiency of the gear unit. These operations are usually scheduled by the Manufacturer, who defines the qualifications and tasks involved.

Reactive maintenance

The set of operations required to preserve the functionality and efficiency of the gear unit. These operations are not scheduled by the Manufacturer and must be carried out by an expert maintenance technician.

Expert maintenance technician

An authorised technician with the qualifications, skills and mechanical and electrical training required to do repairs and non-routine maintenance work on the gear unit.

Overhaul

An overhaul consists in the replacement of bearings and other mechanical components which have worn to such an extent as to compromise the operation of the gear unit. An overhaul also includes verification of the condition of all gear unit components (keys, seals, gaskets, vents, etc). If any such components are damaged they must be replaced and the reason for the damage identified.

1.4 - REQUESTING TECHNICAL ASSISTANCE

For any technical service needs, contact the Manufacturer's sales network quoting the information indicated on the unit's nameplate, the approximate hours of service and the type of defect.

1.5 - MANUFACTURER'S LIABILITY

The Manufacturer declines all liability in the event of:

- use of the gear unit in contravention of local safety at work legislation
- incorrect installation, disregard or incorrect application of the instructions provided in this manual
- incorrect or defective electrical/hydraulic power supply (garmotors)
- modifications or tampering
- work done on the unit by unqualified or unsuitable persons.

The safety of the gear unit also depends on scrupulous observance of the instructions given in this manual, and in particular:

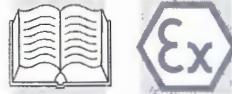
- always operate the unit within its operating limits
- diligently observe the routine maintenance schedule
- only allow trained operators to inspect and service the unit
- only use original spare parts
 - the configurations given in the gear unit catalogue are the only ones permitted
 - do not attempt to use the unit in any other way
 - the instructions given in this manual do not substitute but rather supplement the provisions of established safety legislation.



1.6 - CONSIGNMENT CONDITIONS

Gear units are supplied by BONFIGLIOLI TRASMITAL in the following conditions:

- Configured for installation in the mounting position specified in the purchase order.
- Not charged with lubricant and with internal components protected by a film of oil compatible with the recommended lubricant.
- All surfaces and mating parts are treated with rustproofing products.
- Mating surfaces are not painted while the unit's exterior is treated with a coat of grey water-based rustproofing primer (RAL 7042/C441). Application of a top coat is the responsibility of the Client.
- Tested to factory standards.
- Packaged suitably for the final destination.



2.0 - TECHNICAL INFORMATION

2.1 - DESCRIPTION OF THE GEAR UNIT

The gear unit, driven by an electric or hydraulic motor, has been designed and constructed for integration into an assembly of interlocking parts or mechanisms as part of a specific application.

Depending on the requirements of the application, the gear unit can be supplied in a variety of motor executions and configurations. It is capable of satisfying a range of specific requirements in the mechanical, chemical, agricultural and food industries, etc.

BONFIGLIOLI TRASMITAL supplies a range of accessories and optionals to make their products as versatile as possible. For further technical information and descriptions, refer to the corresponding Sales Catalogue.

The User is responsible for using the products recommended for installation and maintenance of

SAFETY SPECIFICATIONS OF GEAR UNITS COMPLYING WITH DIRECTIVE 94/9/EC	
	<ul style="list-style-type: none">unit selection must be made with a higher safety service factoruse only synthetic lubricants (oil and grease)VITON® seal ringsvent plugs with spring-loaded anti-intrusion valveoil plugs with aluminium washeroil seals with dust trapno metal moving parts external to the gear unitno plastic parts capable of building up an electrostatic charge, or, if present, duly shieldedfor installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme for all surfaces and recesses to avoid dust build ups of more than 5 mm in depth.

2.2 - CONFORMITY

All gear units or gearmotors (when supplied with electric motor) are designed in compliance with the provisions of applicable Essential Health and Safety Requirements, the "Machinery Directive" 98/37/EC and, if requested, can be supplied with a Manufacturer's Declaration - Annex IIB as provided by said Directive.

All BONFIGLIOLI gearmotor electric motors conform to the provisions of the Low Voltage Directive 73/23/EEC and the Electromagnetic Compatibility Directive 89/336/EEC.

	Furthermore, if specified for use in potentially explosive atmospheres, the gear units are designed and constructed to conform with the Essential Health and Safety Requirements (EHSR) of Annex II of the ATEX Directive 94/9/EC and conform to the following classification:
	<ul style="list-style-type: none">Equipment group: II.Category: Gas 2G - Dust 2D.Zone: Gas 1 - Dust 21.Maximum surface temperature: temperature class T4 for 2G and 130°C for 2D.

2.3 - OPERATING LIMITS AND CONDITIONS

	Modification of the motor execution or mounting position is only permitted if previously authorised by BONFIGLIOLI TRASMITAL's Technical Service.
	Failure to obtain said authorisation renders the ATEX certification null and void.



Ambient conditions

- Ambient temperature: min. - 20°C; max. + 40°C.
- Do not use the gear unit, if not explicitly intended for the purpose, in a potentially explosive atmosphere or where the use of explosion-proof equipment is specified.



The nameplate specifications regarding the maximum surface temperature, refer to readings taken in normal ambient and installation conditions.



Even minimal variations to said conditions (e.g. smaller mounting cabinet) may have a significant effect on the unit's heat output.

- Lighting



If the unit is to be serviced in a poorly lit area, use additional lamps and ensure that the work is done in compliance with the safety requirements of established legislation.

3.0 - SAFETY INFORMATION

3.1 - SAFETY STANDARDS

- Carefully read the instructions given in this manual and those posted directly on the gear unit, especially those regarding safety.
- Persons charged with working on the gear unit at any time in its service life must be trained specifically for the purpose with special abilities and experience in the area as well as being equipped with the appropriate tools and individual safety equipment (as per Legislative Decree 626/94). Failure to meet these requirements constitutes a risk to personal health and safety.
- The gear unit must only be used for the applications permitted by the Manufacturer. Improper use can result in risks to personal health and safety and economic damages.



The applications permitted by the Manufacturer are the industrial applications for which the gear units have been designed.



- Keep the gear unit at its maximum efficiency by following the routine maintenance schedule. Good maintenance ensures the unit's maximum performance, extended service life and continued compliance with safety regulations.
- When working on the unit in areas which are difficult to access or hazardous, ensure that adequate safety precautions have been taken for the operator and others in compliance with established legislation on health and safety at work.
- All maintenance, inspection and repairs must only be carried out by an expert maintenance technician fully familiar with the attendant hazards. It is therefore essential to implement operating procedures that address potential hazards and their prevention for the entire machine. The expert maintenance technician must always work with caution in observance of applicable safety standards.
- During operation wear only the apparel and safety equipment indicated in the User Instructions provided by the Manufacturer or stipulated by legislation on safety at work.
- Replace worn components with original spare parts. Use the lubricants (oil and grease) recommended by the Manufacturer.
- Do not dump polluting materials into the environment. Dispose of all such materials as stipulated by applicable legislation.
- After replacing lubricants clean the gear unit's surfaces and the walk-on surfaces around the work area.



If the gear unit is to be serviced in a potentially explosive atmosphere, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning.



Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc.).

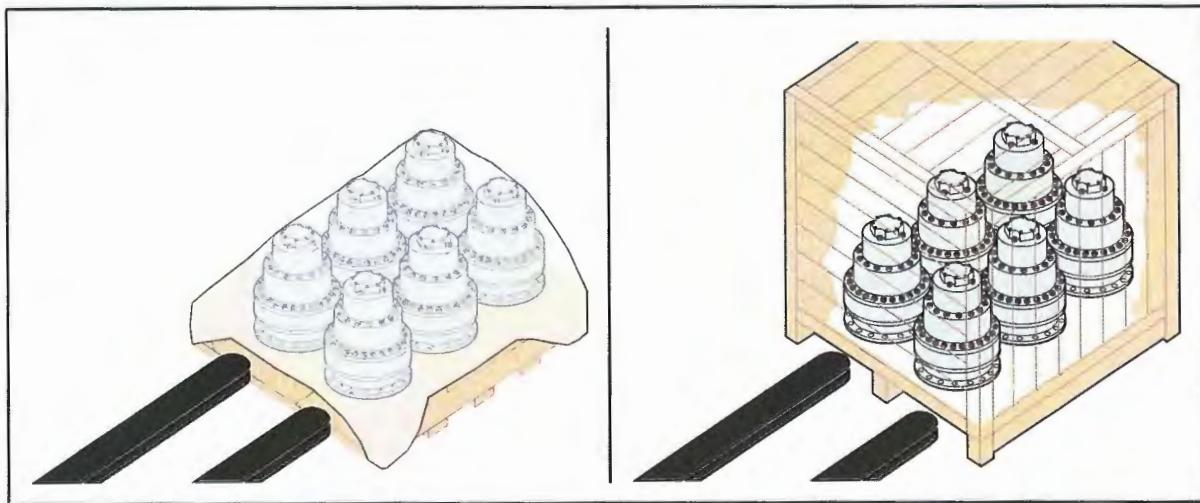
4.0 - HANDLING AND TRANSPORT

4.1 - PACKAGING

The standard packaging, if supplied and unless otherwise agreed, is not proofed against rainfall and is intended for shipping by ground and not sea, and for storage in areas which are under cover and not humid. The material can be stored in suitable conditions for a period of two years under cover at a temperature between -15 °C and +50 °C at a relative humidity not in excess of 80%. Storage in all other conditions requires specific packaging.

The most frequent types of packaging are shown in the figures below.

- Packaging on pallet with heat shrink film for ground shipping.
- Packaging in wooden crate for shipping by sea or air.



On receipt of the gear unit, make sure the delivery corresponds to the purchase order and that it is not damaged or faulty in any way.
Report any nonconformity to your BONFIGLIOLI TRASMITAL reseller.

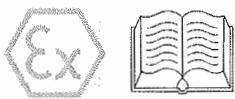
Dispose of packaging materials as stipulated by applicable legislation.

4.2 - HANDLING INSTRUCTIONS

Handle packages as per the Manufacturer's instructions and those marked on the packages themselves. Since the weight and shape of the packages may make manual handling unfeasible, special equipment must be used to avoid damage and injury. Persons authorised for this purpose must be trained and experienced in the work in question to avoid risks to themselves and others.



The person authorised to handle the product must take all necessary precautions to safeguard his safety and that of all other persons involved.



4.2.1 - Moving the packages

- Prepare a suitable, delimited area with a level floor or surface for unloading the packages.
- Prepare the equipment required to handle the package. The lifting and handling equipment (e.g. crane or lift truck) must be of adequate capacity for the weight and size of the load, taking into account its attachment points and centre of gravity. If required, this information is indicated on the package itself. Harness heavy packages with chains, belts and steel ropes after checking that they are suitable for the weight of the load, which is always indicated.
- When handling the load keep it level to avoid tipping and instability.

4.2.2 - Moving the equipment



All the following operations must be carried out with care and caution and without sudden movements.



When lifting, use accessories such as eyebolts, screw clamps, snap hooks, straps, ropes and hooks etc. which are certified and adequate for the load in question.

The weight of the product to be lifted is given in the Sales Catalogue.

The following pages illustrate in detail the different attachment methods for the various product series, sizes and configurations described in this Manual.

The most suitable solution for lifting and handling the product in safety is indicated for each.

Symbols:

Type of lifting	Manual	With mechanical equipment	
Symbol	M	A	B
Approximate weight	$\leq 15\text{ Kg}$	$> 15\text{ Kg}$	
Instruction	—	Recommended method for positioning	Recommended method for handling and positioning
Warning	—	The load may be unstable	The load may sway or oscillate
Solution	—	Slide the lifting ring to align it with the load's centre of gravity as shown in the diagrams below Lock the ropes below the ring with a cable clamp or similar device so as to prevent them sliding, and lift the load Observe all precautions regarding the handling of loads	Stabilise the moving load by hand Observe all precautions regarding the handling of loads

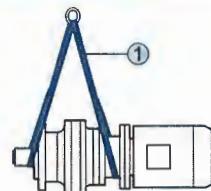
The load must not be allowed to sway by more than 15° in any direction when being lifted.
If swaying exceeds this amount, stop and repeat the lifting operation as instructed.

Identify the attachment points for lifting the gear unit. Refer to the diagrams given below.

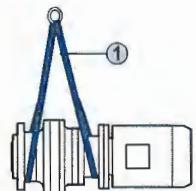
A

300 L ... 316 L

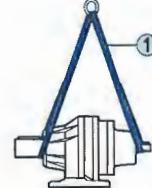
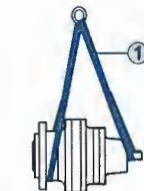
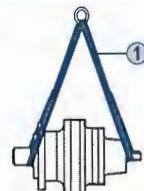
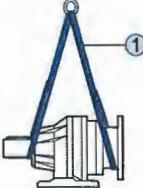
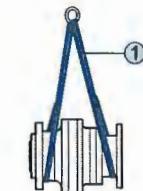
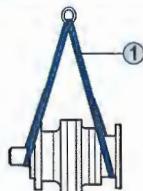
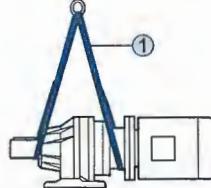
H 



F 



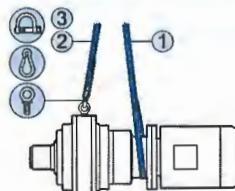
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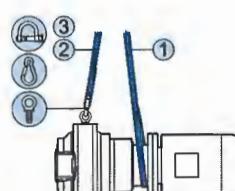
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317 L ... 321 L

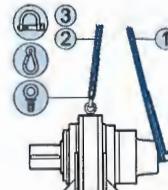
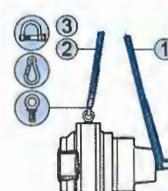
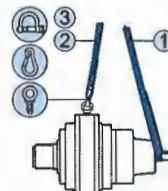
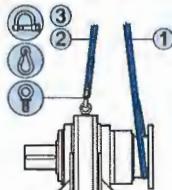
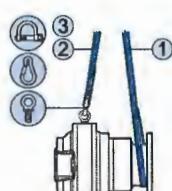
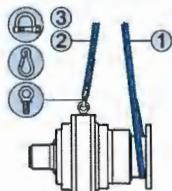
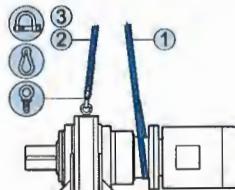
H 



F 



P 



① Ring harness

 Screw clamp
(use with harness)

 Maximum permissible tilt during handling: 15°

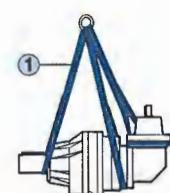
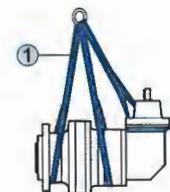
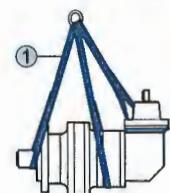
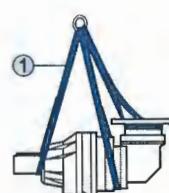
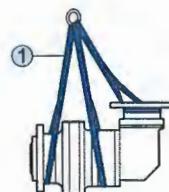
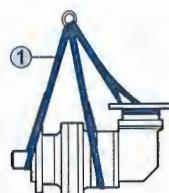
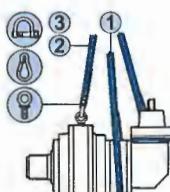
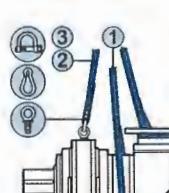
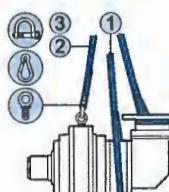
② Rope and hooks

 Snap hook
(use with rope)



③ Open harness
with eyelets

 Eyebolt (already fitted on gear units 317-321)

**A****300 R ... 316 R****H** **F** **P** **B****317 R ... 321 R****H** **F** **P** 

① Ring harness

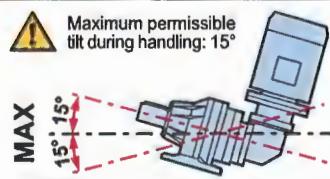
Screw clamp (use with harness)

② Rope and hooks

Snap hook (use with rope)

③ Open harness with eyelets

Eyebolt (already fitted on gear units 317-321)

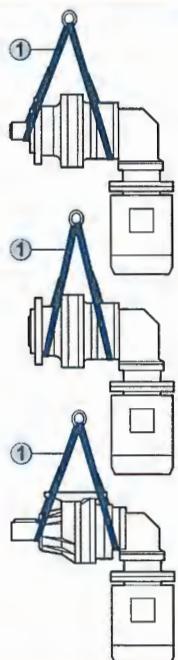




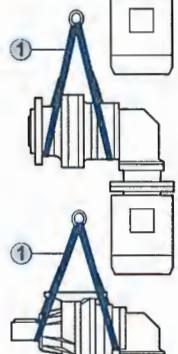
A

300 R ... 316 R

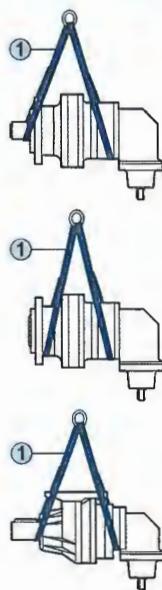
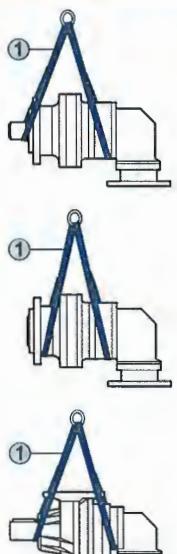
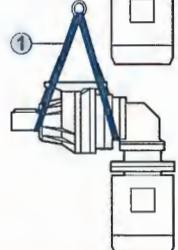
H



F



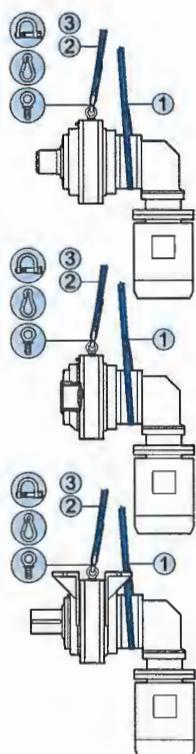
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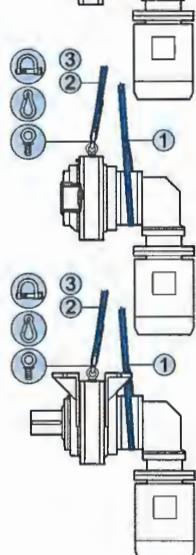
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317 R ... 321 R

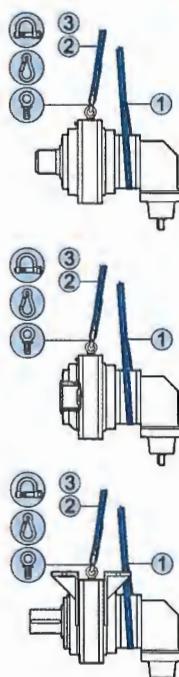
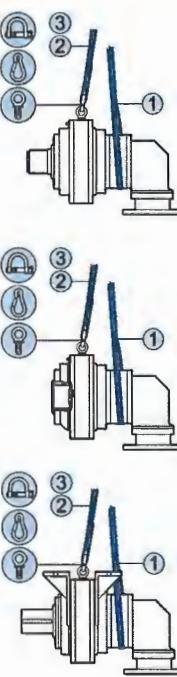
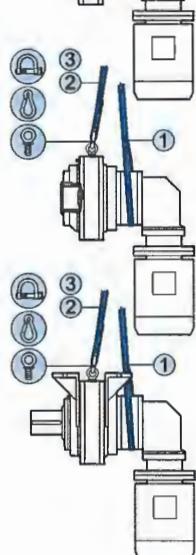
H



F



P



① Ring harness

Screw clamp
(use with harness)

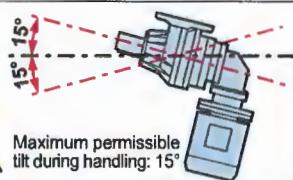
② Rope and hooks

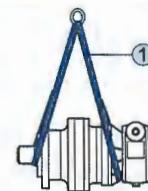
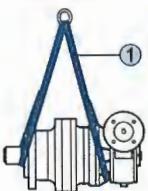
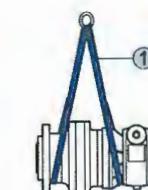
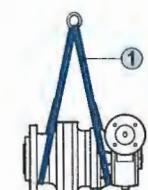
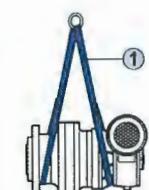
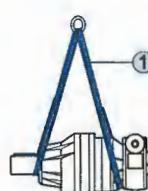
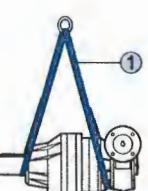
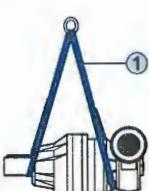
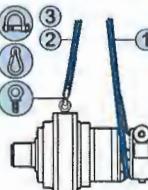
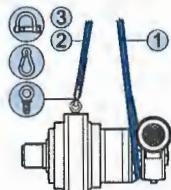
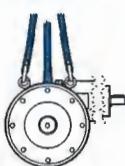
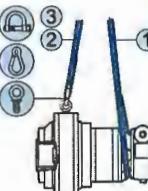
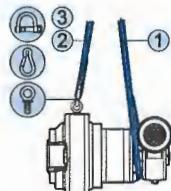
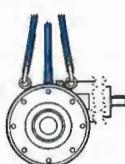
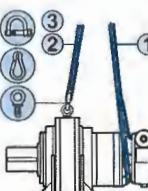
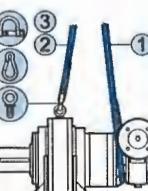
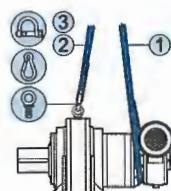
Snap hook
(use with rope)

③ Open harness
with eyelets

Eyebolt (already fitted
on gear units 317-321)

MAX



**A****3V 00 ... 3V 16****H** **F** **P** **B****3V 17 ... 3V 21****H** **F** **P** 

① Ring harness

Screw clamp
(use with harness)⚠ Maximum permissible tilt during
handling: 15°

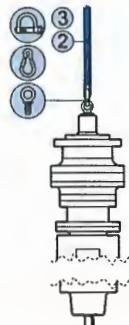
② Rope and hooks

Snap hook
(use with rope)③ Open harness
with eyeletsEyebolt (already fitted
on gear units 317-321)**Bonfiglioli**
Trasmital

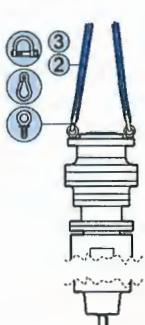


300 L ... 321 L

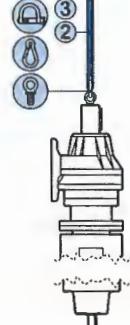
H □



F □

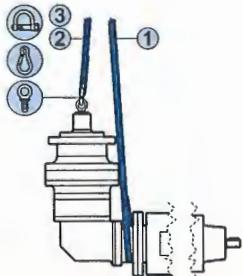


P □

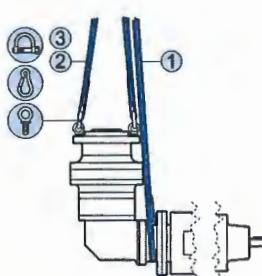


300 R ... 321 R

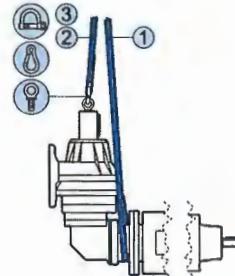
H □



F □

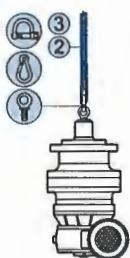


P □

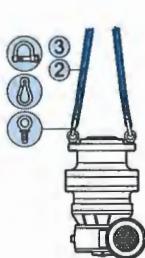


3V 00 ... 3V 21

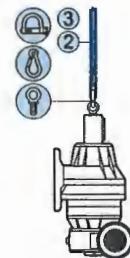
H □



F □



P □



① Ring harness

Screw clamp
(use with harness)

⚠ Maximum permissible tilt during handling: 15°

② Rope and hooks

Snap hook
(use with rope)



③ Open harness
with eyelets

Eyebolt (already fitted on gear units 317-321)



- Prepare the gear unit for lifting by attaching straps, hooks and screw clamps etc. to its attachment points. Alternatively, use a pallet to move the load. If using a crane, first lift the gear unit vertically out of its packaging.
- If using a lift truck or pallet truck, remove the packaging and insert the truck's forks at the indicated positions.
- First lift the load very slowly to check that it is stable.
- Move the gear unit to the unloading area and lower it gently into position, taking care not to tip it suddenly in transit.



If the gear unit is already equipped with an electric motor, do not use the eyebolts on the motor casing for lifting, unless expressly specified.

4.3 - STORAGE

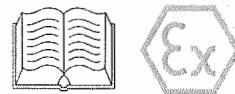
The following recommendations should be followed when storing the gear unit.

1. Do not store the unit in excessively humid conditions or where it is exposed to the weather (do not store outdoors).
2. Do not place the gear unit directly on the ground.
3. Place the gear unit on a stable base and make sure that it is not subject to accidental displacement.
4. Store the packaged gear unit (if allowed) in accordance with the instructions on the packaging itself.

If the gear unit is to be stored for more than 6 months, the following **additional** precautions must be taken:

5. Cover all machined external surfaces with a rustproofing product such as Shell Ensis or other product with similar properties and application range.
6. Fill the unit with lubricating oil and make sure the vent plug is positioned uppermost. Before putting the unit into service, the oil used for storage must be drained and replaced with the correct quantity of recommended operating lubricant.

 	<p>PRECAUTIONS to be taken when returning the gear unit to service after storage.</p> <p>The output shafts and external surfaces must be thoroughly cleaned of all rustproofing product, contaminants and other impurities (use a standard commercial solvent). Do this outside the explosion hazard area.</p> <p>The solvent must not touch the seal rings as this may damage them, causing them to leak</p> <p>If the oil or protective material used during storage is not compatible with the synthetic oil used during the machine's operation, the interior of the unit must be thoroughly cleaned before filling with the operating oil.</p> <p>The service life of the bearing grease is reduced if the unit is stored for more than 1 year. The bearing grease must be synthetic.</p>
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5.0 - INSTALLATION

5.1 - INSTALLING THE GEAR UNIT

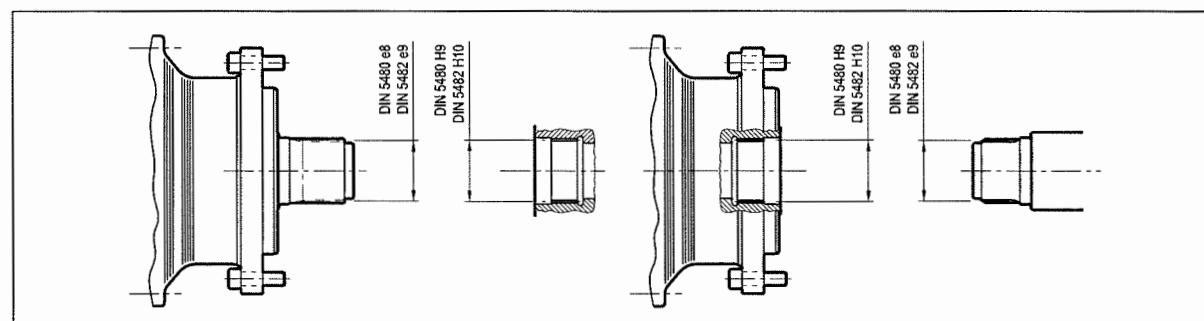
⚠ The entire installation process must be planned as early as the general design phase of the machine. The person authorised to do the work must, if necessary, set out a safety plan to protect the health and safety of all persons directly involved and apply all applicable legislation.

1. Carefully remove all packaging and protective product residue from the gear unit.
Pay particular attention to the mating surfaces.
2. Check that the data on the nameplate correspond to those specified in the purchase order.
3. Ensure that the structure to which the gear unit is to be mounted is sufficiently robust and rigid to support its weight and operating stresses.
4. Check that the machine to which the gear unit is to be installed is switched off and cannot be accidentally switched on again.
5. Make sure all mating surfaces are flat.
6. Make sure the shaft/shaft or shaft/ bore are perfectly aligned for coupling.
7. Fit suitable guards to protect against the gear unit's external moving parts.
8. If the work environment is corrosive for the gear unit or any of its parts, follow the special precautions required for aggressive environments. In this case, contact the BONFIGLIOLI TRASMITAL sales service.
9. We recommend applying a protective paste to all gear unit/motor mating surfaces and other parts (Klüberpaste 46 MR 401 or other product with similar properties and application range) to ensure optimal coupling and protection against fretting corrosion.
10. In the case of outdoor installations fitted with an electric motor, protect the latter from direct sunlight and the weather by means of guards or a casing. Also make sure that the assembly is properly ventilated.

5.1.1 - Flanged execution

Machine the coupling counterflange on the machine to which the gear unit is to be installed.

The flanges must be plane and machined with machine tools. Connect the output shaft to the driven component as indicated in the drawings below.



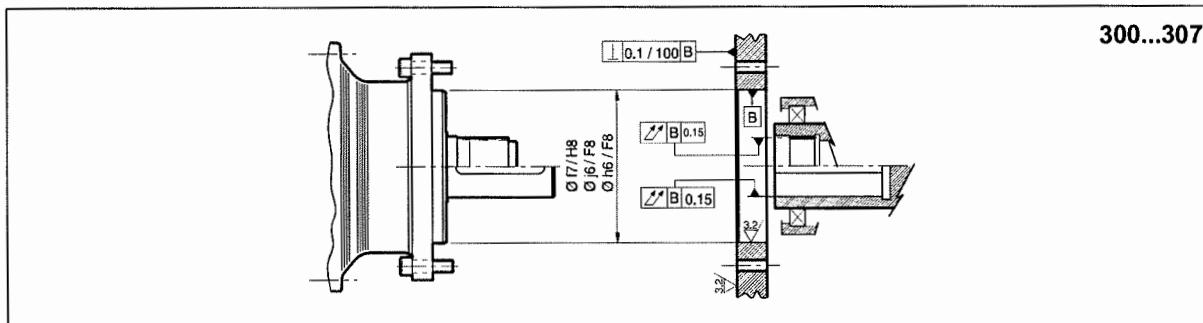
Recommended tolerances

Loose coupling		Coupling with interference	
Solid shaft	Hollow shaft	Solid shaft	Hollow shaft
\varnothing d h6	\varnothing D G7	\varnothing d h6	\varnothing D P7
\varnothing d k6	\varnothing D F7	\varnothing d k6	\varnothing D M7
\varnothing d m6	\varnothing D F7	\varnothing d m6	\varnothing D K7
\varnothing d r6	\varnothing D E7	\varnothing d r6	\varnothing D H7



For machining the spigot on the driven machine, refer to the diagrams below:

300...307 gear units - male output shaft motor execution

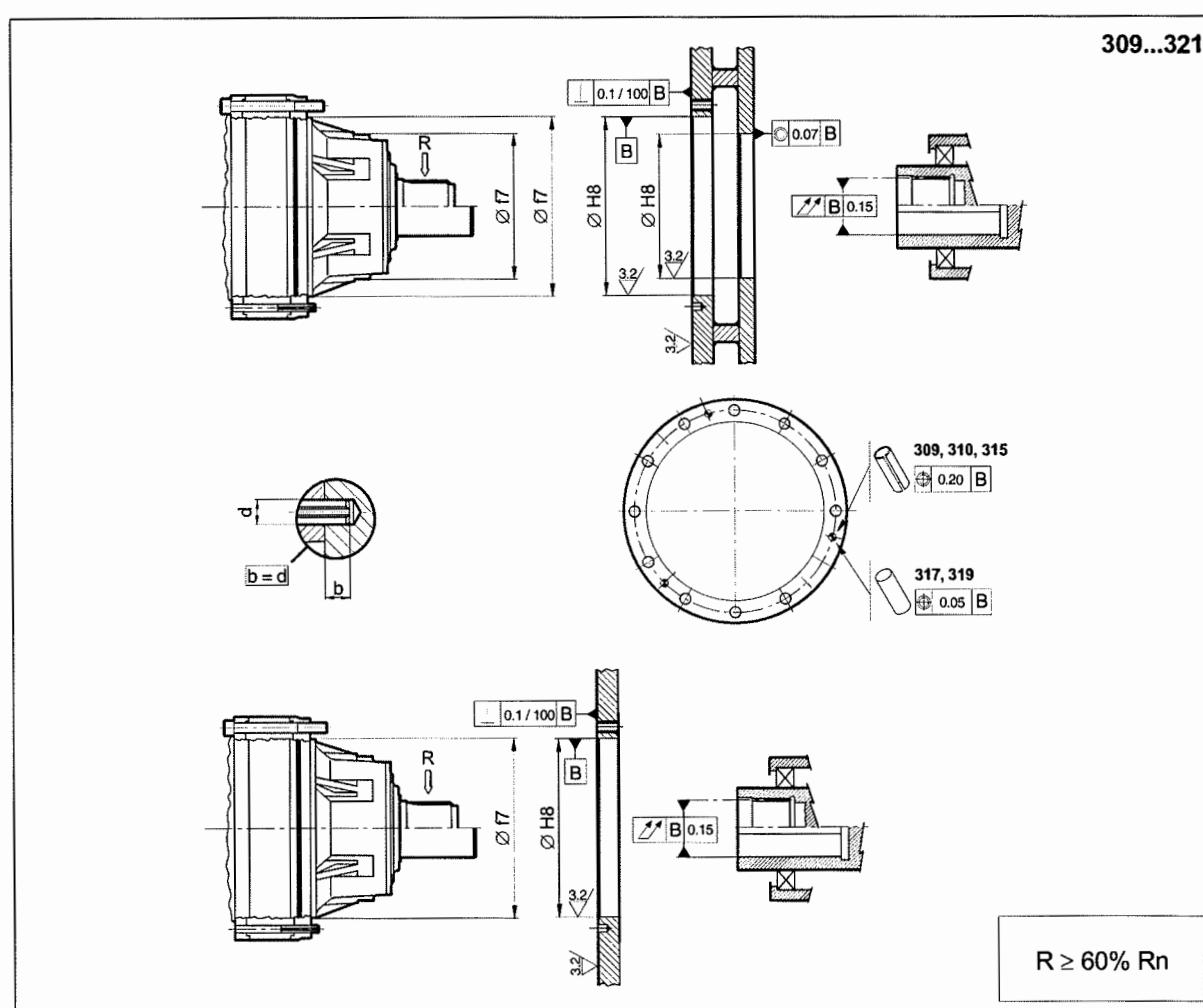


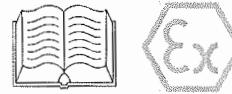
309...321 gear units - male output shaft motor execution

These gear units are fitted with two spigots. When machining the coupling flanges, one spigot may be sufficient if the output shaft is not subject to overhung loads or loads are less than 60% of the permissible load. For heavier loads, the mounting must use both spigots on the gear unit.

If the gear unit is instead required to transmit high torque or is subject to heavy shock loads and inversions in the direction of rotation, the counterflange must be drilled to accept the spigots.

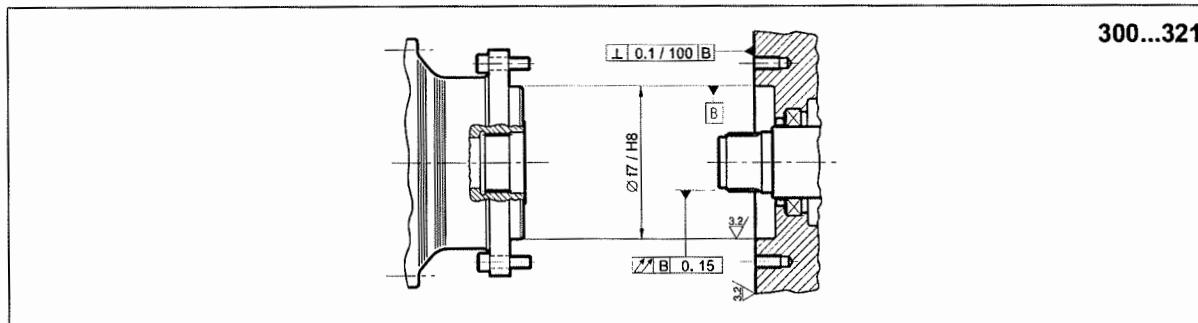
At the time of installation, move the spigots mounted on the gear unit forward into the counterflange by an amount equal to their diameter. See diagram below:





Mounting with hollow splined shaft

Ensure that the gear unit and driven shaft are aligned and that the latter is not subject to flexing during operation. See diagram below:



Flanged gear unit mounting bolts

	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M10	M10	M12	M12	M12	M14	M16	M16	M16	M16	M16	M20	M20	M20	M30	M24	M30	M30
Quantity	8	8	10	10	10	12	10	12	15	24	30	20	20	30	24	32	30	36
Class	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Tightening torque (Nm)	50	50	85	85	85	135	200	200	200	200	400	400	400	1400	700	1400	1400	1400

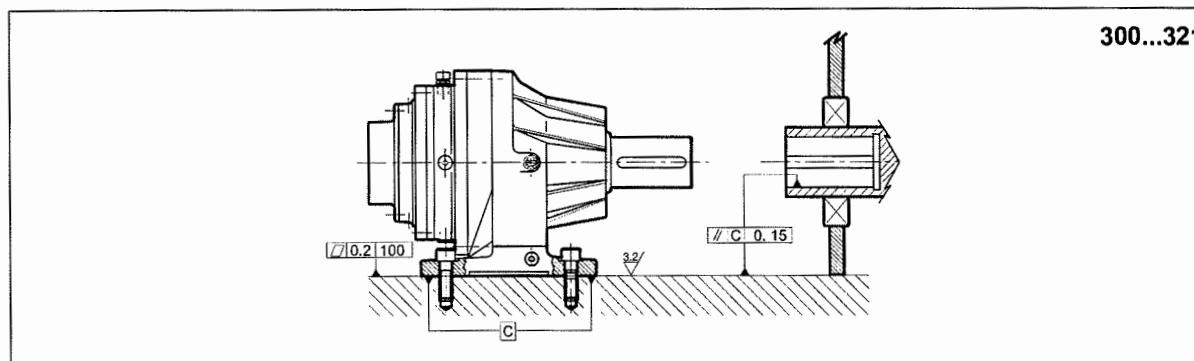
For maximum transmitted torques greater than or equal to 70% of the torque indicated as $M_{2\max}$, and with frequent inversions of the direction of rotation, use at least class 10.9 bolts.

5.1.2 - Foot mounting

Foot-mounted motor execution

Gear units of this type must be mounted on a suitably rigid base, machined flat with a planarity error margin of no more than 0.2 mm / 100 mm.

See diagram below:



Foot-mounted gear unit mounting bolts

	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M16	M16	M16	M16	M16	M20	M24	M24	M24	M30	M30	M30	M30	M36	M30	M36	M48	M48
Quantity	4	4	4	4	4	4	4	4	4	4	4	4	4	8	8	8	8	4
Class	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
Tightening torque (Nm)	200	200	200	200	200	400	700	700	700	1400	1400	1400	1400	1400	2500	1400	2500	6000



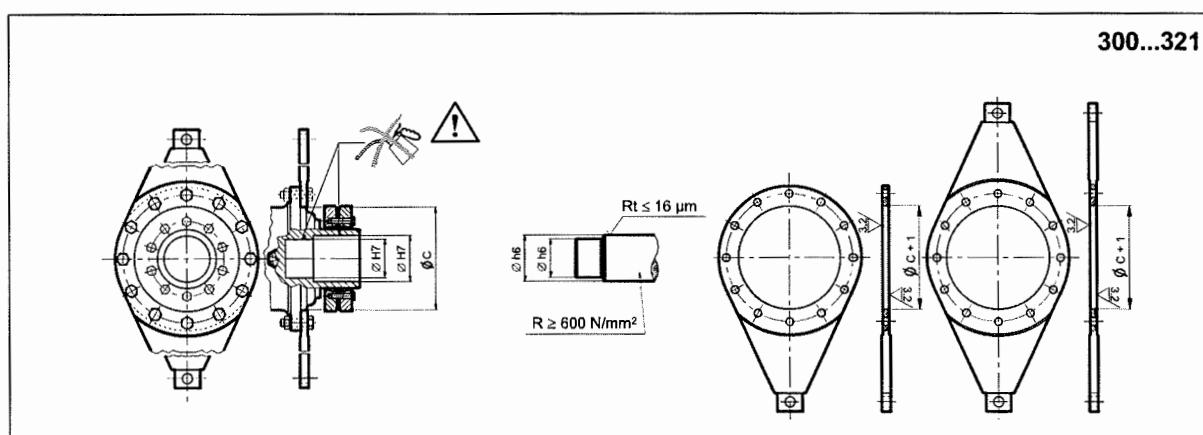
5.1.3 - Shaft mounting

Mount the torque arm with bolts of at least class 8.8 tightened to a torque of 70% of their failure stress. Clean and degrease both the internal coupling surface of the gear unit shaft and the external coupling surface of the machine's driven shaft.

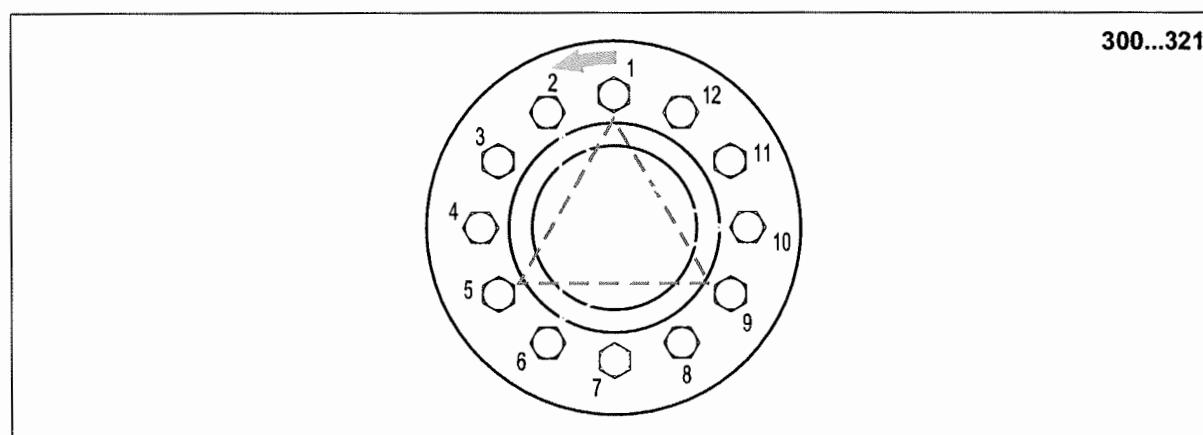
Mount the shrink disk to the gear unit's shaft after lightly lubricating its entire **outer surface**. Snug down a first set of 3 bolts located at the corners of an equilateral triangle (for example: bolts in pos. 1-5-9 of the diagram below). Fit the gear unit to the driven shaft.

Tighten down the bolts (following the triangular pattern) in a circular direction, repeating the operation several times until all bolts are tightened to the torque specified in chart 2, in accordance with the type of disk/gear unit.

N.B.: Do not tighten down diametrically opposed bolts in sequence.

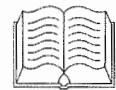


Do not use molybdenum bisulphide or any other grease, which could reduce the friction of the mating surfaces and affect the performance of the shrink disk.



Shrink disk mounting bolts

	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
Bolt	M6	M6	M8	M8	M8	M10	M10	M16	M16	M16	M16	M20	M20	M20	M20	M20	M24	
Quantity	8	10	12	12	12	9	12	8	8	10	10	12	12	15	18	21	24	21
Class	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
Tightening torque (Nm)	12	12	30	30	30	58	58	250	250	250	250	490	490	490	490	490	490	840



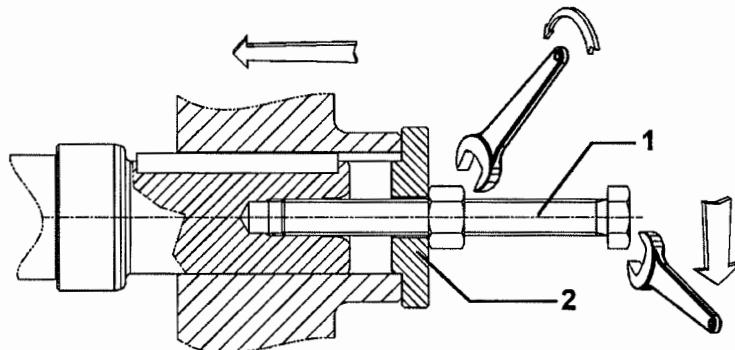
Proceed with the installation as follows:

1. Place the gear unit in the vicinity of the installation area.
2. Mount the gear unit and secure it to the structure at the points provided. The gear unit should be secured to the structure at all the mounting points (bores) on the mount provided (feet or flange).
3. Tighten down the mounting bolts and check that the service plugs are screwed down to the torques given in the chart.

	Locate the closed oil plug used during shipping and replace it with the vent plug supplied in the shipment.

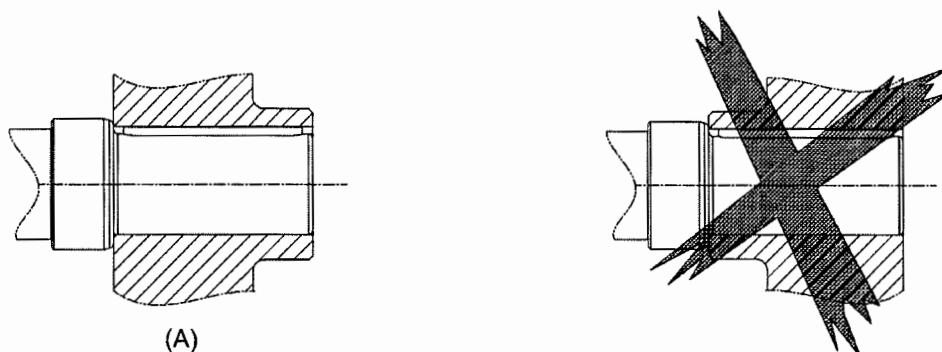
5.1.4 - Installing accessories on solid input and output shafts

Do not use hammers or other tools that might damage the gear unit's shafts or bearings when mounting external parts. Instead, proceed as illustrated in the diagram below:



Bolt (1) and spacer (2) are not included in the consignment.

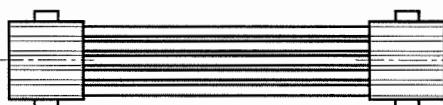
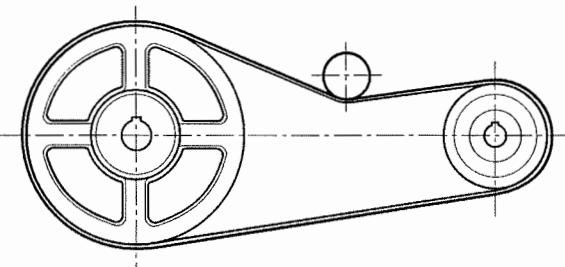
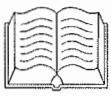
To minimise the loads on the shaft bearings, when mounting transmission mechanisms with asymmetrical hubs use the configuration shown in diagram (A) below:



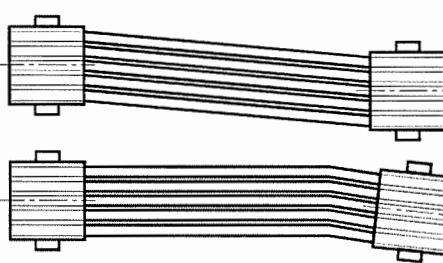
Mounting pulleys

Clean all parts before installing them. When installing belt drive pulleys, the shafts must be parallel with their pulleys aligned.

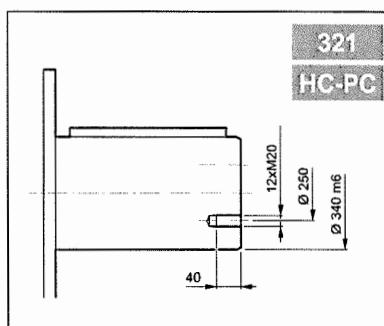
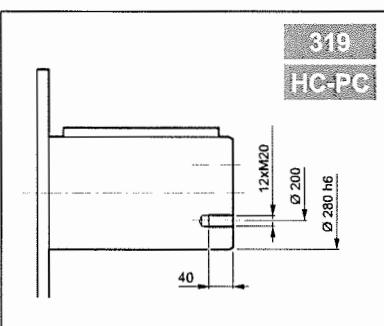
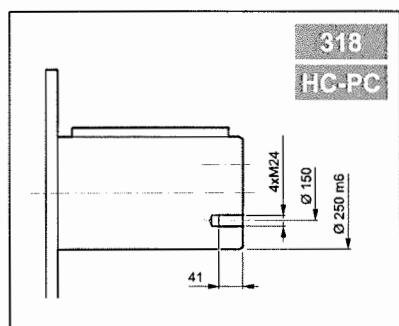
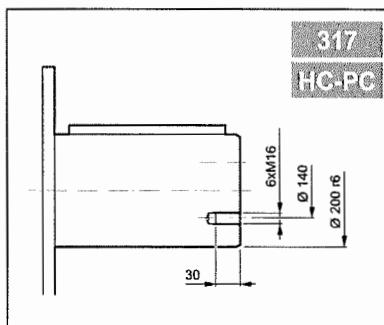
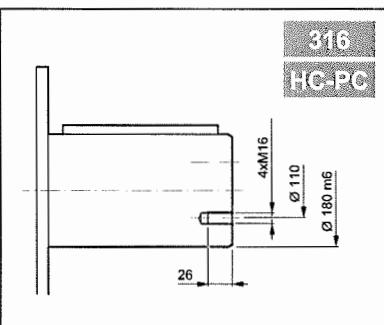
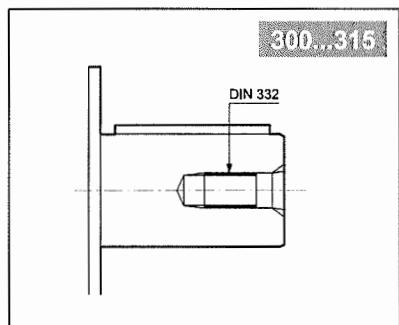
Do not over tension the drive belt as this can damage the bearings.



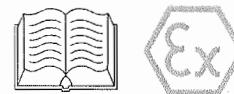
OK



Shaft end: threads



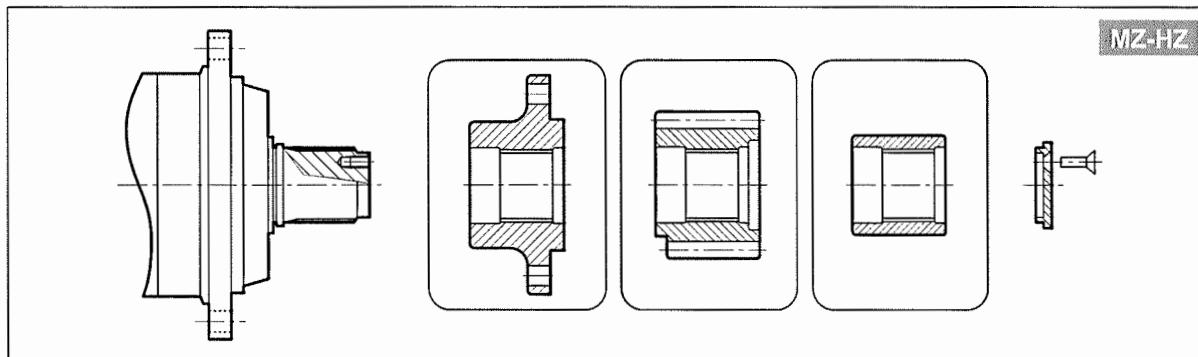
	300	301	303	304	305	306	307	309	310	311	313	314	315	316	317	318	319	321
MC	M12	M12	M20	M20	M20	M20	M20	—	—	—	—	—	—	—	—	—	—	
HC	M16	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	—	—	—	—	
PC	M12	M16	M20	M20	M20	M20	M20	M24	M24	M24	M24	M24	M24	—	—	—	—	
VK	—	—	M20	M20	M20	M24	M24	M24	M24	M24	M30	M30	M30	—	—	—	—	



Installing accessories on splined shafts



Do not use hammers or other tools that might damage the gear unit's shafts or bearings when mounting external parts. Instead, proceed as illustrated in the diagram below:

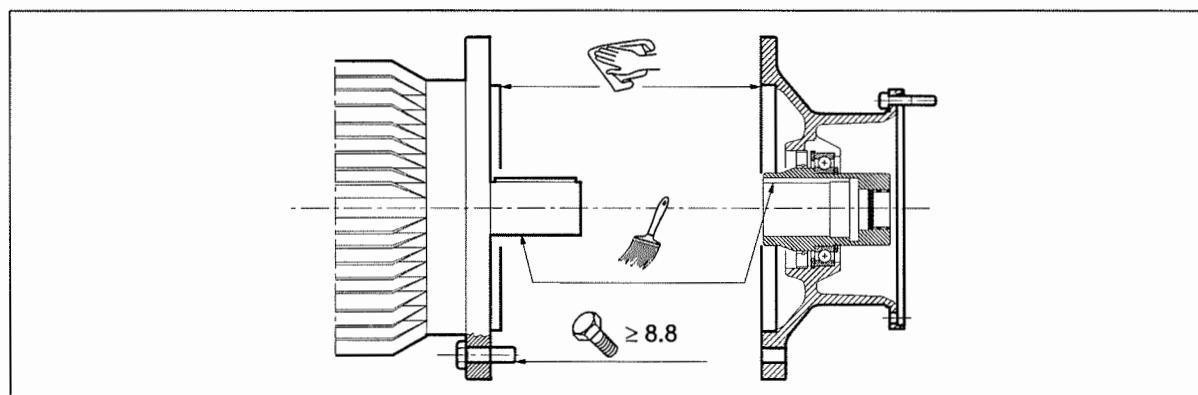


Always use the stop end plate supplied with the gear unit.

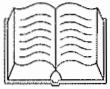
5.2 - INSTALLING THE ELECTRIC MOTOR

Further to all the precautions indicated above, when installing a standard IEC 72-1 electric motor, the following precautions must also be observed:

- Do not force the coupling and do not use inappropriate tools during assembly. Take care not to damage the flat/cylindrical coupling surfaces.
- Do not force the rotary coupling mechanisms with heavy overhung or thrust loads.
- To facilitate assembly, use a lubricating synthetic oil paste such as Klüberpaste 46 MR 401 or another product with similar properties and application range.



 	<p>Provided all the above checks have been performed and passed and all other instructions in this manual have been strictly observed, an electric motor with ATEX rating equal to or greater than that of the gear unit may be installed, thus forming a garmotor which itself complies with the provisions of Directive 94/9/EC.</p> <p>If, instead, the assembly of the motor to the gear unit requires actions other than those prescribed in this Manual or one or more of the manual's prescriptions have not been satisfied, the User shall be responsible for analysing the risks attendant on this particular motor/gear unit combination. The risk analysis is in any case obligatory if the motor is powered by an inverter.</p> <p>Only in this way, and subject to self-certification by the assembler, shall the assembly, including the gear unit itself, be compliant with the requirements of Directive 94/9/EC.</p>
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5.3 - INSTALLING THE HYDRAULIC MOTOR

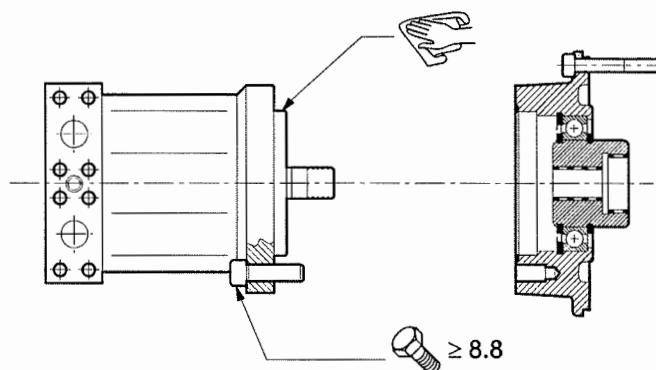
Connecting the hydraulic motor

Remove the protective plug.

Hydraulic motor mountings are available in two versions:

- Version with O-ring oil gasket between motor flange and gear unit.

In this case, mount the gasket to ensure an oil tight seal between the motor and gear unit, taking care to fit it correctly in its seat without damaging it.

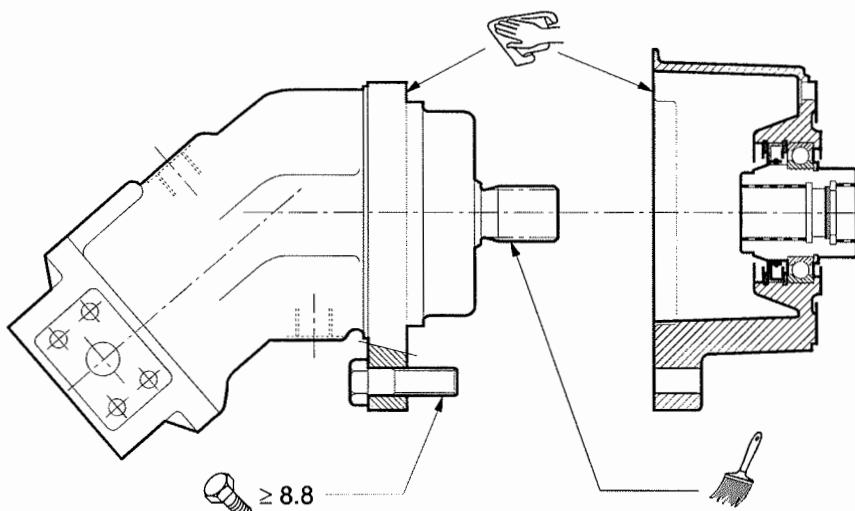


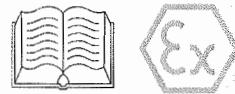
- Version with gasket already mounted to the coupling.

In this case no special intervention is required to ensure an oil tight seal since this is already provided by the motor coupling. Merely smear the motor shaft with grease.

In both cases, clean the spigot and the coupling where the motor is to be fitted, fit the motor and tighten down the flange mounting bolts.

Always use bolts rated to at least class 8.8.



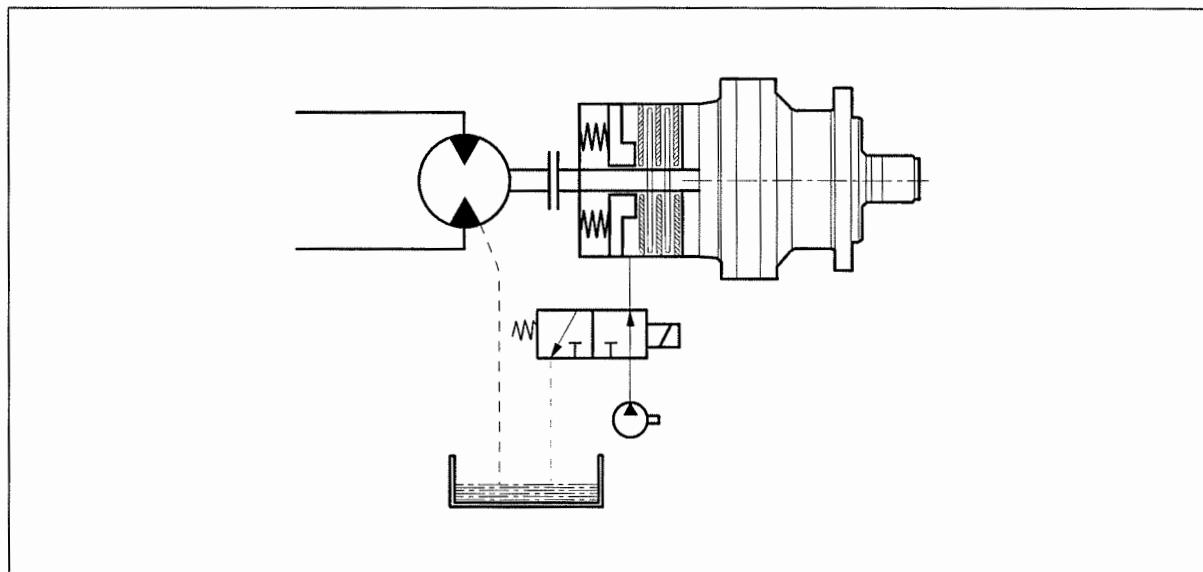


5.4 - CONNECTING THE HYDRAULIC BRAKE

On gear units designed for coupling to hydraulic motors and fitted with a brake, connect the brake control fitting to the hydraulic circuit at the time of assembly.

Start-up

The minimum pressure to release the brake (see chart) must be less than 320 bar.



Technical data

Characteristics	Brake	4...							5...							6...						
		A	B	D	F	H	K	L	B	C	E	G	K	B	C	E	G	K	L			
Braking torque	M _{bs} [daNm]	5	10	16	26	33	40	44	40	50	63	80	100	85	110	150	210	260	320			
Minimum release pressure	bar	10	20	30	20	25	30	33	20	27	20	25	32	14	19	25	19	24	28			
Max. pressure	bar	320																				
Weight	kg	10							18							35						

NOTE: The static torque M_{bs} is the maximum torque the brake can exert.

Under dynamic loads the braking torque is reduced. The actual M_{bs} values can vary from -5% to +15% of the rating given in the chart.

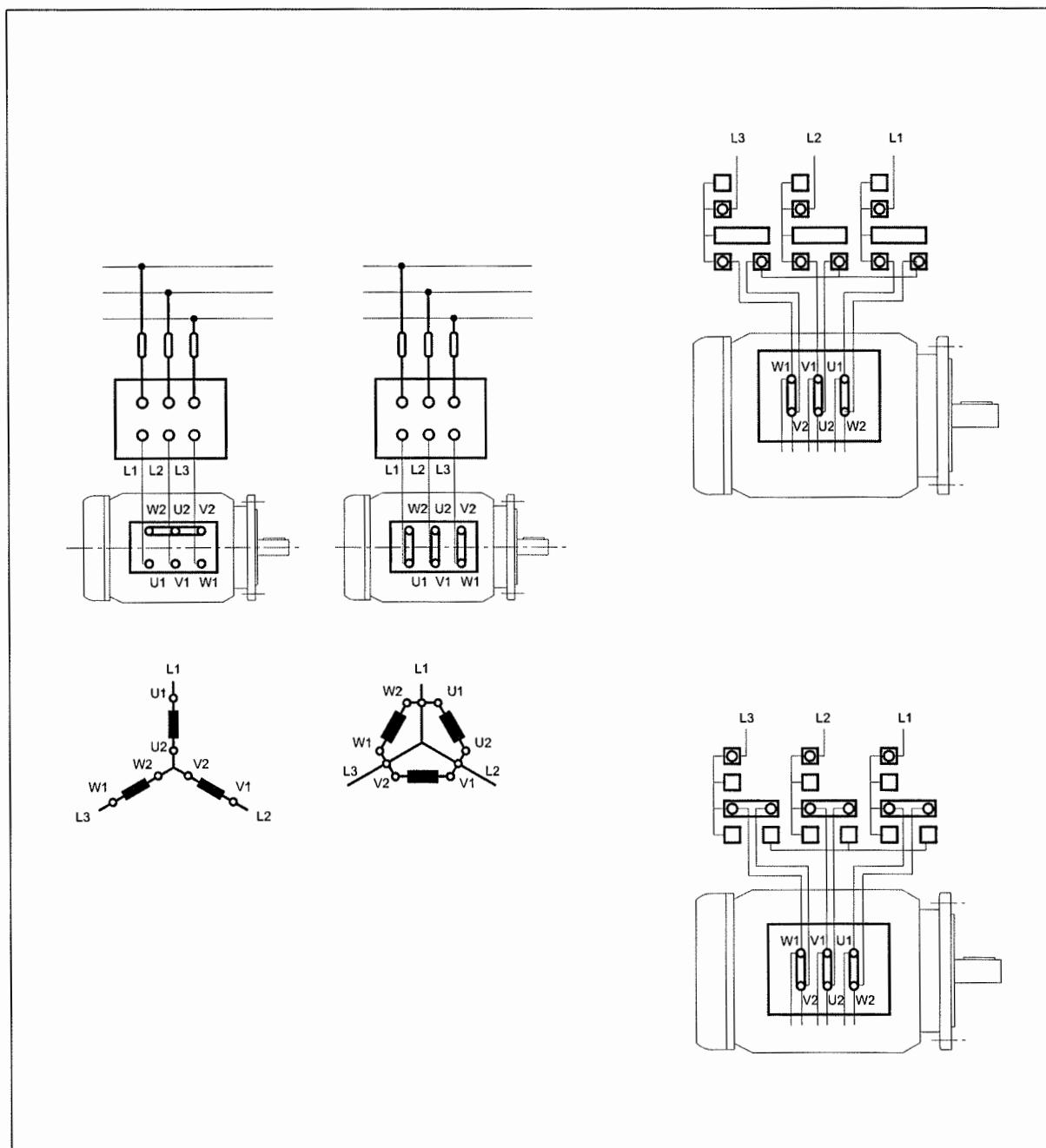


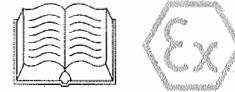
Installing the gearmotor

If a gearmotor is supplied fully assembled, follow the precautions and instructions given above when mounting to the machine.

For the electrical and hydraulic connection, refer instead to the two sample diagrams below. These are generic only since each specific installation has its own special requirements, which must be evaluated on a per case basis by the Manufacturer.

Drive with electric motor.





Drive with TRASMITAL MG orbital hydraulic motor

In addition to the instructions governing installation of the gear unit, the following instructions should also be observed when installing a hydraulic motor.

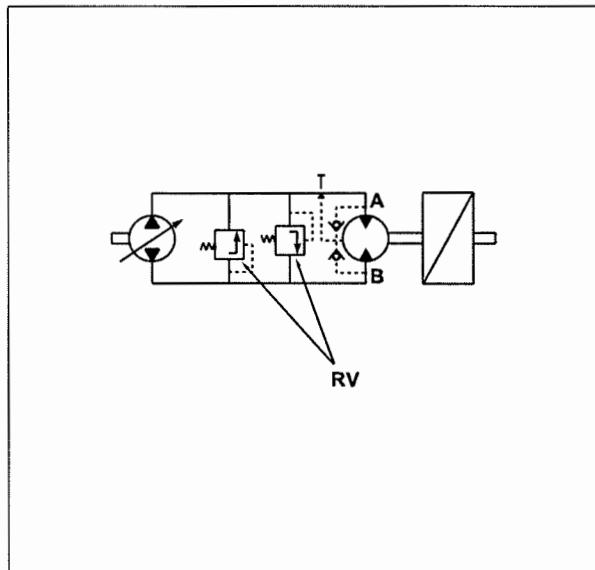
a) Connecting to the hydraulic circuit

The motor can be installed on both a closed and open loop circuit.

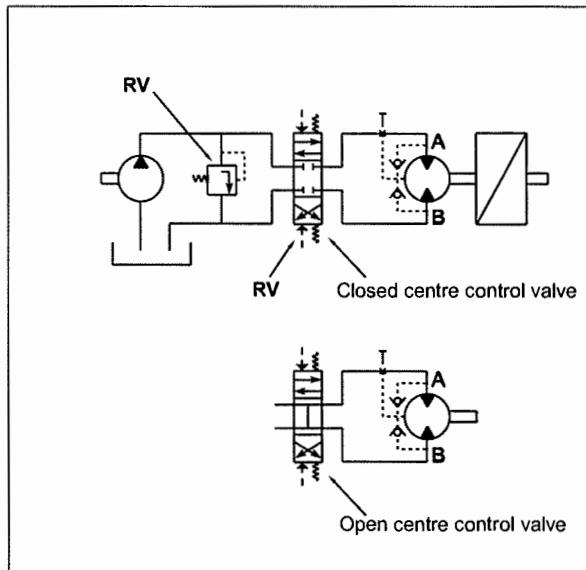
In the case of an open circuit installation, the solenoid valve or control valve may be of either the closed centre or open type.

The circuit line corresponding to the hydraulic motor delivery port must always be equipped with a pressure relief valve calibrated to a pressure no greater than the motor's pmax. Refer to the hydraulic circuit diagrams below.

Closed loop circuit

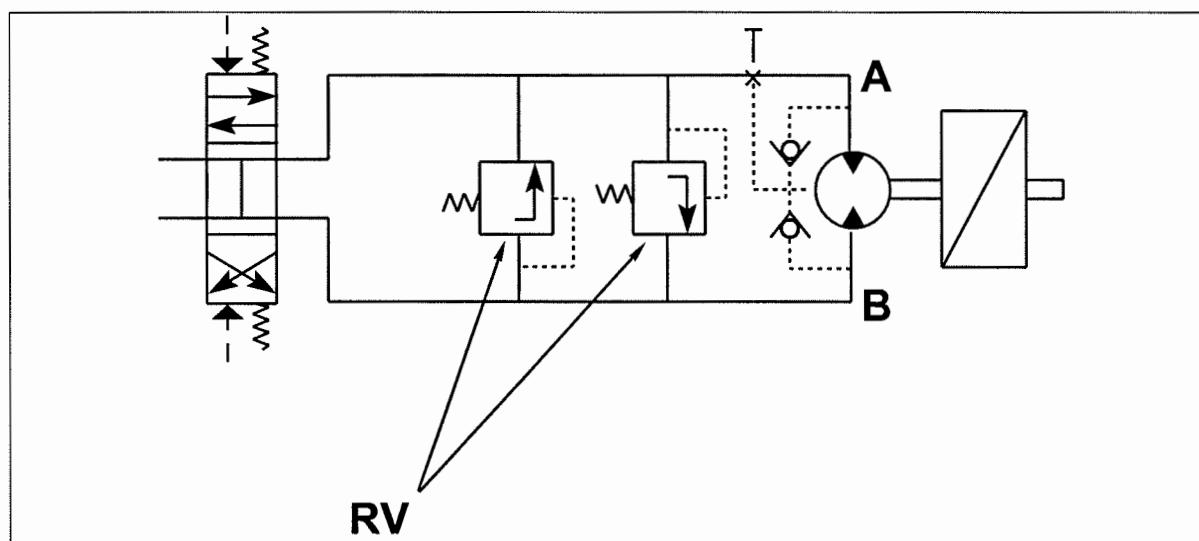


Open loop circuit

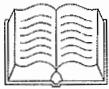


RV = pressure relief valves calibrated to $p_{RV} < p_{max}$.

If this is not possible because the circuit must also actuate other equipment at a higher pressure, or the control valve is of the closed centre type and the motor drives components with high inertia, auxiliary pressure relief valves must be installed as close as possible to the motor.



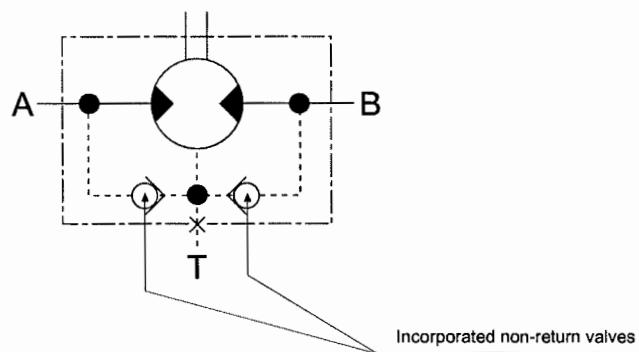
RV = pressure relief valves calibrated to $p_{RV} < p_{max}$.



b) Connecting drain port T

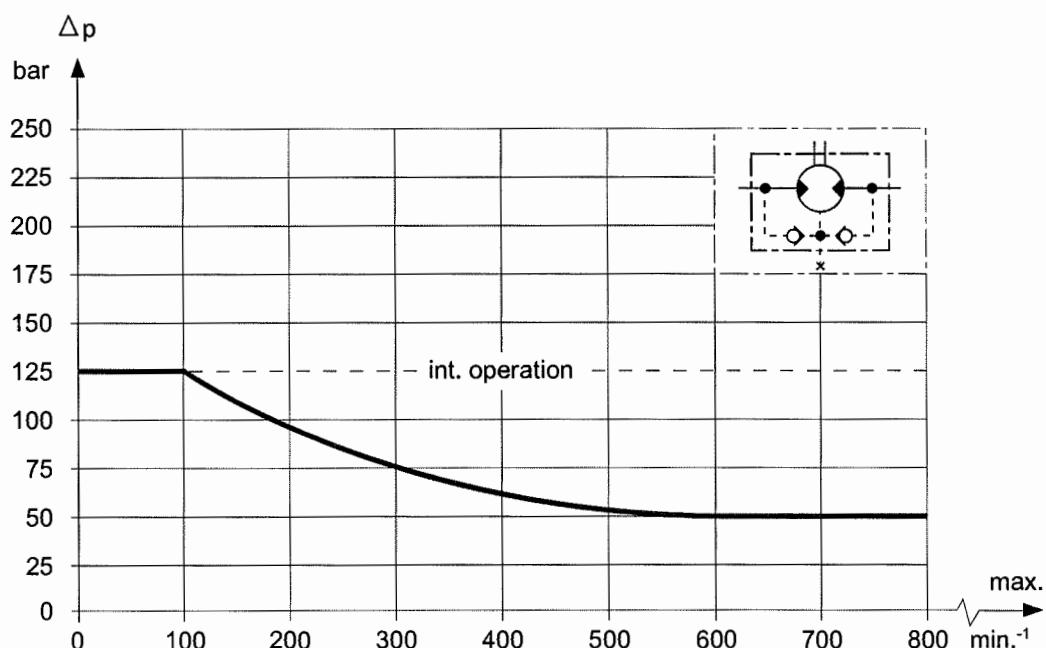
These motors have a 1/8" G drain hole in the centre of the cover. The motor is supplied with the port closed by a metal plug (see figure below).

Two non-return valves are incorporated in the motor casing to maintain internal pressure at the same level as the low pressure line A or B if the drain port is not connected to the tank.



- 1) If the drain port is connected up, pressure at the shaft seal is always equal to the pressure in the drain line.
- 2) If the drain port is closed off, pressure at the shaft seal never exceeds pressure in the return line.

The maximum values for pressure in the drain line (case 1) or return line (case 2) are given in the following figure (for continuous and intermittent operating conditions).



The drain port must always be connected up when more motors are operated in series.



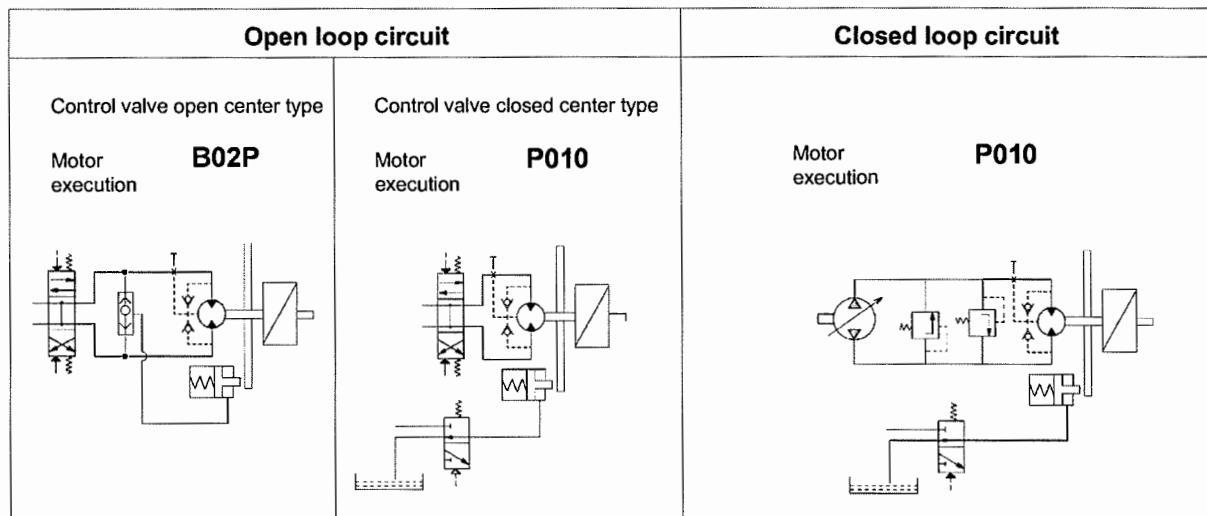
c) Brake control

For gearmotors equipped with brakes, there are two motor versions available, i.e. the B02P or P010 executions.

In the B02P version, the motor has an in-built, direct brake control system.

In the P010 version, an auxiliary branching is required to control the brake.

See the following diagram.



d) Hydraulic oil

Use hydraulic mineral oil with viscosity ISO VG 46 (46 Cst at t = 40°C).

It is recommended the oil temperature should be between +30°C and +70°C.

e) Oil filtering

For reliable motor operation and long life, it is important that the hydraulic circuit has a filter for a proper oil filtering according to the following degree:

degree 9 NAS 1638

degree 6 SAE

degree 18/15 SO DIS 4406

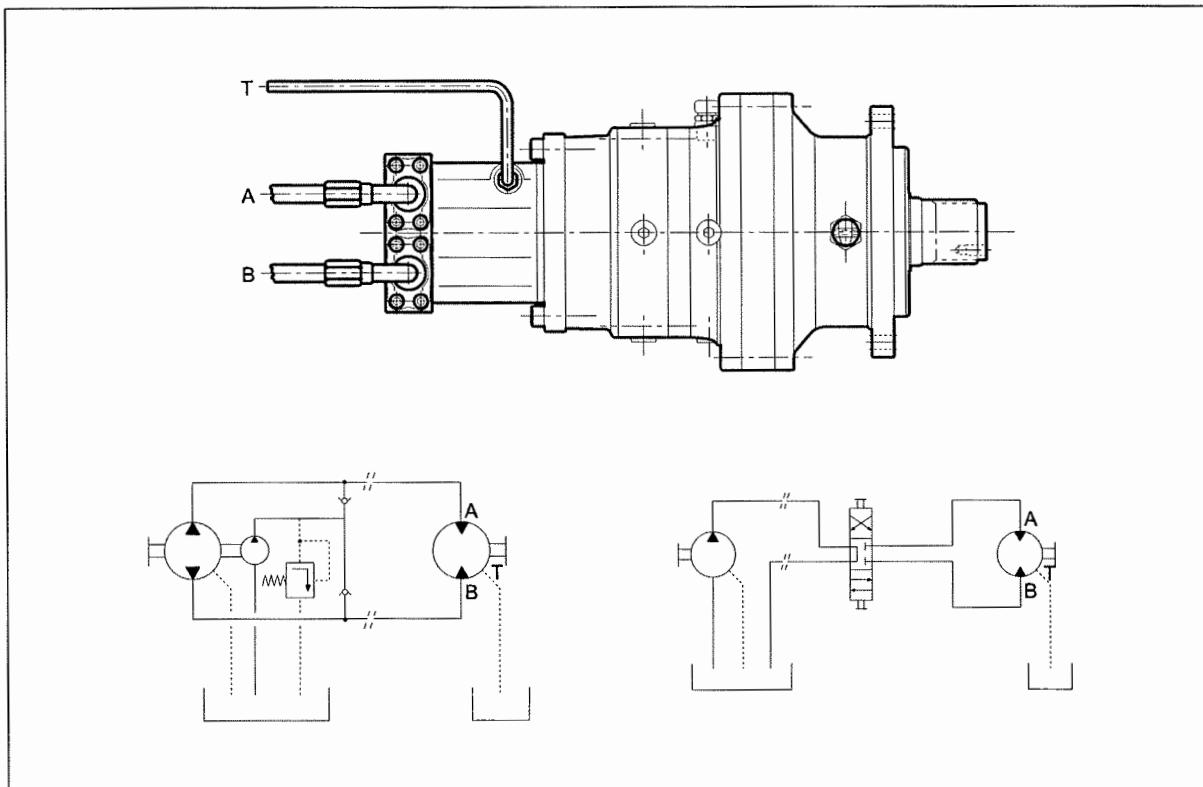


Drive with hydraulic motor

All motors must be charged with hydraulic fluid before being operated and during installation.

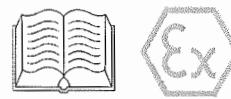
Position the drain hole so that it is positioned uppermost for charging with fluid.

Make sure the hoses are routed in such a way as to prevent the motor casing from emptying and hence, prevent air pockets from forming which may affect pump suction during operation.



A - B = Supply lines

T = Drainage



5.5 - LUBRICATION

Before starting up the gear unit, it must be charged with lubricant to the level corresponding to its specified mounting position.

The lubricant and its relative viscosity should be selected from the following chart, in accordance with the type of duty and ambient temperature.



If the gear unit is supplied ready charged with lubricant, replace the closed shipping plug with the vent plug included in the shipment before installing it.

(A1)

Plug thread	Pitch	Tightening torque [Nm]	Plug thread	Pitch	Tightening torque [Nm]
M14	1,5	15 - 20	1/8"	28	10 - 15
M16	1,5	15 - 20	1/4"	19	10 - 15
M18	1,5	15 - 20	3/8"	19	15 - 20
M20	1,5	20 - 30	1/2"	14	20 - 30
M22	1,5	20 - 30	3/4"	14	20 - 30
M24	1,5	20 - 30	1"	11	30 - 40
M30	2	30 - 40			
M42	3	40 - 50			

(A2)

	INDUSTRIAL PLANTS			MOBILE MACHINES	
	ISO standard .. EP grade			SAE standard .. API GL5 grade	
T _a	-10°C / +30°C	+10°C / +45°C	-20°C / +60°C	-20°C / +30°C	+10°C / +45°C
AGIP	ISO VG 150	ISO VG 220	ISO VG 150-220	SAE 80W/90	SAE 85W/140
ARAL	BLASIA 150	BLASIA 220	BLASIA SX 220	ROTRA MP	ROTRA MP
BP	DEGOL BG 150	DEGOL BG 220	DEGOL PAS 150-220	GETRIEBEOL HYP	GETRIEBEOL HYP
CASTROL	ENERGOL GR XP 150	ENERGOL GR XP 220	EVERSYN EXP 150-220	HYPGEAR EP	HYPGEAR EP
CEPSA	ALPHA SP 150	ALPHA SP 220	ALPHASYN EP 150-220	HYPOY	HYPOY
CHEVRON	ENGRANAJES HP 150	ENGRANAJES HP 220	ENGRANAJES HPX 150-220	TRANSMISIONES EP	TRANSMISIONES EP
ESSO	N.L. GEAR COMPOUNDS EP 150	N.L. GEAR COMPOUNDS EP 220	TEGRA SYNTHETIC GEAR EP 150-220	RPM UNIVERSAL GEAR LUBRICANTS	RPM UNIVERSAL GEAR LUBRICANTS
FUCHS	SPARTAN EP 150	SPARTAN EP 220	SPARTAN S EP 150-220	GEAR OIL GX	GEAR OIL GX
KLUBER	RENOLIN CKC 150	RENOLIN CKC 220	RENOLIN UNISYN CKC 150-220	PONTONIC MP	PONTONIC MP
Q8	GOYA 150	GOYA 220	EL GRECO 220	TITAN SUPER GEAR	TITAN SUPER GEAR
MOBIL	MOBILGEAR 600 XP 150	MOBILGEAR 600 XP 220	MOBILGEAR SHC XMP 150-220	MOBILUBE HD	MOBILUBE HD
MOLYCOTE	L-0115	L-0122	L-2115 / L-2122		
REPSOL	SUPER TAURO 150	SUPER TAURO 220	SUPER TAURO SINTETICO 150-220		
SHELL	OMALA EP150	OMALA EP220	TIVELA OIL S	SPIRAXHD	SPIRAX HD
TOTAL	CARTER EP 1500	CARTER EP 2200	CARTER SH 150-220	TRANSMISSION TM	TRANSMISSION RS

► Polyalphaolefin synthetic oils (PAO)

Brake lubrication

The hydraulic multi-disk brakes are lubricated with the same oil as the gear unit.

 	Only synthetic lubricants may be used on gear units conforming to European Directive 94/9/EC. Refer to the above chart for the brand and type.
------	---



6.0 - TESTING THE GEAR UNIT

The gear unit has been factory tested by the Manufacturer. Before start-up, make sure that:

- the machine incorporating the gear unit complies with the provisions of the "Machinery Directive" 98/37/EC and any other applicable safety legislation
- the gear unit's mounting position in the installation corresponds to that prescribed and indicated on the nameplate
- the electrical power supply is suitable and operational as prescribed in EN 60204-1, and is grounded as per EN 50014
- the motor's electric power supply corresponds to that prescribed and is within +/-5% of the rated value
- the hydraulic system is suitable and operational, and the oil in the hydraulic motor's lubrication circuit conforms to ISO VG 46. It must be filtered with a maximum grade of 10 µm and contamination level less than or equal to class 9 as per NAS 1638 or 18/15 as per ISO/DIS 4406
- there are no signs of lubricant leaks from the plugs or gaskets
- the vent plug is not obstructed by dirt or paint
- the unit does not run noisily or with excessive vibration.

	<p>Before starting up the unit, check and make sure that:</p> <ul style="list-style-type: none">• the unit is not assembled in a potentially explosive atmosphere (oil, acid, gas, vapour, radiation) and is free of dust build ups greater than 5 mm in depth• during operation the gear unit is sufficiently ventilated and is not subject to radiation from external heat sources• during operation the cooling air does not exceed 40 °C• the oil level check and filler plugs and the vent plugs are all easily accessible• all accessories mounted to the gear unit are ATEX certified• gear units with hollow shafts, with or without shrink disk, have been correctly mounted as described in this manual• the gear unit has been thoroughly cleaned after installation• all guards are installed to prevent accidental contact between operators and the unit's rotary moving parts, and seals are oil tight
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7.0 - USING THE EQUIPMENT

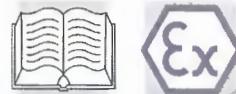
Before putting the gear unit into service, the User must ensure that the plant in which it is installed complies with all applicable directives, especially those regarding health and safety at work.

The gear unit may not be used in areas and environments:

- with highly corrosive/abrasive vapours, smoke or dust.
- in direct contact with loose food products.

Danger zones and exposed persons:

The danger zone of the gear unit is the protrusion of the shaft which constitutes a hazard for exposed persons in direct contact with it (crushing, shearing, trapping). In particular, when the gear unit is operating in automatic mode in an accessible area, the shaft must be protected by a guard.



8.0 - MAINTENANCE



Maintenance and replacement work must be carried out by expert maintenance technicians trained in the observance of applicable laws on health and safety at work and the special ambient problems attendant on the installation.



Before doing any work on the unit, the operator must first switch off power to the gear unit and ensure that it is out of service, as well as taking all necessary precautions against it being accidentally switched on again or its parts moving without warning (due to suspended loads or similar external factors).

Furthermore, all additional environmental safety precautions must be taken (e.g. elimination of residual gas or dust, etc).

- Before doing any maintenance work, activate all the safety devices provided and, if necessary, inform persons working in the vicinity. Cordon off the area around the unit and prevent access to any equipment which, if activated, might be the cause of unexpected health and safety hazard.
- Replace worn components with original spare parts.
- Use the lubricants (oil and grease) recommended by the Manufacturer.
- When working on the gear unit always replace all gaskets and seals with original new ones.
- If a bearing requires replacement, it is good practice to also replace the other bearing supporting the same shaft.
- We recommend replacing the lubricating oil after all maintenance work.

The above instructions are aimed at ensuring efficient and safe operation of the gear unit.

The Manufacturer declines all liability for injury to persons and damage to components due to the use of non-original spare parts and non-routine work that modifies the safety requirements without the Manufacturer's express prior authorisation.

Refer to the specific spare parts catalogue when ordering spare parts for the gear unit.



**Do not dump polluting liquids, worn parts and maintenance waste into the environment.
Dispose of all such materials as specified by applicable legislation.**

 	<ul style="list-style-type: none">• Observe the routine inspection and maintenance schedule to ensure the unit's correct operation and the effectiveness of the explosion protection.• Always apply fresh Loctite 510 or other product with similar properties and application range to all disassembled threads.• Before servicing or repairing internal components, allow the gear unit to cool down completely before opening the casing so as to avoid burns from parts which are still hot.• On completion of maintenance work, make sure that all safety measures and equipment have been applied and reset.• Clean the gear unit thoroughly after maintenance and repair work.• On completion of maintenance, tighten all vent, filler and level plugs to their specified torques (chart A1).• On completion of any maintenance work all seals must be refitted and sealed as prescribed.• Regardless of the type of gear unit, whenever a seal ring is replaced its lips should be smeared with a thin layer of grease (Fluorocarbon gel 880 ITP or other product with similar properties and application range) before assembly.• Use only original spare parts for repairs.
------	---



8.1 - ROUTINE MAINTENANCE



Keep the gear unit at its maximum efficiency by following the routine maintenance schedule. Good maintenance ensures the unit's maximum performance, extended service life and continued compliance with safety regulations.

(A3)

Frequency	Component	Type of check	Action
at start	Gear unit casing	Check that the external temperature does not exceed 75-80 °C	Stop the machine and contact Bonfiglioli Trasmital's Technical Service
after 200 hrs	Original consignment lubricant	Replace	Replace with new lubricant
	External fasteners	Check locking torque	Tighten down to specified torque
1000 hrs	External seals and gaskets	Check oil level Check for leaks by eye	Service or replace components as required
2500 hrs	Lubricant	Replace	Replace with new lubricant
5000 hrs	Gear unit seals and gaskets	Inspect carefully for wear/ageing of external seals	Replace if aged/worn

 	<p>For installations in zones 21 and 22 the User must schedule and implement a regular cleaning programme for all surfaces and recesses to avoid dust build-ups of more than 5 mm in depth.</p> <p>Every 1000 hrs. of operation or after 6 months:</p> <ul style="list-style-type: none"> Measure the surface temperature at the coupling between the gear unit and motor, and at the points which are most shielded from the motor's cooling fan. The maximum temperature must not be more than 75-80°C, nor may this value be exceeded during operation. <p>Every 5000 hrs. of operation:</p> <ul style="list-style-type: none"> Change the synthetic oil and bearing grease if the gear unit is not life lubricated. Replace all externally accessible seal rings unless this has already been done as a result of problems occurring before the scheduled maintenance deadline.
------	---



8.2 - OIL CHANGES

1. Place an adequate container under the drain plug.
2. Remove the filler and drain plugs and allow the oil to drain out.



The oil will drain better if it is warm.

3. Wait for a few minutes until all the oil has drained out, then screw the drain plug back on after first changing the plug seal.
4. Fill with new oil until it reaches the level mark. **Do not mix oils of different makes or specifications and check that the oil is highly resistant to foaming and is EP rated.**
5. Tighten down the filler plug after changing its seal.



The gear unit may be supplied with or without lubricant, as requested by the User. The quantity of charge oil required is specified in the Sales Catalogue. This specification is however, approximate, and reference must always be made to the mark on the level plug, the placement of which depends on the mounting position specified in the purchase order.

Life lubricated gear units which are not subject to external contamination do not normally require periodic lubricant changes. If the same type of oil as that already in use is not available, drain the gear unit casing completely and wash its interior thoroughly with a light solvent before refilling with the new lubricant.



If a leak is found, identify the cause of the fault and repair it before topping up the lubricant and operating the unit.

Lubricants, solvents and detergents are toxic/harmful to health:



- they may cause irritation in direct contact with the skin
- they may cause intoxication if inhaled
- they may be fatal if swallowed.

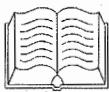
Handle them with care using suitable individual safety equipment. Do not dump them into the environment and dispose of in accordance with applicable legislation.

8.3 - CHECKING OPERATIONAL EFFICIENCY

- Remove any dust from the gear unit and motor casings.
- Check that the noise generated at continuous load does not vary. Excessive vibration or noise can indicate wear of the gear train or failure of a bearing.
- Check the power absorption and voltage against the rated values given on the motor's nameplate.
- Check the wear of the friction surfaces and braking gasket on the brake motors (if fitted) and, if necessary, adjust the gap.
- Check for lubricant leaks from the gaskets/seals, plugs and casings.
- Check all bolted couplings for wear, deformation and corrosion and tighten them down fully, but without over tightening.

8.4 - CLEANING

Remove all dust and process waste from the gear unit. Do not use solvents or other products that are incompatible with the unit's construction material and do not direct high pressure jets of water at the gear unit.



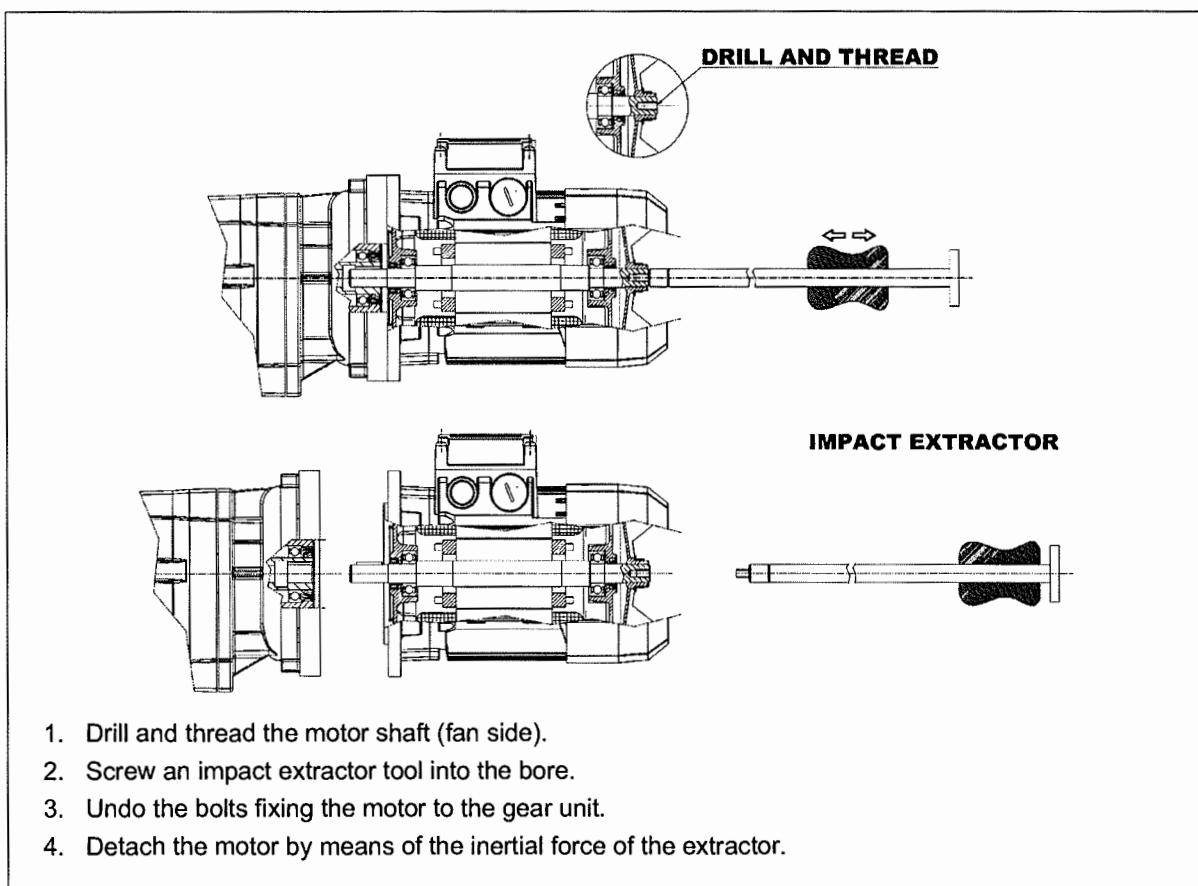
9.0 - REPLACING PARTS

- Immediately replace parts and components if they are not able to guarantee safe and reliable operation.
- ⚠ • Never improvise repairs.
- The use of non-original spare parts not only renders the warranty null and void but can jeopardise the gear unit's operation.

9.1 - REMOVING THE MOTOR

If during operation the mobile coupling between the motor and gear unit has not rusted significantly, it should be possible to remove the motor without applying excessive force.

If instead, it proves difficult to remove the motor, do not use screwdrivers or levers to apply force as this may damage the flanges and mating surfaces, but proceed as illustrated below.



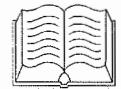
9.2 - DECOMMISSIONING THE GEAR UNIT

The unit must only be taken out of service by operators trained in the observance of applicable laws on health and safety at work.

Do not dump non-biodegradable products, lubricants and non-ferrous materials (rubber, PVC, resins, etc.) into the environment. Dispose of all such materials as stipulated by established environmental legislation.



Do not re-use parts or components which appear to be in good condition after they have been checked or replaced by qualified personnel and declared unsuitable for use.



10.0 - TROUBLESHOOTING

The following information is intended to serve as an aid in locating and eliminating defects and faults. In some cases, problems may be caused by the plant or machine to which the gear unit is assembled and hence, the cause and remedy will be described in the Manufacturer's technical documentation for the machine/plant in question.

FAULT	CAUSE	REMEDY
Bearing temperature too high	Oil level too low	Top up oil level
	Oil spent	Replace oil
	Defective bearings	Contact authorised workshop
Operating temperature too high	Oil level too high	Check oil level
	Oil spent	Replace oil
	Contaminant in oil	Replace oil
Abnormal running noise	Gears damaged	Contact authorised workshop
	Bearing axial backlash too high	Contact authorised workshop
	Bearings defective or worn	Contact authorised workshop
	Excessive load applied	Correct load to rated values given in Sales Catalogue
	Contaminant in oil	Replace oil
Abnormal noise at gear unit mounting	Mounting bolts loose	Tighten bolts to specified torque
	Mounting bolts worn	Replace bolts
Oil leaks	Oil level too high	Check oil level
	Casing/coupling seals inadequate	Contact authorised workshop
	Gaskets worn	Contact authorised workshop
Gear unit does not run or runs with difficulty	Oil viscosity too high	Replace oil (see recommended lubricant chart)
	Oil level too high	Check oil level
	Excessive load applied	Redesign drive for actual load required
Output shaft does not turn with motor running	Gears damaged	Contact authorised workshop



ANNEX 1 - CHECKING THE OIL LEVEL ON ATEX-SPECIFIED GEAR UNITS

Gear units are normally fitted with oil level check plugs.

To check the oil level, first identify the level plug.

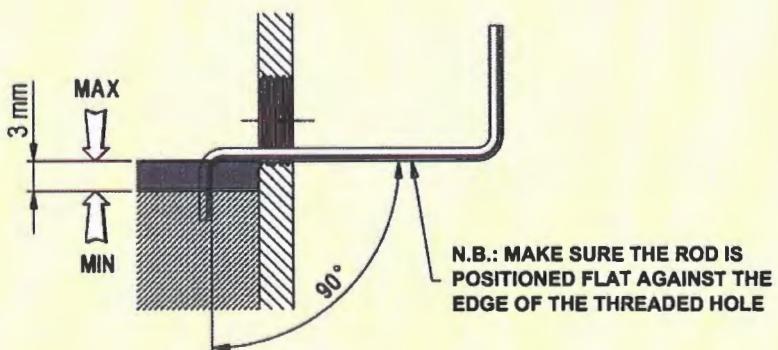
- **Horizontal position:**

Remove the plug and insert a bar of the right size in the hole and of the shape shown in the figure.

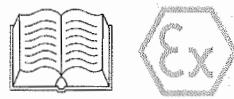
- **Vertical position:**

Use a rod to check that the oil level is between the MIN and MAX marks, then screw the plug back in.

If the level is more than 3 mm below the spill level, top up and check the reason for the drop in oil level.



Gear units conforming to Directive 94/9/EC and designed for a vertical mounting position, are normally equipped with an oil expansion chamber fitted with service plugs for filling, checking the oil level and venting internal overpressure.



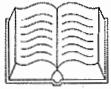
ANNEX 2 - LUBRICANT CHARGE QUANTITY

3_L Series

		Mounting position		
		A	T	O
300	L1	0.6	1.0	0.9
	L2	0.9	1.3	1.2
	L3	1.2	1.6	1.5
	L4	1.5	1.9	1.8
301	L1	0.8	1.2	1.1
	L2	1.1	1.5	1.4
	L3	1.4	1.8	1.7
	L4	1.7	2.1	2.0
303	L1	1.3	2.3	2.0
	L2	1.6	2.6	2.3
	L3	1.9	2.9	2.6
	L4	2.2	3.2	2.9
304	L1	1.4	2.4	2.2
	L2	1.9	2.9	2.7
	L3	2.2	3.2	3.0
	L4	2.5	3.5	3.3
305	L1	1.6	2.6	2.4
	L2	2.1	3.1	2.9
	L3	2.4	3.4	3.2
	L4	2.7	3.7	3.5
306	L1	2.5	3.5	3.2
	L2	3.3	4.3	4.0
	L3	3.6	4.6	4.3
	L4	3.9	4.9	4.6
307	L1	3.5	5.0	4.5
	L2	4.5	6.0	5.5
	L3	5.0	6.5	6.0
	L4	5.3	6.8	6.3
309	L1	4.0	5.5	5.0
	L2	5.0	6.5	6.0
	L3	5.5	7.0	6.5
	L4	5.8	7.3	6.8

		Mounting position		
		A	T	O
310	L1	5.0	6.5	6.0
	L2	6.3	7.8	7.3
	L3	7.1	8.6	8.1
	L4	7.4	8.9	8.4
311	L1	7.0	12	10
	L2	9.0	14	12
	L3	10	15	13
	L4	11	16	14
313	L1	9.0	14	12
	L2	12	17	15
	L3	13	18	16
	L4	13	18	16
314	L2	17	25	21
	L3	19	27	23
	L4	20	28	24
	L2	19	27	23
315	L3	21	29	25
	L4	22	30	26
	L2	22	30	26
316	L3	24	32	28
	L4	25	33	29
	L2	26	41	36
317	L3	29	44	39
	L4	30	45	40
	L3	40	55	50
318	L4	43	58	53
	L3	50	70	60
319	L4	53	73	63
	L3	56	76	66
321	L4	60	80	70
	L3			

N.B. Oil quantities are indicative. Check actual level after filling through the appropriate plug.

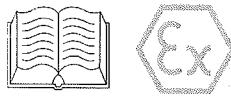


3_R Series

		Mounting position		
		B0	U_	P_
300	R2	1.2	1.7	1.5
	R3	1.5	2.0	1.8
	R4	1.8	2.3	2.1
301	R2	1.6	2.1	1.9
	R3	1.9	2.4	2.2
	R4	2.2	2.7	2.5
303	R2	2.2	2.8	2.6
	R3	2.5	3.1	2.9
	R4	2.8	3.4	3.2
304	R2	2.3	2.9	2.7
	R3	2.8	3.4	3.2
	R4	3.1	3.7	3.5
305	R2	2.5	3.1	2.9
	R3	3.0	3.6	3.4
	R4	3.3	3.9	3.7
306	R2	4.0	5.0	4.8
	R3	4.8	5.8	5.6
	R4	5.1	6.1	5.9
307	R2	6.0	8.0	7.0
	R3	7.0	9.0	8.0
	R4	7.5	9.5	8.5

		Mounting position		
		B0	U_	P_
309	R2	6.5	8.5	7.5
	R3	7.5	9.5	8.5
	R4	8.0	10	9.0
310	R2	13	15	14
	R3	11	13	12
	R4	12	14	13
311	R2	14	19	17
	R3	16	21	19
	R4	17	22	20
313	R2	16	21	19
	R3	19	24	22
	R4	20	25	23
314	R3	25	33	29
	R4	28	36	32
315	R3	27	35	31
	R4	30	38	34
316	R3	30	38	34
	R4	33	41	37
317	R3	38	52	48
	R4	42	56	52
318	R4	48	63	58

N.B. Oil quantities are indicative. Check actual level after filling through the appropriate plug.

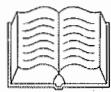


3/V Series

	[I]												
	AA - EA - FD			AF - EF - FE		AE - EE - FF		AD - ED - FA		TA - TE - TF TD - VA - VE VF - VD		OA - OE - OF OD - QA - QE QF - QD	
	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	P(IEC) 	
3/V 00 L3	0.9	0.12	0.12	0.9	0.12	0.9	0.12	0.9	0.12	1.3	0.12	1.2	0.12
3/V 01 L3	1.1			1.1		1.1		1.1		1.5		1.4	
3/V 03 L3	1.6	0.25	0.25	1.6	0.31	1.6	0.31	1.6	0.38	2.6	0.31	2.3	0.25
3/V 04 L3	1.9	0.38	0.38	1.9	0.43	1.9	0.43	1.9	0.52	2.9	0.52	2.7	0.38
3/V 05 L3	2.1			2.1		2.1		2.1		3.1		2.9	
3/V 06 L3	3.3	0.64	0.64	3.3	0.76	3.3	0.76	3.3	0.85	4.3	0.76	4	0.76
3/V 10 L4	7.1			7.1		7.1		7.1		8.6		8.1	
3/V 07 L3	4.5			4.5		4.5		4.5		6		5.5	
3/V 11 L4	10	2.4	2.8	10	2.6	10	2.6	10	1.7	15	1.9	13	1.9
3/V 13 L4	13			13		13		13		18		16	
3/V 09 L3	5			5		5.0		5		6.5		6	
3/V 10 L3	6.3			6.3		6.3		6.3		7.8		7.3	
3/V 14 L4	19	4.3	4.5	19	3.9	19	3.9	19	3.0	27	3.5	23	3.5
3/V 15 L4	21			21		21		21		29		25	
3/V 16 L4	24			24		24		24		32		28	
3/V 11 L3	9			9		9		9		14		12	
3/V 13 L3	12	7.8	9.6	12	6.7	12	6.7	12	5.0	17	5.5	15	5.5
3/V 14 L3	17			17		17		17		25		21	
3/V 17 L4	29			29		29		29		44		39	
3/V 15 L3	19			19		19		19		27		23	
3/V 18 L4	40	11	15	40	8.9	40	9.4	40	7.5	55	9.5	50	9.5
3/V 19 L4	50			50		50		50		70		60	
3/V 16 L3	22			22		22		22		30		26	
3/V 17 L3	26	23	28	26	16.8	26	17.5	26	10.7	41	17	36	17
3/V 21 L4	56			56		56		56		76		66	

Life lubrication

NOTE: In combined gear units, lubrication of the planetary stage is separate from that of the worm (3/V) or helical bevel (3/A) stages.

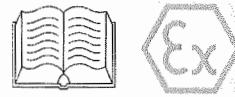


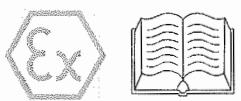
3/A Series

	oil [l]											
	AA - EA - FD		TA - TE - TF TD - VA - VE VF - VD		OA - OE - OF OD - QA - QE QF - QD		AD - ED - FA		AF - EF - FE		AE - EE - FF	
3/A 00 L2	0.60	1.4	1.0	1.4	0.9	1.4	0.6	1.4	0.6	1.4	0.6	1.4
3/A 01 L2	0.80	2.3	1.2	2.3	1.1	2.3	0.8	2.3	0.8	2.3	0.8	2.3
3/A 03 L2	1.3	3.2	2.3	3.2	2.0	3.2	1.3	3.2	1.3	3.2	1.3	3.2
3/A 04 L2	1.4	3.8	2.4	3.9	2.2	3.9	1.4	4.5	1.4	5.0	1.4	4.2
3/A 05 L2	1.6	4.0	2.6	4.1	2.4	4.1	1.6	4.7	1.6	5.2	1.6	4.4
3/A 06 L2	2.5	4.9	3.5	8.1	3.2	4.7	2.5	8.4	2.5	11	2.5	9.2
3/A 07 L2	3.5	6.8	5.0	8.1	4.5	12	3.5	15	3.5	18	3.5	15

Life lubrication

NOTE: In combined gear units, lubrication of the planetary stage is separate from that of the worm (3/V) or helical bevel (3/A) stages.





INDEX OF REVISIONS (R)

R2

110926

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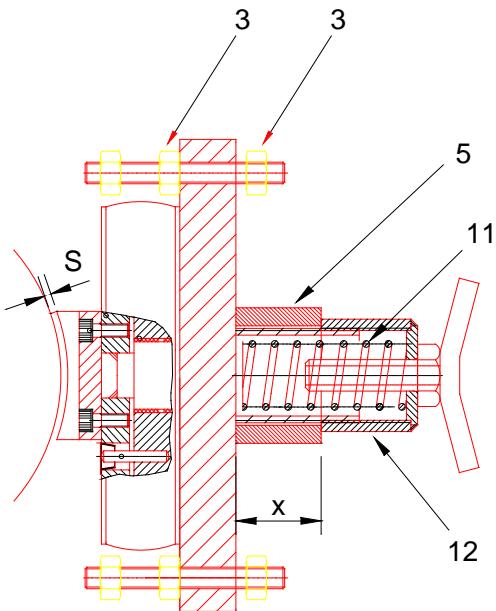
power, control and green solutions

Bonfiglioli has been designing and developing innovative and reliable power transmission and control solutions for industry, mobile machinery and renewable energy applications since 1956.

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tel: +39 051 647 3111
fax: +39 051 647 3126
bonfiglioli@bonfiglioli.com
www.bonfiglioli.com

Slewing brake type : K8
 Part number : 16.00045720



Pos 5

Type	x [mm]	Part No.
K8	38	43.00039656

Adjustment of K-brake type K8

The air gap (S) should be between 1.0 and 1.5 mm and is set by adjusting the nuts (3) equally while the brake is energized.

The distance ring (5) for the respective brake torque – according to the crane data sheet – should always be fitted.

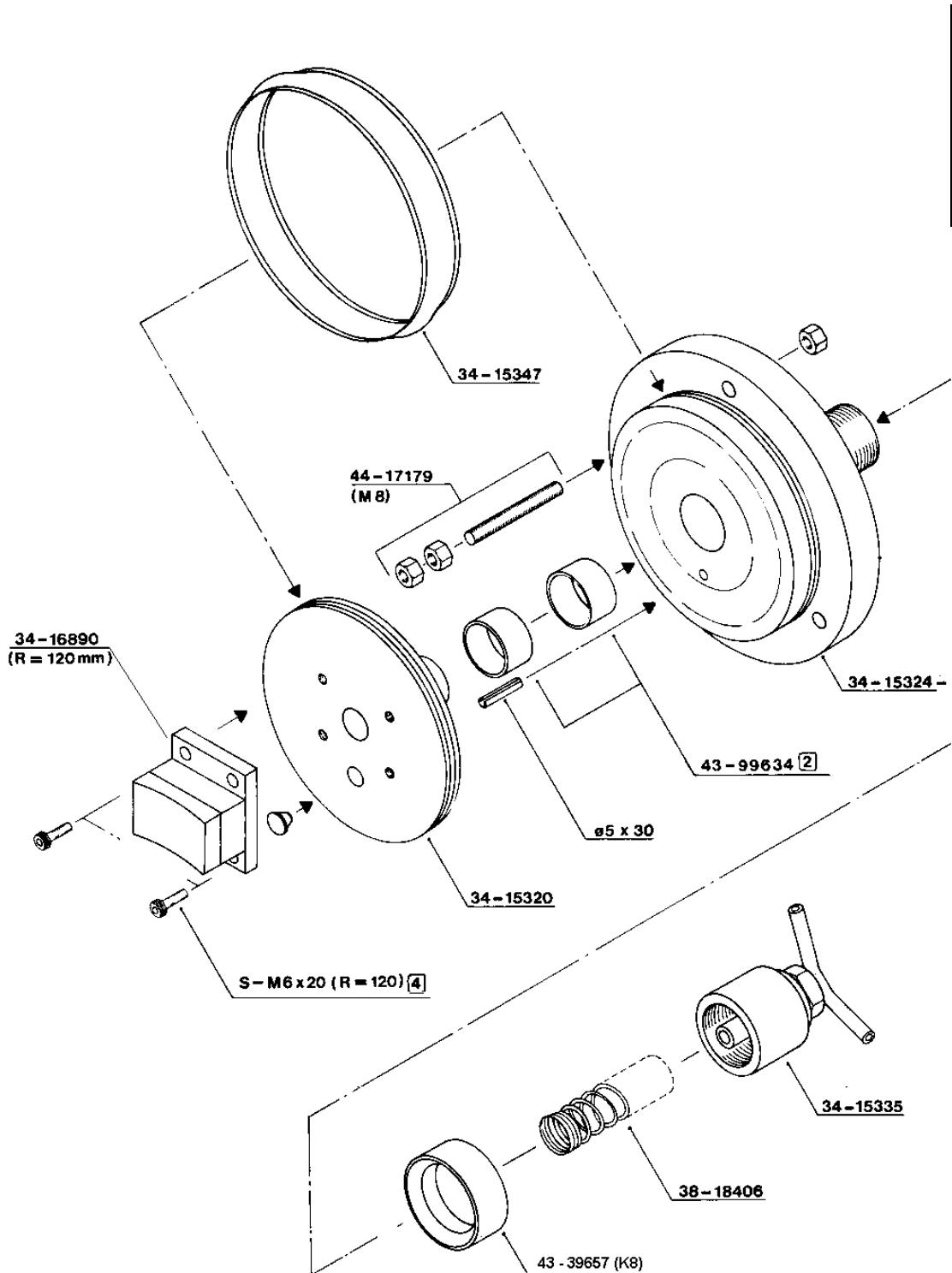
The maximum brake torque is obtained by turning the adjusting nut (12) up against the ring (5). If required, the brake torque can be reduced by loosening the adjusting nut (12), thus releasing the compression of the spring (11).

When used as a slewing brake, the adjusting nut (12) must be loosened when the crane is out of service to allow the jib to weather-vane.

The internal parts of the brake are greased with light ball bearing grease before leaving the works. It is advisable to keep these parts well greased.

SPRING-APPLIED BRAKE WITH ELECTROMAGNETIC RELEASE

38 mm



**Getriebe-Nocken-
Endschalter**

Geared Cam
Limit switches

Serie 51 / 51 DZ

51



- Planetengetriebe: Kunststoff
- Präzise
- Sehr einfach einstellbar
- Gehäuse: Kunststoff oder Aluminiumguss

- Planetary gears: plastics
- Precise
- Very simple adjustment
- Housing: Plastics or aluminium cast

Wir geben Ihrem Antrieb Sicherheit

Katalog - Nr. D 142

Alle Angaben über Getriebe - Nocken - Endschalter der Reihe 51 und Getriebe - Nocken - Endschalter mit Differenzzahn - Getriebe der Reihe 51 DZ in Druckschriften älteren Datums sind mit dem Erscheinen dieser Druckschrift nur noch bedingt gültig.

Maß - und Konstruktionsänderungen behalten wir uns vor.

Stromag - Produkte entsprechen dem Qualitätsstandard nach EN ISO 9001.

Catalogue No. D 142

This catalogue for geared cam limit switches series 51 and geared cam limit switches with differential tooth gear series 51 DZ cancels and replaces all former editions.

We reserve the right to modify the dimensions and constructions.

Stromag products comply with the Quality Standard to EN ISO 9001.

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1 Standardschalter

1.1 Allgemeines

Getriebe - Nocken - Endschalter der Reihe 51 sind universell einsetzbare, mechanische Schaltgeräte, mit denen eine Vielzahl von Umdrehungen einer Welle auf dem Drehwinkel der eingebauten Nockenscheiben abgebildet wird. Von diesen Nockenscheiben werden die mechanischen Schaltkontakte betätigt.

Getriebe - Nocken - Endschalter werden überall dort eingesetzt, wo Winkel oder Strecken nicht direkt durch Schaltgeräte begrenzt werden können, sondern diese Begrenzung nur indirekt über die Messungen des Drehwinkels einer Welle möglich ist. Das klassische Beispiel für eine solche Anwendung ist die Begrenzung des Hakenweges eines Kranhubwerkes.

Besonders dort, wo im Zusammenhang mit einer möglichen Personengefährdung **zwangstrennende Schaltkontakte nach EN 60947 T5 - 1, IEC 947 - 5 - 1 vorgeschrieben sind**, gibt es keine wirtschaftliche Alternative zu Getriebe - Nocken - Endschaltern.

Abnahmen bzw. Zulassungen

Abnahmen bzw. Zulassungen für Standardausführungen:
Germanischer Lloyd Nr. 11300 - 98 HH (ohne DZ)
CSA Nr. 201 644 (ohne Zusatzanbauten)

Die besonderen Vorteile der Getriebe - Nocken - Endschalter der Reihe 51 sind:

• Patentierte Planeten - Getriebe

Formschlüssiges, reibungsarm laufendes Planetengetriebe mit selbsthemmender, selbstarretierender Schneckenverstellung der Nockenscheiben.

• Im Gehäuse feststehende Nockenverstellung

Die Verstellschnecken der Nockenscheiben sind so angeordnet, daß sie aus der gleichen Richtung zu erreichen sind, wie die Anschlüsse der Kontakte. Damit ist optimale Erreichbarkeit auch unter begrenzten Einbauverhältnissen gewährleistet. Die Verstellung ist auch während des Betriebes möglich. Die Einfachheit und Genauigkeit der Nockenverstellung ist unübertroffen.

• Modularer Aufbau

Durch konsequente Verwendung von gleichen Teilen sowohl im Getriebe als auch beim Gehäuse wird eine wirtschaftliche und flexible Herstellung und Montage garantiert.

• Patentierte Blockverstellung

Das Verstellen aller Schaltkontakte gemeinsam ist durch eine einzige Verstellschnecke (schwarz) möglich, ohne daß die Schaltpunkte der einzelnen Schaltkontakte zueinander verändert werden.

• Große Nockenscheiben - Durchmesser

Das bedeutet eine gute Einstellbarkeit und eine hohe Schaltpunktwiederholgenauigkeit.

1 Standard switches

1.1 General

51 series geared cam limit switches are universal mechanical switching devices that have been designed for use in conjunction with cam discs based on a specific angle of rotation for indication of a large number of shaft revolutions. These cam discs serve to operate mechanical contacts.

Geared cam limit switches are used wherever angles or routes cannot be directly limited by closing devices but only indirectly via measurements of the angle of rotation.

A classic example of such an application is limitation of the hook travel of crane hoisting gear.

Especially where there is a danger to persons and the **use of positive opening switching contacts is required according to EN 60947, part 5 - 1, IEC 947 - 5 - 1**, the use of geared cam limit switches is the most efficient alternative.

Survey and approval

Survey and approval for standard executions:
Germanischer Lloyd No. 11300 - 98 HH (without DZ)
CSA No. 201 644 (without supplementary fittings)

The particular advantages of 51 series geared cam limit switches are as follows:

• Patented planetary gearing

Low friction planetary gearing with irreversible, self-locking worm adjustment of the cam discs.

• Fixed cam adjustment in housing

The adjusting worms of the cam discs are arranged so that they can be accessed from the same direction as the contact connections for optimal accessibility in confined conditions. Adjustment is possible during operation. The simplicity and accuracy of the cam adjustment is unequalled.

• Modular design

The consistent use of the same components for the gearing and housing guarantees economical and flexible manufacture and assembly.

• Patented block adjustment

The adjustment of all switching contacts jointly is made possible by a single adjusting worm (black) without the switching points of the individual switching contacts being altered with respect to each other.

• Large cam disc diameter

This means good adjustability and high switching point repeat accuracy.

1.2 Aufbau des Getriebe - Endschalters

Der Getriebe - Endschalter 51 besteht aus einem Getriebe - und Schalterteil, die in einem Gehäuse untergebracht sind. Das Drehmoment wird formschlüssig von der durchgehenden Antriebswelle auf die Nockenscheiben übertragen. Die Getriebeteile sind aus hochwertigem Kunststoff gefertigt und laufen wartungsfrei.

Getriebe - Endschalter der Reihe 51 werden standardmäßig in der Schutzart IP00/IP20 als Einbauschalter geliefert. Gegen Mehrpreis kann der Schalter in einem Aluminium - Gehäuse der Schutzart IP65 oder in einem GF - verstärkten Polycarbonat Gehäuse in der Schutzart IP66 geliefert werden.

Die Gebrauchslage ist beliebig.

Die Dauer - Betriebstemperatur beträgt - 40°C bis +80°C. Die Schaltkontakte können mit Schraub - oder Flachsteckanschluß 6,3 mm ausgeführt sein.

1.3 Aufbau des Differenzzahn - Getriebes

Getriebeaufbau

Das Differenzzahn - Getriebe der Reihe 51 basiert auf der normalen Planetenstufe der Reihe 51, bei der die Nockenscheiben zur Betätigung der Schaltkontakte auf die Planetenträger aufgesteckt sind.

Die Nockenscheibe des Differenzzahn - Getriebes hat dazu im Unterschied eine eigene Innenverzahnung mit gleichem Teilkreisdurchmesser wie das Hohlrad. Allerdings ist die Zähnezahl der Nockenscheibe um 3 Zähne größer. Die Planetenräder greifen gleichzeitig in beide Verzahnungen ein.

Dadurch verdreht sich bei jedem Umlauf der Planetenräder die Nockenscheibe um den Unterschied der Zähnezahlen von Hohlrad und Nockenscheibe.

Das ergibt eine Untersetzung pro Getriebestufe von 69,98.

Der Vorteil dieser Getriebeausführungen ist, daß die Abmessungen der Differenzzahn - Getriebe gleich sind mit den Abmessungen der bisherigen Planetenstufen. Sie passen aus diesem Grund in die gleichen Gehäusegrößen. Auch die Kombination mit den Voruntersetzen und mit normalen Planetenstufen sind dadurch gewährleistet. Die unterschiedlichen Schaltstufen sind sogar gemischt verwendbar, so daß zwei nebeneinander liegende Nockenscheiben eine um den Faktor 16 unterschiedliche nutzbare Umdrehung haben können. Bei Parallelschaltung der nebeneinander liegenden Schaltkontakte würde der Stromkreis erst unterbrochen, wenn beide Kontakte geschaltet sind. Die Schaltgenauigkeit wird damit um den Faktor 16 verbessert, bei sehr geringem Mehraufwand.

Die technischen Daten der Getriebe entnehmen Sie bitte der Tabelle 2. Die kleinste mögliche Getriebe - Untersetzung ist 69,98. Bei Getriebeuntersetzungen kleiner als diese Untersetzung sind die normalen Planeten - Getriebe der Reihe 51 zu verwenden, s. Tabelle 1.

Die Abmessungen der Getriebegröße 1 der DZ - Getriebe entsprechen der Getriebegröße 1 der Planeten - Getriebe. Damit gelten alle Maßzeichnungen dieses Kataloges für beide Ausführungen.

1.2 Construction of the geared limit switch

The geared limit switch 51 consists of a gearbox and switch combination which are located within a housing. The torque is positively transferred from the input shaft to the cam discs. The gearbox components are made of high - quality synthetic material and are maintenance - free.

The standard geared limit switches of series 51 are supplied as skeleton switches with protection IP00/IP20. Limit switches in an aluminium housing of protection IP65 or GF - reinforced polycarbonate of protection IP66 can be supplied at extra price.

Mounting as required.

The continuous service temperature is - 40°C to +80°C. The switching contacts can optionally be executed with screw terminal connection or flat plug connection 6.3 mm.

1.3 Construction of the differential tooth gear

Gear construction

The differential tooth gear of series 51 is based on the normal planetary step of series 51, whereas the cam discs for actuation of the switching contacts are fitted to the planetary carrier.

Difference: the cam disc of the differential tooth gear is provided with an own internal toothing having the same pitch circle diameter as the internal geared wheel. However, the cam disc has 3 teeth more. The planetary wheels catch simultaneously into both toothings.

With every rotation of the planetary wheels the cam disc turns by the difference of the gear number of the geared wheel and the cam disc.

Hence it follows a gear reduction of 69.98 per gear step.

This gear execution offers the advantage that the dimensions of the differential tooth gear are identical with the dimensions of the former planetary steps. Therefore they suit into the same housing sizes. The possibility of combination with pre-reductions and with normal planetary steps as well is assured. It is even possible to mix the different switching steps so that two adjacent cam discs may have a useful travel differing by factor 16. With parallel operation of the adjacent switching contacts the current circuit would only be interrupted when both contacts are actuated. Thereby the switching accuracy is improved by factor 16, whereas the additional expenditure is very low.

The technical data of the gear are stated in table 2. The smallest possible gear reduction is 69.98. For smaller gear reductions use the normal planetary gears of series 51, see table 1.

The dimensions of gear size 1 of the differential tooth gear correspond to gear size 1 of the planetary gear. So all dimensional drawings of this catalogue apply to both executions.

Die Antriebswelle kann wie bei den normalen Planetenstufen nach hinten verlängert werden, so daß hinter dem Getriebeschalter Inkrementalgeber, Impulsgeber oder Multiturn - Absolutwertgeber angebaut werden können, s. Seiten 20 und 23.

Beschränkungen

Nicht mehr möglich bei dieser Getriebe - Ausführung ist die konkurrenzlos einfache Blockverstellung der normalen Reihe 51. Kunden die diese Eigenschaft benötigen, verwenden weiterhin die normale Reihe 51. Außerdem ist bei dieser Ausführung der Einbau einer Potikupplung nicht mehr möglich. Sollen Potentiometer oder Singleturn - Absolutwertgeber angebaut werden, sind weiterhin die normalen Schaltstufen der Reihe 51 zu verwenden.

Vorteile der DZ - Getriebe

Bei gleicher Getriebe - Untersetzung reduziert sich die Baulänge der Getriebeschalter um ca. 19 mm.

1.4 Schaltpunkteinstellung

Die Schaltpunkteinstellung jedes einzelnen Kontaktes erfolgt durch einen selbsthemmenden Schneckenantrieb (2) stufenlos auf die Nockenscheibe (1). Der Schaltpunktabstand kann innerhalb des nutzbaren Umdrehungsbereiches stufenlos eingestellt werden. Eine Umdrehung an der Verstellschnecke entspricht einer Drehung der Nockenscheibe von $2,464^\circ$ (Reihe 51) und $3,168^\circ$ (Reihe 51 DZ). Die Verstellung kann in beiden Drehrichtungen erfolgen.

Die Schaltpunkte können unabhängig voneinander eingestellt werden. Ein Feststellen irgendwelcher Teile ist nach der Einstellung nicht erforderlich.

As for the normal planetary steps, the input shaft can be extended to the rear side so that incremental encoders, pulse generators or multturn absolute value encoders can be mounted behind the gear switch, see pages 20 and 23

Restrictions

The simple block adjustment (which is without any competition) of the normal series 51, however, cannot be used for this gear execution. Customers requiring this characteristic still use the normal series 51. It is not possible, too, to mount a potentiometer coupling. If intended to fit potentiometers or singleturn absolute value encoders, the normal switching steps of series 51 have still to be used.

Advantages of the differential tooth gears

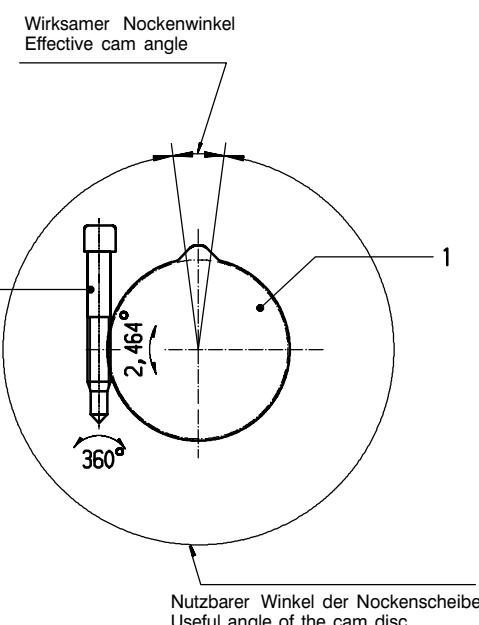
With the same gear reduction, the assembly length of the geared switch reduces by approx. 19 mm.

1.4 Switching point adjustment

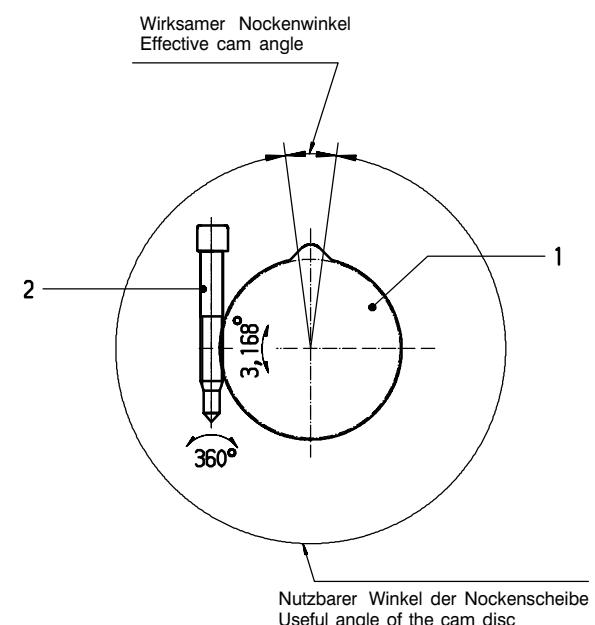
The switching point adjustment of each contact is infinitely made on the cam disc (1) by means of a self - locking worm gear (2). The switching point distance is infinitely adjustable within the range of usable revolutions. One revolution of the controllable worm corresponds to a revolution of 2.464° (Series 51) and 3.168° (Series 51 DZ) of the cam disc. The adjustment can be made in both directions.

The switching points are independently adjustable. Locking of any parts after adjustment is not necessary.

Reihe / Series 51



Reihe / Series 51 DZ



1.5 Blockverstellung

Durch die Bauweise des Getriebes mit Planetenstufen ergibt sich ab der nutzbaren Umdrehung 17,5 (Getriebe - Größe 2) die Möglichkeit einer Blockverstellung. Diese ist standardmäßig eingebaut.

Dabei ist die letzte Getriebestufe ebenfalls mit einer Verstellschnecke, in schwarzer Farbe, ausgerüstet.

Die Blockverstellung ermöglicht, zusätzlich zur Einzeleinstellung, eine gemeinsame Verstellung aller Nockenscheiben.

Die Schaltposition der Einzelkontakte zueinander bleiben dabei unverändert.

Achtung!

Um bei der Reihe 51 DZ gleiche Systemmaße beizubehalten, ist auch die Blockverstellungsstufe eingebaut.

Die eingebaute Verstellschnecke wirkt aber nicht als Blockverstellung.

1.5 Block adjustment

As a standard the planetary gear construction allows a block adjustment in addition to the individual contact adjustment from the usable revolution 17.5 (gear size 2).

The final gear stage is also provided with an adjusting worm, coloured black.

All cam discs can be commonly adjusted by means of this adjusting worm.

The relative adjustments of the individual contacts to each other are not modified.

Caution!

To maintain identical system dimensions with series 51 DZ, the block adjustment step is mounted.

The built-in adjusting worm, however, does not act as block adjustment.

1.6 Typenschlüssel / Key to types

DZ	N	H	C	75	B	M	N	K	4	99	A
Nutzbare Umdrehung / Usable revolutions _____											
(Getriebedaten s. / Gear data see Tab. 1 + 2)											
DZ Differenzzahn - Getriebe / Differential tooth gear											
N nur bei Getriebe Gr. 1 (ohne Blockverstellung) for gearbox size 1 only (without block adjustment)											
B Blockverstellung / Block adjustment											
M Modul - Gehäuse / Modular housing											
H Schalter eingebaut im Aluminium - Gehäuse mit hohem Deckel (Beschreibung s. Kap. 1.12.2; Maßbild s. Kap. 1.13) Switch mounted into aluminium housing with high cover (Description see chap. 1.12.2; Dimensional fig. see chap. 1.13)											
N Schalter eingebaut im Aluminium - Gehäuse mit niedrigem Deckel (Beschreibung s. Kap. 1.12.2; Maßbild s. Kap. 1.13) Switch mounted into aluminium housing with low cover (Description see chap. 1.12.2; Dimensional fig. see chap. 1.13)											
C Schalter eingebaut im Kunststoff - Gehäuse mit kurzer Haube Switch mounted into synthetic housing with short cap											
K Schalter eingebaut im Kunststoff - Gehäuse mit langer Haube Switch mounted into synthetic housing with long cap											
Anzahl der eingebauten Kontakte / No. of contacts fitted _____											
Kontaktbezeichnung (s. Tabelle 3) / Type of contacts fitted (see table 3) _____											
Anzeige Blockverstellung / Indication "block adjustment" (Option) _____											
Nur auf Anfrage Only on request											

1.6.1 Bestellbeispiel

Notwendige Bestellangaben für Standard - Getriebeschalter:

Reihe / Series	51	
Typ / Type	75 BMH - 499 A	s. Kapitel / see Chapter 1.6
Bauform / Construction	B3	s. Kapitel / see Chapter 1.12 - 1.17
Schutzart / Protection	IP65	s. Kapitel / see Chapter 1.12 - 1.17

Ergänzende Angaben bei Sonderausführungen bzw. bei Optionen:

- Nockenscheiben:
Angabe des wirksamen Nockenwinkels falls abweichend von der 15° Standardnockenscheibe, s. auch Kap. 1.9.
- PTC - Heizung:
Angabe der Anschlußspannung, s. auch Kap. 2.4.
- Geberanbau:
Bei einer Anfrage bzw. Bestellung sind unbedingt verbindliche Maß - bzw. Datenblätter des einzubauenden Gebers erforderlich, s. auch Kap. 2.1.

1.6.1 Ordering example

Ordering data required for standard geared switches:

Additional data for special types and options:

- Cam discs:
Data on effective cam angle if deviating from the 15° standard cam disc, see also Chapter 1.9.
- PTC heater:
Data on supply voltage, see also Chapter 2.4.
- Sensor:
For enquiries or orders, binding dimension and data sheets on the sensor to be fitted are required, see also Chapter 2.1.

1.7 Tabelle / Table 1 Getriebedaten / Gear data Reihe 51

Getriebe- begröße Gear size	Nenn - Umdrehungen für Nockenscheibe 15° Nominal revolutions for cam disc 15°	Nutzbare Umdrehungen theo. bei Nockenscheiben 15° Usable revs. theor. at cam discs 15°	Ge- triebe i Gear - ratio i	Vorsatz- stufe Input/ output stage	Anzahl i ges. Planeten - stufen No. of planetary stages i	1 Umdr. der Antriebswelle = Grad an der Nockenscheibe 1 rev. of the drive shaft - corresp. to an ang. motion of cam disc = ° 1 Umdr. of the drive shaft - corresp. to an ang. motion of cam disc = °	Rückschalt - Umdr. an der Antriebswelle für Schnapp- schalter Reset rev. at driving shaft for snap ac- tion	max. Antriebs- drehzahl max. drive speed min. drive shaft (only for change - over contact) min -1	min. Antriebs- drehzahl (nur bei Wechsler) min. drive shaft (only for change - over contact) min -1
1	4,1	4,16	4,285	-	1x4,285	84	0,01 - 0,02	1000	0,67
	6,5	6,88	7,083	1,653	1x4,285	50,8	0,01 - 0,02	1200	1,1
	11	11,23	11,56	2,698	1x4,285	31,14	0,02 - 0,04	1500	1,8
2	17,5	17,84	18,361	-	2x4,285	19,6	0,03 - 0,06	1800	2,9
	29,0	29,5	30,35	1,653	2x4,285	11,86	0,05 - 0,1	1800	4,7
	48	48,13	49,538	2,698	2x4,285	7,27	0,08 - 0,16	1800	7,7
3	75	76,45	78,678	-	3x4,285	4,57	0,13 - 0,3	1800	12,2
	125	126,39	130,054	1,653	3x4,285	2,77	0,21 - 0,42	1800	20,2
	205	206,26	212,272	2,698	3x4,285	1,69	0,35 - 0,68	1800	33
4	323	327,6	337,135	-	4x4,285	1,06	0,6 - 1,17	1800	52
	540	541,5	557,284	1,653	4x4,285	0,65	0,92 - 1,8	1800	87
	880	883,8	909,59	2,698	4x4,285	0,4	1,5 - 2,9	1800	141
5	1384	1403,7	1444,62	-	5x4,285	0,25	2,4 - 4,7	1800	224
	2288	2320,2	2387,96	1,653	5x4,285	0,15	3,9 - 7,7	1800	371
	3735	3787,1	3897,58	2,698	5x4,285	0,09	6,5 - 12,7	1800	606
6	5900	6014,77	6190,204	-	6x4,285	0,06	10,3 - 20,1	1800	1)
	9800	9942,42	10232,407	1,653	6x4,285	0,04	17,0 - 33,3	1800	1)
	16000	16227,86	16701,17	2,698	6x4,285	0,02	27,8 - 54,2	1800	1)

¹⁾ Nur als Öffner - Kontakt zu verwenden / Only use as normally closed contact

Tabelle / Table 2

Getriebedaten / Gear data 51 DZ

Getriebe - begröße Gear size	Nenn - Um- drehungen für Nocken- scheibe 15° Nominal revolutions for cam disc 15°	Nutzbare Umdrehungen theo. bei Nok- kenscheiben 15° Usable revs. theor. at cam discs 15°	Ge - triebe i Gear - ratio i	Vorsatz- stufe Input/ output stage	Anzahl i_{ges} Planeten - stufen No. of planetary stages i	1 Umdr. der Antriebswelle = Grad an der Nocken- scheibe 1 rev. of the drive shaft - corresp. to an ang. motion of cam disc = °	Rückschalt - Umdr. an der Antriebswelle für Schnapp- schalter Reset rev. at driving shaft for snap ac- tion	max. Antriebs- drehzahl max. drive speed min $^{-1}$	min. Antriebs- drehzahl (nur bei Wechsler) min. drive shaft (only for change - over contact) min $^{-1}$
1	67	67,23	69,98	-	1x 69,98	5,14	0,11 - 0,22	1800	10,9
	110	111,1	115,68	1,653	1x 69,98	3,11	0,19 - 0,4	1800	18,0
	180	181,4	188,8	2,698	1x 69,98	1,90	0,31 - 0,6	1800	29,4
2	280	288,1	299,86	-	1x 4,285 1x69,98	1,20	0,5 - 1,0	1800	46,7
	470	476,25	495,67	1,653	1x 4,285 1x69,98	0,73	0,84 - 1,7	1800	77,1
	770	777,3	809,02	2,698	1x 4,285 1x69,98	0,44	1,35 - 2,6	1800	125,0
3	1200	1234,5	1284,9	-	2x 4,285 1x69,98	0,28	2,1 - 4,1	1800	199,0
	2000	2040,7	2123,97	1,653	2x 4,285 1x69,98	0,17	3,5 - 10,3	1800	330,0
	3300	3330,9	3466,66	2,698	2x 4,285 1x69,98	0,1	5,5 - 11,3	1800	539,0
4	5200	5290,2	5505,87	-	3x 4,285 1x69,98	0,06	9,1 - 17,8	1800	856,0
	8700	8744,7	9101,2	1,653	3x 4,285 1x69,98	0,04	15,1 - 29,5	1800	1415,0
	14200	14272,9	14854,8	2,698	3x 4,285 1x69,98	0,02	24,7 - 48,2	1800	1)

1 Umdrehung der Verstellschnecke entspricht 3,168° an der Nockenscheibe

Revolution of the adjusting worm corresponds to 3.168° at the cam disc

1) Nur als Öffner - Kontakt zu verwenden / Only use as normally closed contact

Achtung!

Bedingt durch die langsame Betätigungs-
geschwindigkeit der Schaltkontakte aufgrund der hohen
Getriebeuntersetzungen wird das Umschaltverhalten der
Kontakte negativ beeinflußt.

Bei Getriebegröße 6 sollten deshalb nur noch die Öffner-
kontakte der Schalter genutzt werden.

Vor Verwendung analoger Rückmeldesysteme (z.B. Poti)
ist Rücksprache mit den technischen Abteilungen nötig.

Caution!

Due to the slow actuation speed of the
switching contacts caused by the high gear reductions,
the change - over behaviour of the contacts is affected
negatively.

From gear size 6 it is therefore recommended to use only
the normally - closed contacts of the switches.

Before using analog feedback systems (e.g. potentiome-
ter) please consult our technical department.

1.8 Kontakte

Die Kontakte können, je nach Art, über Schraubanschlüsse für Leiterquerschnitte 2x0,75 mm²/AWG 18 bis 2x1,5 mm²/AWG 16 oder über Flachstecker 6,3x0,8 mm angeschlossen werden.

Bei Kontakten mit Flachsteckanschluß sind bei Spannungen > 25V AC bzw. 60V DC isolierte Flachsteckhülsen zu verwenden.

Tabelle / Table 3

Kontaktbezeichnung Contact designation		Kontaktart Contact type	Kontaktwerkstoff Contact material	Schalt-system Switch actuation	Kontaktanschlußart Type of contact connection	Zwangstrennung nach Positive opening to EN60947T5 - 1 IEC947 - 5 - 1	Elektrische Daten Electrical data nach/to EN 60947 - 5 - 1				mechanische Lebensdauer in Mio Schaltungen Mech. life in mio. switching operations
							AC - 15 I[A]	U[V]	DC - 13 I[A]	U[V]	
99 ¹⁾	Wechsler Change-over cont.	Silber Silver	Schnapp-schaltung Snap action	Schraubanschluß Screw terminal	ja/yes	1.5 230	0,5	60	10		
99P ¹⁾	Wechsler Change-over cont.	Silber/Silver	Schnapp-schaltung Snap action	Flachstecker 6,3 Flat plug 6,3							
99G ^{1) 3)}	Wechsler Change-over cont.	Gold	Schnapp-schaltung Snap action	Schraubanschluß Screw terminal							
Nicht für Neukonstruktion Not for new construction	92 ²⁾	Wechsler Change-over cont.	Silber/Silver	Schnapp-schaltung Snap action							
	97 2) ³⁾	Wechsler Change-over cont.	Gold	Schnapp-schaltung Snap action							
	96 ²⁾	Öffner Normally closed contact	Silber/Silver	Tast-schaltung push action							
99T ⁴⁾							0,5	60			

1) Therm. Dauerstrom $I_{th} = 10A$; Bemessungsisolationsspannung $U_i = 250V$ bei Verschmutzungsgrad 3

Thermal permanent current $I_{th} = 10A$; Reference insulation voltage $U_i = 250V$ at pollution degree 3

2) Therm. Dauerstrom $I_{th} = 6A$; Bemessungsisolationsspannung $U_i = 250V$ bei Verschmutzungsgrad 3

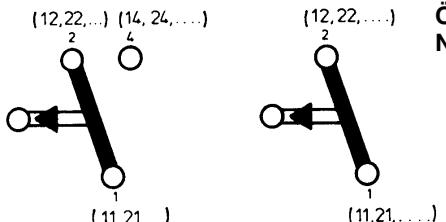
Thermal permanent current $I_{th} = 6A$; Reference insulation voltage $U_i = 250V$ at pollution degree 3

3) Kontakte 99G und 97 für SPS - Anwendungen (Goldkontakte) / Contacts 99G and 97 for PLC applications (gold contacts)

4) Bei Schraubenanschluß zulässiger Leiterquerschnitt: 0,5 - 1,5 mm²/For screw terminal admissible cable cross section AWG 22 - 16

**Wechsler
Change over contact**

99
99P
99G



**Öffner
Normally closed contact**

96
99T

Typentabelle / Table of types

nutzbarer Umdrehungsbereich Usable revolution Reihe / Series 51 + 51 DZ	mit Wechsler - Kontakt with change - over contact 99 Reihe/Series 51	mit Öffner - Kontakt with normally closed contact 96 Reihe/Series 51 + 51 DZ	Größe Size
4,1 67	1) ...NM/DZM 299	1) ...NM/DZM 296	1 A
6,5 110	...NM/DZM 499	...NM/DZM 496	1 B
11,0 180	...NM/DZM 699	...NM/DZM 696	1 C
	...NM/DZM 899	...NM/DZM 896	1 D **
17,5 280	...BM/DZM 299	...BM/DZM 296	2 A
29,0 470	...BM/DZM 499	...BM/DZM 496	2 B
48,0 770	...BM/DZM 699	...BM/DZM 696	2 C
	...BM/DZM 899	...BM/DZM 896	2 D **
75,0 1200	...BM/DZM 299	...BM/DZM 296	3 A
125,0 2000	...BM/DZM 499	...BM/DZM 496	3 B
205,0 3300	...BM/DZM 699	...BM/DZM 696	3 C
	...BM/DZM 899	...BM/DZM 896	3 D **
323,0 5200	...BM/DZM 299	...BM/DZM 296	4 A
540,0 8700	...BM/DZM 499	...BM/DZM 496	4 B
880,0 14200	...BM/DZM 699	...BM/DZM 696	4 C
	...BM/DZM 899	...BM/DZM 896	4 D **
1384,0	...BM 299	...BM 296	5 A
2288,0	...BM 499	...BM 496	5 B
3735,0	...BM 699	...BM 696	5 C
	...BM 899	...BM 896	5 D **
5900,0	...BM 299	...BM 296	6 A
9800,0	...BM 499	...BM 496	6 B
16000,0	...BM 699	...BM 696	6 C
*	...BM 899	...BM 896	6 D **

1) Den gewünschten nutzbaren Umdrehungsbereich einsetzen / Insert the required usable revolution range

* Größere nutzbare Umdrehungen auf Anfrage / Higher usable revolutions on request

** Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

Im Aluminium - Gehäuse ist die Kontaktanzahl durch die Kombination von Getriebegröße und Schaltkontaktanzahl begrenzt
In an aluminium housing, the number of contacts is limited by the combination of gear size and number of switching contacts

1.9 Nockenscheiben

Serienmäßig sind die Nockenscheiben mit 15° - Auflaufnicken ausgerüstet. Auf Wunsch können ohne Mehrpreis auch Nockenscheiben mit 40° eingebaut werden.

Gegen Mehrpreis können beliebige Sondernockenwinkel hergestellt werden.

Werden bei Bestellung keine Nockenwinkel angegeben, werden Nockenscheiben mit 15° Nockenwinkel eingebaut.

Für Sondernockenscheiben mit einem festen Programm bitte ein Diagramm ähnlich der unten stehenden Beispielzeichnung angeben.

Die Nockenscheiben werden nach dem wirksamen Nockenwinkel benannt. Bei Nockenscheiben der Reihe 51 entspricht dieser dem Schaltpunktwinkel auf dem Schaltpunktstrahl der Nockenscheibe. Der Fertigungswinkel ergibt sich aus der Konstruktion der Nockenscheibe.

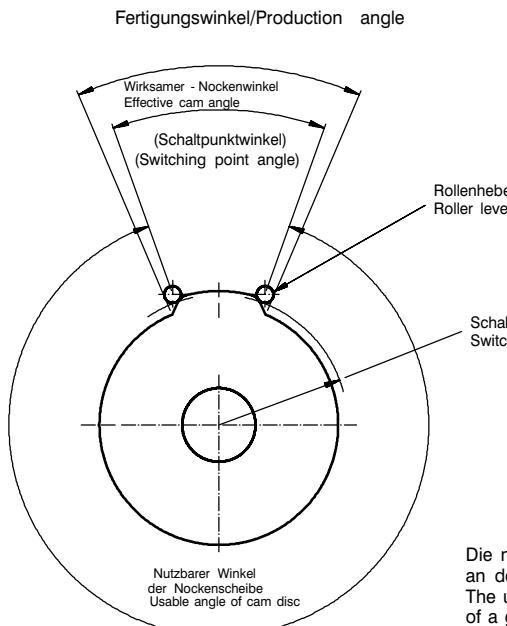
1.9 Cam discs

The cam discs are provided with 15° contact cams as standard. Cam discs with 40° can be provided at no extra charge on request.

At extra charge various special cam angles can be made.

When not stating the cam angle on order placement, cam discs with a cam angle of 15° will be fitted.

For special cam discs with a firm program please provide a diagram similar to the below shown example drawing.



Beispielzeichnung
Example drawing

Kontakt / Contact	Nockenwinkel / Cam angle °					
	0	15	60	270	315	360
1		15				
2			60			
3				270		
4					315	

Die nutzbaren Umdrehungen, die eine Nockenscheibe an der Antriebswelle eines Getriebeschalters ermöglicht, ergibt sich folgendermaßen:
The usable number of revolutions of the drive shaft of a geared switch enabled by a cam disc can be calculated as follows:

$$\frac{(360^\circ - \alpha \text{ (wirkender Nockenwinkel/effective cam angle)}) \times i \text{ (Getriebeunterersetzung des Schalters/gear reduction of switch)}}{360^\circ}$$

DD1_40294V DD - _140184

1.10 Antrieb

Der Antrieb kann radial, z.B. über einen Kettenantrieb, oder axial, z.B. über eine elastische Kupplung, erfolgen. Bei Ketten-, Zahnrad- oder Zahnriementrieb ist die maximal zulässige radiale Belastung der Antriebswelle zu beachten (s. Diagramm). Bei einigen Schutzartgehäusen ist zusätzlich zum Gleitlager ein Rillenkugellager eingebaut. Bei Verwendung dieser Gehäuse kann der zulässige Kurvenwert verdoppelt werden.

Der ideale Antrieb erfolgt über eine drehsteife elastische Kupplung mit geringen axialen und radialen Rückstellkräften. Hierbei werden Fluchtfehler und Achsversatz ausgeglichen.

1.10 Drive

The drive can be transmitted radially, e.g. by a chain, or axially, e.g. by a flexible coupling. With chain, toothed wheel or synchronous belt drive, pay attention to the max. admissible radial load (f_{max}) of the input shaft (see diagram).

To some housings a grooved ball bearing is fitted in addition to the plain bearing. When using these housings, the admissible graphical values can be doubled.

The ideal drive is transmitted by a torsionally stiff, flexible coupling with low axial and radial restoring forces. Thereby misalignment and axial displacement are balanced.

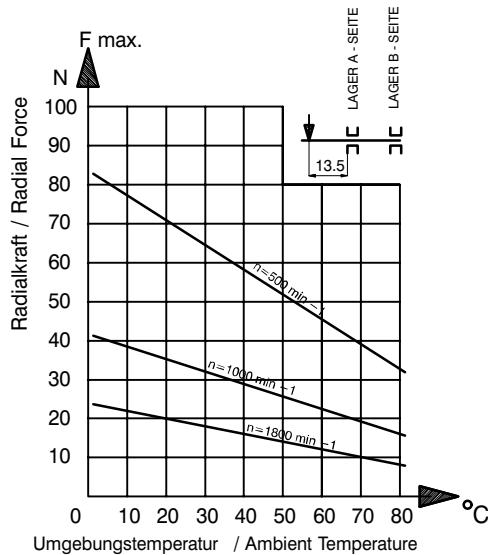
Achtung!

Bei Montage von Antriebselementen wie z.B. Kettenräder keine unzulässigen axialen Kräfte ausüben. Axiale oder radiale Schläge auf die Welle vermeiden.

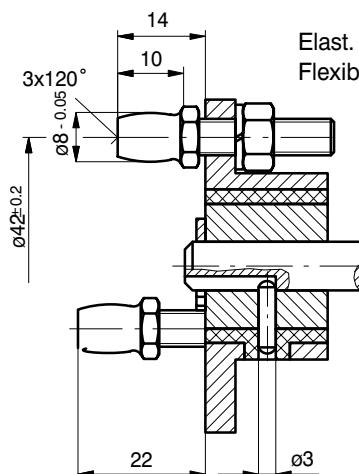
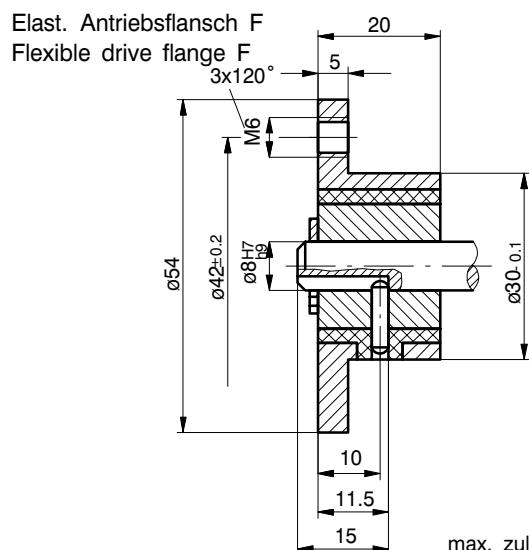
Caution!

When mounting driving elements, such as chain wheels, do not exercise inadmissible axial forces. Avoid axial or radial shocks onto the shaft.

Beispiel / Example:
Bei / with $n_1 = 1800 \text{ min}^{-1}$ / rpm
und / and
 40°C Umgebungstemperatur
ambient temperature $F_{\max} = 16 \text{ N}$
und / and
 80°C Umgebungstemperatur
ambient temperature $F_{\max} = 9 \text{ N}$



DD - _140161



max. zulässige Betriebsdrehzahl:
max. adm. service speed:

Verdrehwinkel bei/twisting angle at 5Nm:

$n = 1000 \text{ min}^{-1}$
 $5 \pm 0.5^\circ$

DD1_40170V

1.11 Elastischer Antriebsflansch F bzw. F+M

Alle Ausführungen der Getriebe - Endschalter Reihe 51 können zusätzlich mit elastischen Antriebsflansch F bzw. F+M geliefert werden.

Bei Gehäuseform C/K ist die Verwendung von F+M - Flansch nur auf Anfrage möglich.

1.11 Flexible driving flange F or F+M

All executions of the geared limit switch series 51 can also be supplied with flexible driving flange F or F+M.

With housing form C/K, the utilisation of a flange F+M is possible only on request.

1.12 Gehäuseausführungen

1.12.1 Einbaugehäuse Schutzart: IP20/IP00

Diese Gehäuseausführung wird eingesetzt, wenn kundenseitig bereits ein Gehäuse zur Verfügung steht, in das der Getriebeschalter eingebaut werden kann. Er wird auch in den nachfolgend beschriebenen Schutzgehäusen aus Aluminium (Schutzart IP65) und Polycarbonat (Schutzart IP66) verwendet.

Der Schalter ist modular aufgebaut. Die Baulänge hängt ab von der Getriebeunterersetzung und der Anzahl der eingebauten Kontakte. Die Detailmaße entnehmen Sie bitte dem nachfolgenden Maßbild.

Zur Befestigung stehen Füße und Gewindebohrungen an der Stirnseite zur Verfügung.

Kontakte mit Schraubanschluß standardmäßig mit Berührungsschutz, Schutzart IP20.

Kontakte mit Flachsteckanschluß Schutzart IP00. Bei Spannungen > 25V AC oder 60V DC sind zum Erreichen einer Handrückensicherheit isolierte Flachstecker zu verwenden.

Auch bei Öffnerfunktion muß der Schließeranschluß mit einem isolierten Stecker versehen sein.

1.12.2 Aluminium - Schutzgehäuse Schutzart IP65

- Für rauhe Umgebungsbedingungen
- Zum äußeren Anbau schwerer und großer Geber
- Öffnung des Gehäuses nach oben

Dieses robuste Schutzgehäuse wird überall dort eingesetzt, wo bei hohen mechanischen Beanspruchungen auch hohe Korrosionsfestigkeit benötigt wird. Standardmäßig wird das Gehäuse geliefert mit Zentrierungen an der B - Seite für Geber mit Einpaßdurchmessern von 36 mm und 50 mm. Über Zwischenflansche können auch größere Geber oder Tachogeneratoren angebaut werden. Das Gehäuse kann mit 2 Haubenhöhen geliefert werden:

Typ B (N) MH oder DZMH

In dieser Gehäusegröße sind alle Einbauteile, z.B. Motorverstellung einzubauen.

Typ B (N) MN oder DZMN

Bei dieser Gehäusegröße wurde auf eine Bauhöhe früherer Gehäuseausführungen (Ersatzbedarf) Wert gelegt.

1.12.3 Kunststoff - Gehäuse Schutzart IP66

Das Kunststoffgehäuse aus glasfaserverstärktem Polycarbonat ist das preisgünstigste Gehäuse für allgemeine Anwendungen. Es zeichnet sich durch hohe Formstabilität über einen großen Temperaturbereich (- 40° bis +80°C) und eine hohe Schutzart aus.

Das Kunststoffgehäuse ist modular aufgebaut. Es wird über Zwischenstücke den Erfordernissen angepaßt.

Das Gehäuse wird in drei Bauformen geliefert:

Bauform B14

Grundausführung, Anbau über 3 Gewindegusseln M6 im Gehäusevorderteil.

Bauform B3

An das Gehäusevorderteil wird zusätzlich ein Aluminiumwinkelfuß angeschraubt.

Bauform B5

An das Gehäusevorderteil wird zusätzlich ein Aluminiumflansch angeschraubt.

1.12 Housing variants

1.12.1 Component housing protection IP20/IP00

This housing variant is used where a housing is already available in which the geared switch can be integrated. It is also used in the following described protective housings of aluminium (protection IP65) and polycarbonate (protection IP66).

The switch is in a modular design. The overall length depends on the gear reduction and number of installed contacts. The detail dimensions are shown in the following dimension diagram.

Provided for fixing purposes are feet and tapped holes on the front face.

Contacts with screw - connection are provided with a cover as standard, protection IP20.

Contacts with push - on connections, protection IP00. At voltages above 25V AC or 60V DC, insulated tab connectors must be used for safety from touch by the back of the hand. With function "normally closed" as well the normally open contact has to be provided with an insulated plug.

1.12.2 Aluminium protective housing protection IP65

- For use in harsh environments
- For external fitting of large and heavy encoders
- Housing opens upwards

This tough protective housing is suitable for use wherever high corrosion resistance is required under high mechanical loads. The housing is supplied with centering lugs on the B - Side for encoders with fitting diameters of 36 mm and 50 mm as standard. Also larger encoders or tachogenerators can be fitted via intermediate flanges.

The housing is available with two cover heights:

Type B (N) MH or DZMH

This housing size is designed to accept all built - in components, e.g. motor adjustment.

Type B (N) MN or DZMN

This housing size corresponds to the height of earlier housing variants (replacement requirement)

1.12.3 Plastic housing protection IP66

This plastic housing of glass fibre reinforced polycarbonate is a reasonably priced housing for general applications. It is characterised by high dimensional stability, suitability for use over a wide temperature range (- 40° to +80°C) and a high protection.

This plastic housing is in a modular design and can be adapted via intermediate pieces to suit individual requirements. This housing is available in three types:

Type B14

Basic type, fitting via 3 M6 threaded bushes at the front of the housing.

Type B3

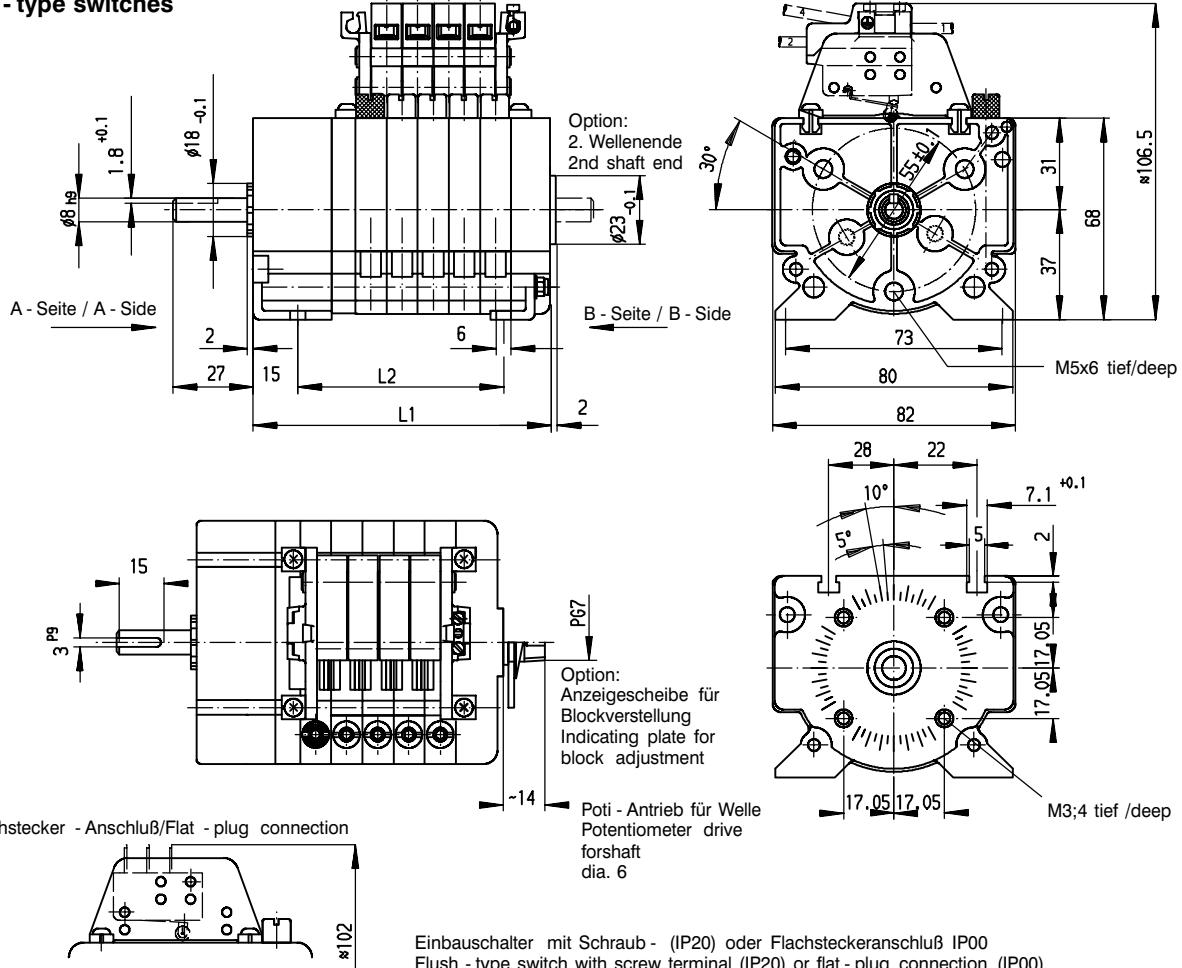
An aluminium angle foot is additionally screwed to the front of the housing.

Type B5

An aluminium flange is additionally screwed to the front of the housing.

Einbauschalter IP00/IP20

Flush - type switches

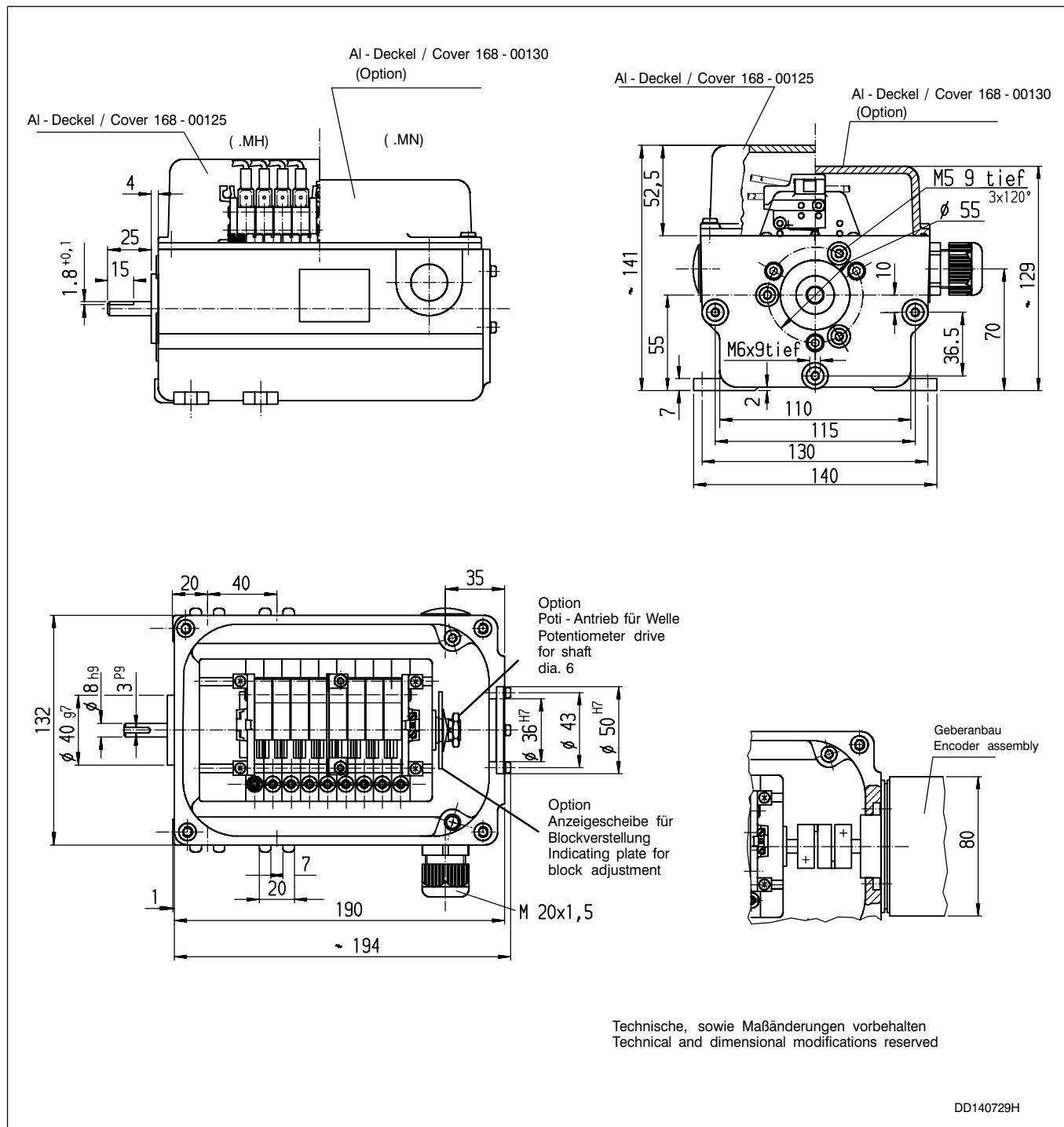


Einbauschalter mit Schraub - (IP20) oder Flachsteckeranschluß IP00
Flush - type switch with screw terminal (IP20) or flat - plug connection (IP00)

DD140728V

Nutzb. Umdrehung/Usable rev.		Anzahl Kontakte/No. of contacts	Größe/Size	Maß/Dim. L1	Maß/Dim. L2
4,1 NM 6,5 NM 11 NM	51 DZ 67 DZM 110 DZM 180 DZM	2	1A	62,5	32,5
		4	1B	83,5	53,5
		6	1C	104,5	74,5
		8	1D	125,5	95,5
17,5 BM 29 BM 48 BM	280 DZM 470 DZM 770 DZM	2	2A	73,0	43,0
		4	2B	94,0	64,0
		6	2C	115,0	85,0
		8	2D	136,0	106,0
75 BM 125 BM 205 BM	1200 DZM 2000 DZM 3300 DZM	2	3A	81,5	51,5
		4	3B	102,5	72,5
		6	3C	123,5	93,5
		8	3D	144,5	114,5
323 BM 540 BM 880 BM	5200 DZM 8700 DZM 14200 DZM	2	4A	90,0	60,0
		4	4B	111,0	81,0
		6	4C	132,0	102,0
		8	4D	153,0	123,0
1384 BM 2288 BM 3735 BM		2	5A	98,5	68,5
		4	5B	119,5	89,5
		6	5C	140,5	110,5
		8	5D	161,5	131,5
5900 BM 9800 BM 16000 BM		2	6A	107	77
		4	6B	128	98
		6	6C	149	119
		8	6D	170	140

Bauform / Construction B3



1.13 Schalter im Aluminium - Gehäuse IP65

(Bauform B3, B3/5)

Merkmale:

Getriebeschalter eingebaut im Aluminium - Gehäuse für den Einsatz in rauher Umgebung.

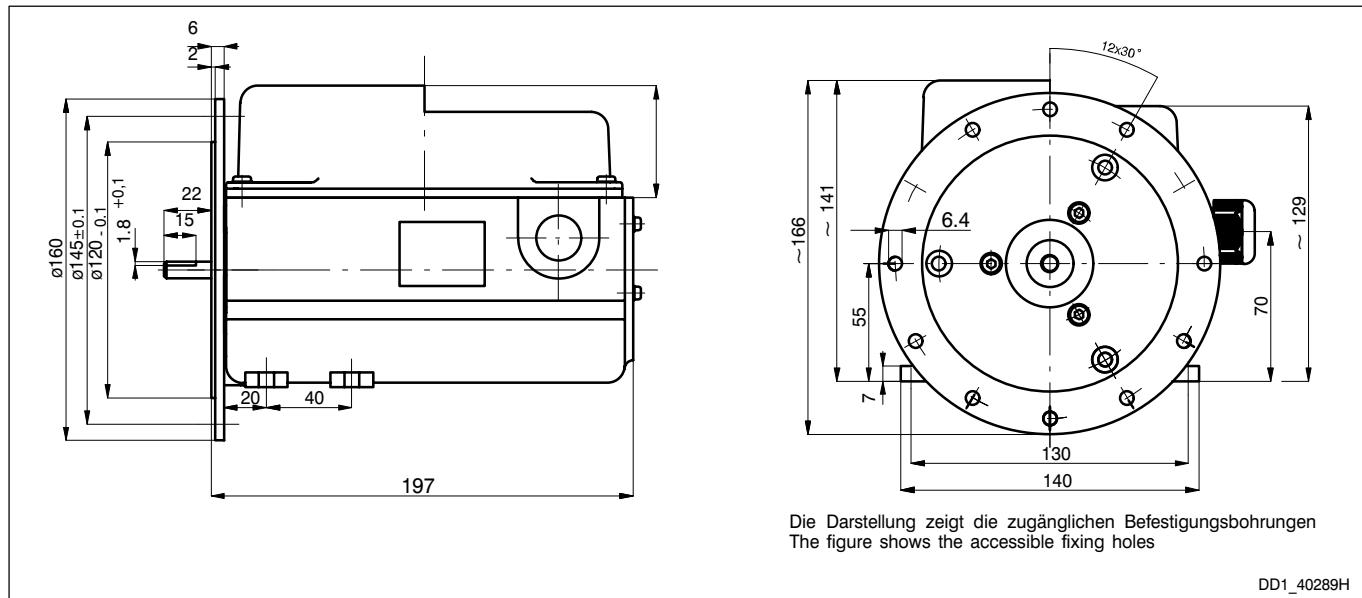
1.13 Switches in aluminium housing IP65

(Type B3, B3/5)

Features:

Geared switch installed in aluminium housing for use in harsh environments.

Bauform / Construction B3/B5



Mögliche Baugrößen in Al - Gehäuse IP65 / Possible sizes in aluminium housing IP65

						Zusatz / Accessory: Anzeigenscheibe für Blockverstellung (nicht möglich bei Reihe 51 DZ) Indicating plate for block adj. (not possible for series 51 DZ)		
nutzbare Umdrehung / usable rev. 51		2 Kont. 2 Cont.	4 Kont. 4 Cont.	6 Kont. 6 Cont.	8 Kont. 8 Cont.	2 Kont. 2 Cont.	4 Kont. 4 Cont.	6 Kont. 6 Cont.
4,1 NMN/NMH	67 DZMN/DZMH	1A	1B	1C	1D			
6,5 NMN/NMH	110 DZMN/DZMH							
11 NMN/NMH	180 DZMN/DZMH							
17,5 BMN/BMH	280 DZMN/DZMH	2A	2B	2C	2D	2A	2B	2C
29 BMN/BMH	470 DZMN/DZMH							
48 BMN/BMH	770 DZMN/DZMH							
75 BMN/BMH	1200 DZMN/DZMH	3A	3B	3C	3D	3A	3B	3C
125 BMN/BMH	2000 DZMN/DZMH							
205 BMN/BMH	3300 DZMN/DZMH							
323 BMN/BMH	5200 DZMN/DZMH	4A	4B	4C		4A	4B	4C
540 BMN/BMH	8700 DZMN/DZMH							
880 BMN/BMH	14200 DZMN/DZMH							
1384 BMN/BMH		5A	5B	5C		5A	5B	
2288 BMN/BMH								
3735 BMN/BMH								
5900 BMN/BMH		6A	6B			6A		
9800 BMN/BMH								
16000 BMN/BMH								

Beispiele für Typbezeichnung bei Endschalter Reihe 51 im Al - Gehäuse IP65

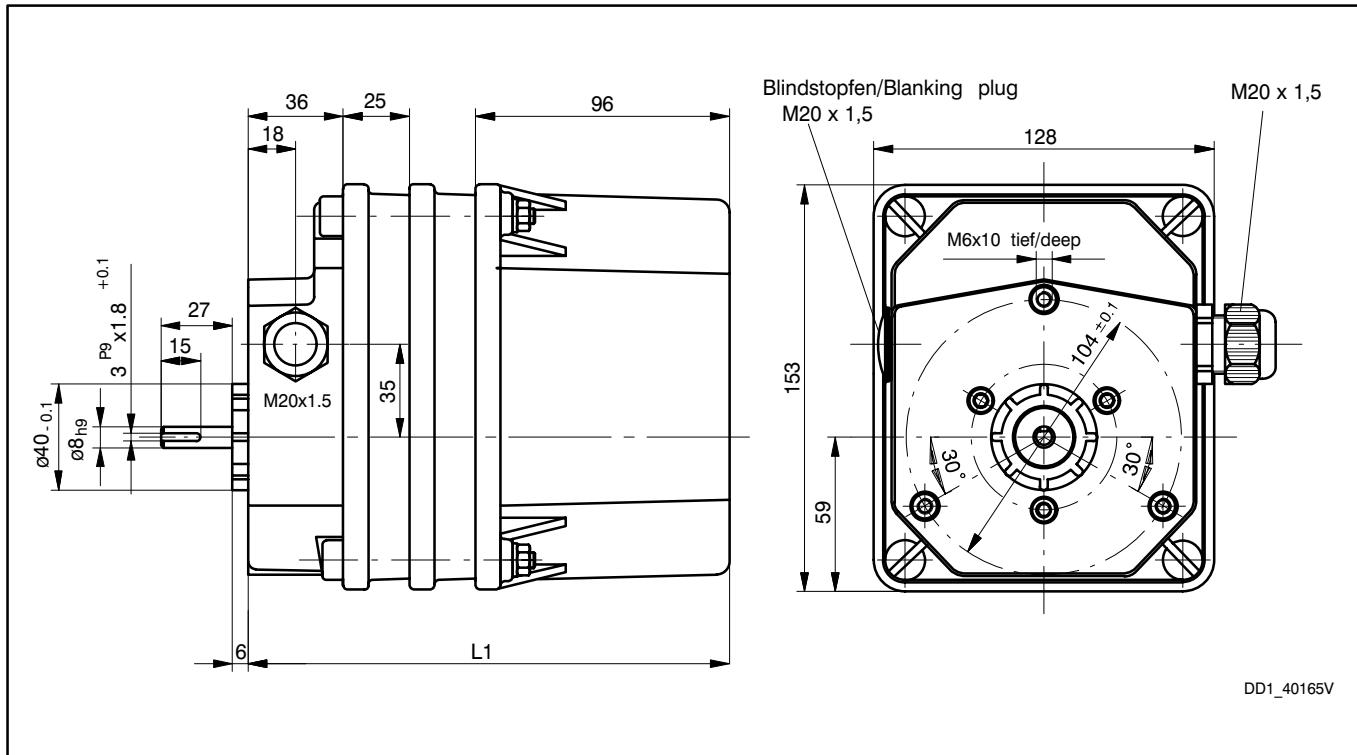
z. B. 48 BMH... = 48 nutzbare Umdrehungen (48BM_),
im 141 mm hohen Al - Gehäuse IP65 (_H_)
11 NMN... = 11 nutzbare Umdrehungen ohne
Blockverstellung (11NM_), im 129 mm hohen
Al - Gehäuse IP65 (_N_)
(Kein Kontaktanschluß mit Flachstecker möglich)

Examples of type designation for 51 series limit switches in aluminium housing IP 65

e. g. 48 BMH... = 48 usable revolutions (48BM_),
in 141mm high aluminium housing IP65 (_H_)
11 NMN... = 11 usable revolutions without block
adjustment (11NM_), in 129mm high aluminium
housing IP65 (_N_)
(Contact connection with flat plug not possible)

**1.14 Kunststoff - Modul - Gehäuse IP66
Bauform B14**

**1.14 Plastic module housing IP66
Construction B14**



Merkmale:

Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.

Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.

Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.

Modular design enables optimal space utilisation also for special types.

Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe-größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.						
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	132	0	132	0	132	0	157	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	132	0	132	0	157	1	182	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	132	0	132	0	157	1	182	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	132	0	157	1	182	2	182	2
1384BM 2288BM 3735BM		5	132	0	157	1	182	2	207	3
5900BM 9800BM 16000BM		6	157	1	157	1	182	2	207	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

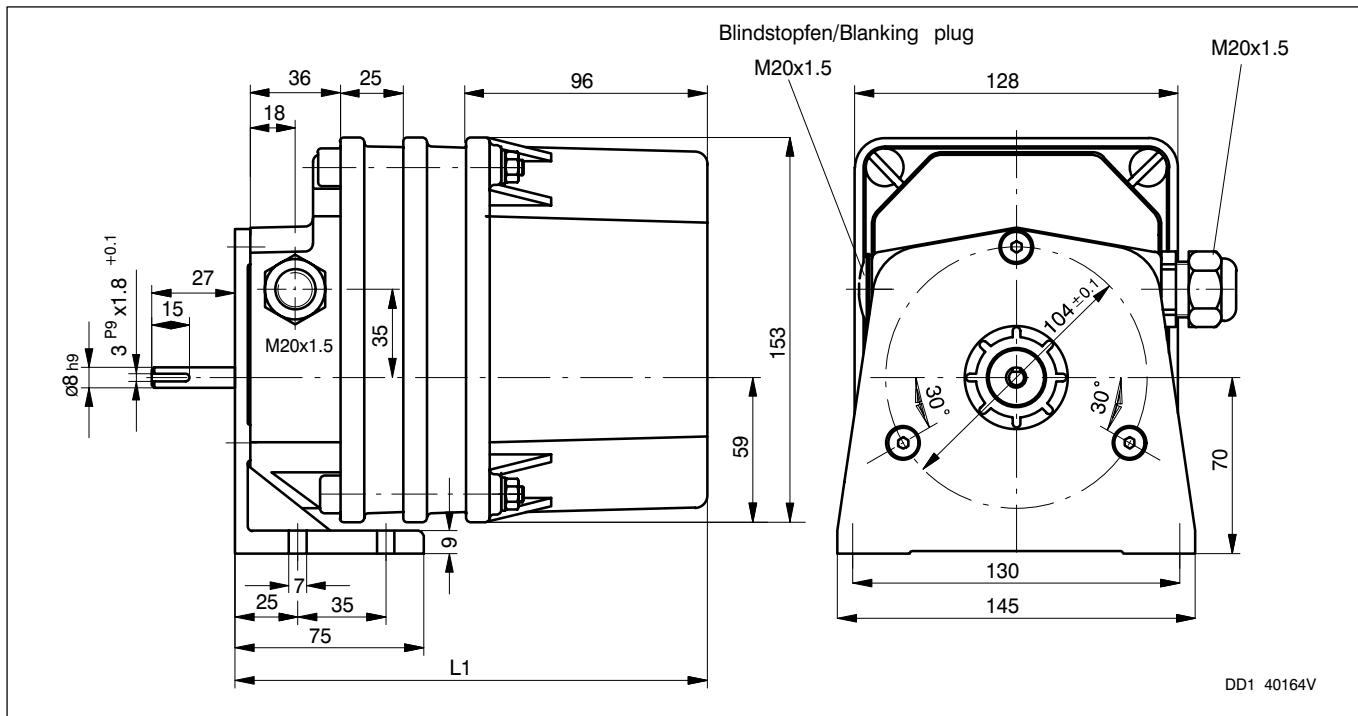
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage

Dimensions with more than 8 contacts and with special executions , e.g. potentiometer, on request

Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

**1.15 Kunststoff - Modul - Gehäuse IP66
Bauform B3**

**1.15 Plastic module housing IP66
Construction B3**



Merkmale:

Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.
Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.
Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.
Modular design enables optimal space utilisation also for special types.
Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe-größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.						
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	138	0	138	0	138	0	163	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	138	0	138	0	163	1	188	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	138	0	138	0	163	1	188	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	138	0	163	1	188	2	188	2
1384BM 2288BM 3735BM		5	138	0	163	1	188	2	213	3
5900BM 9800BM 16000BM		6	163	1	163	1	188	2	213	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

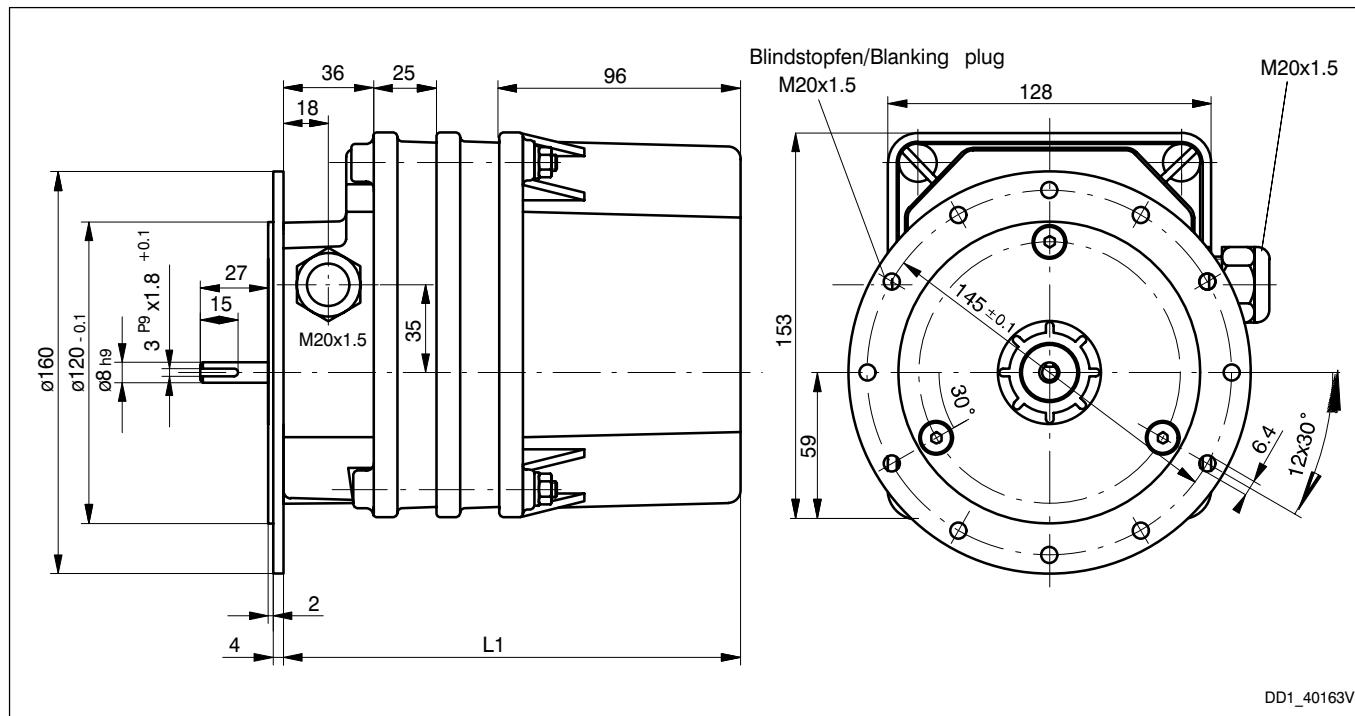
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage

Dimensions with more than 8 contacts and with special executions, e.g. potentiometer, on request

Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

**1.16 Modul - Gehäuse IP66
Bauform B5**

**1.16 Module housing IP66
Construction B5**



Merkmale:

Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.
Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.
Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.
Modular design enables optimal space utilisation also for special types.
Overall length can be extended as required with 25mm wide intermediate pieces.

51	51 DZ	Getriebe-größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwest.						
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	132	0	132	0	132	0	157	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	132	0	132	0	157	1	182	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	132	0	132	0	157	1	182	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	132	0	157	1	182	2	182	2
1384BM 2288BM 3735BM		5	132	0	157	1	182	2	207	3
5900BM 9800BM 16000BM		6	157	1	157	1	182	2	207	3

Mehr als 8 Kontakte auf Anfrage möglich / More than 8 contacts on request

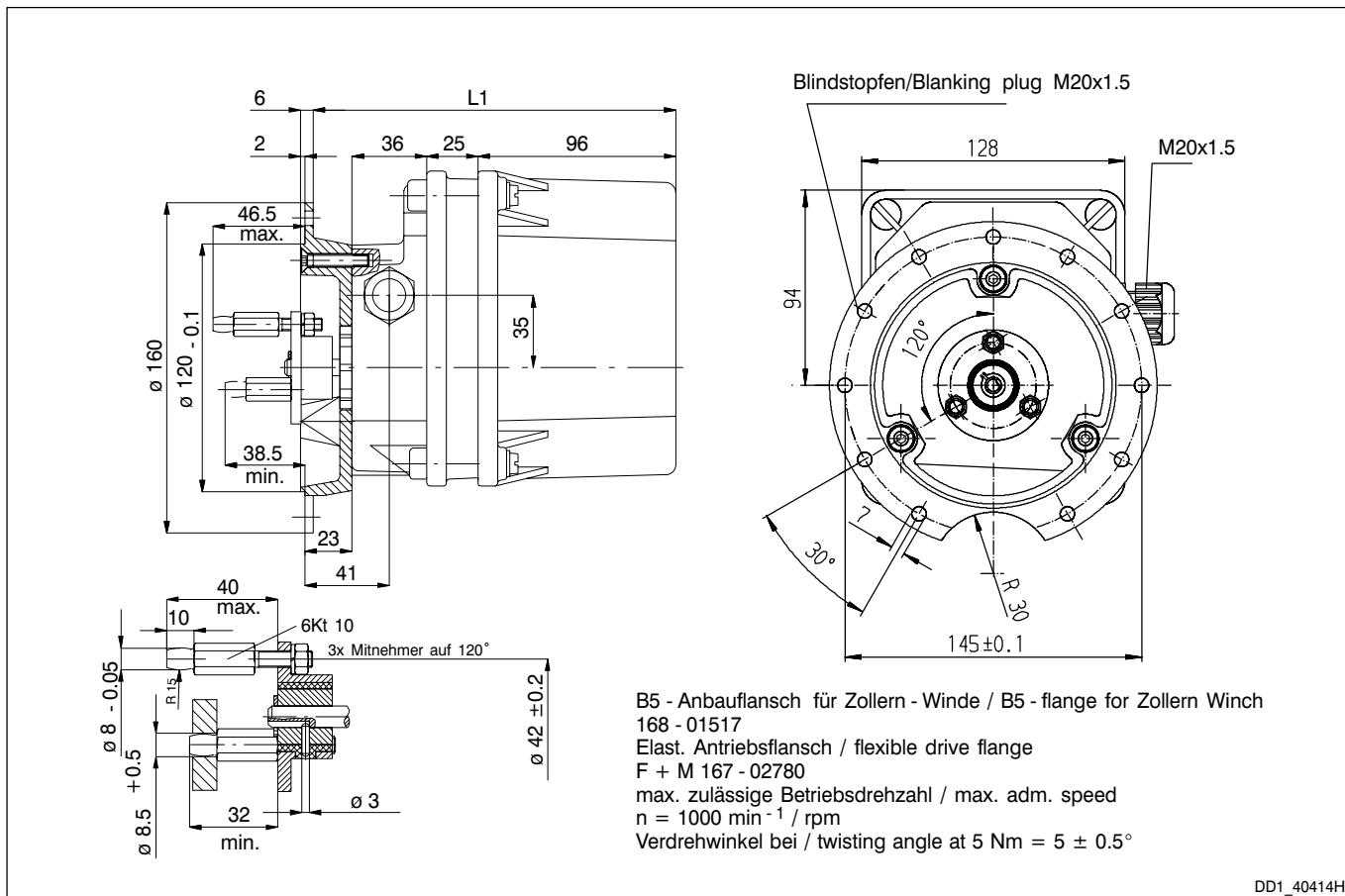
Abmessungen bei mehr als 8 Kontakten und bei Sonderausführungen, z. B. Poti, auf Anfrage

Dimensions with more than 8 contacts and with special executions , e.g. potentiometer, on request

Für jedes weitere Zwischenstück sind zu L1 25 mm zu addieren / For any further intermediate piece add 25 mm to L1

**1.17 Modul - Gehäuse IP66
Bauform B5 "Zollern - Winde"**

**1.17 Module housing IP66
Construction B5 "Zollern winch"**



Merkmale:

Gehäuse aus GF-verstärktem Polycarbonat in Schutzart IP66.
Modultechnik ermöglicht bestmögliche Raumausnutzung auch bei Sonderausführungen.
Gesamtlänge durch den Einbau von 25 mm breiten Zwischenstücken nahezu beliebig verlängerbar.

Features:

Housing made of glass fibre reinforced polycarbonate with the degree of protection IP66.
Modular design enables optimal space utilisation also for special types.
Overall length can be extended as required with 25mm wide intermediate pieces.

51	51DZ	Getriebe-größe Gear size	2 Kontakte/Contacts A		4 Kontakte/Contacts B		6 Kontakte/Contacts C		8 Kontakte/Contacts D	
			L1 / mm	Anz. Zwst.						
4,1NM 6,5NM 11NM	67DZM 110DZM 180DZM	1	151	0	151	0	151	0	176	1
17,5BM 29BM 48BM	280DZM 470DZM 770DZM	2	151	0	151	0	176	1	201	2
75BM 125BM 205BM	1200DZM 2000DZM 3300DZM	3	151	0	151	0	176	1	201	2
323BM 540BM 880BM	5200DZM 8700DZM 14200DZM	4	151	0	176	1	201	2	201	2
1384BM 2288BM 3735BM		5	151	0	176	1	201	2	226	3
5900BM 9800BM 16000BM		6	151	1	176	1	201	2	226	3

2 Sonderausführungen

2.1 Durchgeführte Antriebswelle

Bedingt durch die Konstruktion der Getriebe - Nocken - Endschalter der Reihen 51 und 51 DZ wird die Antriebswelle durch den Schalter geführt. Sie schließt normalerweise mit dem Modulhinterteil ab.

Gegen Mehrpreis wird auf Wunsch die Antriebswelle verlängert (Sonderwelle).

Synchron zur Antriebswelle können damit Inkremental - und Absolut - Encoder zur digitalen Stellungsrückmeldung angetrieben werden. Auch Tachogeneratoren werden direkt von der Antriebswelle angetrieben.

Je nach Gewicht des anzubauenden Gebers sind unterschiedliche Anbaukonstruktionen möglich.

Hohlwellengeber werden direkt auf die Welle aufgesteckt und das Gehäuse über eine Drehmomentenstütze gehalten.

Geber mit Zapfenwelle bis zu einem Gewicht von ca. 250 g und bei Einsatzfällen ohne Vibrationen und Schläge werden über ein leichtes Halteblech angebaut.

Geber mit Zapfenwelle ab einem Gewicht von ca. 250 g oder für den Einsatz unter erschwerten Bedingungen werden über einen Adapterflansch mit einer zusätzlichen Verstärkung angebaut.

Für die konstruktive Überprüfung der Einbausituation benötigen wir **verbindliche Maß - und Gewichtsangaben** der Anbauteile.

Zusätzlich eingebaute Teile vergrößern unter Umständen die Baulänge der Getriebe - Schalter.

2 Special executions

2.1 Inserted drive shaft

On account of the design of 51 and 51 DZ series geared cam limit switches, the drive shaft is inserted through the switch and normally terminates flush with the rear part of the module.

The drive shaft can be extended at an additional charge (special shaft) on request.

As a result, incremental and absolute encoders can be driven synchronous with the drive shaft for digital position feedback. Also tachogenerators can be directly driven by the drive shaft.

In relation to the weight of the encoder to be fitted, various mounting executions are possible.

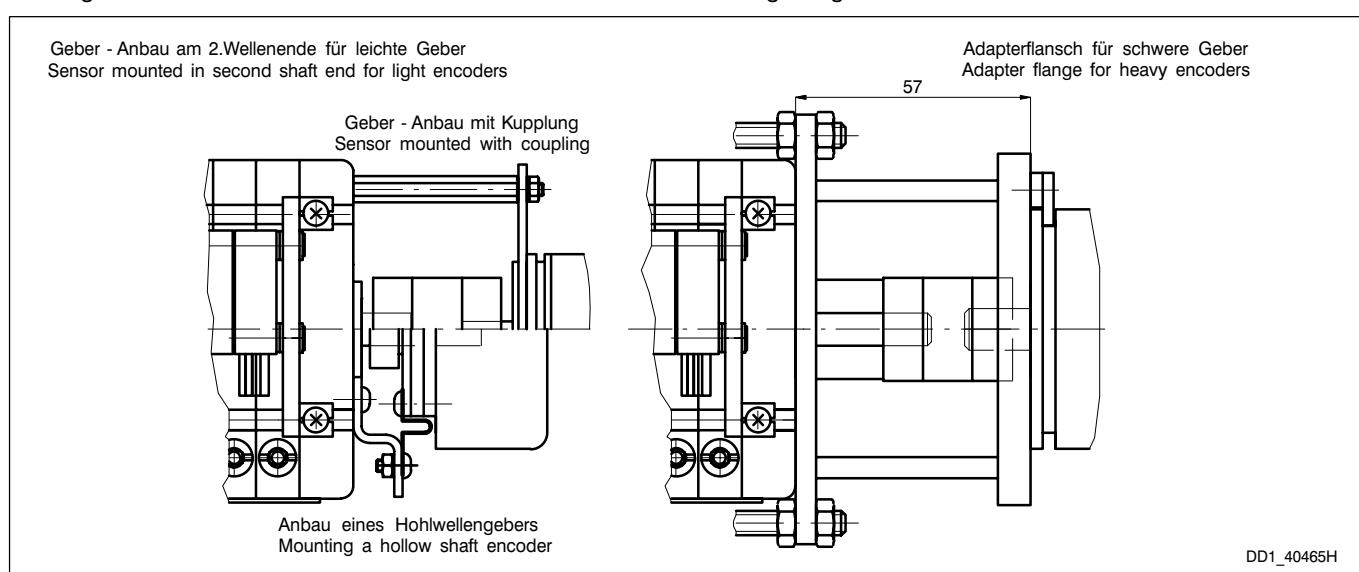
Hollow shaft encoders are directly slipped on the shaft and the housing is held by a torque support.

Encoders with power take - off shaft up to a weight of approx. 250 g and for vibration - free and shock - free applications are mounted through a light holding sheet.

Encoders with power take - off shaft having a weight of more than approx. 250 g or being intended for application under heavy conditions, are mounted via an adapter flange with additional reinforcement

For constructional examination of the mounting situation, we require **binding data on the dimensions and weights** of the mounting components.

Additional mounted parts may increase the overall length of the gearing.



2.2 Potentiometerantrieb (nur bei Reihe 51 möglich)

Für den Antrieb von Drehwiderständen zur analogen Stellungsrückmeldung stehen 2 Ausführungen zur Verfügung. Sie sind konstruktiv gleich ausgeführt und für die Aufnahme von Potentiometerwellen mit einem Durchmesser von 6 mm sowie für ein max. Drehmoment von 10 Ncm vorgesehen.

a) Potikupplung "N"

Die Kupplung dreht synchron mit den Nockenscheiben. Der nutzbare Drehwinkel für die Potentiometer ist max. 345°.

2.2 Potentiometer drive (only possible for series 51)

Available are two types for driving potentiometers for analogue position feedback. They are identical in design and are able to accept two potentiometer shafts with a diameter of 6 mm and a max. torque of 10 Ncm.

a) Potentiometer coupling "N"

This coupling turns synchronous with the cam disc. The usable angle of rotation for the potentiometer is maximum 345°.

Beim Einsatz einer zusätzlichen Nockenscheibengruppe (verlängert den Schalter um 10,5 mm) kann die Einstellung des Potentiometers mit der letzten Verstellschnecke ohne das Lösen von Schrauben und Muttern erfolgen. Die Poti - Einstellung mit zusätzlicher Nockenscheibengruppe kann nur in Ausführung "N" erfolgen.

b) Potikupplung "S"

Die Kupplung dreht synchron mit der Eingangsdrehzahl der Nockenscheibengruppe. Der nutzbare Drehwinkel für die Potentiometer ist max. 1470° (345°x4,285). Für diese Drehwinkel werden üblicherweise Mehrfach - Wendel - Potentiometer eingesetzt.

Zusätzlich eingebaute Potentiometer vergrößern unter Umständen die Baulänge der Getriebe - Schalter. Für die Angabe der genauen Baulänge bitten wir um Rückfrage, evtl. unter Angabe der Potentiometermaße.

When fitting an additional cam disc assy (extends the switch by 10.5 mm), the potentiometer can be adjusted by the last adjusting worm without having to lose the screws and nuts. The potentiometer adjustment with additional cam disc assy is possible with execution "N" only.

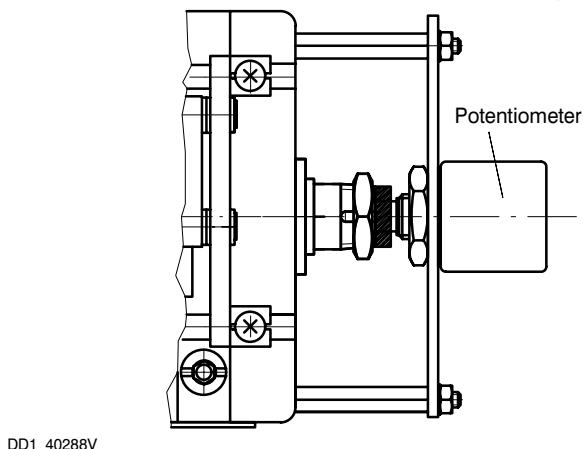
b) Potentiometer coupling "S"

This coupling turns synchronous with the input speed of the cam disc group. The usable angle of rotation for the potentiometer is maximum 1470° (345°x4.285). For this angle of rotation, multi - turn potentiometers are normally used.

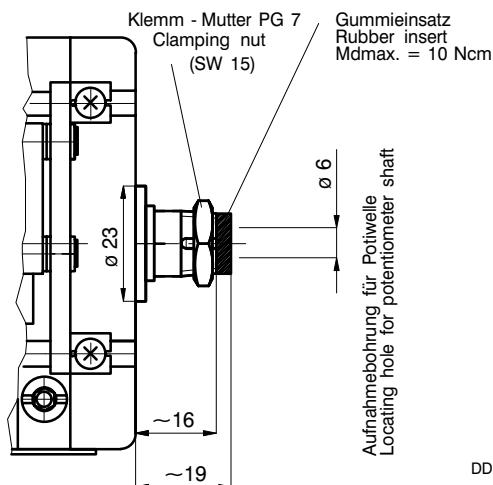
Additionally installed potentiometers may increase the overall length of the geared switch.

For the exact overall length please consult us stating the potentiometer dimensions.

Beispiel für Potianbau/Example of potentiometer mounting



DD1_40288V



DD1_40290V

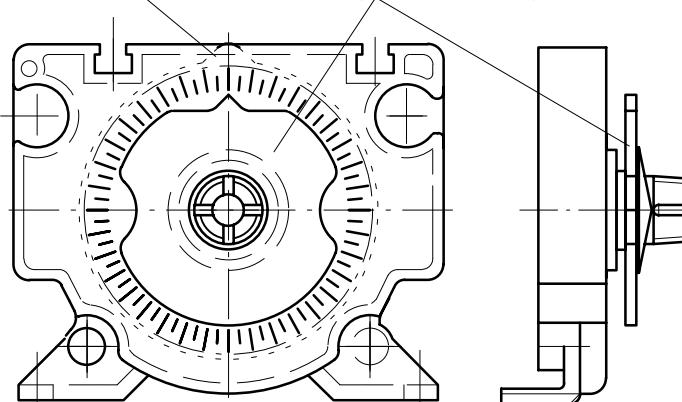
2.3 Anzeigescheibe (nur bei Reihe 51 möglich)

Die Anzeigescheibe zur Blockverstellung (auf Wunsch gegen Mehrpreis lieferbar) dient dazu, die Verstellung der Schalter mittels Blockverstellung zu erleichtern. Die durch Reibschlüsse gehaltene Anzeigescheibe wird auf eine Referenzmarke eingestellt und erleichtert dadurch den späteren Abgleich auf diese Referenzmarke mittels der Blockverstellschnecke wesentlich. Unter Umständen wird durch die Anzeigescheibe ein zusätzliches Gehäuse - Zwischenstück nötig.

2.3 Indicating plate (only possible for series 51)

The indicating plate for block adjustment (available at an additional charge on request) serves to facilitate adjustment of the switch by means of block adjustment. The friction locked indicating plate is set at a reference mark which thus considerably facilitates subsequent adjustment to this reference mark by means of the block adjusting worm. The use of the indicating plate may make an additional housing intermediate piece necessary.

Nockenscheibe / Cam disc Anzeigescheibe / Indicating plate



DD1_40291V

2.4 Stillstandsheizung

Der Innenraum der Getriebe - Endschalter ist ein elektrischer Betriebsraum genau wie ein Schaltschrank. Es sollten bei extrem niedrigen Außentemperaturen oder bei extrem wechselnden Temperaturen bei einer feuchten Umgebungsatmosphäre Vorkehrungen gegen Kondenswasser im Schalter getroffen werden.

Die speziell für die Getriebe - Endschalter entwickelten geregelten Stillstandsheizungen verhindern wirkungsvoll Kondenswasser und zu niedrige Temperaturen im Schalter. Es gibt sie in 2 Ausführungen, die sich nur in der zulässigen Anschlußspannung unterscheiden. Der Einbau der Stillstandsheizung verlängert nicht die Einbaulänge der Schalter. Sie sind in jede Schalterausführung einbaubar. Sie können auch nachgerüstet werden.

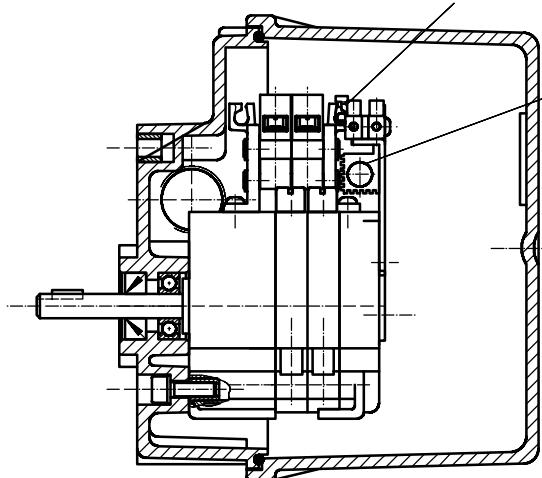
2.4 Anti - condensation heater

The interior space of the geared switch is an electrical operating area just like a switchgear cabinet. Precautions should be taken to prevent condensation from forming inside the switch at extremely low outside temperatures or extreme changes of temperature in a damp atmosphere.

These controlled, anti - condensation heaters, which have been specially developed for use with our geared limit switches, effectively prevent condensation and excessively low temperatures in the switches. They are available in two versions and differ only by the permissible supply voltage. The anti - condensation heater, which can be installed in any switch version, will not increase the overall length of the switches and can also be retrofitted.

Beispiel für den Einbau einer PTC - Heizung in ein IP66 Gehäuse
Example of installation of a PTC heater in an IP66 housing

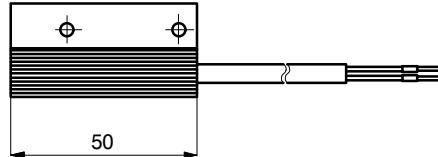
Anschlußklemme/Connection terminal



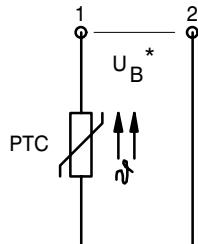
DD1_40285V

PTC - Heizungsgruppe/PTC heater assembly
für/for 12 - 36V AC/DC, P ca./approx. 2.5 Watt
oder/or 110 - 250V AC/DC, P ca./approx. 4 Watt

PTC - Heizung/Heater



Ersatzschaltbild
Equivalent wiring diagram



Ausführung/Execution: U_B 12 - 36V AC/DC

Heizleistung/Heating cap.: ca. 2.5 Watt

(im ausgeregelten Zustand/in levelled condition)

Kaltwiderstand PTC (bei 25°C)

Cold resistance PTC: R_{25} 20 ± 35%

PTC - Bezugstemperatur:

PTC ref. temperature: 50°C

Schutzklasse:

Protection (VDE 0100, 0160): II

Anschlußleitung: 2x0.25mm², Silikonkabel

Connection cable: 2x0.25mm², Siliconecable

Heizkörper/Radiator: Aluminium eloxiert/eloxyed

Gewicht / Weight: ca. 40 g

110 - 250V AC/DC

ca. 4 Watt

R_{25} 1500 ± 35%

50°C

II

2x0.25mm², Silikonkabel

2x0.25mm², Siliconecable

Aluminium eloxiert/eloxyed

ca. 40 g

*Anschlußspannung je nach ver - wendeter Variante 12 - 36V AC/DC bzw. 110 - 250V AC/DC

Connection voltage in relation to the variant used 12 - 36V AC/DC or 110 - 250V AC/DC

2.5 Impulsgeber I 49

Speziell für den Einsatz in Mobilkranen wurde ein Impulsgeber mit besonderen technischen Eigenschaften entwickelt. Es wird magnetisch ein Zahnrad mit 50 Zähnen abgetastet (50 Impulse/Umdrehung). Die Elektronik ist für den Betrieb in einem Fahrzeug - Bordnetz vorgesehen und ist besonders geschützt gegen die in diesen Netzen auftretenden Überspannungen. Der Versorgungsspannungs - Anschluß ist verpolungssicher. Der einkanalige Impulsgeberausgang kann induktive Lasten bis zu einem Strom von ca. mittl. 110 mA treiben und er ist kurzschlußfest. Um eine zu starke Erwärmung der anzuschließenden Hubmagnetspulen bei einem Dauersignal zu verhindern, schaltet der Ausgangsverstärker jeden Impuls nach ca. 20 ms aus (Monoflop - Funktion).

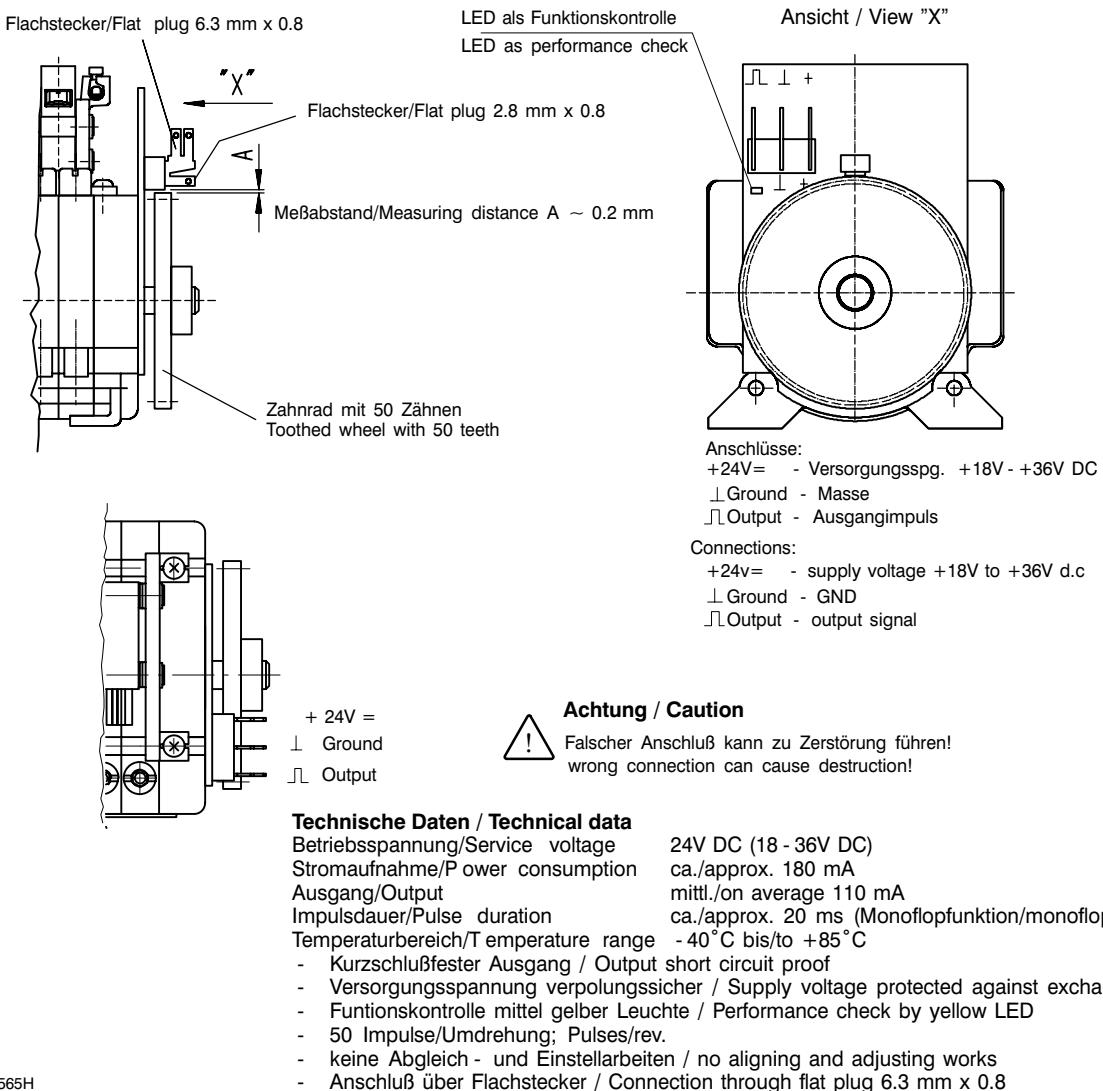
Mit diesem Impulsgeber wird eine Drehung des Endschalters angezeigt und es kann die Geschwindigkeit erkannt werden. Eine Erkennung der Rechts - und Linksdrehrichtung ist nicht möglich.

2.5 Pulse transmitter I 49

This pulse transmitter has been specially developed for use in mobile cranes and has special technical features. A toothed wheel with 50 teeth is magnetically scanned (50 pulse/revolution). The electronic circuitry is designed for operation in a motor vehicle supply system and is specially protected against the overvoltages occurring on these systems. The supply voltage connection is protected against polarity reversal. The single channel pulse transmitter output can drive inductive loads up to a current of on average approx. 110 mA and is short - circuit proof. To prevent excessive heating of the solenoid coils to be connected, with a continuous signal, the output amplifier disconnects each pulse after about 20 ms (monoflop function).

With this pulse transmitter, rotation of the limit switch is indicated and the speed can be identified. It is not possible to distinguish between clockwise and counter - clockwise rotation.

Impulsgeber mit 50 Impulsen/Umdrehung für Endschalter der Reihe 51 zur Montage an der B - Seite des Schalters
Pulse generator with 50 pulses/rev. fitted to the B - side of the limit switch



2.6 Motorische Blockverstellung (nur bei Reihe 51)

Durch die Möglichkeit, alle Kontakte mit einer einzigen Verstellschnecke zu verstellen, bietet sich die Möglichkeit, diese Verstellung mittels eines kleinen Getriebe - Motors zu automatisieren. Einer der eingebauten Schaltkontakte wird dabei zur Abschaltung des Verstellmotors verwendet. Damit lassen sich nach einer Verstellung des Antriebssystems und einer anschließenden Referenzfahrt alle Kontakte wieder in eine vorbestimmte Position zu diesem Motorabschaltkontakt bringen. Eingesetzt werden kann dieses System z. B. nach einem Seilwechsel bei Kranen und Schräppern. Nach dem Seilwechsel wird das Lastaufnahmemittel per Hand in eine vorgegebene Position gefahren. Durch Knopfdruck wird der Verstellvorgang gestartet. Sobald die Nockenscheibe den Motorabschaltkontakt (Selbsthaltung der Verstellung) betätigt, wird der Verstellvorgang gestoppt. Alle Abschaltpunkte der Maschine stehen jetzt wieder in dem vorherigen Verhältnis zum Referenzpunkt. Auch mit der Potikupplung "N" angebaute Potentiometer werden mitverstellt, siehe dazu Einbaubild und Schaltungsvorschlag.

Dieses System kann auch in verstellbaren Punktzügen von bühnentechnischen Einrichtungen eingesetzt werden. Dabei ist zu beachten, daß durch die Verstellung der Nockenscheiben die Antriebswelle, und damit evtl. dort angebaute Encoder, nicht mit verstellt werden.

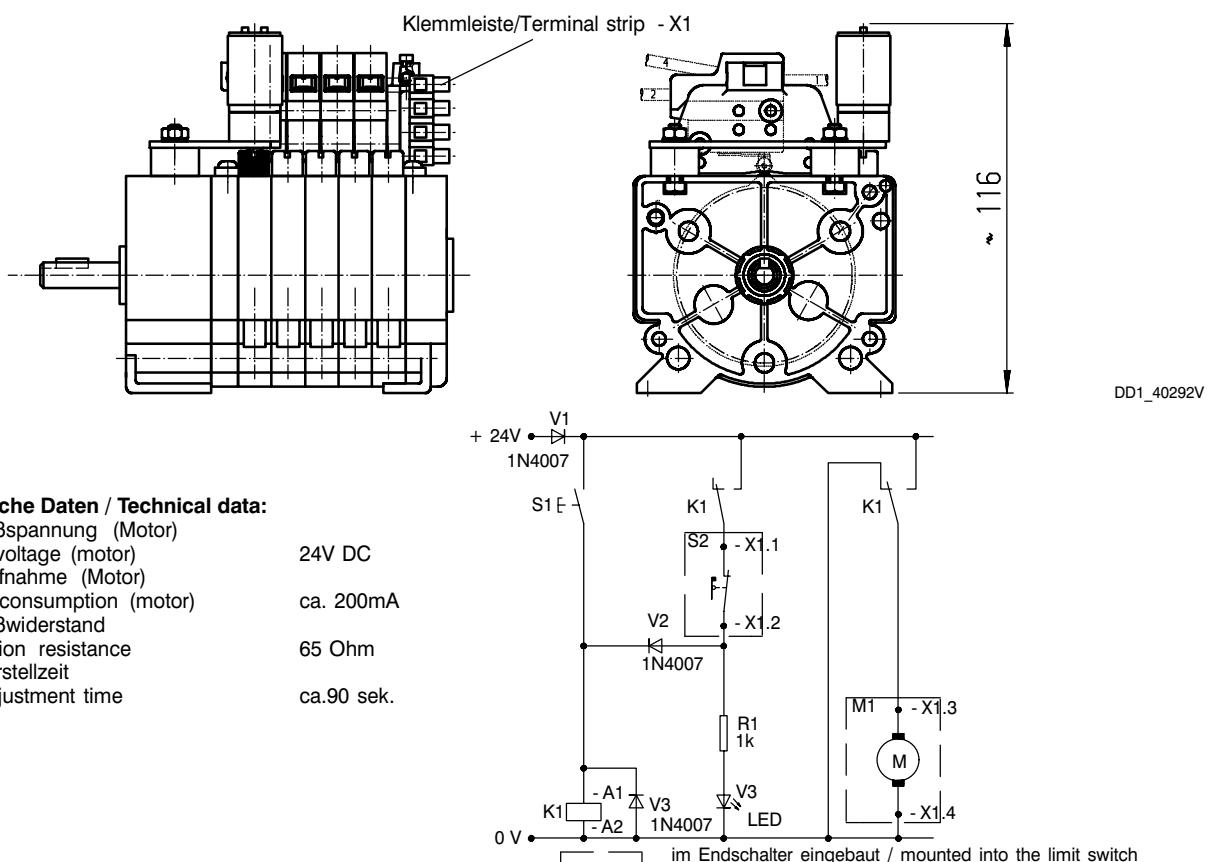
Dieser ist gesondert nachzusteuern.

2.6 Motor - driven block adjustment (only for series 51)

The possibility to adjust all contacts with a single adjusting worm offers the option of automating this adjustment by means of a small geared motor. One of the switching contacts provided is used for disconnection of the adjusting motor. After adjustment of the drive system and subsequent reference operation, all contacts can be reset to a predetermined position with respect to this motor disconnecting contact. This system can be used, e.g. after a rope change for cranes and scrapers. After the rope change, the lifting appliance is moved into a predetermined position manually. Adjustment can be initiated by pressing a button. Adjustment is stopped as soon as the cam disc actuates the cam disc of the motor disconnecting contact (self - holding of adjustment). All disconnecting points of the machine are now placed in their previous relation to the reference point. Potentiometers with the potentiometer coupling "N" are also adjusted, see installation diagram and circuit suggestion.

This system is also suitable for use in adjustable stage machinery, whereby it is important to ensure that the drive shaft and in turn a possibly installed encoder is not affected through adjustment of the cam discs.

The encoder has to be re - adjusted separately.



Technische Daten / Technical data:

Anschlußspannung (Motor)	24V DC
Supply voltage (motor)	
Stromaufnahme (Motor)	ca. 200mA
Current consumption (motor)	
Anschlußwiderstand	65 Ohm
Connection resistance	
max. Verstellzeit	ca.90 sek.
max. adjustment time	

3 Getriebe - Nocken - Endschalter Reihe 51
Ausführung für erhöhte Anforderungen nach BGV C1
(VBG 70) (Bühnentechnik)

3.1 Allgemeines

Die gesamte moderne Bühnentechnik, mit den für diesen Bereich speziell entwickelten Hebezeugen, ist ein typischer Einsatzfall für Getriebe - Nocken - Endschalter. Bei normalen Hebezeugen ist der Aufenthalt unter schwebenden Lasten verboten. Auf den Theaterbühnen müssen sich Schauspieler und weiteres Theaterpersonal immer unter den schwebenden Lasten der Obermaschinerie aufhalten. Das ist der Grund für die Unfall - Verhütungsvorschrift BGV C1. Sie legt für verschiedene Komponenten der Hebezeuge zwingend einen Mindeststandard fest und schreibt vor, daß die Anlagen sicherheitstechnisch abgenommen werden müssen. Für diese Abnahmen sind die Technischen Überwachungs - Vereine (TÜV) der einzelnen Bundesländer zuständig. Zur Vereinfachung der Anlagenprüfungen können sicherheitstechnisch relevante Komponenten separaten Typenprüfungen unterzogen werden.

Dieser **Baumuster - Teilprüfung** wurde auch unser **Getriebe - Nocken - Endschalter Reihe 51 / 51 DZ** von dem zuständigen RWTÜV in Essen unterzogen. Die Prüfzertifikate werden jeder Lieferung beigelegt, sie können aber auch separat als PDF - Datei angefordert werden.

Reihe 51: TÜ - 04 - 94 - 250

Reihe 51 DZ: TÜ - 04 - 99 - 348

Die Katalogausführung der Getriebe - Nocken - Endschalter hat sich auch für diese sicherheitstechnisch sehr anspruchsvolle Anwendung bewährt, es müssen lediglich die ohne Mehrpreis lieferbaren Nockenscheiben mit einem Nockenwinkel von 40° eingesetzt werden. Dadurch ändern sich die nutzbaren Umdrehungen der Getriebe - Nocken - Endschalter; s. Tabelle 4.

Alle im Kapitel 2 beschriebenen Ausführungen sind auch in der Theatertechnik einsetzbar. Es sollte aber immer das für diesen Einsatzfall benötigte Sicherheitsniveau beachtet werden. Im Zweifelsfall fragen Sie zurück oder lassen Sie die neuen Kombinationen einer Baumuster - Teilprüfung unterziehen. Mehrfach eingesetzt wird die Kombination mit einem Absolut - Encoder, der je nach Anwendungsfall mit im Gehäuse oder an der B - Seite außen am Gehäuse angebaut ist.

Da ein zusätzliches Schild für die Baumuster - Teilprüfung am Schalter angebracht und auch zusätzliche Prüfzertifikate ausgestellt werden müssen, benötigen wir unbedingt in Ihrer Bestellung den Vermerk "mit Baumuster - Teilprüfung nach BGV C1".

3 Geared Cam Limit Switches Series 51
Variant for increased requirements according to BGV C1
(VBG 70) (stage technology)

3.1 General

All modern stage technology using hoisting specially developed for this particular use is a typical application of geared cam limit switches. With standard hoisting gear, standing under suspended loads is forbidden. On theatre stages, actors and other personnel must always stand under the suspended loads of machinery in the flies. This is the reason for the accident prevention regulation BGV C1, which specifies for various components of hoisting gear a binding minimum standard, and requires that these installations are tested for safety. Responsible for these tests is the Technical Inspectorate (TÜV) of the individual federal states. For simplification of these tests, safety - relevant components can be tested in separate type tests.

Our **51 / 51 DZ series geared cam limit switches** have been **type tested** by the responsible RWTÜV in Essen. The test certificates are attached to each consignment; they can also be inquired as PDF - file.

Series 51: TÜ - 04 - 94 - 250

Series 51 DZ: TÜ - 04 - 99 - 348

The catalogue version of the geared cam limit switch is also suitable for this application requiring a high degree of safety; only the cam limit switches available at no additional charge with a cam angle of 40° must be used. This changes the useful revolutions of the geared cam limit switch; see table 4.

All variants described in chapter 2 are also suitable for use in stage technology; the level of safety required for this particular application should always be taken into account. If in doubt, we will be pleased to be of assistance or you can have your new combinations type tested. Widely used is the combination with absolute encoder available in a housing or for fitting on the B - Side outside on the housing, depending on the particula application.

Since an additional shield for the type test is provided at the switch and also additional test certificates have to be issued, the indication "with type test according to BGV C1" must be stated in your order.

3.2 Getriebedaten / Gear data**Tabelle / Table 4 (Reihe/Series 51)**

Getriebe größe Gear size	Nenn - Umdrehung 15° - Nock- enscheibe Nominal revolution 15° cam disc	Nutzbare Umdrehungen 40° Nockenscheibe Usable revs. 40° Cam disc	Getriebe i Gear ratio i	Nachlaufumdreh. der Antriebswelle nach jeder Seite Overrun revs. of drive shaft in each direction	Umdrehung der Antriebswelle vom Schaltpunkt bis zur wirk- samen Zwangstrennung Rev. of the drive shaft from switching point up to effec- tive forced separation		Umdrehung der Antriebswelle für wirks. Zwangstrennung im Nachlauf Rev. of the drive shaft from switching point ef- fective forced separa- tion with overrun
					rechtsdreh. clockwise	linksdreh. counter clockwise	
1	4,1	3,8	4,285	0,4	0,038	0,044	0,37
	6,5	6,2	7,083	0,7	0,063	0,073	0,61
	11	10,0	11,56	1,2	0,103	0,118	1,0
2	17,5	16,0	18,361	1,0	0,163	0,188	1,6
	29,0	27,0	30,35	3,2	0,27	0,312	2,6
	48	44,0	49,538	5,3	0,44	0,508	4,2
3	75	70,0	78,678	8,4	0,7	0,808	6,8
	125	115,0	130,054	13,9	1,153	1,335	11,2
	205	185,0	212,272	22,7	1,883	2,18	18,3
4	323	300,0	337,135	36,0	2,99	3,462	29,0
	540	495,0	557,284	59,7	4,94	5,723	48,0
	880	800,0	909,59	97,5	8,07	9,34	78,3
5	1384	1280,0	1444,62	155,0	12,81	14,84	124,4
	2288	2100,0	2387,96	256,0	21,18	24,52	205,6
	3735	3400,0	3897,58	417,0	34,57	40,03	335,6
6	5900	5500,0	6190,204	663,7	55,07	63,57	520,1
	9800	9000,0	10232,407	1097,0	91,04	105,08	856,6
	16000	14500,0	16701,17	1790,7	148,59	171,51	1403,1

Tabelle / Table 4 a (Reihe/Series 51 DZ)

Getriebe größe Gear size	Nenn - Umdrehung 15° - Nock- enscheibe Nominal revolution 15° cam disc	Nutzbare Umdrehungen 40° Nockenscheibe Usable revs. 40° Cam disc	Getriebe i Gear ratio i	Nachlaufumdreh. der Antriebswelle nach jeder Seite Overrun revs. of drive shaft in each direction	Umdrehung der Antriebswelle vom Schaltpunkt bis zur wirk- samen Zwangstrennung Rev. of the drive shaft from switching point up to effec- tive forced separation		Umdrehung der Antriebswelle für wirks. Zwangstrennung im Nachlauf Rev. of the drive shaft from switching point ef- fective forced separa- tion with overrun
					rechtsdreh. clockwise	linksdreh. counter clockwise	
1	67	62	69,98	7,6	0,62	0,718	6,04
	110	100	115,68	12,6	1,025	1,187	9,98
	180	165	188,80	20,7	1,673	1,937	16,29
2	280	265	299,86	32,8	2,656	3,076	25,88
	470	405	495,67	54,3	4,390	5,085	42,77
	770	715	809,02	88,7	7,168	8,3	69,82
3	1200	1140	1284,90	140	11,384	13,183	110,9
	2000	1880	2123,97	323	18,82	21,79	184,1
	3300	3000	3466,66	380	30,71	35,57	299,2
4	5200	4850	5505,87	604	48,78	56,49	475,2
	8700	8000	9101,20	998	80,64	93,38	785,4
	14200	13200	14854,80	1029	131,61	152,41	1282,0

3.3 Elektromagnet - Federdruck - Zahnkupplung EZX 0.1

Speziell für die Anforderungen von Punktzugwinden in der Bühnentechnik wurde die formschlüssige Elektromagnet - Federdruck - Zahnkupplung EZX 0.1 entwickelt. Sie kann mit allen Baureihen der Stromag Steuerstrom - Getriebe - Endschalter kombiniert werden und erfüllt in der Kombination alle aus dieser Spezialanwendung bekannten Forderungen in idealer Weise.

Merkmale (siehe Zeichnung unten)

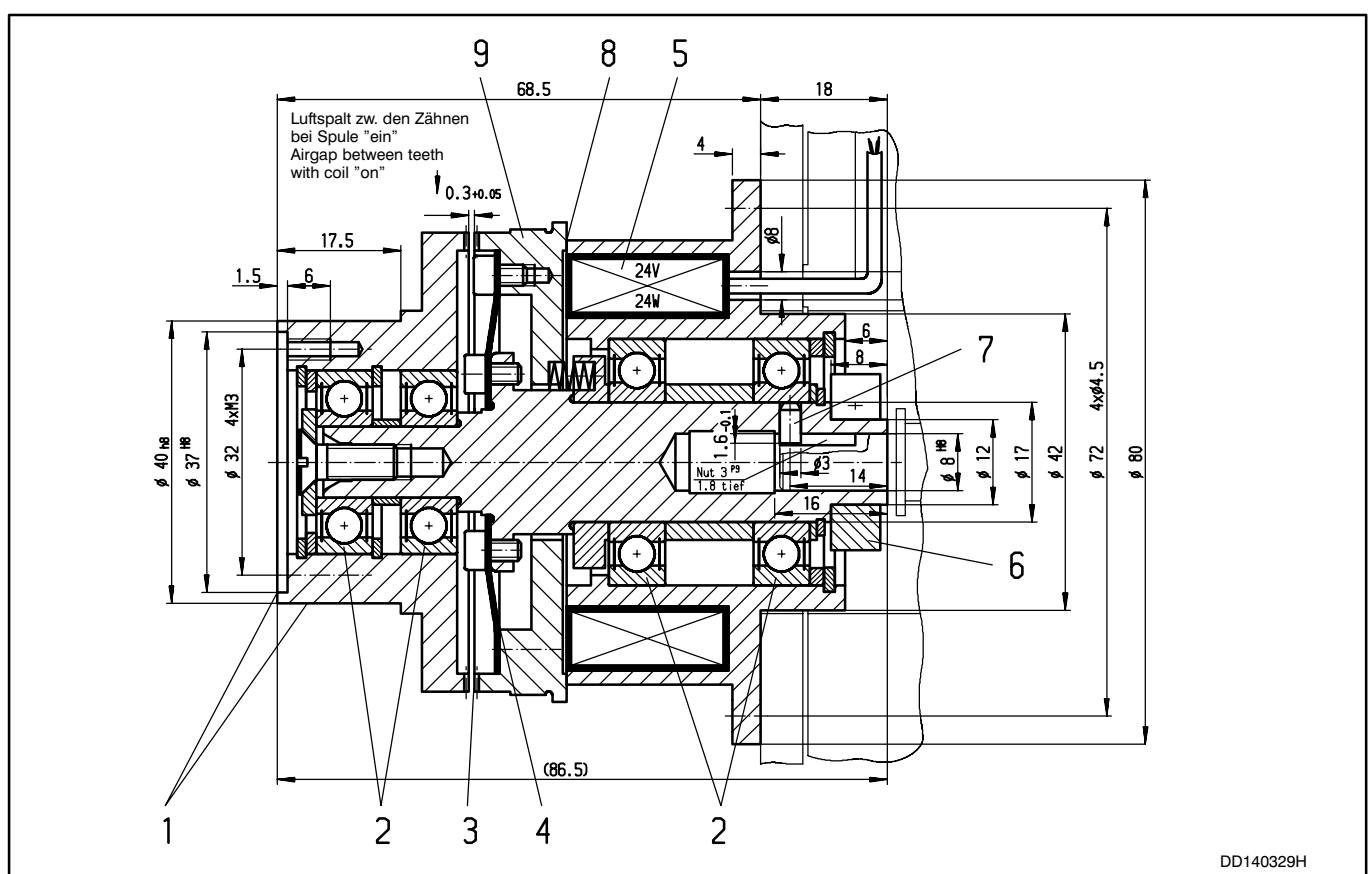
- 1 Innen - und Außenzentrierung der Eintriebsnabe für direktes Anflanschen von Controlflex - Kupplungen oder Ketten - bzw. Zahnriemenrädern.
- 2 Große Lagerabstände für die Aufnahme großer Radialkräfte.
- 3 Formschlüssige Planverzahnung durch Federdruck geschlossen, elektromagnetisch geöffnet.
- 4 Spielfreie Drehmomentübertragung durch Doppelmembran.
- 5 Groß dimensionierte Spule für sicheres Schalten über großen Luftspalt.
- 6 Klemmring für spielfreie Drehmomentübertragung auf den Getriebeschalter
- 7 Zusätzliche formschlüssige Wellenverbindung zwischen Kupplung und Getriebeschalter.
- 8 Im geöffneten Zustand wirkt die Kupplung als Bremse für den Getriebeschalter. Eine ungewollte Verstellung ist verhindert.
- 9 Zusätzliche Zentrierung für das Aufbringen eines Schalttringes zur Schaltzustandsüberwachung der Kupplung mittels berührungsfreien Schalters (auch in geprüfter Sicherheit).

3.3 EZX 0.1 Electromagnetic spring - applied toothed clutch

The EZX 0.1 positive - locking electromagnetic spring - applied toothed clutch has been developed specially for use with stage hoisting gear, and can be combined with all Stromag control current geared limit switch series to fully meet all requirements of this special application.

Features (see drawing below)

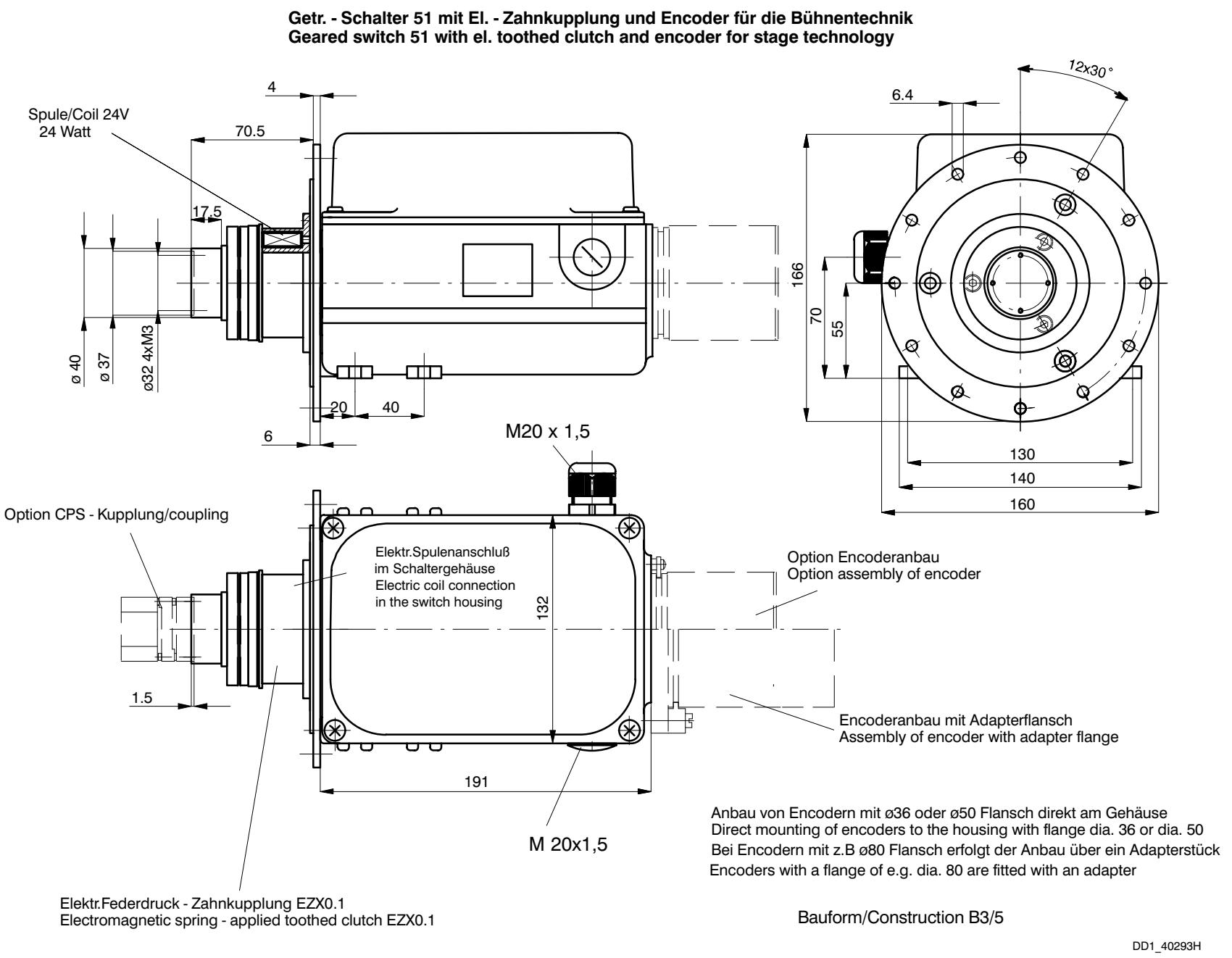
- 1 Internal and external centering of the input hub for direct flange - mounting of Controlflex couplings or chains and toothed belt pulleys.
- 2 Large bearing distances for taking up high radial forces
- 3 Form - locking rack teeth closed by spring pressure and opened electromagnetically.
- 4 Backlash - free torque transmission via double diaphragm.
- 5 Large dimensioned coil for reliable switching via large air gap.
- 6 Clamping ring for backlash - free torque transmission to geared switch.
- 7 Additional form - locking shaft connection between clutch and geared switch.
- 8 In an open condition, the clutch acts as a brake for the geared switch; accidental adjustment is prevented.
- 9 Additional centering for the provision of a contact ring for monitoring the switched condition of the clutch by means of a contactless switch (also safety approved).

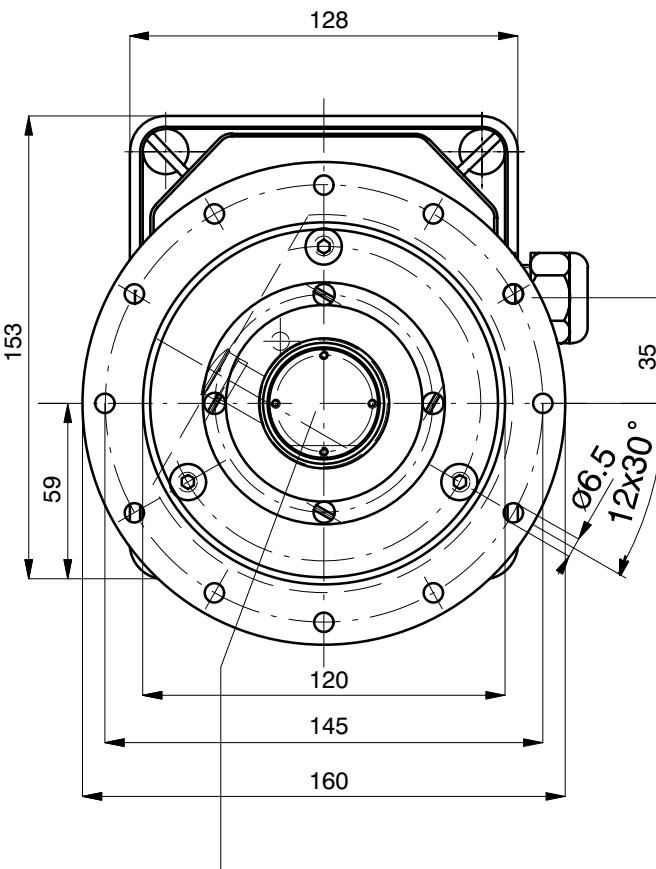


DD140329H

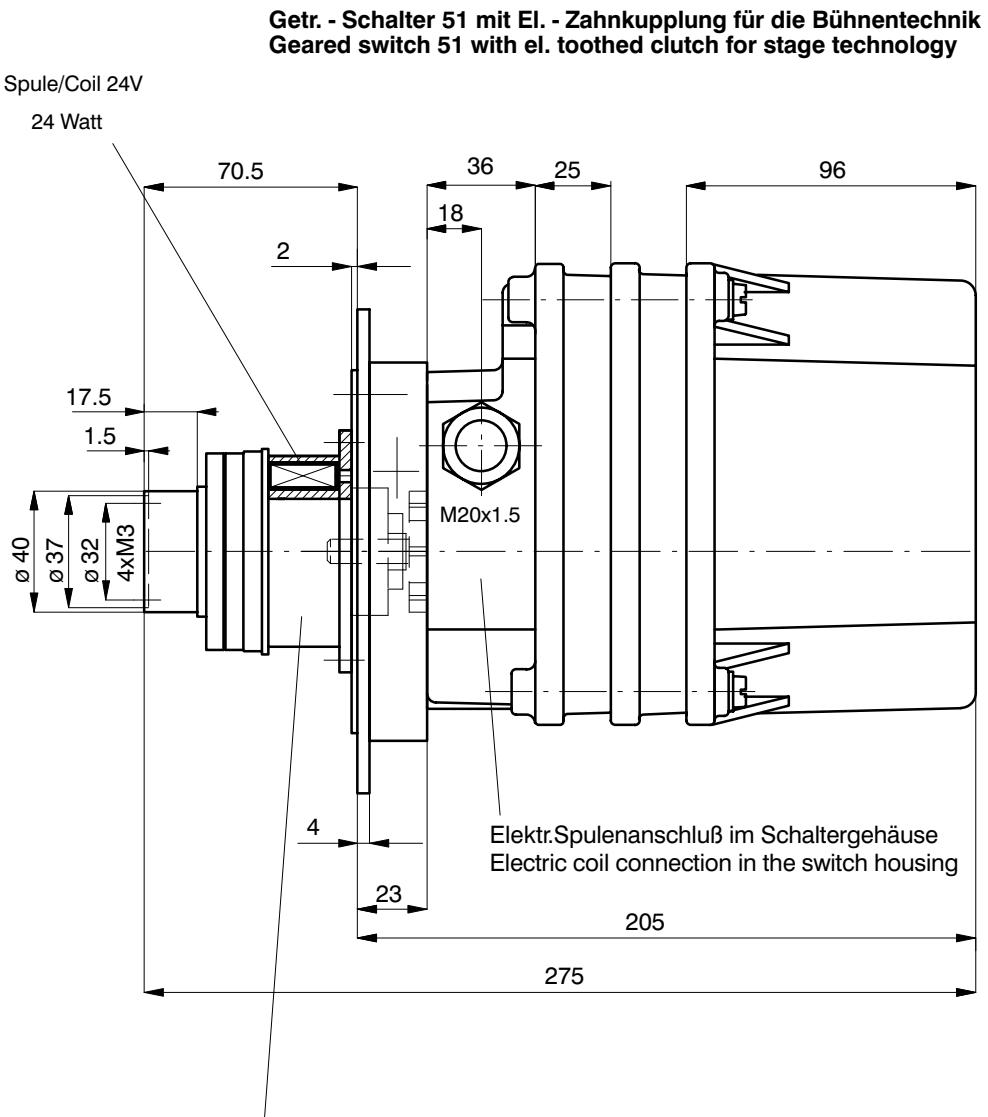
Beispielzeichnung (Bauform B3/B5) / Example drawing (Construction B3/B5)

Stromag





Option CPS - Kupplung/Coupling



Elektr. Federdruck - Zahnkupplung EZX0.1
Electromagnetic spring - applied toothed clutch EZX0.1

Bauform / Construction B5

DD1_40347H

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