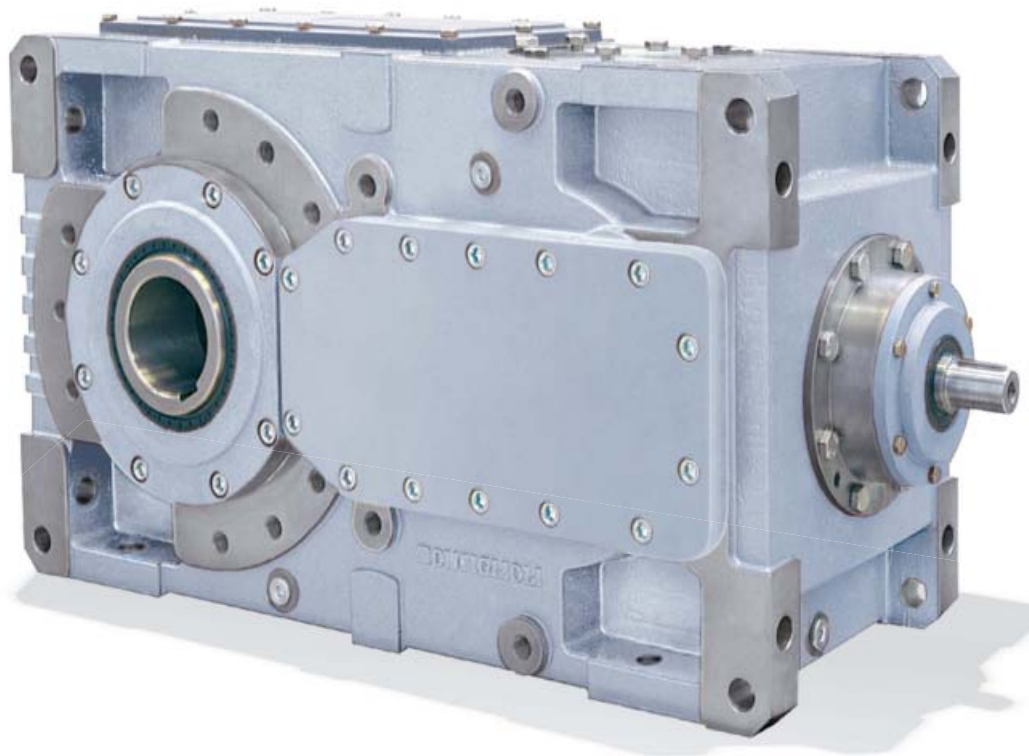
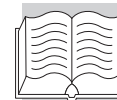


Bonfiglioli Riduttori

HDO serie

Installation, Operation
and Maintenance Manual





INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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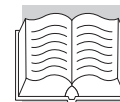
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Revisions

The revision list for this manual is given on page 60. The most recent versions of this manual are available at www.bonfiglioli.com.



1 GENERAL INFORMATION

1.1 PURPOSE OF THIS MANUAL

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

All purchasing and design information is given in the sales catalogue. As well as adhering to good engineering practices, read the information in this manual carefully and apply it rigorously. Information about the motor used with the gear unit must be obtained directly from the motor's own installation, operation and maintenance manual.

Failure to observe the information provided herein may result in risk to personal health and safety, as well as damage to equipment.

This information, provided in the Manufacturer's original language (Italian), may also be made 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.

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.

1.2 GLOSSARY, TERMS AND SYMBOLS

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

Routine maintenance: a 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 and tasks in question.

Non-routine maintenance: a set of operations required for **restoring the functionality** and efficiency of the gear unit. These operations are not routine maintenance operations. In order to maintain the proper functioning and safety of the gear unit/gearmotor, we recommend that users have non-routine maintenance performed by the manufacturer or an authorised, specialist service centre. Contact the manufacturer's sales network. Failure to comply with this requirement during the warranty period automatically invalidates the warranty.

Expert maintenance technician: an authorised technician selected from those having the qualifications, skills and mechanical and electrical training to do routine maintenance work on the gear unit.

SYMBOLS:

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



DANGER - WARNING

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



CAUTION - ATTENTION

This symbol indicates the need to adopt specific precautions to avoid personal injury as well as damage to equipment.



IMPORTANT

This symbol indicates important technical information.



1.3 REQUESTING TECHNICAL ASSISTANCE

For any technical service needs, contact the Manufacturer's sales network (www.bonfiglioli.com) quoting the information indicated on the unit's name plate, the approximate hours of service, the duty cycle and the type of defect.

1.4 MANUFACTURER'S LIABILITY

The Manufacturer declines all liability in the event of:

- use of the gear unit/gearmotor in contravention of local safety at work legislation
- incorrect installation, disregard or incorrect application of the instructions provided in this manual
- electrical power supply defects (for gearmotors and/or gear units with electrical devices)
- modifications or tampering
- work done on the unit by unqualified or unsuitable persons

The functionality and 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

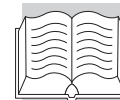


- **the configurations given in the gear unit catalogue are the only permitted ones**
- **do not attempt to use the unit in any other way**
- **the instructions given in this manual do not substitute but rather supplement the provisions of established safety legislation.**

1.5 SUPPLEMENTARY INFORMATION

Additional information about the gear units described in this manual can be obtained from the sales catalogues available on the website www.bonfiglioli.com:

- HDO Series parallel shaft gear units: **Code 1930**



2 SAFETY INFORMATION

2.1 SAFETY STANDARDS



Carefully read the instructions given in this manual and those printed directly on the gear unit, especially those regarding safety.



Use the gear unit only for the applications specified by the Manufacturer. Improper use can result in risks to personal health and safety and damage to equipment.

- Persons charged with working on the gear unit at any time during its service life must be trained specifically for the purpose, must possess the necessary specific skills and experience, and must also be equipped with and trained to work with the appropriate tools and individual safety equipment as required by the safety legislation applicable in the place where the gear unit/gearmotor is installed. Failure to meet these requirements constitutes a risk to personal health and safety.
- 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 which 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 the safety legislation applicable in the place where the gear unit is installed.
- 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 current legislation.
- After replacing lubricants clean the gear unit's surfaces and the walk-on surfaces around the work area.
- 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.
- 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 gear unit is a quasi-machine. The constructor of the plant or machine in which the gear unit is installed must therefore measure the level of noise emitted by the machine as required by the Machinery Directive 200/42/EC. The vibrations produced by the gear unit do not constitute a health risk for personnel. Excessive vibration may be the result of a fault, which should be immediately reported and eliminated.



Unless they have backstop devices, gear units may reverse direction. If there is any risk of uncontrolled movement occurring in the event of a power failure (for example in load lifting applications) measures must be put in place to prevent such movement occurring (for example by using motors with brakes that engage automatically if the power fails).

If the gear unit is installed in a position that cannot be reached from the floor, the constructor of the plant or machine in which it is installed must provide, as necessary, suitable means for accessing a position from which the gear unit can be serviced.



The user is responsible for using the products recommended for the installation and maintenance of the gear unit in an appropriate manner and in accordance with the Manufacturer's instructions.



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 constructor of the plant or machine in which the gear unit/gearmotor is installed must protect all rotating parts to prevent persons coming into accidental contact and incurring a risk of crushing, cutting or entanglement, especially if the gear unit operates automatically and in an accessible area.

- Do not use high pressure jets of water to clean the unit.
- All work must be performed exclusively with the gear unit at a standstill.
- The motor must be protected against accidental startup (e.g. by padlocking the main power switch or removing the power fuses). For this purpose, also affix a notice to the motor indicating that work is in progress on the gear unit.
- Do not perform welding work on the gear unit. The gear unit cannot be used as an earthing post for welding operations because this could damage or destroy parts of the gear teeth and bearings.
- The motor must be disconnected immediately if any alterations in the normal operation of the gear unit are noted when it is running, such as an abnormal increase in operating temperature or abnormal running noise.
- If the gear unit is to be installed in a plant or machine, the manufacturer of said plant or machine is required to include the prescriptions, instructions and descriptions contained in this manual in its own operating manual.
- If the gear unit is installed in situations that are particularly hazardous to personal safety, or that could cause serious damage to equipment, or that involve high inertial loads, vibrations, etc., such as:
 - suspended installations
 - motors supported exclusively by the gear unit
 - low speed shaft with shrink disc oriented downwardsinstall suitable safety devices, such as harnesses, safety chains and restraining systems, etc.,

Depending on the operating conditions, the outer surfaces of the gear unit may reach very high temperatures. Serious burns hazard!



When draining out spent oil at the time of an oil change, beware of the risk of serious burns caused by hot oil!

In the presence of a vent plug with relief valve, wait for the oil in the gear unit to cool before opening the plug and pay attention to possible jets of oil during transportation, lifting, installation, adjustment, operation, cleaning, maintenance, repair, dismantling and scrapping.

Wait for the gear unit to cool before inspecting it.

In the presence of accessories (optional variants), it is strictly forbidden to:

- use any accessory for any purpose other than that specified in the contract of supply
- fill any accessory with lubricants other than those recommended/permited
- use any accessory as a support or mounting surface
- use any accessory as an attachment point for the handling or transport of the gear unit/gearmotor
- modify any accessory in any way
- loosen and/or remove any component (pipe, fitting, flange, control device, etc.) while the system is functioning and/or under pressure
- fail to respect the requirements affixed to any accessory and/or to the gear unit/gearmotor, or remove, cover or render illegible any labels
- start up any accessory without any relevant guards in place and functional
- start up any accessory if damaged



All work on any accessory must be performed by qualified personnel who have a thorough knowledge of the instructions and technical specifications for the product and who are authorised to perform such work by the safety supervisor.

It is the responsibility of the manufacturer or assembler of the machine in which these gear units are incorporated to ensure the safety of that machine as a whole and its conformity to all relevant end product directives.

Parts of accessories may be electrically live or in motion. The removal of electrical or mechanical guards, improper use or inadequate maintenance may therefore lead to serious injury or damage.




3 TECHNICAL INFORMATION

3.1 EQUIPMENT IDENTIFICATION

The gear unit bears the following identifying name plate. The name plate provides all references and indispensable instructions for safe use. The gear unit's identifying code is explained in the sales catalogue. If the gear unit is supplied fitted with a motor (gearmotor), all information regarding the motor itself is supplied in the motor's own manual.

Name plate information

type	A		
option	B		
code	C	batch	D
ratio i =	E	M _{N2} (@ 1400 rpm)	F
mount. pos.	G	P _{N1} (@ 1400 rpm)	H
oil q.ty	I	approx. 	L
remarks	M		
	N		

- A Gear unit type
- B Optional variants
- C Product code
- D Month / Year of manufacture
- E Transmission ratio
- F Rated torque at output shaft
- G Mounting position
- H Rated power at input shaft
- I Approximate quantity of lubricant
- L Weight
- M Notes
- N Name of Manufacturer



Readability of the name plate

The name plate and the information thereon must be kept readable. The plate should therefore be cleaned from time to time.

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

3.2 DESCRIPTION OF THE EQUIPMENT

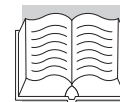
The gear unit has been designed and constructed for integration, driven by motor, into an assembly of interlocking parts or mechanisms as part of a specific application.

Depending on the requirements of the application, the gear unit can be supplied in a variety of executions and configurations.

It is designed to satisfy a range of specific requirements in the mechanical, chemical, agricultural and food industries, etc..

The Manufacturer supplies a range of accessories and optional variants to make these gear units as versatile as possible. For further technical information and descriptions, refer to the corresponding sales catalogue and the «OPTIONAL ACCESSORIES AND VARIANTS» section in this manual.

The user is responsible for using the products recommended for the installation and maintenance of the gear unit in an appropriate manner and in accordance with the Manufacturer's instructions.



3.3 CONFORMITY

All gear units or gearmotors (when supplied with motor) are designed as state of the art devices and in compliance with the provisions of applicable Essential Health and Safety Requirements.

All gearmotor motors conform to the provisions of the Low Voltage Directive 2006/95/EC and the Electromagnetic Compatibility Directive 2004/108/EC.

3.4 OPERATING LIMITS AND CONDITIONS



The applications permitted by the Manufacturer are the industrial applications for which the gear unit has been designed.

Ambient conditions

- The permitted ambient temperature range for these gear units is between -20°C and +50°C.
In ambient temperatures between -20°C and -10°C, the gear unit must only be operated normally after the machine has been properly and gradually warmed up, or after initial no-load operation.
Load may only be applied to the gear unit's output shaft once the unit's temperature has risen to -10°C or higher.



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.

Do not use the gear unit/gearmotor, if not explicitly intended for the purpose, in a potentially explosive atmosphere or where the use of explosion-proof equipment is specified.

The following conditions must be borne in mind if the gear unit is equipped with auxiliary cooling units (MCRW... and MCRA...) or forced lubrication pumps (MOP... and OP...):

- permissible ambient temperature: -10°C to +50°C
- maximum oil pressure: 10 bar
- minimum start-up temperature:
whatever temperature guarantees a minimum oil viscosity of 1500 cSt, generally within the range of +5°C to +25°C depending on the type of oil used.



For precise temperature values, refer to the relevant sales catalogue and/or product data sheet of the lubricant manufacturer.

Irrespective of the degree of protection specified, outdoor installations must be protected against direct sunlight, inclement weather, and infiltration by water and foreign bodies, without, however, compromising effective gear unit ventilation.



4 HANDLING AND TRANSPORT



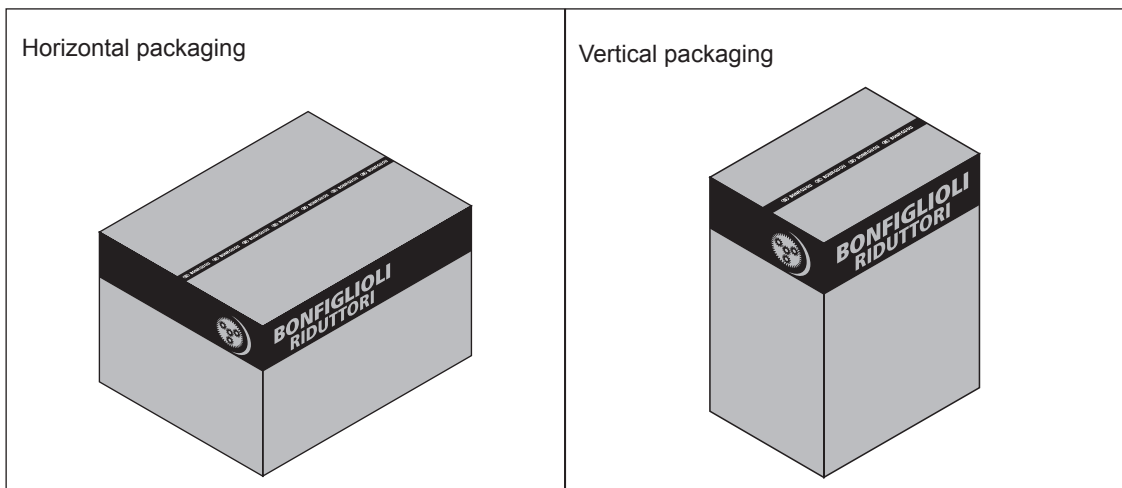
The person authorised to handle the product must take all necessary precautions to safeguard his own safety and that of all other persons involved.

4.1 PACKAGING SPECIFICATIONS

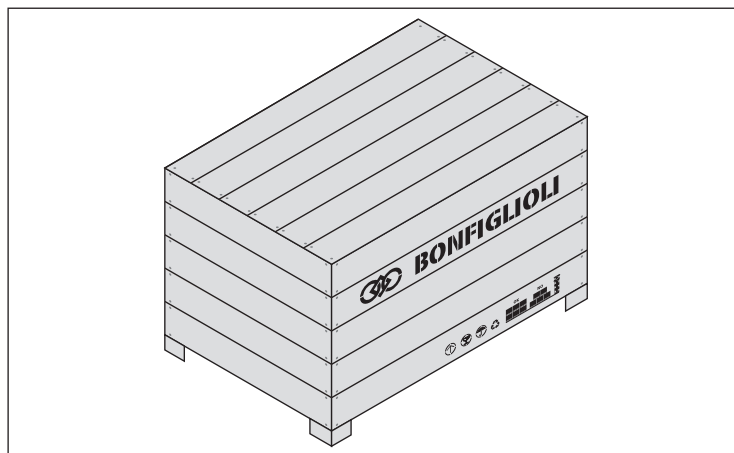
The standard packaging, if supplied, and unless otherwise agreed, is not rainproof and is intended for shipping by ground and not by sea, and for storage in areas which are under cover and not humid. The material must be stored under cover in temperatures between -15°C and $+50^{\circ}\text{C}$ at a 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.

Standard carton pallet packaging for single products and kits.



Wooden crates for miscellaneous products and shipments by sea.



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 problems to the Manufacturer's sales network.



Dispose of packaging materials as stipulated by applicable legislation.

4.2 HANDLING INSTRUCTIONS



Handle packages as per the Manufacturer's instructions on the packages themselves, if present. 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 other persons.

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 for handling 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 specified.
- When handling the load keep it level horizontally 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, hooks, etc. which are certified and adequate for the load in question. The weight of the unit to be handled is specified on the name plate and/or in the relative sales catalogue.

Do not use eyebolts on the motor to lift gearmotors unless specifically instructed to do so.



During lifting operations the load must not be allowed to swing beyond an arc of $\pm 15^\circ$. If greater swinging movements occur during the procedure, stop and repeat the operations required for the type of lifting system adopted.

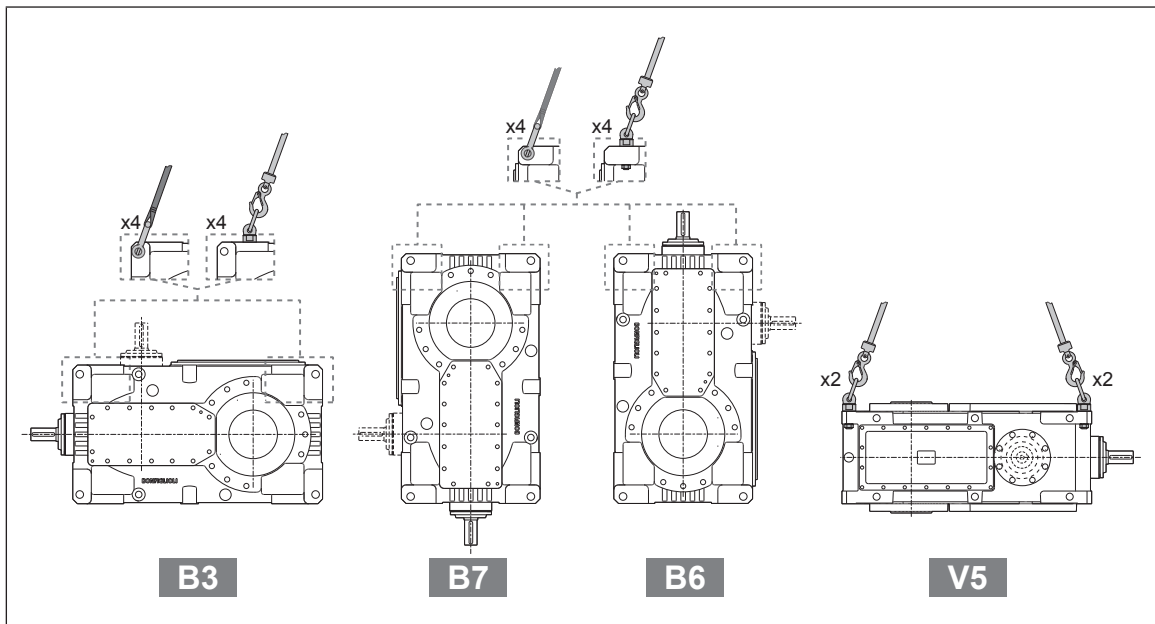
To rotate the gear unit, use the same attachment points used to lift it and proceed as instructed for lifting. Rotate the gear unit as closely as possible to a supporting surface. Pay special attention to the location of the centre of gravity to prevent the load from becoming unbalanced as it is being rotated. Lifting gear must be attached in such a way that it cannot slip off or move, as this could cause the load to fall. This is especially important if the gear unit is being rotated using slings or ropes, since these are particularly prone to slipping off their attachment points.



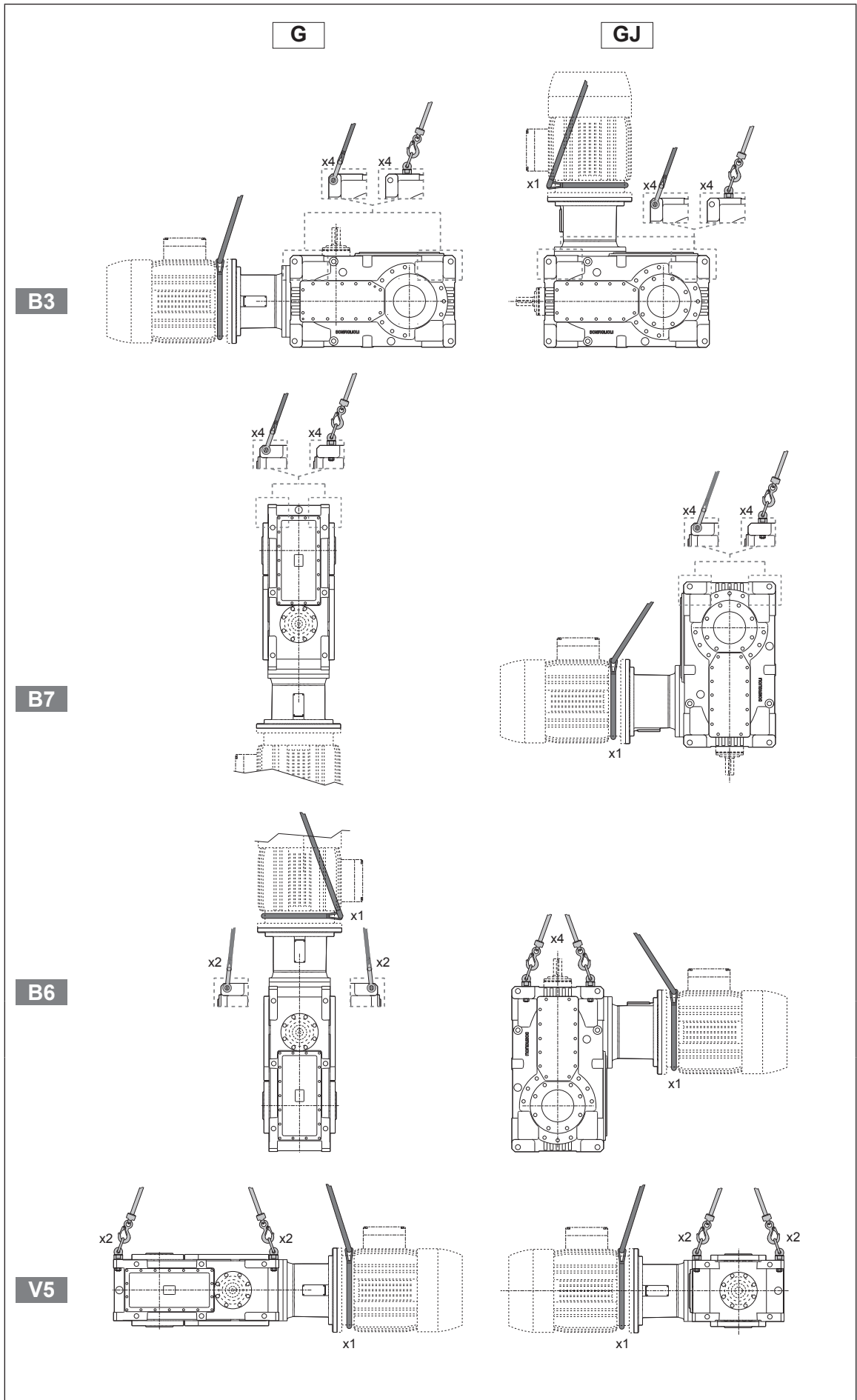
- Identify the attachment points for lifting the gear unit, as shown in the drawings.
- Prepare the gear unit for lifting by attaching straps, hooks, etc. to its attachment points, or alternatively use a pallet for moving the load. If using a crane, first lift the gear unit vertically out of its packaging.
- If using a lift truck or pallet truck, remove the packaging and insert the truck's forks at the positions provided.
- First lift the load very slowly to only a limited height above the ground and check that the load 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.



Do not use the shaft end threads or external pipes as lifting points. Take care not to damage any lubrication or cooling system accessories when lifting, moving or positioning the gear unit.



Miscellaneous accessories (e.g. connecting flanges, etc.) and/or motors coupled to the gear unit may significantly alter the centre of gravity, thereby impairing the stability of the gear unit. In such cases it may be necessary to use an additional anchor point.





4.3 STORAGE



Place the gear unit/gearmotor on a stable base and make sure that there is no risk of it moving or falling off.

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

1. Do not store the unit in excessively humid conditions or where it is exposed to the weather (i.e. outdoors).
2. Avoid excessive variations in temperature as this can cause condensation inside the gear unit and its accessories.
3. Do not place the gear unit directly on the ground.
4. Store the packaged gear unit (if allowed) in accordance with the instructions on the packaging itself.



If the gear unit/gearmotor is stored temporarily outdoors it must be protected to ensure that humidity and foreign matters cannot penetrate to the interior.

If gear units and accessories are to be stored for periods under 6 months, if required, fill them with oil to the right level (see the “LUBRICATION” section in this manual) and run them at regular intervals (at least once every 4 weeks) for at least 1 hour, following all the requirements given in this manual.

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

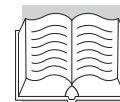
5. Coat all external machined surfaces with a protective anti-corrosion product such as Shell Ensis Fluid SX, Tectyl 506-EH or other product with similar properties and application range. Check the surfaces regularly and re-apply the coating as necessary.
6. Fill the gear unit with lubricating oil and replace the vent plugs with blind plugs.
7. Periodically rotate the gear unit's input and output shafts through a few turns to avoid damage to bearings and seals.



At the end of the storage period, replace the vent plugs before starting up gear units.



To store gear units/gearmotors with a drywell sealing device, and for specific needs and types of storage, consult the Manufacturer's Technical Service.



5 INSTALLATION

5.1 INSTALLING THE GEAR UNIT



All phases of installation and maintenance must be planned to suit the overall design of the machine. The person authorised to do the work must, if necessary, implement a safety plan to protect the health and safety of all persons directly involved and apply all applicable legislation.

It is essential for impact and strain to be avoided during the installation process.

Before installing a gearmotor, also refer to the instructions contained in the installation and user manual for the motor.

Before installing the gear unit:

1. Drain out the oil used for storage if it is not the same as the oil used for normal functioning, and flush the inside of the gear unit out thoroughly (see the "LUBRICATION" section in this manual).
2. Carefully remove all packaging and protective product residues from the gear unit using suitable solvents. Take special care over the mating surfaces but avoid getting solvents on the shaft seal rings.
3. Check that the data on the name plate correspond to those specified in the order.
4. Ensure that the structure in which the gear unit is to be mounted is sufficiently robust and rigid to support its weight and operating stresses.
5. Check that the machine in which the gear unit is to be installed is switched off and cannot be accidentally started up.
6. Check that all coupling surfaces are flat.
7. Check that the shaft/shaft or shaft/ bore are perfectly aligned for coupling.
8. Fit suitable guards to prevent accidental contact with the gear unit's external moving parts.
9. If the work environment is corrosive for the gear unit or any of its parts, follow the special precautions required for aggressive environments. Contact the Manufacturer's sales network for further details.
10. **We recommend applying a protective paste to all key type couplings (Klüberpaste 46 MR 401, or a product with similar properties and application range) to ensure optimal coupling and protection against fretting corrosion. Clean all friction couplings thoroughly but do not apply any protective pastes.**
11. To ensure effective coupling, the driven shafts should be machined to the tolerances specified in the "PREPARING CUSTOMER SHAFTS" section in this manual.
12. In the case of outdoor installations, protect the gear unit and any motor from direct sunlight and inclement weather by means of guards or a casing. Also make sure that the assembly is properly ventilated.
13. Make sure that the casing of the gear unit is connected to the earth circuit of the machine in which it is installed.
14. Evaluate whether accessible surfaces may exceed the temperature limits established in EN ISO 13732-1 on the basis of the gear unit's conditions of use and ambient temperatures. If the temperature of accessible surfaces exceeds the limits established by EN ISO 13732-1 (65°C for occasional brief contact with exposed metal), the surfaces in question must be protected to prevent contact (by means of guards and/or lagging). Wherever impossible, signs bearing symbol 5041 of IEC standard 60417 "Warning! Hot surfaces" must be displayed in such a way that they are clearly visible to machine operators (bearing in mind the position and orientation of the gear unit).



Symbol 5041 of IEC standard 60417 "Risk of burns! Hot Parts"



Proceed with the installation as follows:

15. Place the gear unit in the vicinity of the installation area.
16. Mount the gear unit and secure it to the structure at the points provided. The gear unit should be secured to the structure using all the fixing points on the mounting provided (feet or flange).
17. Locate the closed oil plug used during shipping and replace it with the vent plug supplied in the shipment (if required).
18. Tighten down the mounting bolts and check that the service plugs are screwed down to the torque values given in the following table.

(tab 1)

Bolt size	Bolt torque [Nm]	
	+5% /-10%	
	Bolt class	
	8.8	10.9
M4	3	4.5
M5	5.9	8.9
M6	10.3	15.3
M8	25.5	37
M10	50	73
M12	87.3	127
M14	138.3	201
M16	210.9	314
M18	306	435
M20	432	615
M22	592	843
M24	744	1060
M27	1100	1570
M30	1500	2130
M33	1850	2600
M36	2350	3300
M39 X 3	3200	4500
M42 X 3	4050	5700

Thread Plug/Vent	Pitch (threads per inch)	Tightening torque [Nm] +5%/-10%
1/8"	28	5
1/4"	19	7
3/8"	19	7
1/2"	14	14
3/4"	14	14
1"	11	25
1" 1/2	11	25



After having tightened the fixing bolts check the alignment of the shafts again. Alignment must be checked again and, if necessary, corrected after a few days of operation.

In the presence of high external loads, in particularly dangerous mounting positions and in mounting positions other than B3, use Class 10.9 fixing bolts.

19. Fill the gear unit with oil or top up as necessary, as instructed in the “LUBRICATION” section in this manual.

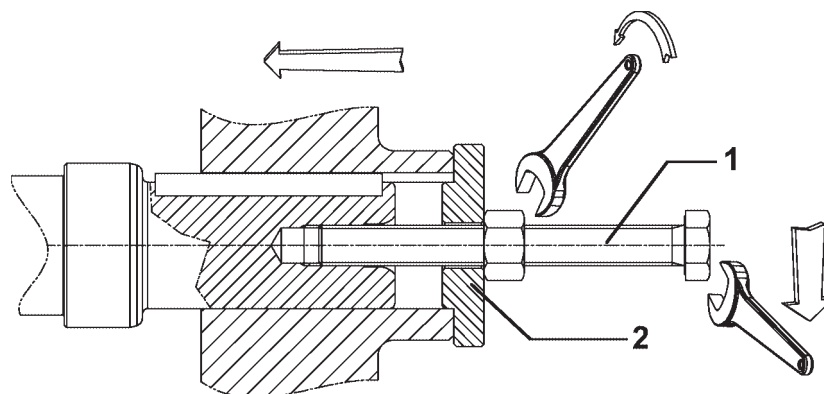


If the gear unit is equipped with a fan or an auxiliary cooling unit with an oil/air heat exchanger, leave enough room to ensure adequate air circulation.

5.1.1 Gear units with solid output shafts

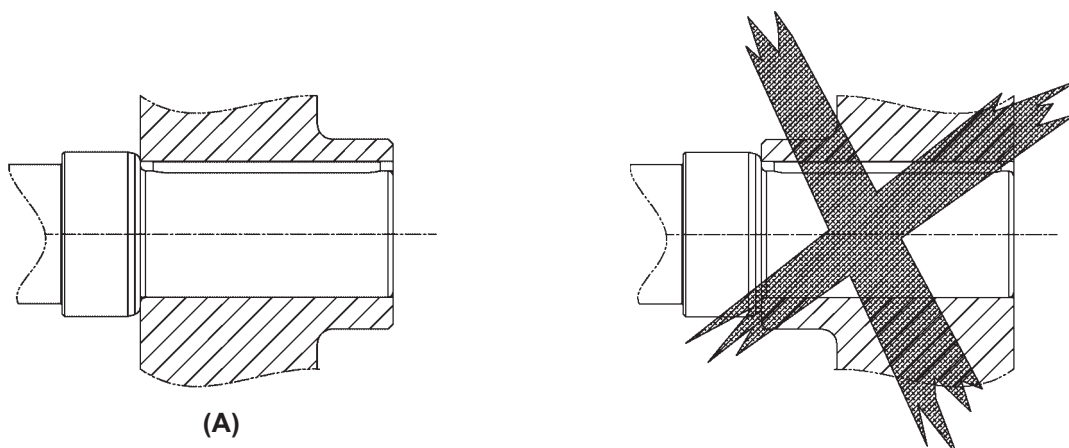


Do not use hammers or other tools which might damage the gear unit's shafts or bearings to mount external parts. Proceed as shown below, following the recommendations of the “INSTALLING CONNECTING ELEMENTS” section in this manual:



Bolt (1) and spacer (2) shown above are not included in the supply.

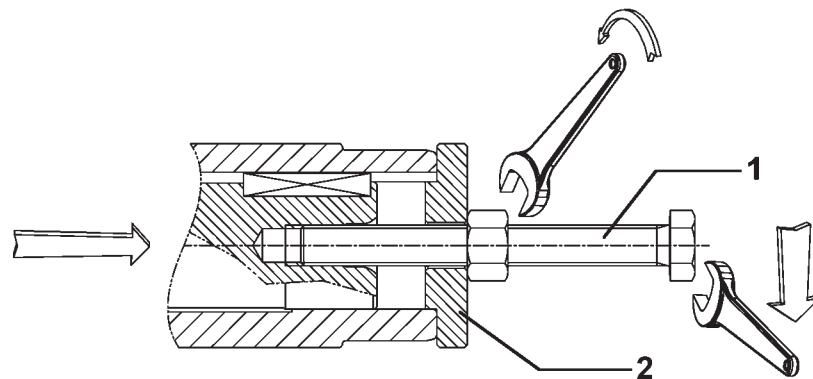
To minimise the loads on the shaft bearings, when mounting transmission mechanisms with asymmetrical hubs use the configuration shown in diagram (A) below:





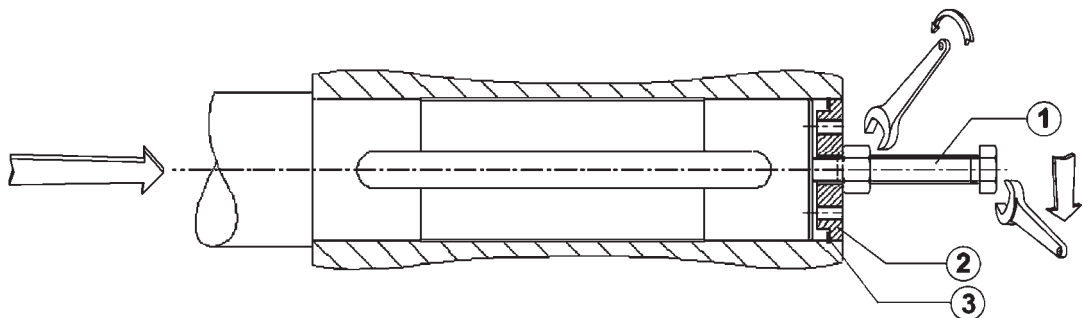
5.1.2 Gear units with hollow output shafts with keyway

To facilitate mounting hollow shaft gear units to the machine's cylindrical shaft, proceed as indicated in the following diagram: See also the "PREPARING CUSTOMER SHAFTS" section in this manual.



The tie bolt (1) and spacer (2) are not included in the consignment.

Alternative method:



The tie bolt (1), spacer (2) and circlip (3) are not included in the supply.



Install suitable devices to secure the hollow shaft to the machine shaft in an axial direction and prevent accidental decoupling.

5.1.3 Gear units with shrink disc

Certain gear units may be equipped with a shrink disc for coupling the hollow output shaft to the driven shaft. When installing a gear unit of this type, proceed as follows:

1. Unscrew the locking bolts gradually one at a time and remove the entire shrink disc.
2. Clean and carefully degrease the coupling surface between the gear unit's output shaft and the machine shaft.

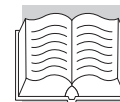


Do not use molybdenum disulphide or any other grease which could reduce the friction of the mating surfaces and affect the performance of the shrink disc.



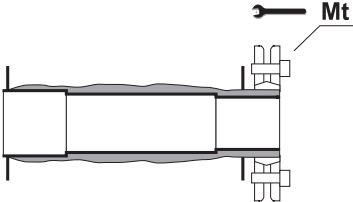
Adopt one of the following techniques to facilitate subsequent disassembly at the cylindrical guide section opposite the shrink disc.

- Use a protective paste (Klüberpaste 46 MR 401 or other product with similar properties and application range).
- Design the machine shaft as suggested in the "PREPARING CUSTOMER SHAFTS" section in this manual, to accept a self-lubricating cylindrical bushing, or with a hole for the injection of an anti-corrosion liquid.



3. Fit the gear unit to the machine and couple its output shaft to the driven shaft.
4. Fit the shrink disc to the gear unit shaft.
5. Fully tighten down the shrink disc bolts gradually one at a time in a clockwise sequence using a torque wrench. This operation usually has to be repeated several times to reach the tightening torque M_t specified in the table below:

(tab 2)



	HDO 100	HDO 110	HDO 120	HDO 130	HDO 140	HDO 150	HDO 160
M_t [Nm]	127	250	250	250	490	490	490

Torque the shrink disc as prescribed to assure axial fixing of the transmission, in the absence of external loads.



The shrink disc coupling must not be disassembled nor lubricated before being reinstalled. Disassemble and clean the shrink plate only when it is fouled.



When cleaning and/or during maintenance, lubricate only the sliding surfaces of the shrink disc using a solid lubricant with friction value of $\mu = 0.04$, such as Klüber Molykombin UMFT 1 (or an equivalent product having the same characteristics and durability of performance).



Never run the gear unit when the shrink disc protective guard is not fitted.

In the presence of external thrust loads, vibration, safety problems, requirements for enhanced reliability, or unfavourable mounting positions (e.g. output shaft directed downwards), install suitable devices to secure the shaft in an axial direction and prevent accidental decoupling.

5.2 INSTALLING A MOTOR WITH AN IEC STANDARD FLANGE (optional variant G, GJ)



Thoroughly clean and degrease the flange of the gear unit and the area of the machine to which it is to be coupled. The correct execution of this procedure is essential for safe torque transmission. Do not use solvents or dirty rags to degrease mating surfaces.

Do not use molybdenum disulphide or any other type of grease, as this would significantly lower the friction coefficient in the contact area and therefore impair the functionality of the coupling.

- 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 large thrust and/or overhung loads.
- To facilitate assembly, use a synthetic oil lubricating paste such as Klüberpaste 46 MR 401 or other product with similar properties and application range.
- Tighten down all motor/gear unit mounting bolts to their prescribed torques. See the "INSTALLING THE GEAR UNIT" section in this manual for details of tightening torque values.



If the gear unit is installed in situations that are particularly hazardous to personal safety, install suitable safety devices, such as harnesses, safety chains and restraining systems, etc.,

5.3 INSTALLING CONNECTING ELEMENTS

Use the utmost caution when installing the various components, to ensure that no damage is caused to the gear unit and its parts, such as oil seals and mating surfaces, or internal parts such as gears and bearings.



Make sure that you have access to suitable lifting equipment to perform the installation operations correctly.



When installing external transmission parts do not use hammers or other unsuitable tools, to avoid the risk of damaging the gear unit shafts or supports.

When installing connecting elements it is advisable to preheat them slightly. Take the following precautions when doing so:



Adopt protection against contact with hot parts: risk of burns!



Protect the oil seals from damage and accidental overheating to avoid impairing their functionality (use a heat shield to protect against radiated heat).



The connecting or transmission elements must not transmit static or dynamic external loads to the shafts unless said loads have been calculated at the time of gear unit selection.

If the element to be coupled to the shaft is not fixed axially by the interference of the coupling, utilise suitable retaining components to prevent axial movement of the element in question on the shaft.

5.4 ACCESSORIES AND OPTIONAL VARIANTS

5.4.1 AUXILIARY COOLING/HEATING SYSTEMS

5.4.1.1 Forced ventilation (optional variants FAN, FANJ)

A fan is keyed to the gear unit input shaft and protected against accidental contact by a guard.



Never run the gear unit when the fan guard is not fitted.
After each maintenance intervention refit the guards before restarting the gear unit.



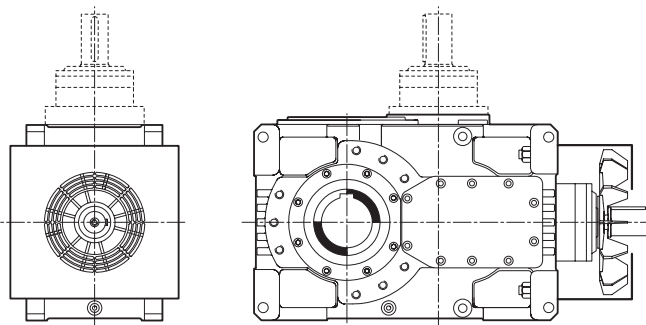
The fan draws in air through the grille in the protective guard and conveys it to the gear unit casing, thereby dissipating a quantity of heat that depends on the rotation speed.



The effectiveness of forced ventilation falls off dramatically:

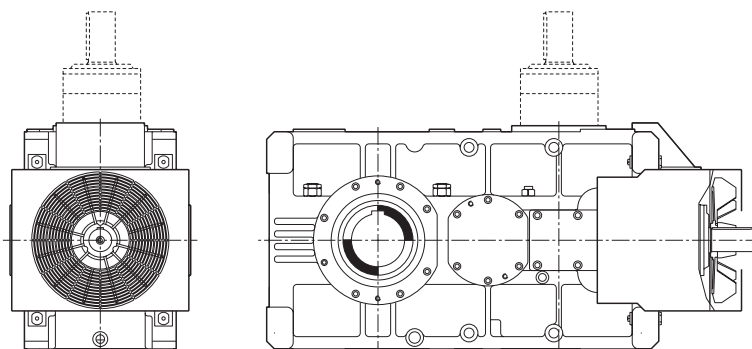
- at rotation speeds below $n_1=900\text{min}^{-1}$; if it proves necessary to increase the thermal capacity of the gear unit under such conditions, an auxiliary cooling device should be installed.
- if dirt builds up on the blades of the fan or blocks the protective grille over the fan. Clean regularly as instructed in the "MAINTENANCE" section in this manual.

HDO 100 ... HDO 140

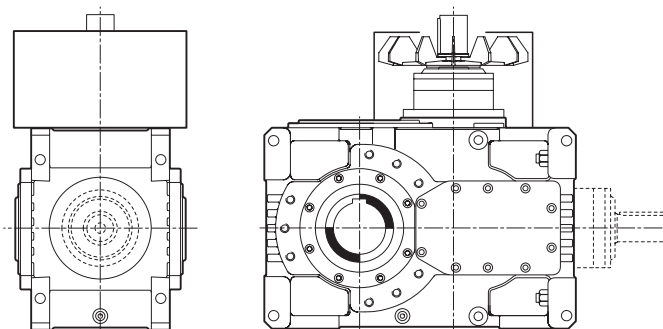


FAN

HDO 150 - HDO 160



FANJ



When installing a gear unit equipped with a forced air cooling fan, it is essential to allow ample space around the unit to ensure sufficient air circulation for cooling purposes.



5.4.1.2 Autonomous control units (optional variants MCRW... , MCRA...)

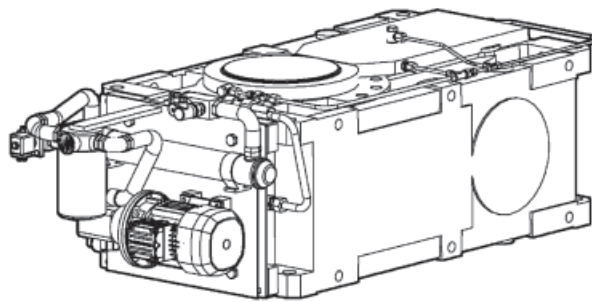
Autonomous cooling units are specially designed to cool gear unit lubricant. They come installed on board the gear units, mounted on special plates and connected to the relevant unions by rigid pipes and/or flexible hoses, also included in the supply.



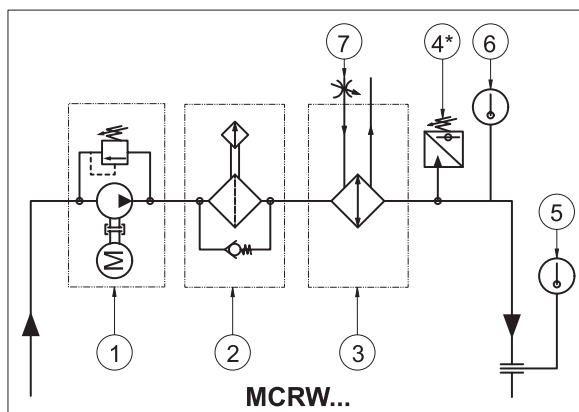
Electrical connections and/or cabling to user points are the responsibility of the Customer and must be completed prior to start-up.

Refer to the sales catalogue for information on the availability of the cooling devices for the different sizes of gear unit and for other technical specifications and dimensions.

5.4.1.2.1 Control units with oil/water heat exchanger (MCRW...).



Cooling circuit and components



- 1) Electric pump with by-pass circuit
- 2) Filter with blockage indicator and by-pass valve
- 3) Water/oil heat exchanger
- 4) Minimum pressure switch (only with forced lubrication)
- 5) Maximum temperature thermostat
- 6) Control thermostat
- 7) Solenoid valve

Design and functional characteristics (MCRW...)

MCRW... control units are available in various sizes, each with a different flow rate and cooling capacity.

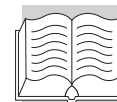
Oil is sucked directly from the gear unit casing and circulated through an external closed circuit by the electric pump [1], which has a by-pass valve calibrated at 6 bar to avoid overpressure in the system.

Before returning to the gear unit, the oil passes through:

- the filter with blockage indicator and by-pass valve [2], which eliminates any suspended solid particles and guarantees a more reliable and long lasting transmission (60 micron metal mesh filter element)
- the copper tube bundle water/oil heat exchanger [3], which removes the excess heat generated by the gear unit

To ensure the proper functioning of the auxiliary cooling system and to save energy and coolant, the following control devices are provided:

- minimum pressure switch [4]
- maximum temperature thermostat [5]
- control thermostat [6]
- water shut-off solenoid valve [7]



Technical specifications (MCRW...)

Frequency of power supply 50-60 Hz (1)

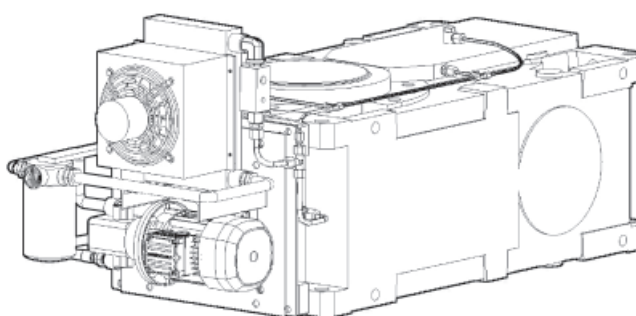
(tab 3)

Control unit	Description	Electric pump					Air/oil heat exchanger + solenoid valve			Filter with element in metal mesh 60 µm Fittings (BSP)
		V (ΔY) [V]	f [Hz]	Pn [kW]	In (Y connection) [A]	Oil flow rate (2) [l/min]	Water flow rate [l/min]	Fittings (GAS) IN OUT		
MCRW 5	BN 71B 6 IP55 CLF B35 CUS	230/400	50	0.25	0.82	5.3	10	3/8" F	3/8" M	3/4"
		265/460	60	0.3	0.79	6.4				
MCRW 9	BN 71C 4 IP55 CLF B35 CUS	230/400	50	0.55	1.55	9.5	18	1/2" F	1/2" M	3/4"
		265/460	60	0.65	1.55	11.4				
MCRW 21	BN 80C 4 IP55 CLF B35 CUS	230/400	50	1.1	2.66	21.4	31	3/4" F	1" F	3/4"
		265/460	60	1.3	2.7	25.7				
MCRW 34	BN 90LA 4 IP55 CLF B35 CUS	230/400	50	1.5	3.6	33.6	56	3/4" F	1" F	1 1/4"
		265/460	60	1.8	3.8	40.3				
MCRW 51	BN 100LA 4 IP55 CLF B35 CUS	230/400	50	2.2	5.2	50.8	81	3/4" F	1" F	1 1/4"
		265/460	60	2.5	5.1	61				

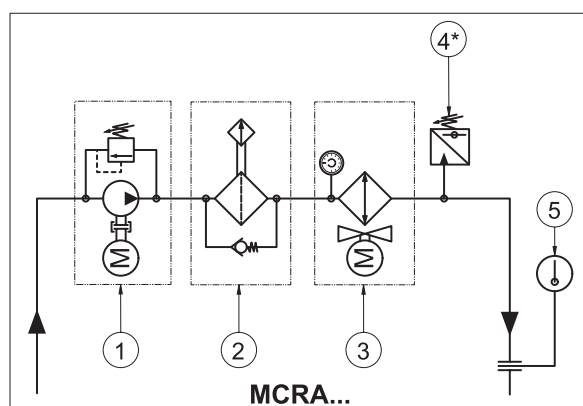
(1) For different mains frequencies, contact the Manufacturer's Technical Service.

(2) Nominal flow rate may vary as a function of oil type and functioning temperature.

5.4.1.2.2 Control units with oil/air heat exchanger (MCRA...).



Cooling circuit and components



- 1) Electric pump with by-pass circuit
- 2) Filter with blockage indicator and by-pass valve
- 3) Air/oil heat exchanger with control thermostat
- 4) Minimum pressure switch (only with forced lubrication)
- 5) Maximum temperature thermostat



Design and functional characteristics (MCRA...)

MCRA... cooling units are available in various sizes, each with a different flow rate and cooling capacity.

Oil is sucked directly from the gear unit casing and circulated through an external closed circuit by the electric pump [1], which has a by-pass valve calibrated at 6 bar to avoid overpressure in the system.

Before returning to the gear unit, the oil passes through:

- the filter with blockage indicator and by-pass valve [2], which eliminates any suspended solid particles and guarantees a more reliable and long lasting transmission (60 micron metal mesh filter element)
- the air/oil heat exchanger unit aluminium radiator, electric fan and control thermostat [3], dimensioned to remove the excess heat generated by the gear unit

The following control devices are provided to ensure the correct functioning of the accessory and to save energy:

- minimum pressure switch [4]
- maximum temperature thermostat [5]
- adjustable control thermostat (on the heat exchanger [3])

Technical specifications (MCRA...)

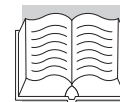
Frequency of power supply 50-60 Hz (1)

(tab 4)

Control unit	Description	Electric pump					Air/oil heat exchanger					Filter with element in metal mesh 60 µm Fittings (BSP)	
		V	f	Pn	In	Oil flow rate	Degree of protection	V a.c.	P	I	Fittings (GAS)		
		(Δ/Y) [V]	[Hz]	[kW]	(Y con.) [A]	(2) [l/min]		[V]	[W]	[A]	IN		OUT
MCRA 5	BN 71B 6 IP55 CLF B35 CUS	230/400	50	0.25	0.82	5.3	IP 44	1~230	55	0.25	3/4" F	3/4" F	3/4"
		265/460	60	0.3	0.79	6.4			55	0.25			
MCRA 9	BN 71C 4 IP55 CLF B35 CUS	230/400	50	0.55	1.55	9.5	IP 44	1~230	120	0.53	1" F	1" F	3/4"
		265/460	60	0.65	1.55	11.4			160	0.70			
MCRA 21	BN 80C 4 IP55 CLF B35 CUS	230/400	50	1.1	2.66	21.4	IP 54	3~230 Δ/400Y	180	0.61/0.35	1" F	1" F	3/4"
		265/460	60	1.3	2.7	25.7			260	0.74/0.43			
MCRA 34	BN 90LA 4 IP55 CLF B35 CUS	230/400	50	1.5	3.6	33.6	IP 55	3~280 Δ/480Y	230	1.12/0.65	1" F	1" F	1 1/4"
		265/460	60	1.8	3.8	40.3			300	1.10/0.63			
MCRA 51	BN 100LA 4 IP55 CLF B35 CUS	230/400	50	2.2	5.2	50.8	IP 55	3~280 Δ/480Y	230	1.12/0.65	1-1/2" F	1-1/2" F	1 1/4"
		265/460	60	2.5	5.1	61			300	1.10/0.63			

(1) For different mains frequencies, contact the Manufacturer's Technical Service.

(2) Nominal flow rate may vary as a function of oil type and functioning temperature.



5.4.1.2.3 Installing autonomous control units (MCRW... , MCRA...)



Check that the actual mains power, mounting and service conditions correspond to those declared on the name plates of the components and/or specified in this manual.

Electric motors must rotate in the direction shown on the components.

Make sure that all electrical power cables are big enough to carry the current draw and suitable for the installation conditions. Inadequate cables can cause overheating and/or voltage drops.

Information about the pump's motor must be obtained directly from the motor's own sales catalogue or installation, operation and maintenance manual. For all other devices, see the "SENSORS" section in this manual.



Wiring and connections must permit a functioning logic suited to the functionalities of the control unit as described in the following section.

MCRW...: Connections to the solenoid valve must respect the following specifications:

Connection type: three pole, connector type DIN 43650
Contact type: NC (normally closed)
Power [V/Hz]: 220-240/50 - 240/60
Consumption: 9 W DC
Degree of protection: IP 65 (with connector fitted)

To ensure maximum efficiency, provide a water supply system that corresponds to the following specifications:

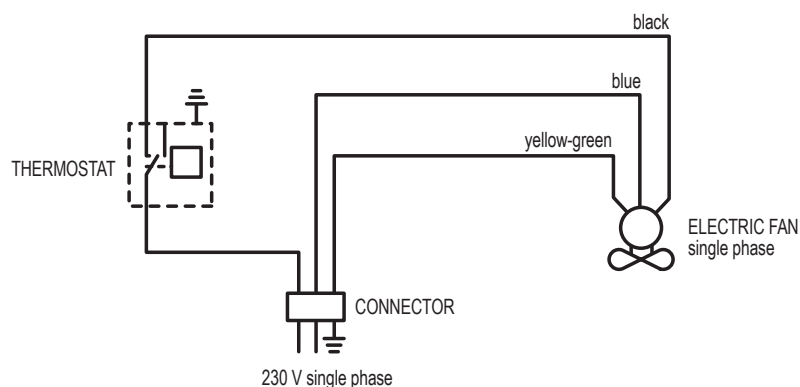
- max. pressure 10 bar
- maximum water delivery temperature 20°C
- minimum flow rate according to the table in the previous section

and make the connections to the water supply circuit so that water enters the heat exchanger via the solenoid valve and the fitting furthest away from the oil circulation pipes, and leaves the heat exchanger through the fitting nearest to them.

If the cooling water is very hard the use of a water softener is recommended. In the case of freezing temperatures or long periods of disuse, to avoid possible damage, the cooling water should be drained from the circuit and compressed air blown through the empty circuit to eliminate all residual moisture.

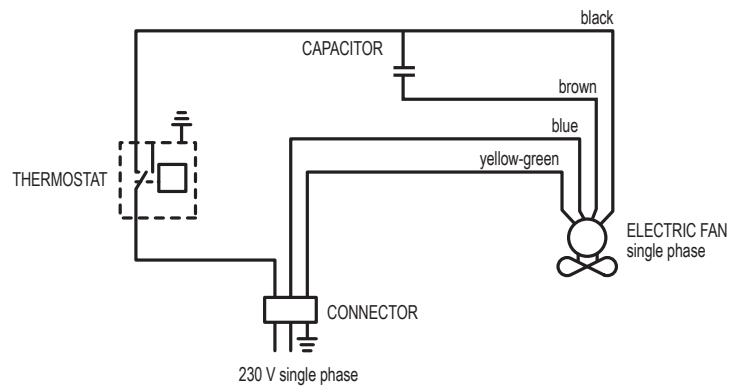
MCRA...: Connections to the electric fan of the air/oil heat exchanger must respect the following specifications:

MCRA5: Single phase power supply

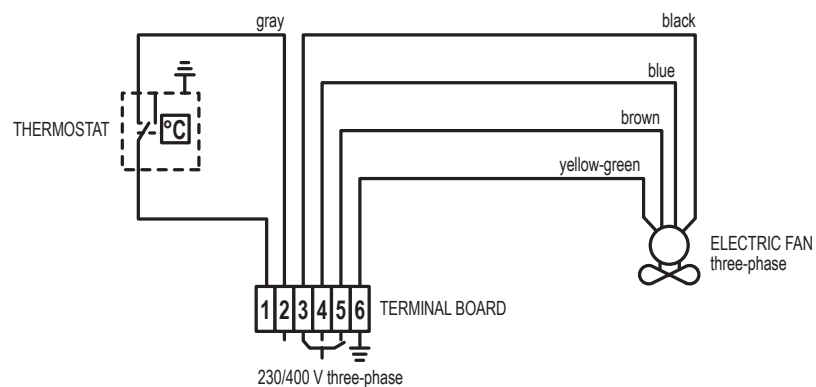




MCRA9: Single phase power supply



MCRA21 – MCRA34 – MCRA51: Three phase power supply



To ensure an adequate air flow and good thermal efficiency, install the heat exchanger with at least 1 m of free space around it.

In the case of indoor installations and installations in restricted spaces, make sure that there is sufficient ventilation and/or air recycling to prevent overheating.

For more general information on installation, refer to the “INSTALLING THE GEAR UNIT” section in this manual.

5.4.1.3 Cooling coil (optional variant SR)

The cooling coil, designed for integration in a cooling circuit created by the customer, is installed inside the gear unit sump and is not removable.

For optimal efficiency the cooling circuit supply must comply with the following specifications:

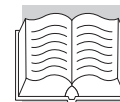
- max. pressure 8 bar
- min. flow rate 10 l/min for HDO 100 ... HDO 140
- max. water temperature 20°C

Cooling water can circulate through the coil in either direction.

If the cooling water is very hard the use of a water softener is recommended.

To avoid excessive energy consumption it is good practice to equip the cooling circuit with a thermostatic valve that admits coolant only when the gear unit oil reaches a temperature max. of 70°C.

In the case of freezing temperatures or long periods of disuse, to avoid possible damage, the cooling water should be drained from the circuit and compressed air blown through the empty circuit to eliminate all residual moisture.



Before starting the gear unit ensure that all the connections have been made properly. It is also advisable to check the cross section of water passages periodically to ensure that they are free from sediment and/or obstructions that could impair the efficiency of the external cooling system.: If necessary, clean the circuit by flushing with a suitable chemical agent, checking with the manufacturer of the cleaning agent that it is compatible with the construction material of the coil. The intervals at which to check the condition of the cooling system depend on the characteristics of the cooling water used (see the “ROUTINE MAINTENANCE” section in this manual).



Pay the maximum attention when using hazardous chemical detergents and take all the necessary precautions to ensure they are disposed of in compliance with the law.

5.4.1.4 Oil heater (optional variant HE)

In significantly low ambient temperatures, increased viscosity can prevent correct oil flow. In such conditions the gear unit can be equipped with one or more electrical heating elements and a minimum temperature thermostat to switch them on and off. Unless otherwise agreed or required this thermostat is set at $25 \pm 5^\circ\text{C}$ (see the “SENSORS” section in this manual). Examples of situations requiring oil heating include:

- operation at temperatures below 0°C
- starting of gear units featuring oil bath and splash lubrication if the minimum ambient temperature is not at least 10°C higher than the oil drop point.
- start-up of gear units with forced lubrication if oil viscosity exceeds 1500 cSt. Depending on the lubricant used, kinematic viscosity is generally between 220 and 460 cSt, and maximum permissible viscosity occurs at ambient temperatures between approximately 5°C and 25°C .



For precise temperature values, refer to the relevant sales catalogue and/or product data sheet of the lubricant manufacturer.

The heating elements are installed directly in the gear unit casing, below the level of the oil. The gear unit must therefore be completely drained before the elements can be removed.

The standard power supply voltage is 220 V AC.

Consumption varies according to size/configuration.

For more detailed information and to ensure correct product selection, contact the Manufacturer's Technical Service.

The electrical circuit connected to the thermostat must be configured so that:

- the heating element/s is/are switched on to heat the oil at temperatures below the minimum threshold
- the heating element/s is/are switched off when the oil temperature reaches the upper threshold

Contact the Manufacturer's Technical Service to determine the ideal temperature thresholds. These may coincide with other thresholds and in any case need to be determined on the basis of the application and the type of lubricant used.



All electrical connections are to be made by the customer prior to the startup of the gear unit.

The heater must remain disconnected during periods in which the gear unit is not in use: the heater must be switched on before the gear unit is started, only when it is completely immersed in the oil, and only for the time required for the oil to reach its minimum specified temperature.

The use of the heater for longer periods than specified can result in carbonisation of the oil molecules, impairing lubrication performance and producing residues that are harmful to the gear unit and its components.



Unless stated otherwise, the requirements and specifications given above are valid even if non-standard control devices have been supplied with the gear unit instead of the standard ones described in this manual.

If the normal heater/s is/are insufficient to heat the oil to the minimum temperature required for startup or operation, or if shorter warm-up times are required, consult the Manufacturer's Technical Service.

In the presence of forced lubrication, if the circuit components, such as the connecting pipelines and pump, etc., are exposed to freezing temperatures, they too must be equipped with a heating system to ensure correct oil circulation following startup.

5.4.2 LUBRICATION SYSTEM

The gear unit's internal parts are usually lubricated with a mixed oil bath and oil splash system. In some configurations certain bearings may be grease lubricated and equipped with Nilos seal rings. A forced lubrication system can be supplied on request.

5.4.2.1 Splash lubrication

In gear units with oil splash lubrication the rotation of the gears splashes the lubricant and distributes it to the gear teeth and bearings even in positions above the oil level.

To guarantee effective lubrication the oil must be sufficiently fluid, i.e. its viscosity must allow it to flow freely, while simultaneously maintaining suitable characteristics to support high gear meshing loads. In particular, special care must be taken in the following conditions and suitable cooling/heating systems provided as required:

- applications involving oil temperatures in excess of 95°C.
- starting in situations in which the minimum ambient temperature is less than 10°C higher than the oil's drop point
- gear unit operation in ambient temperatures below 0°C or above 50°C.

5.4.2.2 Forced lubrication

The gear unit is equipped with a volumetric pump when forced lubrication of gears and/or bearings is required.

The oil pump can be driven mechanically off one of the shafts of the gear unit or connected to a motor fixed to the gear unit casing.



If forced lubrication is installed, pay special attention to the maximum permissible viscosity (1500 cSt), especially at the time of plant startup. Depending on the lubricant used, kinematic viscosity is generally between 220 and 460 cSt, and maximum permissible viscosity occurs at ambient temperatures between approximately 5°C and 25°C.

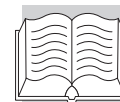
For precise temperature values, refer to the relevant sales catalogue and/or product data sheet of the lubricant manufacturer.

If this value is not reached under normal conditions, the oil must be preheated.

The plant can be equipped with suitable devices to ensure correct operation and to monitor the main functional parameters. For further information, refer to the "SENSORS" section in this manual.

5.4.2.3 Forced lubrication with pump (optional variants OP, OP1, OP2, OP...)

This system comprises a reversible pump keyed directly to a gear unit shaft, a coarse mesh filter, a minimum pressure switch and any necessary connecting pipelines.



To ensure an optimum supply of lubricant, a constant rotation speed must be maintained at a value that is as close as possible to the rotation speed for which the pump is designed (see sales catalogue).



All electrical connections are to be made by the customer prior to the startup of the gear unit.



The electrical contacts of the minimum pressure switch supply an alarm signal when pressure in the lubrication system falls below the minimum permissible value (0.5 bar) (see the “SENSORS” section in this manual).

If an alarm occurs, stop the gear unit as soon as possible and locate the cause of the problem.

5.4.2.4 Forced lubrication with electric pump (optional variant MOP)

This system comprises an electric pump with a separate power supply, a coarse mesh filter, a minimum pressure switch and any necessary connecting pipelines.

To ensure a good lubricant flow rate, make sure that the power supply to the pump motor conforms to the requirements on the motor name plate and to the requirements given in the following tables, unless specified otherwise.

(tab 5)

HDO... V5... MOP... (without DW)					
Mains frequency		50 Hz		60 Hz	
		230Δ/400Y		265Δ/460Y	
Size	Description	Pn [kW]	In [400V] [A]	Pn [kW]	In [460 V] [A]
HDO 100 HDO 110 HDO 120	BN 71A 6 IP55 CLF B34 CUS	0.18	0.67	0.21	0.60
HDO 130 HDO 140	BN 71A 4 IP55 CLF B34 CUS	0.25	0.78	0.30	0.78
HDO 150 HDO 160	BN 71B 6 IP55 CLF B34 CUS	0.25	0.82	0.30	0.79

For HDO 100 ... HDO 160 gear units with Drywell device (optional variant DW), contact the Manufacturer's Technical Service.



All electrical connections are to be made by the customer prior to the startup of the gear unit.



The electrical contacts of the minimum pressure switch supply an alarm signal when pressure in the lubrication system falls below the minimum permissible value (0.5 bar) (see the “SENSORS” section in this manual).

If an alarm occurs, stop the gear unit as soon as possible and locate the cause of the problem.

The lubrication system must be started up before the gear unit is started.
Do not start up the gear unit until the electric pump has been functioning for a few minutes.

The electric pump must always run along with the gear unit and must only be switched off after the gear unit has effectively stopped.



Check that the actual mains power, mounting and service conditions correspond to those declared on the name plates of the components and/or specified in this manual.



Electric motors must rotate in the direction shown on the components.

Make sure that all electrical power cables are big enough to carry the current draw and suitable for the installation conditions. Inadequate cables can cause overheating and/or voltage drops.

Information about the pump's electric motor must be obtained directly from the electric motor's own sales catalogue or installation, operation and maintenance manual. For all other devices, see the "SENSORS" section in this manual.

5.4.3 BACKSTOP DEVICE (optional variant A CW, A CCW)

The backstop device ensures that the gear unit only turns in one direction and prevents reverse movement caused by the load applied to the output shaft. The device consists of a free wheel with centrifugal shoes.



In certain cases the torque transmittable by the backstop device can be limiting with respect to the torque transmitted by the gear unit. Consult the sales catalogue for detailed information on this subject.

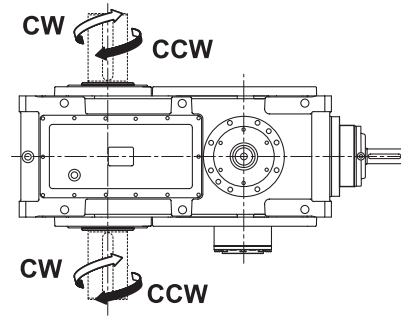
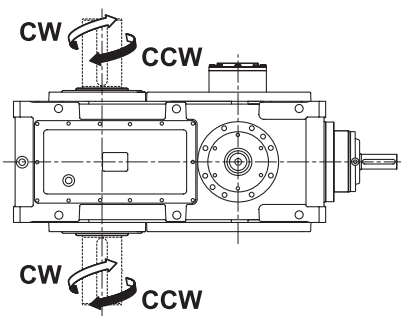
Before commissioning the unit ensure that the output shaft can be freely turned in the required direction of travel without having to apply excessive force.



To avoid damaging the backstop device or the gear train it is essential to prevent the motor from rotating in the wrong direction.



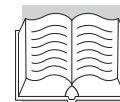
Under continuous operating conditions, it is advisable to maintain a neutral rotation speed n_{1min} greater than that specified in the catalogue in order to ensure the effective centrifugal release of all the shoes and avoid unnecessary wear.
For further details, contact the Manufacturer's Technical Service.



The device keyed on to an intermediate shaft shares the same lubrication as the gear unit but is easily accessible for inspection and maintenance purposes.



The direction of the backstop device can be reversed by turning the device's outer cage around. Contact the Manufacturer's Technical Service for information on how to proceed if you wish to change the direction of the backstop device.



5.4.4 GEAR UNIT WITH FIXING FLANGE (optional variant F...L, F...R)

Thoroughly clean and degrease the flange of the gear unit and the area of the machine to which it is to be coupled. Safe torque transmission depends largely on the correct execution of this procedure. Do not use solvents or dirty rags to degrease mating surfaces.



Do not apply any type of grease, as this would significantly lower the friction coefficient in the contact area and therefore impair the functionality of the coupling.

Tighten the bolts fully down, working in a crosswise sequence and applying the maximum tightening torque shown in the table below using a torque wrench.

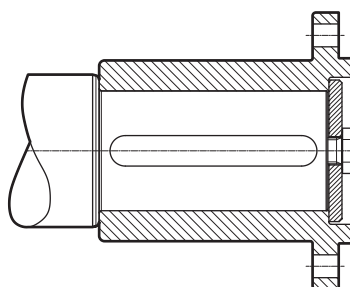
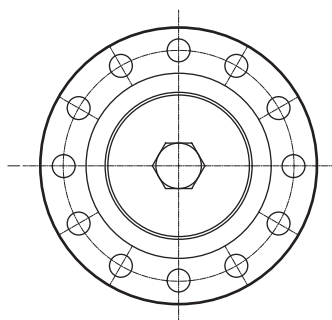
(tab 6)

	Thread	Screw UNI 5737	Nut UNI 5588	Tightening torque
HDO 100	M20	Class 10.9	Class 10	615 Nm
HDO 110	M20	Class 10.9	Class 10	615 Nm
HDO 120	M20	Class 10.9	Class 10	615 Nm
HDO 130	M24	Class 10.9	Class 10	1060 Nm
HDO 140	M24	Class 10.9	Class 10	1060 Nm
HDO 150	Contact the Manufacturer's Technical Service.			
HDO 160				



If the gear unit is installed in situations that are particularly hazardous to personal safety, install suitable safety devices, such as harnesses, safety chains and restraining systems, etc.,

5.4.5 GEAR UNIT WITH SLEEVE FLANGE (optional variant FM)



Thoroughly clean and degrease the flange of the gear unit and the area of the machine to which it is to be coupled. Safe torque transmission depends largely on the correct execution of this procedure. Do not use solvents or dirty rags to degrease mating surfaces.



Do not apply any type of grease, as this would significantly lower the friction coefficient in the contact area and therefore impair the functionality of the coupling.

Tighten the bolts fully down, working in a crosswise sequence and applying the maximum tightening torque shown in the table below using a torque wrench.



(tab 7)

	Thread	Screw UNI 5737	Nut UNI 5588	Tightening torque
HDO 100	M24	Class 10.9	Class 10	1060 Nm
HDO 110	M24	Class 10.9	Class 10	1060 Nm
HDO 120	M24	Class 10.9	Class 10	1060 Nm
HDO 130	M30	Class 10.9	Class 10	2130 Nm
HDO 140	M30	Class 10.9	Class 10	2130 Nm
HDO 150	Contact the Manufacturer's Technical Service.			
HDO 160				



If the gear unit is installed in situations that are particularly hazardous to personal safety, install suitable safety devices, such as harnesses, safety chains and restraining systems, etc.,

5.4.6 SEALS AND GASKETS (optional variants VS, DS, DVS, TK)

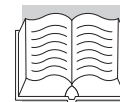
The gear units can be supplied with alternative seal systems on request:

Contact seals:

- single or double (DS) nitrile rubber compound seal rings
- single (VS) or double (DS) Viton® compound seal rings
- Taconite (TK) seals are recommended for environments characterised by the presence of abrasive dust or powders. Taconite seals incorporate a combination of sealing rings, labyrinths and grease chambers. At the intervals specified in the "ROUTINE MAINTENANCE" section in this manual, inject about 30 grams of grease for rolling contact bearings through the grease nipples.



All work must be performed exclusively with the gear unit at a standstill. The motor must be protected against accidental startup (e.g. by padlocking the main power switch or removing the power fuses). For this purpose, also affix a notice to the motor indicating that work is in progress on the gear unit.



5.4.7 SENSORS

5.4.7.1 Bimetal thermostat (optional variant TG)

Non-adjustable thermostats are preset to a fixed switching temperature. The actual temperature depends on the thermostat's function and the accessory with which it is used, as shown below:

- $90^{\circ}\text{C} \pm 5^{\circ}\text{C}$ – **optional variant TG**, in this case the thermostat trips when the lubricant reaches its maximum permissible temperature. If an alarm occurs, stop the gear unit as soon as possible and locate the cause of the problem.
- $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ – **setting of optional variant HE**, see the "Oil heater" section in this manual for further details.
- $60^{\circ}\text{C} \pm 5^{\circ}\text{C}$ e $90^{\circ}\text{C} \pm 5^{\circ}\text{C}$ – **settings of optional variant MCRW...**, see the "Autonomous control units" section in this manual for further details.
- $90^{\circ}\text{C} \pm 5^{\circ}\text{C}$ – **setting of optional variant MCRA...**, see the "Autonomous control units" section in this manual for further details.

Depending on configuration, thermostats may be installed on board the gear unit or supplied separately. If supplied separately, remove the blind plug fitted for transport purposes and fit the thermostat in its place.



Electrical connections and/or cabling to user points are the responsibility of the Customer and must be completed prior to start-up.

Contact type: NC (normally closed)
Contact current rating: 5 A (resistive) / 240 V AC
5 A (resistive) / 24 V DC
Degree of protection: IP 65 (with connector fitted)
Threaded fitting: GAS 1/2" M

5.4.7.2 Oil level sensor (optional variant OLG)

A sensor for the remote monitoring of lubricant safety level can also be installed on request. If the sensor is supplied separately, remove the clearly identified blind plug fitted for transport purposes and fit the sensor in its place.

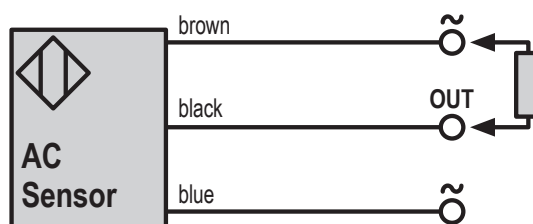


The device functions when the gear unit is idle. When the gear unit is running the oil level sensor must be bypassed.



Electrical connections and/or cabling to user points are the responsibility of the Customer and must be completed prior to start-up.

Contact type: NC (normally closed) in air



Power supply: 28 V AC
Degree of protection: IP 65
Threaded fitting: GAS 1/2" M



5.4.7.3 Minimum pressure switch

The minimum pressure switch used with forced lubrication (**see optional variants OP..., MOP, MCRW..., MCRA...**, and refer to the “AUXILIARY THERMAL DEVICES” and “LUBRICATION SYSTEM” sections in this manual), provides an alarm signal if pressure in the lubrication system falls below the minimum permissible value of 0.5 bar.

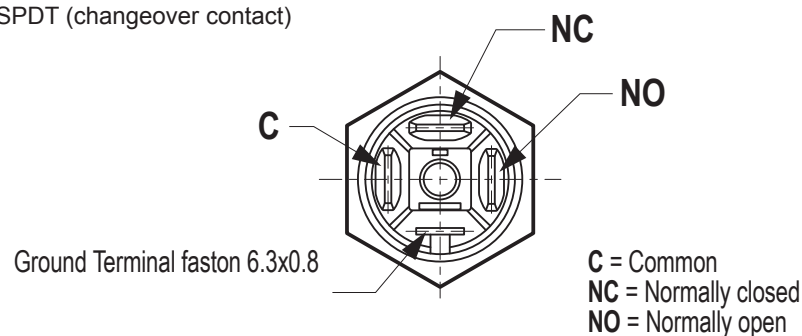
The output of the pressure switch must be bypassed for a brief period (approx. 30 seconds) immediately after start-up while the oil starts to circulate.



Do not modify the pressure switch trip setting with the adjuster screw at the top of the device.

Electrical connections and/or cabling to user points are the responsibility of the Customer and must be completed prior to start-up.

Contact type: SPDT (changeover contact)



The position of the contacts is purely indicative.

Contact current rating: 5 A (resistive) / 240 V AC

2 A (resistive) / 24 V DC

Degree of protection: IP 65 (with connector fitted)

5.4.8 DRYWELL (optional variant DW)

The drywell device prevents oil leaking from the gear unit's output shaft seals into the driven machine. It consists of a grease-filled chamber that stops oil leaks and provides the necessary lubrication for the shaft's bottom bearing.

At the intervals specified in the Operating and Maintenance table, inject about 40 grams of grease for rolling contact bearings through the grease nipples.

To ascertain the exact quantity of grease to use, contact the Manufacturer's Technical Service.



The gear unit is supplied with no grease in the output shaft's bottom bearing.



All work must be performed exclusively with the gear unit at a standstill. The motor must be protected against accidental startup (e.g. by padlocking the main power switch or removing the power fuses). For this purpose, also affix a notice to the motor indicating that work is in progress on the gear unit.



The gear unit must always be drained of oil before it is moved, to avoid oil overflowing into the grease chamber.

5.4.9 ANCHORING OF TORQUE ARM (optional variant TA)

For shaft-mounted solutions the gear unit can be equipped with a torque arm on request. Depending on circumstances, this type of device may be equipped either with an anti-vibration bushing or a cup spring damper (included in the supply). Because it is designed and sized specifically for the purpose, this type of device provides the best possible guarantee for the correct operation of the assembly.

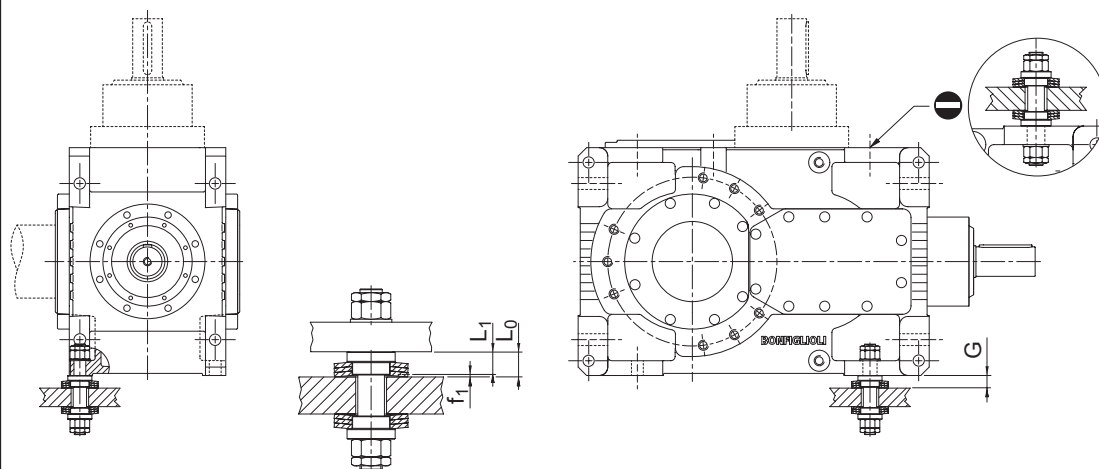


The machine shaft must be able to support the gear unit radially and axially. The torque arm must fit without stress.

The torque bolt must be fitted on the side of the gear unit next to the driven machine. Supporting surfaces should be hardened and tempered (minimum hardness 58 HRC, with case hardening to a minimum depth of 0.6 mm), smooth and ground if possible. Nitriding is an alternative treatment that guarantees a sufficiently resistant base material capable of resisting the compression and scoring of the surface.

If safety is at risk and/or maximum reliability is required, install suitable devices to stop the gear unit rotating or breaking free if the torque arm or machine shaft should break.

HDO 100 ... HDO 140



(tab 8)

	HDO 100	HDO 110	HDO 120	HDO 130	HDO 140
G* [mm]	33.4	33.4	33.4	42.7	42.7
f₁ [mm]	0.8 ^{+0.1} ₀	0.8 ^{+0.1} ₀	0.8 ^{+0.1} ₀	0.9 ^{+0.25} ₀	0.9 ^{+0.25} ₀

L₀ = Free height [mm]

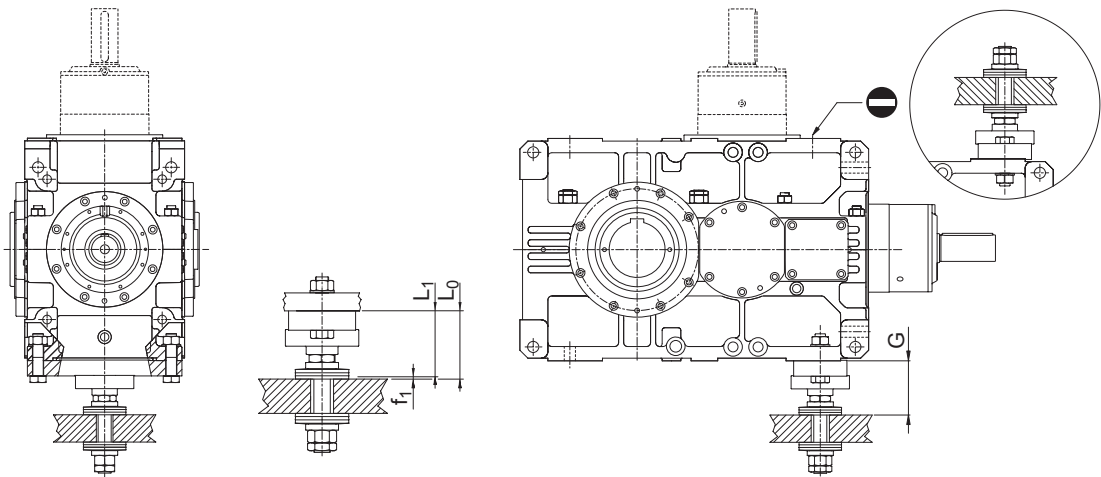
L₁ = Height under load [mm]

f₁ = Deflection L₀-L₁ [mm]

* (nominal value)



HDO 150 - HDO 160



(tab 9)

	HDO 150	HDO 160
G^* [mm]	204.3	204.3
f_1 [mm]	1.05 $\begin{matrix} +0.5 \\ 0 \end{matrix}$	1.05 $\begin{matrix} +0.5 \\ 0 \end{matrix}$

L_0 = Free height [mm]

L_1 = Height under load [mm]

f_1 = Deflection L_0-L_1 [mm]

* (nominal value)

To ensure the necessary preload, the user must adjust the torque arm before the gear unit is started up in line with gap G shown in the table.

In spring sets, friction and spring height change over time. After the initial running in period, and then at regular intervals, check for wear and the adjustment setting G.



To improve drive conditions, reduce friction and extend the working life of the cup springs, lubricate the sliding paths with grease, a paste with molybdenum disulphide additives, lubricating paints or other solid lubricants.

5.4.10 OTHER ACCESSORIES

For any special accessories installed on the gear unit in accordance with contractual specifications refer to the instructions supplied by the manufacturer of the accessories in question or to any accompanying manuals. Such components may require special maintenance and/or lubrication.

5.5 PAINTWORK

HDO gear units are externally and internally sprayed with a coat of epoxy primer, and then sprayed externally with a coat of epoxy finishing paint in RAL 7042 grey, to achieve a total external paint thickness of 130-180 μm .



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



5.6 LUBRICATION

Before operating the gear unit, check the oil level. As with filling, this operation must be done with the gear unit in the mounting position in which it will be used in the application. If necessary, fill or top up the lubricant to the half way point in the level window, to the reference notch on the dipstick, or until it starts to flow out of the plug hole.

The lubricant utilised must be new and uncontaminated and can be poured in through the filler hole or from the inspection cover opening using a filler filter with 25 µm mesh, ensuring that the relative gasket is refitted without damaging it or reapplying the sealant to provide a perfectly oil-tight fit.



The oil level must never be below the minimum mark and must be checked periodically with the gear unit at a standstill after allowing it to cool for a short period.

Do not mix oils of different makes or specifications and check that the oil is highly resistant to foaming and is EP (Extreme Pressure) rated.

If you do not have the same type of oil, completely drain the gear unit and flush it out thoroughly with the new oil to remove all traces of the old oil and any contaminants from inside the casing before filling the unit with the new oil.

To facilitate flushing, pre-heat the oil of the viscosity specified for functioning or use an oil of the same type but of lower viscosity (contact the lubricant manufacturer for further information).



Adopt protection against contact with hot parts: risk of burns!

In the case of gear units equipped with forced lubrication, the oil circuit must also be filled. In this case the unit must be run for a short period and then stopped before rechecking the oil level.












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 personal protection equipment. Do not dump them into the environment and dispose of in accordance with applicable legislation.




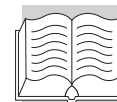
5.6.1 PolyAlkylene Glycol (PAG) synthetic oils

		HDO 100 ... HDO 160
 Shell	Omala S4 WE 220	
	Omala S4 WE 320	
	Omala S4 WE 460	
 Agip	Blasia S 220	
	Blasia S 320	
 KLÜBER LUBRICATION	Klübersynth GH 6 220	
	Klübersynth GH 6 320	
	Klübersynth UH1 6-320	F
 Mobil	Mobil Glygoyle HE 220-320-460	
 Castrol	Alphasyn PG 220	
	Alphasyn PG 320	
 TOTAL	Carter SY 220	
	Carter SY 320	
	Carter SY 460	
	Nevastane SY 460	F
 ARAL	Degol GS 220	
	Degol GS 320	
 TEXACO	Synlube CLP 220	
	Synlube CLP 320	
 FUCHS	Renoling PG 220	
	Renoling PG 320	




F = Food grade.

 Recommended use.

 Permitted use. The Manufacturer cannot guarantee the quality or suitability of lubricants. Characteristics must be verified directly with the manufacturer of the chosen lubricant.



5.6.2 PolyAlphaOlefin (PAO) synthetic oils




		HDO 100 ... HDO 160
 Shell	Omala S4 GX 220	
	Omala S4 GX 320	
	Klübersynth GEM2 150-220-320-460	
Mobil	Mobilgear SHC XMP 220-320	
	Mobilgear SHC 630-632	
	Mobil SHC Cibus 320-460 (USDA H1)	F
	Degol PAS 220	

F = Food grade.

Recommended use.

Permitted use. The Manufacturer cannot guarantee the quality or suitability of lubricants. Characteristics must be verified directly with the manufacturer of the chosen lubricant.

5.6.3 Mineral oil with EP (Extreme Pressure) additives

		HDO 100 ... HDO 160
 Shell	Omala S2 G 220-320-460	
	Blasia 220-320-460	
	Klüberoil GEM1 220-320-460	
Mobil	Mobil XMP 220-320	
	Mobil 600 XP 220-320	

Permitted use. The Manufacturer cannot guarantee the quality or suitability of lubricants. Characteristics must be verified directly with the manufacturer of the chosen lubricant.



Refer to the individual sales catalogue for lubricant viscosity.




5.6.4 Compatible greases

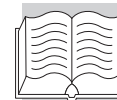
- Klüber Staburags NBU 8 EP (for bearings)
- Klüberpaste 46 MR 401 (to facilitate the coupling of cylindrical parts)
- ITP Fluorocarbon gel 880 (to grease contact seals)
- Klüber Petamo GHY 133 N (for Taconite seals)

5.6.5 Quantity of lubricant

The quantity of lubricant specified in the following tables is purely indicative. Gear units must be filled to the mid point of the sight glass, or to the reference notch on the dipstick, or until oil starts to flow out of the plug hole, according to the mounting position specified on order.

(tab 10)

	 []			
	B3	B6	B7	V5
HDO 100 2	27	42	49	51
HDO 100 3	32	52	56	58
HDO 100 4	34	70		
HDO 110 2	27	44	49	51
HDO 110 3	32	52	56	58
HDO 110 4		70		
HDO 120 2	35	59	64	68
HDO 120 3	45	72	74	79
HDO 120 4		96		
HDO 130 2	57	110	119	128
HDO 130 3	86	138	140	150
HDO 130 4		181		
HDO 140 2	76	117	126	115
HDO 140 3	89	146	147	135
HDO 140 4	88	191		
HDO 150 2	109	174	189	173
HDO 150 3	125	212	217	199
HDO 150 4		281		
HDO 160 2	118	191	204	187
HDO 160 3	135	230	234	214
HDO 160 4		303		

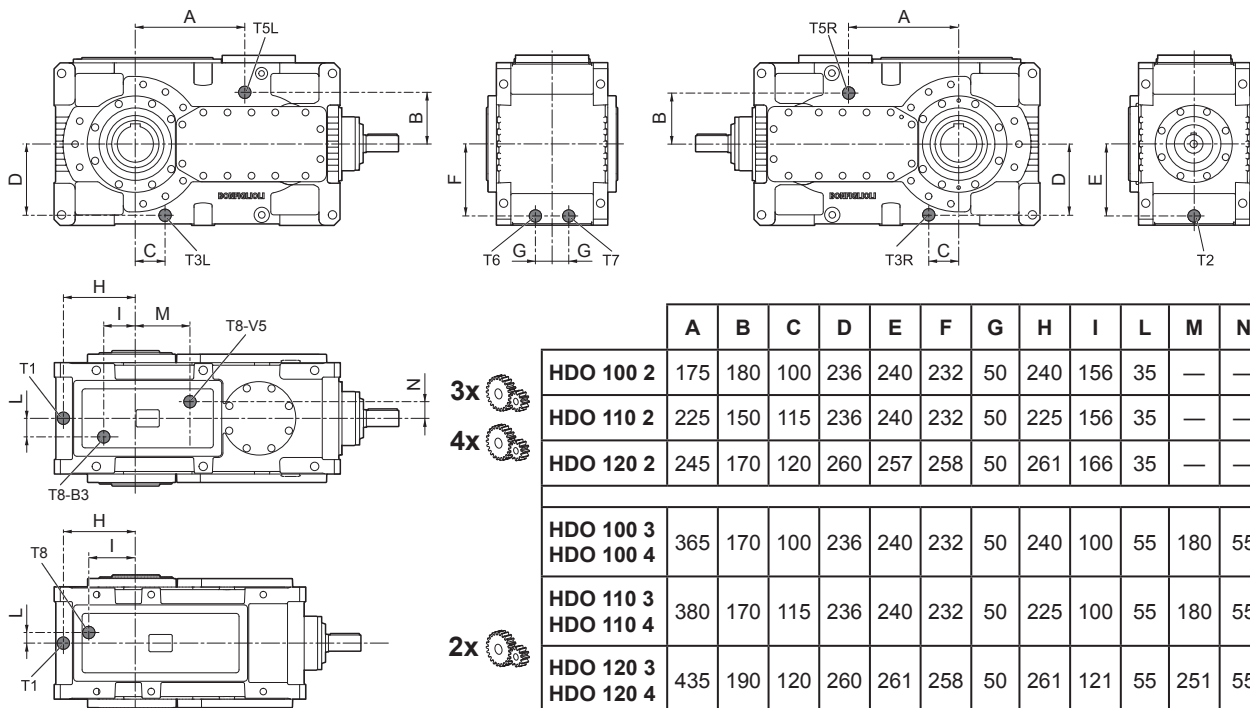


5.6.6 Service plugs



The following charts identify the position of the various service plugs.

HDO 100 ... HDO 120

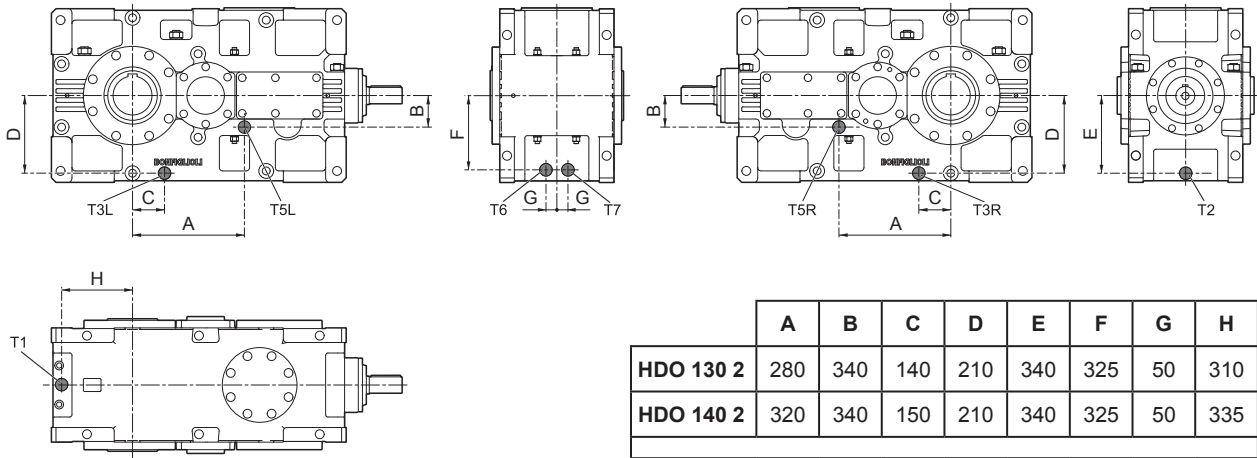


C = Filler plug with air vent	T = Blank plug
L = Level plug	● = No plug present
S = Drain plug	L* = Overflow level plug
	B3
	T1 T2 T3L T3R T5R T5L T6 T7 T8
	L S T T T T T T C
	B6
	T1 T2 T3L T3R T5R T5L T6 T7 T8
	S C T T L L T T T 2/3x
	S L/C T T T T T T T 4x
	B7
	T1 T2 T3L T3R T5R T5L T6 T7 T8
	T S L L T T C T T
	V5 (*)
	T1 T2 T3L T3R T5R T5L T6 T7 T8
	T T S-T C-T C-T S-T T T L

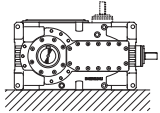
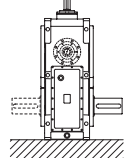

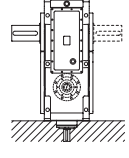
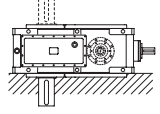
(*) Excluding DW



HDO 130 - HDO 140



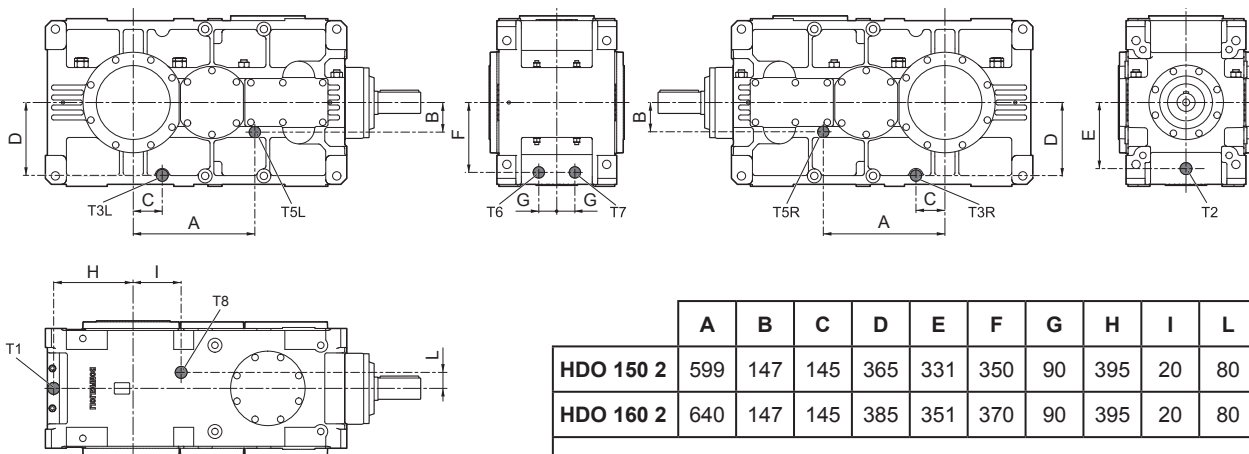
	A	B	C	D	E	F	G	H
HDO 130 2	280	340	140	210	340	325	50	310
HDO 140 2	320	340	150	210	340	325	50	335
HDO 130 3	530	138	140	340	340	325	50	310
HDO 130 4	530	138	140	340	340	325	50	310
HDO 140 3	538	138	150	340	340	325	50	335
HDO 140 4	538	138	150	340	340	325	50	335

C = Filler plug with air vent					T = Blank plug					
L = Level plug					● = No plug present					
S = Drain plug					L* = Overflow level plug					
	B3									
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8	
	L/C	S	T	T	T	T	T	T	●	
	B6									
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8	
	S	C	T	T	L	L	T	T	●	
	S	L/C	T	T	T	T	T	T	●	4x 
	B7									
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8	
	T	S	L	L	T	T	C	T	●	
	V5 (*)									
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8	
	T	T	S-T	L/C-T	L/C-T	S-T	T	T	●	

(*) Excluding DW



HDO 150 - HDO 160



	A	B	C	D	E	F	G	H	I	L
HDO 150 2	599	147	145	365	331	350	90	395	20	80
HDO 160 2	640	147	145	385	351	370	90	395	20	80
HDO 150 3	609	147	145	365	331	350	90	395	240	80
HDO 150 4	609	147	145	365	331	350	90	395	240	80
HDO 160 3	650	147	145	385	351	370	90	395	240	80
HDO 160 4	650	147	145	385	351	370	90	395	240	80

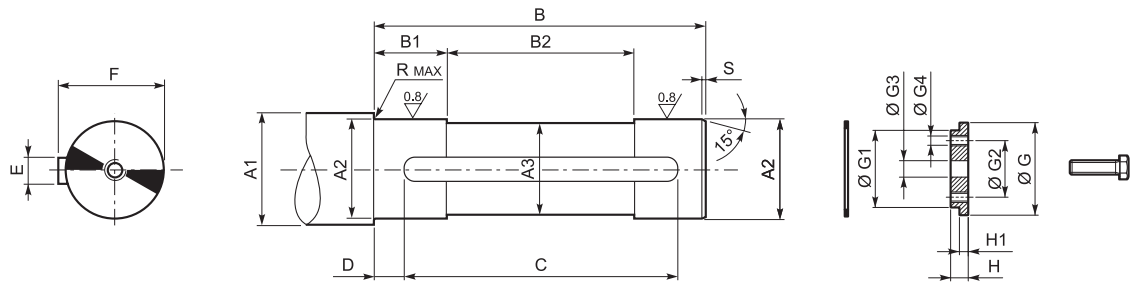
C = Filler plug with air vent	T = Blank plug								
L = Level plug	● = No plug present								
S = Drain plug	L* = Overflow level plug								
	B3								
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8
	L	T	S	S	T	T	T	T	C
	B6								
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8
	S	L/C	T	T	T	T	T	T	T
	B7								
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8
	T	S	L	L	T	T	C	T	T
	V5 (*)								
	T1	T2	T3L	T3R	T5R	T5L	T6	T7	T8
	T	T	S	C	T	T	T	T	L


(*) Excluding DW












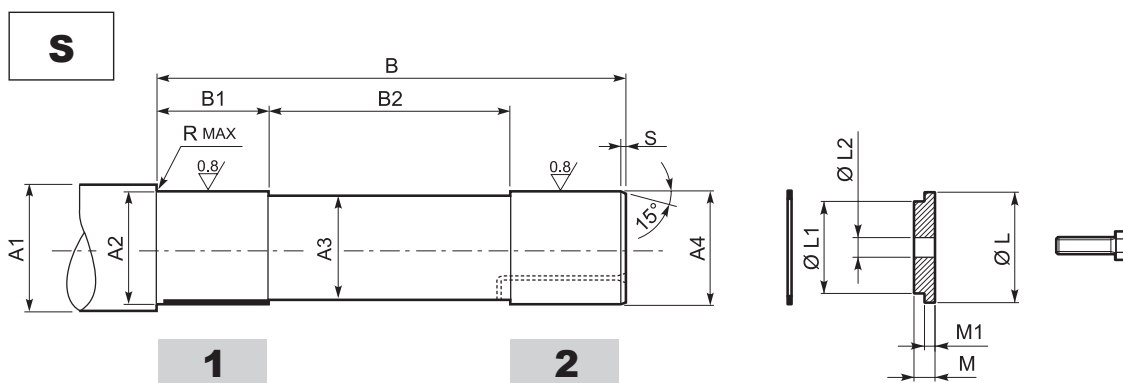
5.7 PREPARING CUSTOMER SHAFTS

Make the driven shaft to be coupled to the gear unit's output shaft from a good quality steel, respecting the dimensions given in the table. A device such as that illustrated below should also be installed to secure the shaft axially. Take care to verify and dimension the various components to suit the needs of the application.





	A1	A2	A3	B	B1	B2	C	D	E	F	R	S	 UNI 6604
HDO 100	≥ 133	120 h6	119.5	420	100	250	360	30	32 h9	127	3	2.5	32x18x360A
HDO 110	≥ 143	130 h6	129.5	420	100	250	360	30	32 h9	137	3	2.5	32x18x360A
HDO 120	≥ 153	140 h6	139.5	444	110	260	400	40	36 h9	148	3	2.5	36x20x400A
HDO 130	≥ 183	170 h6	169.5	540	135	310	400	80	40 h9	179	3	2.5	40x22x400A
HDO 140	≥ 193	180 h6	179.5	540	135	310	400	80	45 h9	190	3	2.5	45x25x400A
HDO 150	≥ 223	210 h6	209.5	667	155	400	500	100	50 h9	221	3	3	50x28x450B
HDO 160	≥ 223	210 h6	209.5	667	155	400	500	100	50 h9	221	3	3	50x28x450B

Not included in the supply									
	 UNI 7437	 G	 G1	 G2	 G3	 G4	 H	 H1	 UNI 5739
HDO 100	120x4	120 d9	96	64	26	M16	24	12	M24x70
HDO 110	130x4	130 d9	105	69	26	M20	24	12	M24x70
HDO 120	140x4	140 d9	115	79	26	M20	30	15	M24x80
HDO 130	170x4	170 d9	142	102	33	M24	34	17	M30x90
HDO 140	180x4	180 d9	150	110	33	M24	34	17	M30x90
HDO 150	210x5	210 d9	178	140	33	M24	36	18	M30x100
HDO 160	210x5	210 d9	178	140	33	M24	36	18	M30x100



	A1	A2	A3	A4	B	B1	B2	R	S
HDO 100	≥ 138	125 h6	119.5	120 g6	517	104	328	3	2.5
HDO 110	≥ 148	135 h6	129.5	130 g6	523	104	334	3	2.5
HDO 120	≥ 158	145 h6	139.5	140 g6	550	104	354	3	2.5
HDO 130	≥ 188	175 h6	169.5	170 g6	681	104	462	3	2.5
HDO 140	≥ 198	185 h6	179.5	180 g6	689	104	470	3	2.5
HDO 150	≥ 228	215 h6	209.5	210 g6	839	104	593	3	3
HDO 160	≥ 228	215 h6	209.5	210 g6	839	104	593	3	3

Not included in the supply							
	 UNI 7437	L	L1	L2	M	M1	 UNI 5739
HDO 100	120x4	120 d9	96	26	16	12	M24x65
HDO 110	130x4	130 d9	105	26	16	12	M24x65
HDO 120	140x4	140 d9	115	26	19	15	M24x70
HDO 130	170x4	170 d9	142	33	21	17	M30x80
HDO 140	180x4	180 d9	150	33	21	17	M30x80
HDO 150	210x5	210 d9	178	33	29	18	M30x90
HDO 160	210x5	210 d9	178	33	29	18	M30x90

To facilitate disassembly, provide a machine shaft with a hole through which an anti-corrosion fluid can be injected (2) or a machine shaft with provision for fitting a self-lubricating bush at the cylindrical guide section opposite the shrink disc (1).

In the presence of external thrust loads, vibration, safety problems, requirements for enhanced reliability, or unfavourable mounting positions (e.g. V5 mounting positions, output shaft directed downwards), install suitable devices to secure the shaft in an axial direction and prevent accidental decoupling.



5.8 STARTING UP THE GEAR UNIT

The gear unit has been factory tested by the Manufacturer.

Before starting the unit, make sure:

- that the machine or part of the machine in which the the gear unit/gearmotor is to be installed has been declared to conform to the requirements of the Machinery Directive 2006/42/EC and to any other relevant and applicable safety standards
- that the gear unit's mounting position in the installation corresponds to that prescribed and indicated on the name plate
- that the electrical power supply is suitable and operational as prescribed in EN 60204-1, and is grounded as per EN 60079
- that the rating of the power supply to the motor and any installed electrical devices corresponds to that prescribed and is within +/- 10% of the rated value
- that the oil level in the gear unit/gearmotor and any lubricated installed accessories is as required and that there are no leaks from any plugs, seals or pipes
- that any connections to parts and/or accessories disconnected for transport purposes have been reconnected
- that any of the Manufacturer's guards that might have been removed have been refitted
- that there are no unusual noises and/or vibrations when the gear unit/gearmotor is started up
- After the first 100 hours of operation, check the tightening torque of all screw couplings:
 - shrink discs
 - motor flanges
 - machine flanges
 - supports



In the presence of optional accessories it is also necessary to check that all the operations required for their correct functioning have been carried out as described in the relative sections and/or manuals.

When the gear unit is started for the first time, allow it to run at slow speed and at zero load for some time. If no irregular operation is noted during this period, the load and speed can be gradually increased to the rated operating conditions over a reasonable period of time during which the gear unit must be monitored closely.

5.8.1 Starting up autonomous control units (MCRW... , MCRA...)

If the gear unit is equipped with an autonomous control unit, also follow the instructions given below during start-up.



Unless stated otherwise, the requirements and specifications given below are valid even if non-standard control devices have been supplied with the gear unit instead of the standard ones described in this manual.

Perform regular checks during functioning to identify any malfunctions or problems as early as possible.



Under operating conditions, take care to avoid all contact, including accidental contact, with the surfaces of the heat exchanger, which can reach high temperatures.

Case 1) Functionality: cooling with oil/water heat exchanger (MCRW...)

- once the gear unit has started and the oil has reached a temperature of 60°C, the control thermostat must give the signal to start the electric pump and open the water supply solenoid valve
- when oil temperature reaches 90°C, the maximum temperature thermostat must activate an alarm and stop the gear unit as soon as possible



Cooling with oil/air heat exchanger (MCRA...)

- once the gear unit has started, start the control unit in compliance with the requirements of the "OPERATING LIMITS AND CONDITIONS" section in this manual
- to avoid the fan running continuously even when not needed, its motor can be controlled to run over a range of temperatures by a thermostat in the heat exchanger. Unless instructed otherwise, set the said thermostat to switch on the electric fan at a temperature of 60°C whenever possible.
- when oil temperature reaches 90°C, the maximum temperature thermostat must activate an alarm and stop the gear unit as soon as possible

Case 2) Functionality: cooling and forced lubrication of internal components

- start the control unit in compliance with the requirements of the "OPERATING LIMITS AND CONDITIONS" section in this manual
- do not start up the gear unit until the control unit has been functioning for a few minutes



The control unit's electric pump must always run along with the gear unit and must only be switched off after the gear unit has effectively stopped.

Autonomous control units with oil/water heat exchanger (MCRW...)

- once the oil has reached a temperature of 60°C, the control thermostat must give the signal to open the water supply solenoid valve
- when oil temperature reaches 90°C, the maximum temperature thermostat must activate an alarm and stop the gear unit as soon as possible
- when pressure falls below 0.5 bar, the minimum pressure switch must activate an alarm and stop the gear unit as soon as possible

Autonomous control units with oil/air heat exchanger (MCRA...)

- to avoid the fan running continuously even when not needed, its motor can be controlled to run over a range of temperatures by a thermostat in the heat exchanger. Unless instructed otherwise, set the said thermostat to switch on the electric fan at a temperature of 60°C whenever possible.
- when oil temperature reaches 90°C, the maximum temperature thermostat must activate an alarm and stop the gear unit as soon as possible
- when pressure falls below 0.5 bar, the minimum pressure switch must activate an alarm and stop the gear unit as soon as possible



6 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. In order to maintain the proper functioning and safety of the gear unit/gearmotor, we recommend that users have non-routine maintenance performed by the Manufacturer or an authorised, specialist service centre. Contact the manufacturer's sales network. Failure to comply with this requirement during the warranty period automatically invalidates the warranty.



Never improvise repairs.

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 commencing any maintenance work, power to the machine in which gear units are installed must be disconnected and the switches secured in OFF position. All persons performing maintenance must secure the disconnecting switches for themselves, using personal devices (e.g. padlocks) the keys of which they must keep with them for the duration of the work.
- If the temperature of accessible surfaces exceeds the limits established by EN ISO 13732-1 (65 °C for occasional brief contact with exposed metal), wait for the said surfaces to cool before commencing work. If necessary, wear anti-burn safety gloves when working on gear units.
- 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 hazards.
- Use the lubricants (oil and grease) recommended by the Manufacturer.
- When working on the gear unit always replace gaskets and seals with original spare parts.
- We recommend replacing the lubricating oil after all maintenance work.
- If, during work, there is any risk of coming into contact with oils and greases, respect the safety precautions provided on the manufacturer's data sheets and use any items of personal protective equipment specified therein.

If the gear unit is not used for a prolonged period following installation or run-in, it must be run at least once a month. If this is not possible, the gear unit must be protected against corrosion with a suitable rust inhibitor, or completely filled with new oil of the type normally utilised for operating duty. (See the "STORAGE" section in this manual.)

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 which modify 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 disperse contaminant liquids, worn parts and maintenance residues in the environment. Dispose of all such substances in strict compliance with applicable statutory legislation.



6.1 CHECKING OPERATIONAL EFFICIENCY

- Periodically remove any dust from the gear unit and motor casings.
- Check that the noise generated 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 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, casings and pipes.
- Check that temperature does not rise over normal operating levels unless this is not justified by a corresponding increase in the applied load, the rotation speed, ambient temperature or any other factor. If it does, the gear unit must be stopped immediately and the cause of the fault identified.
- Check all bolted couplings for wear, deformation and corrosion and tighten them correctly, without exceeding the values specified in the "INSTALLING THE GEAR UNIT" section in this manual.

6.2 ROUTINE MAINTENANCE



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

Good maintenance ensures the unit's maximum performance, extended service life and continued compliance with safety regulations.

List of routine checks

We recommend keeping a checklist of inspections so that any changes in individual control parameters can be identified rapidly and easily.



The times indicated in the following tables vary significantly in relation to the conditions of use of the gear unit and must be construed as valid in the absence of other types of problems.

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

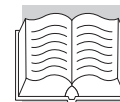
(tab 11)

Oil temperature t [°C]	Lubrication interval [h]	
	Synthetic oil	Mineral oil
$t < 65$	25000	8000
$65 \leq t < 80$	15000	4000
$80 \leq t \leq 95$	12500	2000



(tab 12)

Frequency	Inspection parameter
300 h	first oil change after commissioning
see table	subsequent oil changes
24 h	oil temperature
24 h	bearing temperature
24 h	oil pressure
24 h	noise, vibration
170 h ... 720 h	gear unit external conditions (fouling, oil deposits)
720 h	oil leaks, external seals and gaskets
720 h	oil level
720 h	oil filter contamination indicator
2200 h	vent filter
2000 h ... 4000 h	check tightness of the fixing bolts, connecting flanges and drive transmission components
2000 h ... 4000 h	check the elastic elements in all joints for wear
2000 h ... 4000 h	regrease the Drywell device, bearings and seals (where required)
3000 h	check cup springs for wear and adjust the torque arm
3000 h	condition of torque arm polymer bushes (aging, cracking)
2000 h ... 9000 h	condition of gear unit oil (possible presence of contaminants, especially water)
9000 h ... 18000 h	internal cleanliness of the cooling coil and water/oil heat exchanger; possible presence of deposits
9000 h ... 18000 h	alignment of gear unit shafts with respect to coupled machine shafts
at every oil change	general internal functioning conditions of gear unit, lubrication devices and/or oil cooling devices, and control devices
at every oil change	condition of gear tooth flanks
at every oil change	cleanliness of fan, fan cowl, and gear unit casing



6.2.1 MAINTENANCE OF AUTONOMOUS COOLING UNITS (optional variants MCRW... , MCRA...)

If the gear unit is equipped with an autonomous control unit, also follow the instructions given below.



Before commencing any cleaning and/or maintenance:

- **activate all necessary safety devices to prevent the accidental start-up of the gear unit and control unit**
- **wait for the gear unit and all parts of the control unit to cool down**
- **drain the gear unit or lower the oil level so that no oil flows out during work to replace components**

In particular, perform the following periodical checks:

- check the blockage indicator, always when the oil is hot, and clean or replace the filter element with another of the same characteristics if the pressure gauge, depending on the type installed:
 - displays a pressure above 6 bar or 1.5 bar above the value displayed with a new filter element or,
 - is in the red area.
- the cross section of water passages (**MCRW...**), to check that they are free from sediment and/or blockages that might impair the efficiency of the auxiliary cooling system: If necessary, clean the circuit by flushing with a suitable chemical agent, checking with the manufacturer that the cleaning agent is compatible with the construction material of the heat exchanger.

The interval for checking the condition of the heat exchanger and any maintenance work depends on the characteristics of the cooling water used.

Any defects in the heat exchanger water supply circuit can be identified by observing the condition of the lubrication oil in the gear unit, which will display a high degree of foaming if it has become contaminated with water.

- the condition of the radiator (**MCRA...**), to verify that it is free from sediment and/or blockages that might impair the efficiency of the heat exchange process: if necessary, blow the fins clean with compressed air (max. pressure 6 bar), taking care to direct the air jet parallel to the fins to avoid damaging them, and protecting any electrical components. Only if absolutely necessary, spray a detergent product compatible with the material from which the heat exchanger is made before blowing clean.

The interval for checking the condition of the heat exchanger and any maintenance work depends on the characteristics of the installation environment.

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 personal protection equipment. Do not dump them into the environment and dispose of in accordance with applicable legislation.



Pay the maximum attention when using hazardous chemical detergents and take all the necessary precautions to ensure they are disposed of in compliance with the law.

Before re-starting the gear unit or the control unit, fill the gear unit and any relevant accessories with oil to the correct level.

Never run the control unit without the necessary guards in place. Always replace the guards before starting the unit.



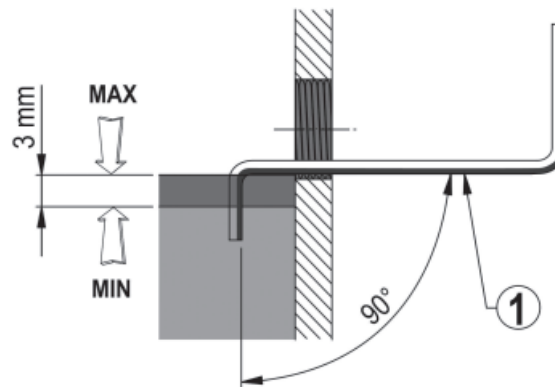
6.3 CHECKING THE OIL LEVEL

Oil level sight glass:

To check the correct level of oil refer to the mid point of the sight glass or to the marks on the dipstick. If the oil level is lower than the lower edge of the sight glass or the dipstick minimum mark, replenish the oil and locate the cause for the fall in level.

Overflow level plug:

Gear units equipped with certain options (e.g. Drywell device), may also be equipped with a yellow plug for use as an overflow level check. To check the oil level, first identify the yellow level cap on the gear unit. Remove the plug and insert a bar of the right size in the hole and of the shape shown in the figure. If the level is more than 3 mm below the spill level, top up and check the reason for the drop in oil level.



1)N.B. Make sure that the dipstick rests firmly on the edge of the threaded hole.

6.4 OIL CHANGES

1. Place a suitable container under the drain plug.
2. Remove the filler and drain plugs and allow the oil to drain out.
3. Wait for a few minutes to ensure all the oil has drained out, and then refit the drain plug after renewing the seal and cleaning the drain plug magnet (if fitted) carefully.
4. With the gear unit installed in its final mounting position, fill it with oil to the mid point of the sight glass, or to the reference notch on the dipstick, or until oil starts to flow out of the plug hole.
5. Tighten down the filler plug after changing its seal.



See the “LUBRICATION” section in this manual for details of the quantity of oil required. Specified quantities are only approximate. Gear units must be filled to the mid point of the sight glass, or to the reference notch on the dipstick, or until oil starts to flow out of the plug hole, according to the mounting position specified on 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 may be fatal if swallowed.

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



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

6.5 CLEANING

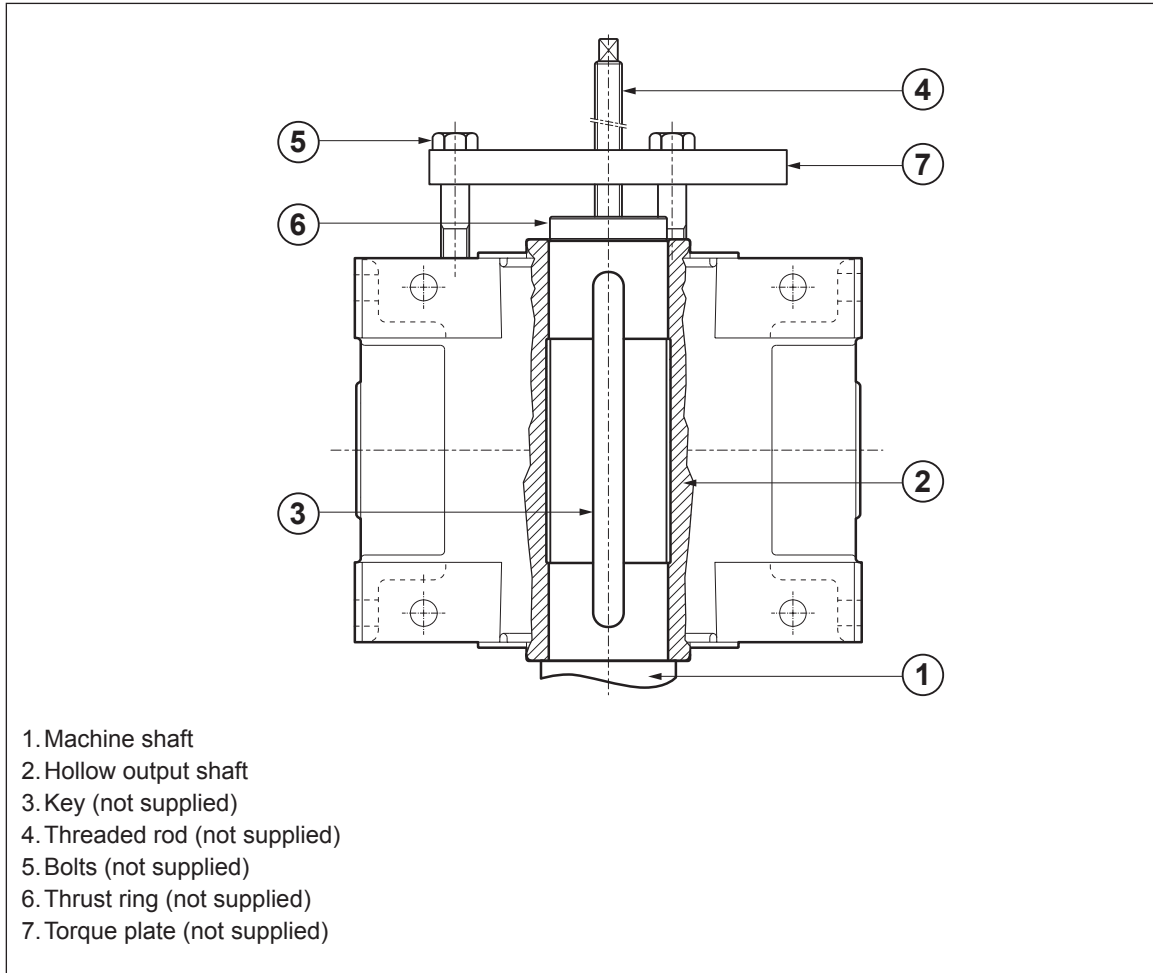
To clean dust, dirt and process residues off the gear unit, do not use solvents or other products that might be incompatible with the materials from which it is made, and do not direct high pressure jets of water on to the gear unit.



7 REMOVAL

7.1 DISASSEMBLING A GEAR UNIT EQUIPPED WITH HOLLOW OUTPUT SHAFT WITH KEYWAY

- Remove the device that secures the gear unit axially.
- The machine's shaft can be extracted directly in-situ using a hydraulic device, or by using the device shown in the figure below:



During the extraction process observe the maximum thrust values specified in the table below and take care to avoid knocks or misalignment.

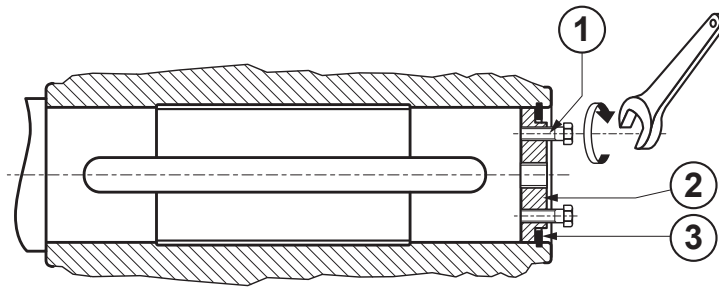
(tab 13)



	HDO 100	HDO 110	HDO 120	HDO 130	HDO 140	HDO 150	HDO 160
Maximum thrust force [N]	59000	59000	76000	122000	122000	122000	122000



Alternatively proceed as shown in the figure below by turning the bolts one at a time:



1. Bolts (not supplied)
2. Thrust ring (not supplied)
3. Circlip (not supplied)

7.2 DISASSEMBLING A GEAR UNIT EQUIPPED WITH HOLLOW OUTPUT SHAFT AND SHRINK DISC COUPLING

- Unscrew the fixing bolts gradually one at a time and then remove the shrink disc coupling.
- Extract the machine shaft as instructed in the section “DISASSEMBLING A GEAR UNIT WITH HOLLOW OUTPUT SHAFT WITH KEYWAY”.



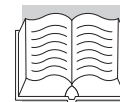
8 TROUBLESHOOTING

The following information is intended to serve as an aid in locating and eliminating defects and faults. In some cases, such 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.

If any components fail or require replacement as a result of levels of wear likely to compromise the functioning of the gear unit, contact the Manufacturer's sales network.

8.1 Gear units:

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 table).
	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.



8.2 Autonomous control units (MCRW... , MCRA...):

FAULT	CAUSE	REMEDY
Operating temperature too high.	No or insufficient oil circulation.	Check the speed and direction of rotation of the electric pump. Check that the filter is clean. Check that the control thermostat is functioning correctly. Check that the pressure switch is functioning correctly.
	Water/oil heat exchanger not working correctly (MCRW...).	Check the water supply circuit. Check that the solenoid valve is functioning correctly. Check that the heat exchanger is clean. Check that the control thermostat is functioning correctly.
	Air/oil heat exchanger not working correctly (MCRA...).	Check the speed and direction of rotation of the electric fan. Check that the heat exchanger is clean. Check that the control thermostat is functioning correctly.
Bearing temperature too high.	No or insufficient oil circulation.	Contact authorised workshop.
Unusual noise during functioning (in general) caused by no or insufficient pressure in the circuit.	No or insufficient oil circulation.	Check oil level. Check the used lubricant. Check that all components are correctly secured and sealed. Check that the electric pump is functioning correctly. Check that the filter is clean.
	Electric pump damaged or worn. Bypass circuit valve damaged or worn. Pressure switch damaged or incorrectly calibrated.	Contact authorised workshop.
	Suction pipe blocked.	Check that the pipe is clean.
	Operating temperature too high.	See relevant section.
Unusual noise during functioning (in general) caused by excess pressure in the circuit.	Oil too viscous.	Check the used lubricant. Wait for the gear unit to reach its normal operating temperature.
	Delivery pipes or components blocked.	Check that the pipes are clean. Check that the filter is clean. Check that the heat exchanger is clean.
Abnormal running noise (air/oil heat exchanger).	Electric fan damaged or worn.	Check that the electric fan is functioning correctly. Check that the heat exchanger is clean.
Oil leaks or excessive oil consumption.	Fittings loose.	Check correct tightness.
	Damaged seals.	Check correct tightness. Contact authorised workshop.
	Filter seals damaged.	Check correct tightness. Replace the filter element.
	Leaks in heat exchanger.	Contact authorised workshop.



FAULT	CAUSE	REMEDY
Water leaks (MCRW...).	Heat exchanger damaged or fittings loose.	Check the condition of the water heat exchanger. Check the water supply circuit.
Filters frequently become clogged with metal particles.	Oil too old or high level of impurities.	Replace oil.
	Electric pump damaged or worn.	Contact authorised workshop.
	Pipes or components blocked.	Check that the pipes are clean. Check that the heat exchanger is clean.
	Unusual wear of gear unit components.	Check the condition of internal components (gears, bearings, etc.).



9 DISPOSING OF THE GEAR UNIT



Make sure that the gear unit cannot function accidentally while it is being taken out of service.

The gear unit/gearmotor must be disposed of in compliance with environmental legislation, and the various materials used in its manufacture must be delivered to an authorised disposal/recycling centre.




The gear 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 current environment protection laws.

Do not 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.



INDEX OF REVISIONS (R)

	COD. 1691 R0

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