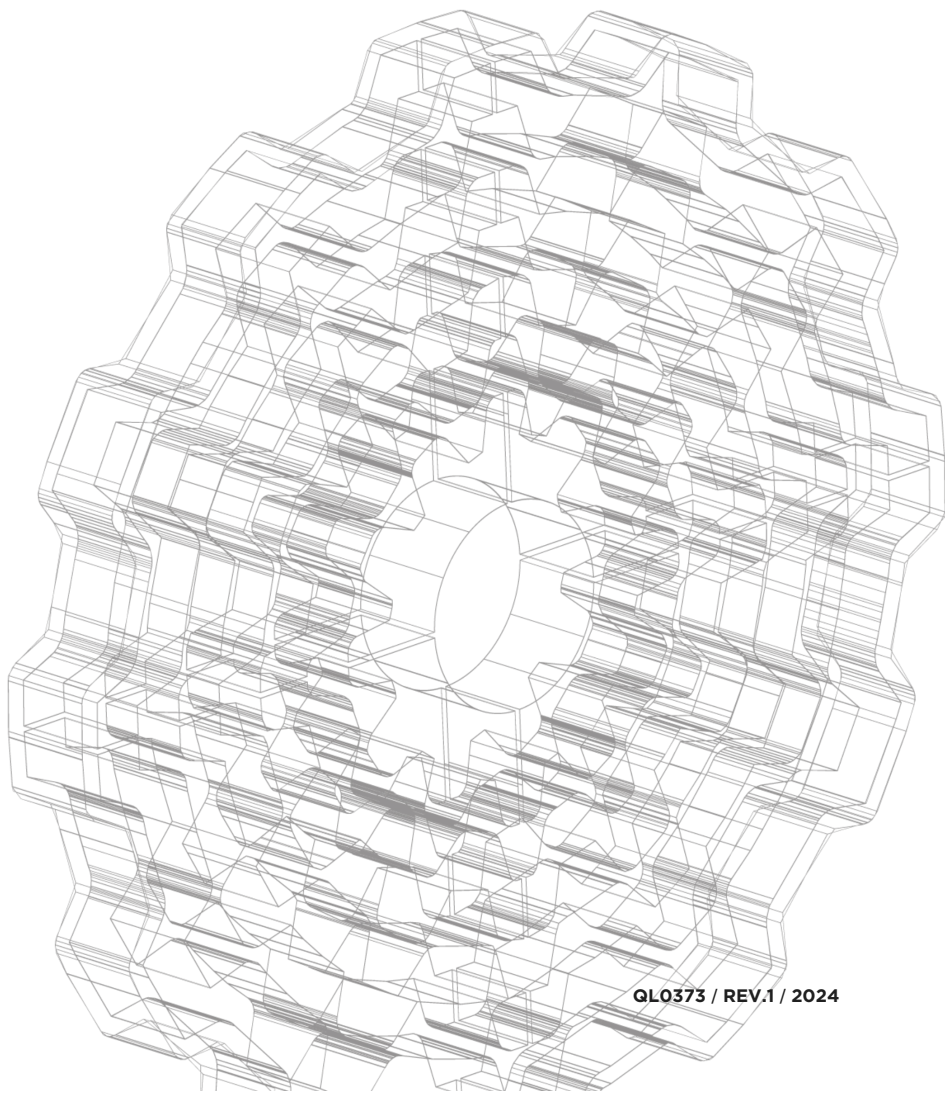


Instructions for installation, use and maintenance HPL planetary reducers



ENGLISH TRANSLATION OF THE ORIGINAL ITALIAN VERSION

IMPORTANT! The data and information given in this document substitute those given in previous editions which are thus to be considered obsolete; periodically consult the technical documentation available on Motovario web site for up-to-date performance information and specifications. For the motor section relating to motorvariators and geared motors, consult the motors manual available on Motovario web site.

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1. INTENDED USE OF THE MANUAL

INSTALLATION, USE AND MAINTENANCE INSTRUCTIONS FOR MOTOVARIO HPL PLANETARY GEARED UNITS:

STANDARD

"ORIGINAL VERSION IN ITALIAN"

IMPORTANT!

The data and updated information given in this technical catalogue substitute those given in previous editions, which are thus to be considered obsolete; periodically consult the technical documentation available on Motovario website for up-to-date performance information and specifications.

2. GENERAL INFORMATION

2.1 PURPOSE

This manual has been provided by Motovario to give information to authorized persons regarding transport, handling, installation, maintenance, repair, disassembly and scrapping of the unit.





Information regarding the electric motor can be found in the motor's "Use and maintenance instructions".

Failure to follow the instructions is a health and safety hazard and can result in economic damages.

The information must be kept carefully by the person charged with doing so and be available at all times for reference in good condition.

In case of damage or loss, the documentation can be requested directly from Motovario.

2.2 SYMBOLS

	CAUTION - DANGER Indicates a serious personal health and safety hazard.
	CAUTION - HOT PARTS Indicates a serious thermal hazard which may endanger personal health and safety.
	CAUTION - HIGH VOLTAGE Indicates a serious personal health and safety hazard due to the presence of dangerous voltage.
	IMPORTANT INFORMATION Indicates important technical information.

2.3 PRODUCT IDENTIFICATION

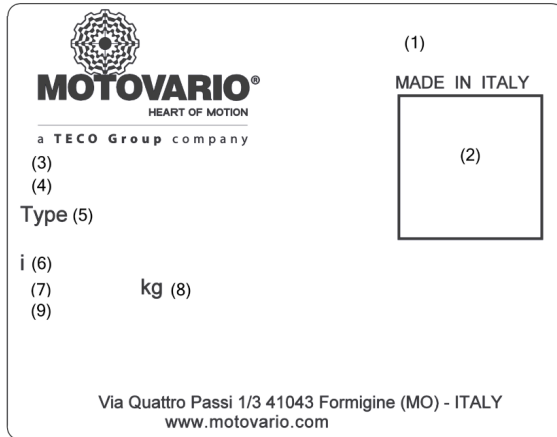
In order to identify the product, the unit bears a label of the following model. The nameplate must not be removed and must be kept intact and readable. In case you need a copy of it just contact MOTOVARIO TECHNICAL SERVICE.

Gear reducer label

Information contained on the nameplate:

1. Mounters team.
2. QR CODE (if any).
3. Serial number (Order number-Job order progressive number-Manufacturing year).
4. Material code.
5. Type: Unit abbreviation.
6. i: reduction ratio + S (present only in case of reduction ratio composition out of catalog).
7. Mounting position.
8. Gearbox weight without oil.
9. Gear reducer oil.

The nameplate must not be removed and must be kept intact and readable. In case you need a copy of it just contact the Motovario technical service.

**2.4 SERVICE**

For any service request please contact the Motovario sales network directly indicating the data on the nameplate.

3. COMPLIANCE

Gearmotors are designed in compliance with the safety requirements of the Machinery Directive 2006/42/EC and are supplied with a Declaration of Incorporation. We recommend considering the Machinery Directive 2006/42/EC on the entire system where the MOTOVARIO product is installed.

Motovario electric motors comply with the Low Voltage Directive 2014/35/EU and the Directive EMC 2014/30/EU regarding the intrinsic characteristics concerning emissions and immunity levels.

4. TECHNICAL INFORMATION

4.1 PRODUCT DESCRIPTION

The unit has been designed to be used in specific applications and, to satisfy particular requirements, it may be supplied in several mounting arrangements and configurations, including accessories and optional variants. The user is responsible for using it appropriately and in line with the warnings given in this manual and the instructions on the product identification labels.

4.1.1 Design features

MOTOVARIO HPL planetary reducers are supplied with the following surface treatment characteristics:

External worm wheel in nitrided steel

Sun and planetary gears in case-hardened steel

High-resistance spheroidal cast-iron struts

Connection rings and planet-carriers in ductile iron or structural steel, depending on the size of the gear reducer

Versions available (output modules):

- Version for flange fastening;
- Root-mounting version, integral.

High-resistance spheroidal **cast-iron output module housings:**

- The castings are supplied protected by an antirust primer, in Black-Grey RAL 7021.

Input versions available:

- PAM flange for coupling with IEC motor;
- PAM flange for coupling with IEC motor with coupling;
- Compact gear motor;
- Input shaft.

Performance:

- Loading capacity verifiable in accordance with DIN 3990, ISO 6336, AGMA 2101, ISO 10300, DIN 3991, ISO 281, DIN 743.

Dynamic η :

- The efficiency is the ratio between the output power P_2 and the power absorbed by the gear reducer P_1 : $\eta = P_2 / P_1$.

HPL-range helical gear reducers have an average value equal to:

HPL..1 stages = 0,97
 HPL..2 stages = 0,94
 HPL..3 stages = 0,91
 HPL..4 stages = 0,88

4.2 CRITICAL APPLICATIONS

HPL	n _{max} [rpm]			
	1s	2s	3s	4s
010	4000	4000	4000	4000
020	4000	4000	4000	4000
030	3800	4000	4000	4000
050	3800	4000	4000	4000
080	3000	3800	4000	4000
130	2500	3800	4000	4000
180	2000	3800	4000	4000

The performance indicated in the catalogue correspond to position B3 or similar. For other mounting contexts and/or particular input and output speeds, please refer to the tables highlighting the main critical situations for each gear reducer size. It is also necessary to take due consideration of and carefully assess the following applications by contacting MOTOVARIO TECHNICAL ASSISTANCE:

- Use in services that could be hazardous for people if the gear reducer fails
- Use as a lifting winch.
- Use in places with Ambient T° below -15°C or over 50°C.
- Use in chemically-aggressive environments.
- Use in a brackish environments.
- Use in radioactive environments.
- Use in environments with pressures other than atmospheric pressure.
- Applications with especially high inertia.
- Applications with high dynamic strain on the casing of the gear reducer.
- Applications where even partial immersion of the gear reducer is required.
- Mounting positions not envisaged in the catalogue.

Pay particular attention in the following conditions:

- Avoid use as multiplier.
- Do not use in an environment with an explosive or potentially-explosive atmosphere.

In the presence of overloads due to starting at full load, braking, shocks or other static and dynamic causes, check that the peak torque is always lower than the maximum torque M_{2max} (see the table on catalogue in the paragraph on Product Selection).

5. SAFETY INFORMATION

Carefully read the content of this manual and any instructions reported directly on the plates applied to the gear reducer. The personnel working on the gear reducer must have specific technical expertise, experience and skills, as well both the necessary work tools and PPE (in accordance with current applicable laws). Failure to comply with these requirements may affect the health and safety of people.

Only use the gear reducer for the purposes permitted by Motovario. Incorrect use poses a risk to the health and safety of people, as well economic damage. Always keep the gear reducer in good working order by carrying out the required maintenance. The gear reducer is can become very hot. Avoid touching the surface with bare hands and ensure the necessary safety protections are in place.

Ensure maintenance is carried out in safe conditions, with the help of protective clothing and/or equipment, in accordance with current laws on safety in the workplace.

Only use original Motovario spare parts for replacements. Only use oils and greases recommended by Motovario. Do not discard polluting material into the environment and ensure disposal is carried out in compliance with current applicable laws. After replacing the lubricant, clean the surface of the gear reducer, as well as the area where the work was carried out.

6. HANDLING AND STORAGE

6.1 RECEIPT

Upon receipt, immediately check that the gear reducer matches the order and has not undergone any damage during transport. Any discrepancy of the product from the specifications ordered must be reported to Motovario.

Always make sure the paintwork is intact. If it isn't, contact Motovario to have it fixed.

Do not start gear reducers that have undergone damage, including minor damage, or that are not considered suitable for their intended use: in these cases, contact Motovario.

Dispose of packaging material in accordance with current applicable standards.

6.2 HANDLING

Provide for the following to receive and unload the gear reducer:

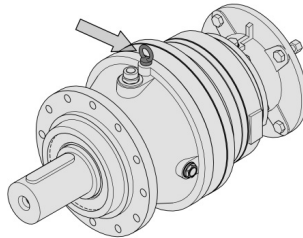
1. A suitable and well-defined area with a flat bottom
2. Handling equipment, taking into account the overall dimensions, weight and gripping points, data on the gear reducer to be handled (cranes, forklifts, eyebolts, ropes, slings, snap links, hooks, etc.) to avoid injury to people and/or damage to property. The weight to be handled can be found on the related sales catalogue.

Those authorised to handle the gear reducer must ensure all the necessary safety conditions.

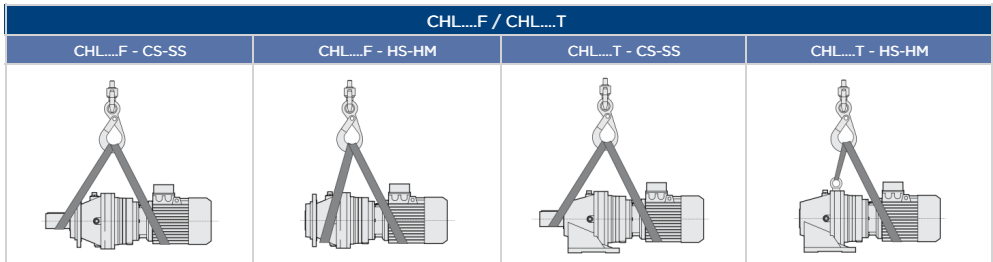
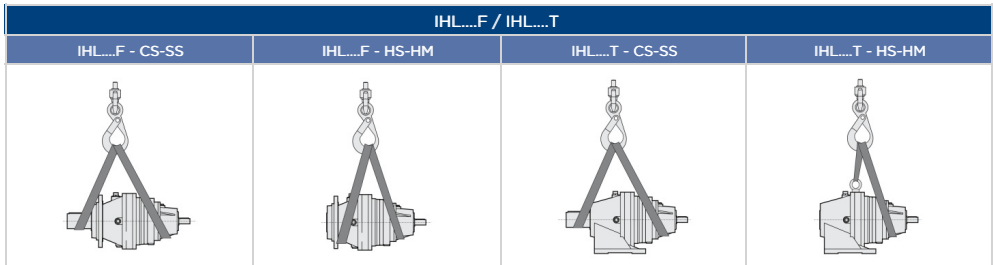
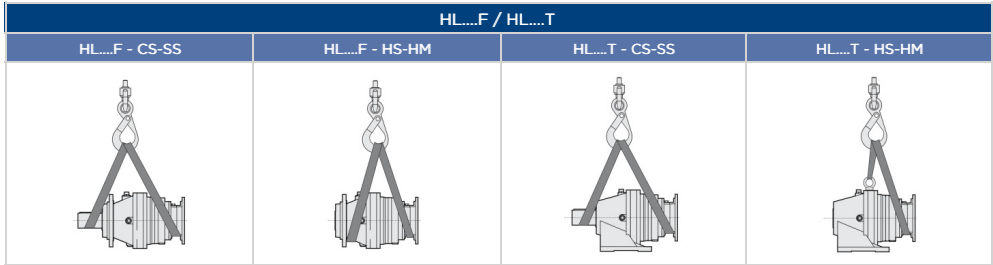
Carry out all handling operations with extreme caution. The precautions to be taken during handling are measures suitable to ensure the safety of the operator and avoid failures or damage due to accidental shocks or falls.



Identify the gripping points on the gear reducer and go ahead with handling by using straps/slings. Accessories such as flanges, pumps, driving motors can change the centre of gravity, in which case an additional anchoring point may be required. Do not exceed 15° of oscillation for the load during the lifting phases; should this happen, stop and repeat the operation.
Do not use piping, threads or protrusions of accessory or shaft ends as anchoring points and pay attention to any lubrication and cooling systems.
 Use the through holes in place on the fixing feet or flange of the gear reducer's case. These points are designed to only withstand the weight of the gear reducer. Do not add more weight during the lifting and handling phases.



NOTE: Lifting eyebolts not supplied (hole for eyebolt M8x14).



6.3 STORAGE

The units must be stored according to the following requirements:

- Be placed as per specified mounting position of the label;
- Be free from vibration and protected from accidental impacts;
- Be kept at relative humidity <60%, with no intense temperature change, no ultraviolet light and no direct sunlight, and in case of low temperatures ($T_{\text{am}} < -5^{\circ}\text{C}$) take special care to avoid shocks and vibration that could damage the structure.

In the event of prolonged storage/downtime periods (4/6 months) and/or environmental conditions other than those listed:

- Completely fill the unit with oil. The appropriate level should be restored at the time of commissioning of the unit;
- We suggest replacing any sealing ring not submerged in lubricant;
- Apply plenty of grease or suitable protective and water-repellent products on the shafts and surfaces processed in order to prevent metal oxidation or deterioration of rubber parts;
- Periodically rotate the shafts to prevent gluing of the oil seals.


7. INSTALLATION

Pay special attention to the installation conditions as these are the main cause of damage and downtime. When choosing the motor, consider the mounting position and presence, below the motor itself, of parts, things or materials which may be damaged by oil leaks, however limited in amount. Choosing the right mounting position can eliminate many problems. It is often sufficient to place a guard under the motor to ensure operation in optimal safety.

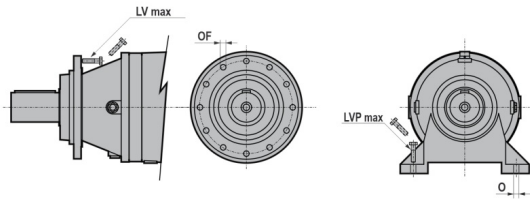


The unit can only be mounted in the mounting position indicated on the nameplate: a different mounting position must be authorized by Motovario. Changes in angle or inclination with respect to the horizontal are allowed by $\pm 5^\circ$.

Before the commissioning of the unit, carry out the following operations:

- Check the nameplate data of the gear reducer and, if needed, of the electric motor;
 - Make sure the equipment supplied corresponds to the equipment ordered;
 - Make sure that the category of the equipment is suitable for the environmental classification in which it will be installed and subsequently operated;
 - The fastening of the machine to the structure must be stable and without any vibrations. The structure must not be subject to torsional movements;
 - For the fastening use screws with a minimum resistance class of 10,9, without deforming the case due to incorrect fastening (see the table with the TIGHTENING TORQUES FOR FIXING SCREWS). In threaded joints we recommend using thread locking liquids to prevent loosening due to vibrations. Always check the correct tightening after the first hours of operation.
 - Make sure the supporting surface is flat and large enough to fit the whole gear reducer;
 - Make sure the operating position matches the mounting position reported on the nameplate;
 - Check the position of the oil level plug, which must always be clearly visible for periodic inspections even after fitting the gear reducer on the machine. Make sure the oil drain/filler plugs are accessible.
 - Make sure the gear reducer has been filled with the right amount of oil according to the required mounting position;
 - Replace the closing plug, if present, with the breather plug in the kit provided with the gear reducer;
 - Check for any lubricant leakages. If there are any, interrupt the installation, identify the leak and contact MOTOVARIO's TECHNICAL SERVICE;
 - Remove any traces of dirt or dust from the shafts and from the areas around the sealing rings;
 - Lubricate contact surfaces to prevent oxidation or seizure;
 - Check the static seals and the bolted joints;
 - Do not install the unit in an environment with fumes or abrasive and/or corrosive dust, or in environments with ionising radiation;
 - Install all the protections designed for the rotary parts to ensure the system is safe, in accordance with current regulations;
 - Check the correct direction of rotation of the output shaft of the unit;
 - In case of shaft mounting, it is recommended to use Motovario torque arms;
 - Ensure proper cooling of the motor through a good flow of air from the fan side;
 - Avoid solar radiation or irradiation from other heat sources. The cooling air temperature must never exceed 40°C or drop below -20°C;
 - Check that the assembly of the various parts (pulleys, sprockets, couplings, etc.) on shafts is performed by using the relevant threaded holes or any other system able to ensure a correct operation without damaging the bearings or the outer parts of the gear reducer, see paragraph for details SPECIFIC ASSEMBLIES;
 - Do not install the unit in direct contact with food products in bulk.
-  Ensure an equipotential bond (earthing) of the gear reducer case by using one of the free holes previously cleaned to remove oxides or paint. The electrical connection must be carried out in accordance with EN standard 60079-0 "Paragraph 15 - Connection facilities for earthing or bonding conductors". The cable section must comply with Table 10 and in any case must not be less than 4 mm².
- For the operating ranges with temperatures below 0°C, please consider the following:
 - For the gear reducers, please contact MOTOVARIO TECHNICAL SERVICE beforehand;
 - The motors must be suitable for operation with the expected ambient temperature;
 - The electric motor power must be adjusted when exceeding the higher starting torques required.

- To assemble sizes 010-130, use screws with maximum length as in the table.



HPL	LV max	OF	LVP max	O
010-020	M10x30	10,5 n°8	M16x75	17 n°4
030-050	M12x40	12,5 n°10	M16x90	18 n°4
080	M14x45	15 n°12	M20x70	22 n°4
130	M16x50	16,5 n°10	M24x70	26 n°4

In case of ambient temperature not listed in the table LUBRICANTS RECOMMENDED BY MOTOVARIO, please contact MOTOVARIO TECHNICAL SERVICE. If the temperature is lower than -30°C or higher than 60°C use special mixture sealing rings.



Check that all accessible surfaces do not exceed the temperature limits established by EN ISO 13732-1. Should these temperatures be reached or exceeded, arrange suitable protective systems (insulation or guards) or signs, clearly visible to the operator, carrying the symbol CAUTION HOT PARTS according to EN ISO 7010 standard.

Indicative table of FIXING SCREW TIGHTENING TORQUE with resistance class 8.8 - 10.9 - 12.9

	Mn [Nm] +5% / -10%		
	8.8	10.9	12.9
M 4	3,0	4,4	5,1
M 5	5,9	8,7	10,2
M 6	10,3	15,1	17,7
M 8	25	36	43
M 10	49	72	85
M 12	85	126	147
M 14	133	202	237
M 16	215	316	370
M 18	306	435	560
M 20	436	618	724
M 22	600	851	997
M 24	750	1064	1245
M 27	1111	1579	1848
M 30	1507	2139	2504
M 33	2049	2911	3407
M 36	2628	3735	4370
M 39	3417	4858	5685
M 42	4212	5999	7070
M 45	5278	7518	8847
M 48	6366	9067	10609
M 52	8210	11693	13684
M 56	10232	14572	17053
M 60	12726	18125	21210

8. SPECIFIC ASSEMBLING

8.1 OUTPUT SHAFT CONNECTIONS

8.1.1 Solid shaft

Before going ahead with the assembly of the elements, carefully clean the contact surfaces and grease them to reduce the risk of seizure and contact oxidation.

It is essential to assemble and disassemble the connecting parts to the shafts with the help of tie rods and extractors, using the threaded hole at the top of the shaft end and avoiding shocks and blows that may damage bearings, spring rings or other components, please refer to Fig. 1, 2 and 3.

Rotating elements with an external peripheral speed greater than 20 m/s must be dynamically balanced.

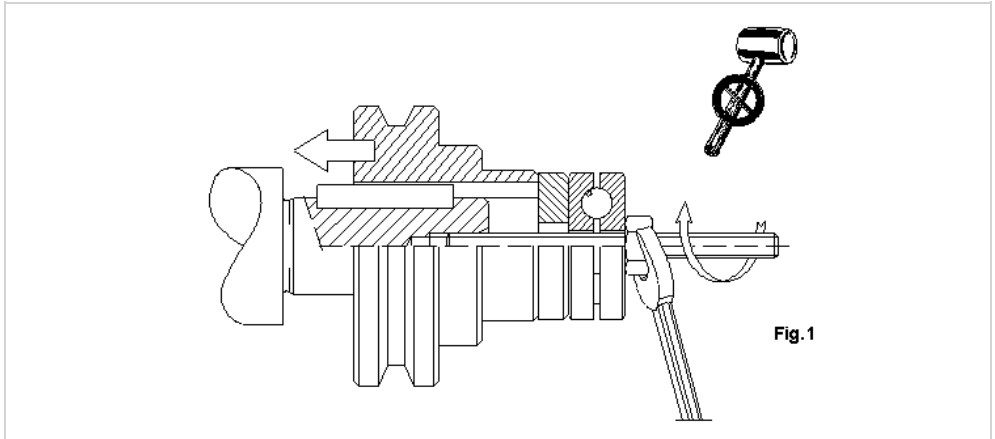
In all cases where the ingoing and/or outgoing movement is operated by external transmissions (belt and pulley, chains, gears...), ensure that:


- The resulting radial and axial loads do not exceed the limit values indicated on the gear reducer's plate. Loads beyond those allowed result in premature wear and failures, as well as overheating of the gear reducer and bearings;
- The chain transmissions, in particular, are not preloaded and that in case of linear speeds exceeding 1 m/s, they are kept at the right tension by special tensioners;

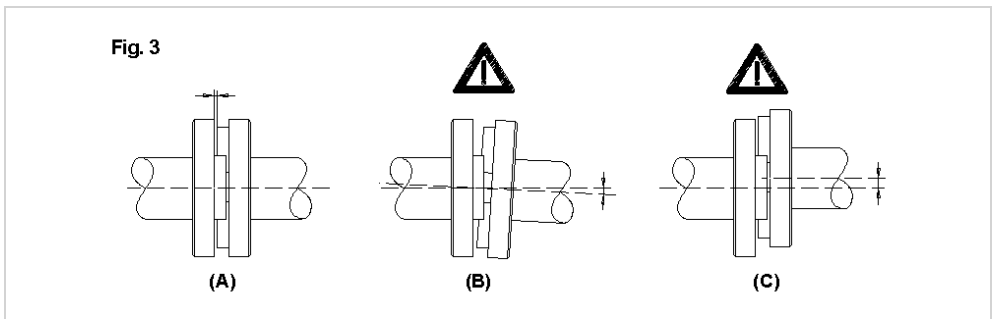
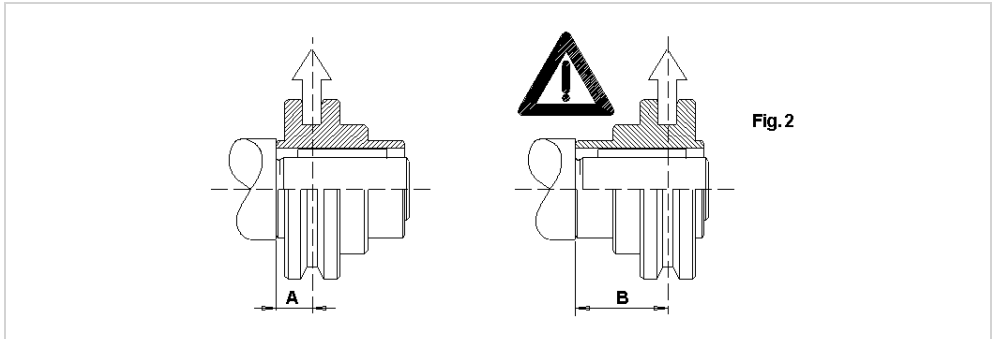
See the information supplied by the following figures 1-2-3.

- Fig. 1 **Example of correct installation of a part to the output shaft of a gear reducer.** We recommend to avoid using inadequate tools.

Always follow the instructions reported in the installation manual of the part to be mounted. Also make sure that it is compatible with the environmental class in which it will be installed.



- Fig. 2, 3: Examples of correct and incorrect installation () on the output shaft of the gear reducer.



8.1.2 Splined shaft

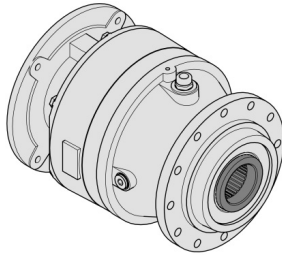
The hollow splined shaft, solid splined shaft and wheel flange have mesh compliant with DIN5482.

Before going ahead with the assembly of the elements, carefully clean the contact surfaces and grease them to reduce the risk of seizure and contact oxidation.

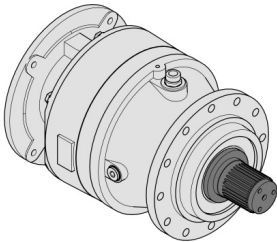
Check alignment between the gear reducer and duct shaft and for any signs of flexion during assembly and operation. The wedge meshes of the duct shaft's gear reducer must engage.

Always follow the instructions reported in the installation manual of the part to be mounted. Also make sure that it is compatible with the environmental class in which it will be installed.

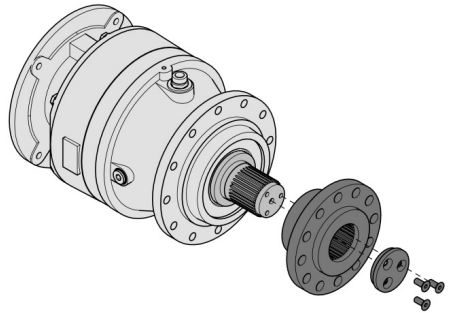
Splined hollow shaft



Splined solid shaft



Wheel flange



8.1.3 Mounting with shrink disc series HPL

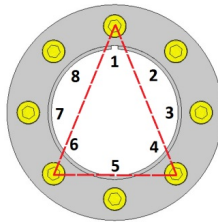
Only standard reducers and ATEX 3G/3D. Gear reducers may be fitted with a shrink disc to lock the hollow shaft on the driven shaft.

It is essential not to tighten the locking unit on the hollow shaft before inserting the machine pin to avoid deforming it. For the correct dimensioning of the machine shaft, refer to the paragraph "Hollow low speed shaft with shrink disc" in the LOW SPEED SHAFTS section of the technical catalogue.

Mounting

For fitting the locking unit proceed as follows:

- Undo the shrink disc screws, in sequence and gradually;
- Degrease with care the surfaces of the hollow shaft and of the machine pin to couple;
- Check that the locking shaft diameter is correct (refer to the paragraph of the catalogue mentioned earlier);
- Mount the locking unit on the gear reducer hollow shaft, lubricating beforehand the outer surface of the hollow shaft;
- Tighten slightly a first set of three screws placed at approx. 120° as shown in the figure;



- Tighten the locking unit gradually and uniformly with a torque wrench up to the torque (indicated in the table TIGHTENING TORQUE SCREW below), with continuous sequence (not crossed) making ¼ of a turn at a time until reaching the prescribed tightening torque;
- Keep applying the torque for 1 or 2 further steps and at the end check the bolt tightening torque;
- In case of stressful working cycles with frequent motion inversions, check again, after a few hours of operation, the screws' tightening torque. In any case, the tightening must be checked at each maintenance interval of the gear reducer.

Table "TIGHTENING TORQUE SCREW"

HPL	M _T 12,9 [Nm]
010	12
020	12
030	30
050	30
080	59
130	59
180	250

Disassembling

For disassembling the locking unit proceed as follows:

- Clean all the oxidized areas;
- Loosen one fixing screw after the other only by rotating them by $\frac{1}{2}$ a turn at a time, with continuous sequence (not crossed), until the locking unit can be moved on the hollow shaft
- Remove the gear reducer from the machine's shaft.

In any case, refer to the installation manual of the part to be assembled.



**In case of safety problems, unfavourable mounting positions (shaft pointing down), vibration or external axial loads, arrange suitable devices to prevent the shaft from sliding out!
Do not remove completely the fixing screws before releasing the locking rings. Risk of serious injury!**

If the shrink disc was not supplied by Motovario, follow the manufacturer's instructions and in any case never tighten the locking unit on the hollow shaft without first inserting the machine pin.

8.2 INPUT SHAFT CONNECTIONS

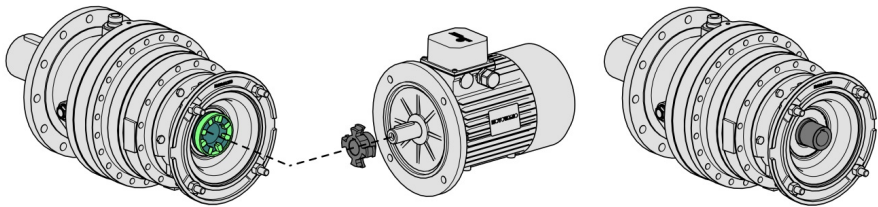
8.2.1 Motor mounting flanges

When the gear reducer is supplied without the motor, follow the recommendations below to ensure correct assembly of the drive unit on the transmission:

- First of all make sure, by checking the nameplate data of the motor and gear reducer, that the dimensions of the transmission are suitable to install the motor's rated power. Also ensure the motor is suitable for the class of the environment where it will operate;
- Check that the tolerances of the shaft and motor flange comply with the provisions of standard IEC 60072-1;
- Carefully clean the shaft, spigot and surface of the flange from traces of paint or dirt;
- Lubricate the motor shaft with grease to facilitate the assembly of the coupling joint and avoid surface oxidation (recommended MACONGREASE TBL SPECIAL 2 antifretting grease);
- Place the proper gasket (supplied by Motovario on request) on the motor flange (**or spread a layer of sealant**) and proceed to the mechanical connection to the gear reducer.

For input version with elastic coupling

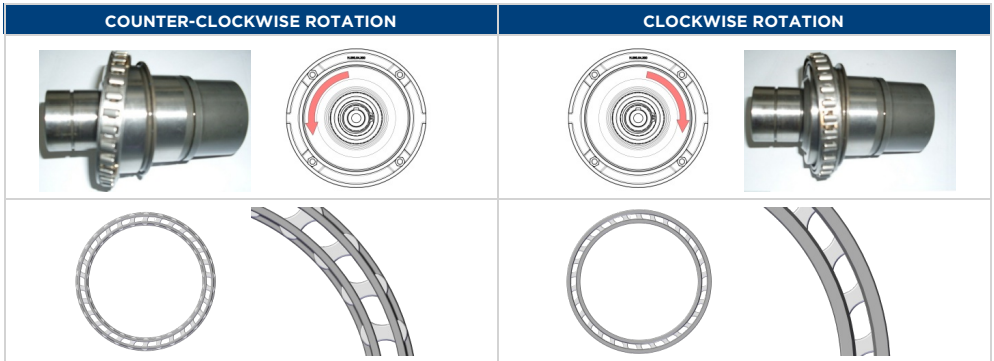
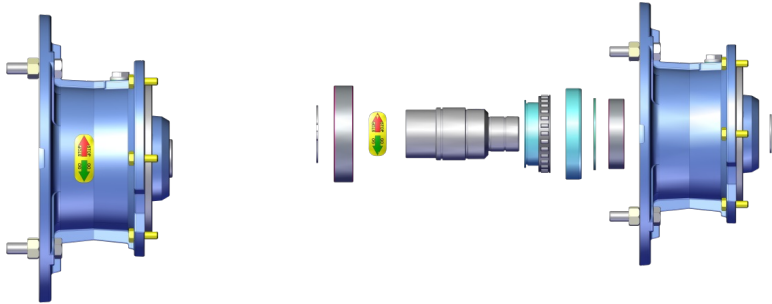
Before the mechanical connection to the gear reducer, proceed mounting the coupling half (see figure) on the shaft of the electric motor that must be done without applying excessive force to avoid damaging the motor bearings. Otherwise check the correct position and the tolerance of the motor key. Then mount the motor complete with coupling half, timing the motor side coupling half drive teeth with those of the elastic element on the gear reducer side coupling half.



8.3 ACCESSORIES

8.3.1 Backstop device

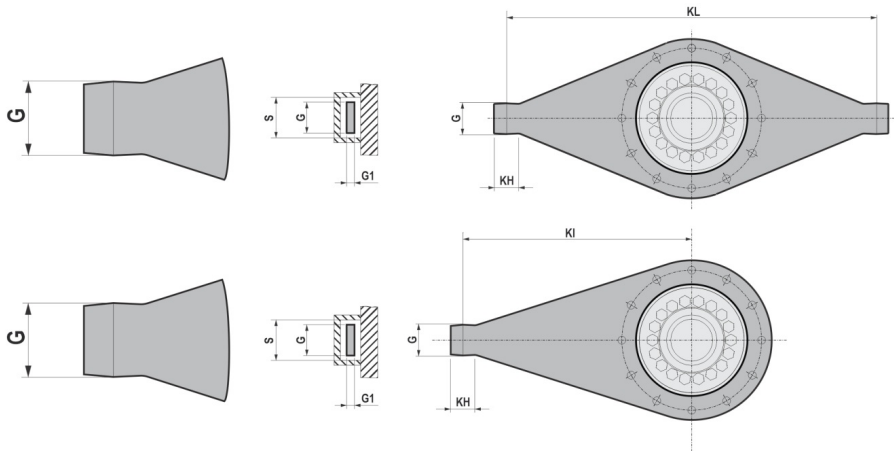
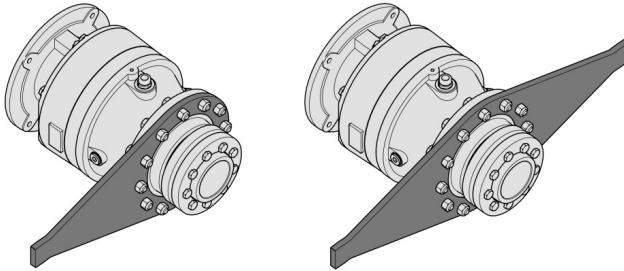
The gear reducer may be supplied with a backstop device on the fast axis. The backstop device allows the rotation of the shafts in one direction only; depending on the size is available in the PAM flange or in the motor, without additional space (with the exception of the PAM flange type PAM 100/112). It is essential to specify the input side direction of rotation (clockwise/counter-clockwise) in the order. On the PAM flange is applied a nameplate showing the free direction of rotation of the unit. Check that the free direction of rotation corresponds to what is required.



8.3.2 Shaft mounting with reaction arm

The HPL gear reducers can be assembled (but are not supplied with) a one-sided or symmetrical torque arm. Use appropriate safety systems to prevent rotation or sliding of the gear reducer from the machine pin. For the housing on the customer's side, proceed as follows. Use two plates to be welded on the structure on the machine. Assemble the gear reducer, placing the arm between the two welded plates. Next, weld a third sealing plate on the two plates welded on previously (see figure).

Recommended material S275JR - S355JR UNI EN 10025



HPL	KI	KL	KH	G	G1	S
010	325	520	30	40	8	42
020	325	520	30	40	8	42
030	400	640	35	44	12	46
050	400	640	35	44	12	46
080	490	800	45	55	14	57
130	490	700	50	60	22	62
180	600	900	50	60	24	62

Suggested values.

8.4 DEVICES

8.4.1 Cooling and heating systems

Air/oil or water/oil cooling unit:

1. Water/oil cooling unit. Gear reducer oil circulates, through a circuit of the system, thanks to a motor pump and, before being returned inside the gear reducer, it passes through a filter - if any - (purifying the oil and thus ensuring gear reducer reliability and duration over time) and the water/oil heat exchanger (with bundle of copper tubes removing the exceeding heat). The unit features a minimum pressure switch, a maximum thermostat and a water shut-off solenoid valve.
2. Air/oil cooling unit. Gear reducer oil circulates, through a circuit of the system, thanks to a motor pump and, before being returned inside the gear reducer, it passes through a filter - if any - (purifying the oil and thus ensuring gear reducer reliability and duration over time) and the air/oil heat exchanger (with aluminium pack with electric fan and thermostat removing the exceeding heat). The unit features a minimum pressure switch, a maximum pressure switch and an adjustable thermostat.

For any technical information, please contact MOTOVARIO TECHNICAL SERVICE.

In any case, refer to the installation manual of the part to be assembled.



***Before starting the gear reducer, make sure that the system is in perfect conditions and with no obstructions; should this not be the case, clean it with suitable means and detergents compatible with the system.
When using chemical detergents, take all the necessary measures to protect people's health and to dispose of them in compliance with the applicable standards!***

Periodically clean the system using suitable means and detergents compatible with the system itself.

9. MAINTENANCE



Maintenance must be carried out by expert operators and in accordance with current regulations concerning safety in the workplace and matters relating to environmental risks. Do not discard polluting liquids like lubricants, replaced parts and maintenance residues into the environment.
Never improvise repairs!



Before working on the unit disconnect its power supply, being careful to be protected against inadvertent reactivation, and in any case against the mobility of the components of the unit itself. Wait until the unit reaches the ambient temperature.
Inform staff working in the area or nearby, by duly signalling the areas nearby and preventing access.
Put in place all necessary measures for environmental safety (dust, gas...).

The precise machining of the unit's internal components ensures correct operation with minimum maintenance. In general the following rules are valid: periodic check of the unit external cleanliness, especially in the areas more involved in the cooling process; periodic check for any leaks of lubricant, especially in the areas of the sealing rings; check and cleaning of the vent cap hole. Check periodically by means of the specific level indicators the correct quantity of lubricant. If topping up is necessary, use the same brand and type of lubricant as the one already used, or in any case compatible with it. Use oils and greases recommended by Motovario. During an oil change follow the above mentioned recommendations. Do not hesitate to replace unreliable components. Replace worn parts only with original spare parts. Using non-original spare parts can compromise the operation of the unit, and also voids the warranty. For the request of the components, follow the instructions given in the spare parts section of the specific unit.

1. Keep the unit in good running order with periodic checks of vibration and noise, absorption and voltage, wear of friction surfaces, lubricant leaks, gaskets, bolted gaskets for wear, deformation and corrosion and restore replace as necessary;
2. Keep the unit clean of dust and process residues (do not use solvents or other products incompatible with the materials of construction, and do not aim high pressure jets of water directly at the unit).

For the units used in AGGRESSIVE ENVIRONMENTS AND FOOD INDUSTRIES:

In the event of accidental damage to the paint, restore it as soon as possible by using the repair kit available on request.

Following the above mentioned rules ensures the operation of the unit and the required safety level.

9.1.1 Oil change procedure

The lubricant must be replaced in all of the following cases:

- One of the oil replacement intervals has been reached, in this case see the “Checks and Maintenance Table” and the “OIL REPLACEMENT INTERVAL”;
- Significant oil leakage;
- Suspected external contamination of the lubricant.

Bring the gear reducer to a surface temperature below 30 °C before changing the oil: with moderately warm oil, the emptying procedure and the removal of deposits is easier. Take all necessary precautions to avoid burns due to high temperature of the gear reducer and/or oil.



CAUTION - HOTPARTS

Indicates a serious thermal hazard which may endanger personal health and safety.

- Put in place a system to collect the lubricant that is proportional to the gear reducer on which maintenance is to be carried out;
- Identify the filler and drain plugs of the gear reducer (the filler plug may be the drain plug); First unscrew the filler plug and then the drain plug, paying attention to gradually reducing any internal overpressure;
- Bleed out all the oil and collect it with the system put in place;
- Wash the inside of the gear reducer's casing with the same type of oil required for operation and empty it again;
- Replace the gasket of the drain plug and tighten it again by applying the appropriate tightening torque (see the table with the “TIGHTENING TORQUE FOR OIL PLUGS”);
- Pour the new lubricant into the gear reducer until you reach the required level, which corresponds to the centre line of the indicator plug or to the upper notch of the dipstick; see the LUBRICATION paragraph for overflow levels. Refer to the tables in the LUBRICATION paragraph for the type of oil and the recommended viscosity.
- Replace the gasket of the filler plug and tighten it again by applying the adequate tightening torque (see the table with the “TIGHTENING TORQUE FOR OIL PLUGS”);
- After about 30 minutes verify whether the level is correct (top up as required) and check for any oil leaks. Clean the gear reducer's surface with antistatic materials. As in the case of first commissioning, there may be air pockets trapped between the gears and the casing, which would prevent the filling process from being completed. After the first minutes of operation, stop the gear reducer, check the oil level and top up if necessary;
- Dispose of used oil in accordance with current local regulations.

The oil must be changed (for NON ATEX products) after approximately 5,000 hours/6 months of operation, for mineral oil with EP additive or after approximately 9,000 hours/1 year of operation for PAD synthetic oil. However, the oil must be changed more frequently if the gear reducer runs at operating temperatures above 65°C or under environmental conditions that could cause dirtying of the oil (see table).

Table “MAXIMUM OIL CHANGE INTERVAL”

Oil type	Oil temperature		
	< 65° C	80° C	95° c
Mineral oil	8000 h	4000 h	2000 h
Synthetic oil	16000 h	8000 h	4000 h

Table of "OIL PLUGS TIGHTENING TORQUE"

Cap	Tightening torque Nm	
	Hex key	Allen key
3/8"	30	20
1/2"	60	30
3/4"	70	40
1"	80	50
1" 1/4	80	50

9.1.2 Replacement procedure of external sealing rings

The service life of the rotating seals depends on many factors:

- Sliding speed;
- Temperature;
- Operating environment;
- Level of dust;
- Ageing of the compounds.

It is therefore impossible to establish a minimum duration of the component, which must be checked periodically to ensure correct operation.

As well as in the case of leaks, we recommend replacing the rings during the periodic overhauls of the gear reducer, when replacing the lubricant and in general at least every 4 years.

Locate the seal to be replaced and proceed as follows:

- Drain oil (refer to section **OIL CHANGE PROCEDURE**);
- Remove the sealing ring taking the utmost care not to cause any kind of damage to the seat and to the shaft (scratches, dents, etc.);
- Always use new seals of the same brand of those removed.

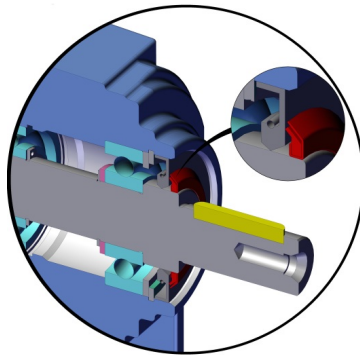
Proceed as follows when fitting the new ring:

- Grease the rotating housing on the shaft with plenty of lubricant, as well as the sealing lip of the ring. The recommended grease to be used is **ENI-MU EP 2** (for sealing rings with double lip in **FKM** use the special grease **TECNOLUBE BC 101**);
- Fit the ring by taking care not to damage the sealing lip during insertion, especially with the sharp edges of the key housings, with excessive shocks and deformations. In this case, it is recommended to use a lubricated plastic cover for cover sharp parts to ensure easy assembly;
- When positioning the ring axially, make sure the sealing lip does not coincide with the groove generated by the previous ring.

Note, in case of presence of external VRM ring (see the figure below):

- Proceed to the installation of oil sealing rings, following the directions above, after having disassembled the VRM. While disassembling be careful not to damage the shaft;
- After the installation of the oil sealing rings, fit the outer VRM ring with the following precautions;
- Fill with grease the volume between the oil sealing ring and the VRM;
- Make sure that the rubber lip of the VRM enters, uniformly, in contact with the sealing ring;

Ensure that the metal ring of the VRM does not touch the oil sealing ring.



9.1.3 Bearings

As in the case of the sealing rings, also the bearings are influenced by the operating conditions of the gear reducer, such as the input speed, loads, operating temperatures, type of load applied and lubrication used, etc. Therefore, it is not possible to provide an intervention interval and it is necessary to check the gear reducer on a monthly basis to detect anomalous noise and/or vibrations. If even a slight deterioration in the noise or vibration levels is detected, stop the gear reducer and contact Motovario.

Only a small amount of grease is normally required to maintain the bearings. The frequency of maintenance depends on the type of bearing, the number of revolutions, the nature of the load and other operating conditions.

To perform maintenance, locate the greaser and grub screw on the opposite side and undo the grub screw. Top up with grease of the type indicated in the table "Specifications of GREASE RECOMMENDED BY MOTOVARIO". When done, retighten the grub screw.

Specifications of GREASE RECOMMENDED BY MOTOVARIO

	* Polyalphaolefin synthetic grease (PAO)	Mineral grease
ENI	-	MU EP 2
SHELL	GADUS S5 T460 1.5	-
KLUBER	-	STABURAGS NBU 8 EP
EXXONMOBIL	MOBILITH SHC 220	-
CASTROL	TRIBOL GR SW 460-1	-

* Recommended

9.1.4 Checks and maintenance table

ROUTINE MAINTENANCE table:

Frequency	Object	Check	Intervention
Daily	Whole unit.	Check temperature and noise level.	Stop and check.
Weekly	Vent plug.	Obstruction due to the presence of dust. For the positions of the caps please refer to the MOUNTING POSITIONS.	Release the vent cap.
1000 h / 5 months	Oil.	Level.	Topping up.
	Sealing rings, gaskets and caps	Oil leaks and ageing.	Replacement.
Yearly or, anyway, at variable intervals (based on the external conditions)	Whole unit.	Check and inspection of tightening and of the operating conditions of the installed devices.	Tightening. Clean and restore operation of devices (if necessary, replace).
4000 h / 1 years (T=80°C)	Mineral oil.	None.	Replacement.
8000 h / 2 years (T=80°C)	Synthetic oil.	None.	Replacement.

10. PROBLEMS DURING OPERATION

If during start-up or the first running hours there are problems of any kind, please contact MOTOVARIO TECHNICAL SERVICE. The "TROUBLESHOOTING" table lists a series of problems with the description of possible remedies. The descriptions below are merely indicative and are only for information purposes.

Any tampering with the unit without Motovario authorisation voids the warranty.

TROUBLESHOOTING table

PROBLEM	CAUSE	SOLUTION	INTERVENTION
Noise in the mounting area.	Vibration in the mounting area.	Check and correct fasteners and, if necessary, tighten them.	Contact MOTOVARIO TECHNICAL SERVICE.
The measured temperature on the gear reducer casing is high.	Incorrect dimensioning of the gear reducer Non-compliant mounting position.	Check application.	Restore the correct work conditions: mounting position and/or lubricant level.
The operating temperature is high.	Excessive oil quantity, old or dirty oil. Cooling system failure.	Check oil and change/top-up. Check application.	Contact MOTOVARIO TECHNICAL SERVICE.
Bearing temperature is high.	Damaged, worn out bearings. Insufficient oil quantity, old or dirty oil.	Check and, if necessary, replace bearings. Check oil and change/top-up.	Contact MOTOVARIO TECHNICAL SERVICE.
The output shaft revolutions of the gear reducer are different from the ones expected.	Gear reducer ratio different than the one expected. Motor with polarity different from the one expected.	Check the ratio of the gear reducer. Check the polarity of the motor.	Replace the gear reducer and/or the electric motor.
Oil leaks from the sealing ring.	Faulty sealing ring.	Replace the ring	Replace the component or contact MOTOVARIO TECHNICAL SERVICE.
	Sealing ring damaged . Damaged shaft seat.	If the shaft seat is damaged restore it (if possible).	
Oil leaks from surfaces.	Flat gasket or O-ring damaged.	Replace the gasket or the O-ring.	Replace the component or contact MOTOVARIO TECHNICAL SERVICE.
The output shaft of the gear reducer turns in the opposite direction.	Incorrect connection of the electric motor.	Invert two phases of the power supply of the electric motor.	
Cyclic noise of the kinematic motion.	Dents on the gears.	No practical problem if the noise is not determinant in the specific application.	Ship the unit to Motovario if the noise is important in the specific application.
Non-cyclic noise of the kinematic motion.	Dirt inside the gear reducer	No practical problem if the noise is not determinant in the specific application.	Ship the unit to Motovario if the noise is important in the specific application.
Noise (whistle) coming from the kinematic motion.	Incorrectly adjusted bearings.	Check the correct quantity of lubricant.	Contact MOTOVARIO TECHNICAL SERVICE.
	Gears with meshing errors.		
	Insufficient quantity of lubricant.		

11. LUBRICATION



Check the oil level before starting up the gear reducer; this operation must be carried out when the gear reducer is arranged in the predetermined mounting position, if necessary restore the level with oil of the same type shown on the nameplate. In case of unavailability, please contact MOTOVARIO TECHNICAL SERVICE.

Proper lubrication makes for:

- Lower friction;
- Less heating;
- Increased efficiency;
- Lower oil temperature;
- Less wear.

MOTOVARIO epicycloidal gear reducers in Series HPL have been designed for oil bath lubrication. Unless expressly requested, the gear reducers are supplied without lubricant (for any requests, see the table with LUBRICANTS RECOMMENDED BY MOTOVARIO). If unavailable, please contact MOTOVARIO's TECHNICAL SERVICE. To extend lubrication intervals and the ambient temperature range, or reduce the oil temperature, we recommend using polyalphaolefin-based synthetic oil.

Unless specifically requested at the time of order, gear reducers are supplied without lubricant. This means they need to be filled up for the first time by choosing the type of oil and right viscosity according to the following tables.

Fill the gear reducer by following the plug diagram indicated in paragraph "Mounting positions". If the gear reducer is supplied already filled with oil (special version), the installer will be responsible for replacing the closure plugs with the breather and filler plugs provided separately.

Check the level of oil before starting the gear reducer. This must be done with the latter in the set mounting position reported on the nameplate. If needed, top up using the same type of oil indicated on the label.

If none of the recommended lubricants is available locally, contact MOTOVARIO's TECHNICAL SERVICE. If it is necessary to use a different type of oil (after checking with MOTOVARIO's TECHNICAL SERVICE), go ahead with a full replacement by also washing the inside of the gear reducer, as recommended in the paragraph **Changing the oil**. Pour the oil through the filling holes or the inspection cover by using a filler filter and then restoring the seal (to be replaced) or gasket.



Periodically check that oil level is never below the minimum level; this operation has to be carried out with stopped gear reducer and after cooling.

11.1.1 Lubricants

Specifications of LUBRICANTS RECOMMENDED BY MOTOVARIO

	* Polyalphaolefin synthetic oil (PAO)	Mineral oil
ENI	BLASIA SX	BLASIA
SHELL	OMALA S4 GXV	OMALA S2 GX
KLUBER	Klubersynth GEM 4-...N	Kluberoil GEM 1-...N
MOBIL	SHC GEAR	MOBILGEAR XMP
CASTROL	ALPHASYN T	ALPHA SP
BP	ENERSYN EPX	ENERGOL GR-XP
TOTAL	CARTER SH	CARTER EP
ESSO	SPARTAN S-EP	SPARTAN EP

* Recommended

n ₂	Oil	ISO 3448 VG	T _{amb} °C															
			-15	-10	-5	0	5	10	15	20	25	30	35	40	45	50		
n ₂ > 150 rpm	PAO	150																
	MIN	220																
n ₂ ≥ 5 rpm	PAO	220																
	MIN	320																
n ₂ < 5 rpm (*)	PAO	320																
	MIN	460																

n₂ - Output speed.

Oil - Oil type.

ISO 3448 VG - Viscosity grades.

T_{amb}°C - Ambient operating temperature.

	<p>Unsuitable Temperature Range for typical oil viscosity:</p> <ul style="list-style-type: none"> - always choose a lubricant with a declared pour point of at least 10 °C lower than the assumed minimum T_{amb}; - if this oil must be used within the unsuitable temperature range, contact Motovario Technical Assistance. Alternatively, to extend the oil temperature range, use external heating devices provided by the Customer with a suitable temperature control system to keep the gear reducer under normal operating conditions.
	<p>Critical Temperature Range based on typical oil viscosity:</p> <ul style="list-style-type: none"> - choose a lubricant with a declared pour point of at least 10 °C lower than the assumed minimum T_{amb}; - perform a soft start with partial load (do not exceed 30% of the nominal load) until the Gear Reducer Temperature Range T_{rid} equal to the Normal Ambient Temperature range T_{amb} for the chosen oil is reached; - higher power input is expected when starting.
	<p>Normal ambient Temperature Range for typical oil viscosity.</p>
	<p>Critical Temperature Range for the gear reducer for typical oil viscosity:</p> <ul style="list-style-type: none"> - check that the chosen oil has a kinematic viscosity of at least 30 cSt at 100 °C (usually indicated on the oil technical data sheet); - use service factor fs > 1.25 in the presence of a constant M₂ (S1), and in any case apply a safeguard against the assumed maximum load during operation in the presence of a load cycle so that M_{2peak} < M₂*1.5.

<p>Maximum gear reducer casing temperature (T_{rid max}) [°C]</p>

Output speed	Oil type	Viscosity grade ISO 3448 VG	Maximum gear reducer casing temperature ($T_{rid\ max}$) [°C]	
			SI operation	Operation for intermittent service and/or FS>1.5
$n_2 > 150\ rpm$	PAO	150	60	70
	MIN	220	55	70
$n_2 \approx 5\ rpm$	PAO	220	70	80
	PAO	320	80	95
$n_2 < 5\ rpm\ (*)$	MIN	320	65	80
	PAO	460	65	90
	MIN			85

(*) If the gear reducer is used in continuous service (S1), check the following:

- choose an oil with a declared pour point of at least 50 °C lower than the assumed minimum T_{amb} ;
- perform a soft start with partial load (do not exceed 30% of the nominal torque Mn_2) until a gear reducer casing temperature range T_{rid} equal to the Normal Temperature range for the chosen oil is reached;
- higher power input is expected when starting;
- be careful of overheating in continuous operation;
- check that the chosen oil has a kinematic viscosity of at least 30 cSt at 100 °C (normally indicated on the oil technical data sheet).

11.1.2 Special lubricants

If 'special' lubricant is required please contact MOTOVARIO TECHNICAL SERVICE.

11.2 QUANTITY



For the gear reducers of the HPL series, the expected mounting position must be always specified. The amount of oil in the table are indicative only and for the proper topping up you will have to refer to the level cap or the dipstick, if any. Any deviations in level can depend on construction tolerances, transmission ratio but also on the placement on the unit or by the mounting surface at the customers' premises. For this reason it is appropriate that the customer checks and, if necessary, restores the level when the unit is installed.


Table OIL CAPACITIES IN LITRES - [l]

HPL-1	010	020	030	050	080	130	180
B3/B5 B6/B7 B8	0,69	0,82	1,21	1,35	2,63	3,63	4,13
V1/V5	0,77	0,92	1,61	1,82	2,96	5,96	6,46
V3/V6	1,04	1,04	1,64	1,63	4,03	6,03	6,56
HPL-2	010	020	030	050	080	130	180
B3/B5 B6/B7 B8	0,95	1,09	1,32	1,49	2,54	3,54	4,04
V1/V5	1,31	1,44	2,09	2,21	4,19	5,19	5,69
V3/V6	1,58	1,72	1,88	1,88	3,88	5,88	6,38
HPL-3	010	020	030	050	080	130	180
B3/B5 B6/B7 B8	1,2	1,38	1,57	1,78	2,66	3,66	4,16
V1/V5	1,85	1,99	2,63	2,75	4,67	6,67	7,17
V3/V6	2,13	2,26	2,42	2,42	4,12	6,12	6,62
HPL-4	010	020	030	050	080	130	180
B3/B5 B6/B7 B8	1,46	1,67	1,82	2,07	2,91	3,91	4,41
V1/V5	2,39	2,53	3,21	3,29	5,17	7,17	7,67
V3/V6	2,67	2,8	2,96	2,96	4,67	6,67	7,17

12. MOUNTING POSITIONS

Install the unit in the intended mounting position. Otherwise, please contact MOTOVARIO TECHNICAL SERVICE.


ATEX 2G/2D: Vent plug with valve.

	VENT PLUG
	LEVEL PLUG

12.1.1 HPL

HPL / 1 -2-3-4				
T	B3	B6	B7	
	B8	V5		
	V6 (1)	V6 (2/3/4)		
	B5	V1	V3 (1)	V3 (2/3/4)

Closing plugs on all other holes.

	VENT PLUG
	LEVEL PLUG

13. SPARE PARTS TABLES

The spare parts tables of the products are available on Motovario website. For spare parts tables of mentioned ATEX products please contact MOTOVARIO TECHNICAL SERVICE. For spare parts orders please refer to the data reported on the product nameplate.

14. UNIT DISPOSAL

During unit disassembling the plastic material must be separated from the metal or the electric material. The operation may be performed only by skilled operators and in compliance with the current regulations concerning health and safety at the workplace. For determining the consecutive and interconnected stages of the company products (life cycle), from the acquisition of raw materials up to final disposal, the different parts of the products that must be sent to recycling / disposal in compliance with the current environmental laws are listed here below:

Parts of the gear reducer/motor	Material
Gear wheels, shafts, bearings, connecting keys, safety rings,	Steel
Casing, parts of the casing	Cast iron
Light alloy casing, parts of the light alloy casing,....	Aluminium
Crowns, bushings,....	Bronze
Sealing rings, covers, rubber parts,...	Elastomers with steel springs
Coupling elements, protection covers, variator knobs, motor terminals....	Plastic
Flat gaskets	Sealing material
Motor terminals, variator screw blocks,...	Brass
Winding	Copper
Stator and rotor	Magnetic steel
Gear reducer oil	Mineral oil
Gear reducer oil	Synthetic oil
Sealants	Resins
Packaging materials	Paper, cardboard



Do not dump in the environment non-biodegradable material, oils, non-ferrous components (PVC, rubber, resins, etc.).



Do not reuse components which may appear in good order on inspection, have them replaced by specialised personnel only.



The crossed out wheeled bin symbol on the nameplate or label indicates that the motor must be collected separately from other waste at the end of its useful life. The separate collection for the delivery of the motor to recycling, to treatment and environmentally compatible disposal helps avoiding possible negative effects on the environment and health and promotes the reuse and/or recycling of materials that make up the motor.

15. RESPONSIBILITY

Motovario declines any responsibility in case of:

- Use of the gear reducer not compliant with national laws on safety and accident prevention;
- Work done by unqualified personnel;
- Incorrect installation;
- Tampering with the product;
- Incorrect or failure to follow the instructions in the manual;
- Incorrect or failure to follow the indications marked on the identification labels fixed on the units;
- For gearmotors, wrong delivery of power supply;
- Incorrect connections and/or use of temperature sensors (when present).

The products supplied by Motovario are intended to be incorporated into "complete machines", so it is prohibited to put them into service until the entire machine has not been declared compliant.



The configurations provided in the catalogue of the unit are the only ones allowed. Do not use the product in contrast with the indications provided in it. The instructions provided in this manual do not replace but compensate the obligations of current laws concerning safety regulations

This manual refers to MOTOVARIO products on sale when it is issued. Motovario reserves the right to modify in the future the data of this manual without prior communication.

