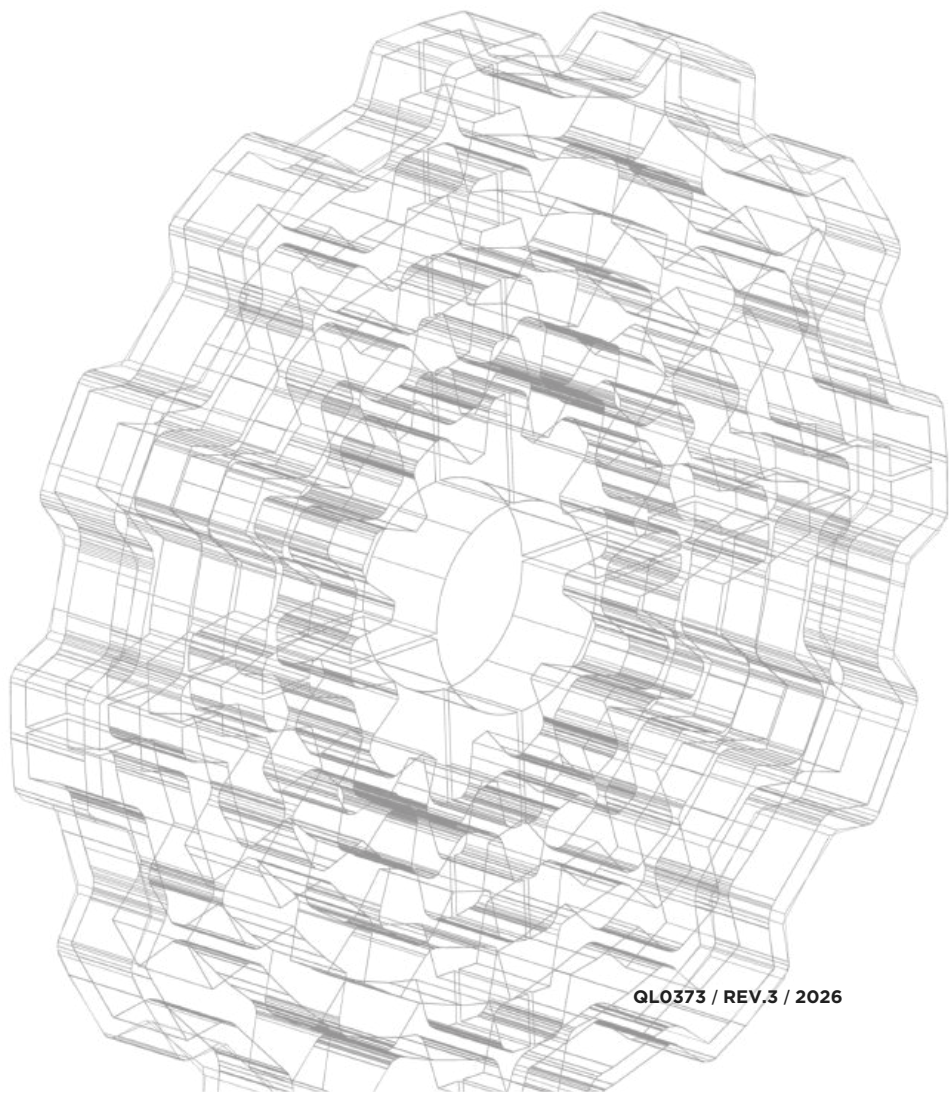


Instructions for installation, use and maintenance HPL planetary reducers



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 document 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

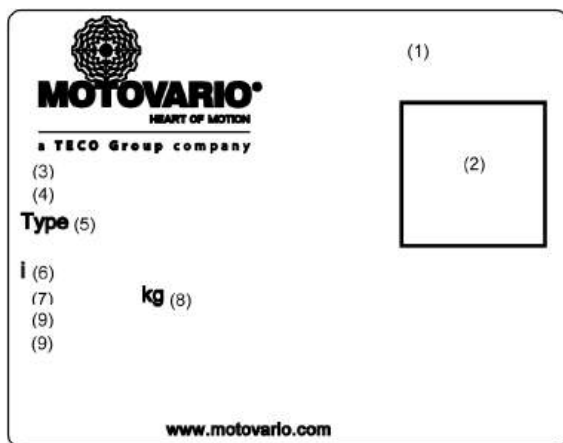
In order to identify the product, the unit bears a label of the following model. The label must not be removed and must be kept intact and readable. In case you need a copy of it just contact MOTOVARIO TECHNICAL SERVICE.

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 + Execution.
8. Gearbox weight without oil.
9. Gear reducer oil (if supplied with first filling).

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

Reducers and 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 directives:

- Directive ROHS 2011/65/EU relating to the prohibition or the limitation of the use of noxious substances in electrical and electronic equipment.
- Directive ErP 2009/125/EC on the ecodesign of energy-related products and in particular EU Regulation no. 1781/2019 on the ecodesign of electric motors.
- Directive EMC 2014/30/EU relating to intrinsic characteristics in relation to emissions and levels of immunity.

The HL and VP gear reducers are designed to be paired with IEC motors and only with the options specified in the configurations. The installation of any other devices or couplings to drive the gear reducer is not permitted.

Motors other than those included in the catalogue may only be used with Motovario's written approval; failure to do so will invalidate all warranties.

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 products are supplied with the following surface treatment characteristics:

HPL - Industrial planetary gear reducers

External ring gear in nitrided steel

Sun and planetary gears in case-hardened steel

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.

High-resistance spheroidal cast-iron output module housings:

- The castings are supplied protected by an antirust primer, in Black-Grey RAL 7021.
- Hole for eyebolt on the output module for all configurations.

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.

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:

HL..1 stages = 0,97

HL..2 stages = 0,94

HL..3 stages = 0,91

HL..4 stages = 0,88

VP - Worm gears combined with HPL planetary gearboxes

The following specifications refer to the worm gear reducer only.

Die-cast aluminium alloy cases for gears (sizes P613-P1183)

Die-cast materials undergo the following surface cleaning operations:

- De-burring by means of a mechanically operated shearing system.
- Accurate shot-peening.
- Washing and passivation.

Painting specifications:

- Orange-peel blue epoxy-polyester RAL 5010. Polyester resin based heat-hardening powders, altered with epoxy resins.

Mechanical properties: Tests carried out onto degreased Unichim white lattens (film thickness: 60 microns) comply with the following specifications: adherence (ISO2409).

Heat resistance: 24 HOURS AT 150°C.

Corrosion strength: ASTM B 117/97 salt fog from 100 to 500 hours depending on the support's preliminary treatment.

Performance:

- Loading capacity in accordance with: ISO 14521, DIN 3996, BS 721, AGMA 6034, ISO 6336, DIN 3990, ISO 281.

4.2 CRITICAL APPLICATIONS

n_{1max}: meaning the maximum speed in intermittent service.

HPL	n _{1max} [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
220	1800	3000	3800	4000
380	1800	2500	3800	4000

The performance indicated in the catalogue correspond to position B3 or similar. 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 or transporting people.
- 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.
- Avoid use as multiplier.
- Do not use in an environment with an explosive or potentially-explosive atmosphere.

In the presence of overloads that are not part of the work cycle – caused, for example, by full-load starts, braking, impact and other static and dynamic causes, ensure that the peak torque on the output shaft is always less than the maximum torque M_{2max} and that the torque on the input shaft is always less than the limit torque M1 (see the tables in the catalogue under the “Product Selection” section). In the case of variable load cycles, the torque M2 must always remain within the values specified for n₂·h = 10,000 cycles (see catalogue). We recommend that you contact MOTOVARIO TECHNICAL SUPPORT.

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.

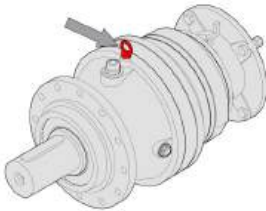
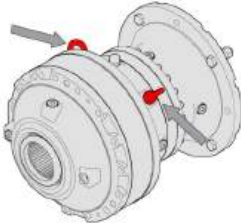
Those authorised to handle the gear reducer must ensure all the necessary safety conditions. Carry out all handling operations with extreme caution. The precautions to be taken during handling are measures suitable to ensure the safety of the operator and avoid failures or damage due to accidental shocks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



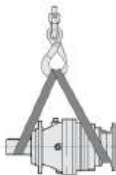
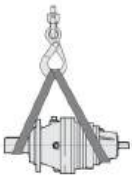
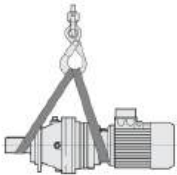
Identify the gripping points on the gear reducer and go ahead with handling by using straps/slings. Special configurations, accessories such as flanges, etc. driving motors can change the centre of gravity, in which case an additional anchoring point may be required. Do not exceed 15° of oscillation 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.

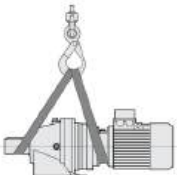
Use the through holes in place on the fixing feet or flange of the gear reducer's case. These points are designed to only withstand the weight of the gear reducer. Do not add more weight during the lifting and handling phases.

In case of groups with the presence of the engine, do not use the engine lifting eye.
For details see "Instructions for installation, use and maintenance Electric motors".

010-130	180-380
	

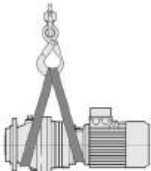
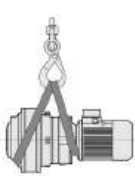
NOTE: Lifting eyebolts not supplied. Use suitable lifting eyebolts consistent with the direction of load application. The eye bolt is intended as a stabilising anchoring point and not as the sole lifting point. Follow the handling instructions provided.
For HS and HM output shaft versions of size 180, use two eye bolts as stabilisation anchoring points (and not as the sole lifting point) and at least two lifting and handling slings, as shown in the diagrams.

HL....F / IHL....F / CHL....F CS-SS		
HL....F - CS-SS	IHL....F - CS-SS	CHL....F - CS-SS
		

HL....T / IHL....T / CHL....T CS-SS		
HL....T - CS-SS	IHL....T - CS-SS	CHL....T - CS-SS
		

HL....F HS-HM	
HL....F - HS-HM (010-130)	HL....F - HS-HM (180-380)
	 

IHL....F HS-HM	
IHL....F - HS-HM (010-130)	IHL....F - HS-HM (180-380)
	 

CHL....F HS-HM	
CHL....F - HS-HM (010-130)	CHL....F - HS-HM (180-380)
	 

VP....F / VP....T		
VP....F - CS-SS	VP....F - HS-HM	VP....T - CS-SS
		

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:

- Fill the unit with oil, where applicable, if not supplied already complete with oil;
- We suggest replacing any sealing ring not submerged in lubricant;
- Apply 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;
- Rotate periodically the reducer.

7. INSTALLATION

Particular attention must be paid to **installation conditions**, which can lead to plant downtime or, worse still, damage; a proper assessment can prevent problems or improve the performance of the machine or plant on which the gear reducers are installed.

It is essential to study or verify the correct **mounting position** in the space, taking due account of all relevant risk factors, including, by way of example (this list is not exhaustive):

- the risk associated with possible **oil spills** which, even if only in **minimal** quantities, may be unacceptable. This can be mitigated by choosing a more suitable design, or by means of external protection (to be provided by the machine manufacturer)
- **The heat** emitted by the gear reducer whilst in operation may, in some cases, reach 90°C; it may therefore be dangerous to touch or have a negative impact on the surrounding environment. It must be handled in such a way as to prevent accidental contact or by installing suitable cooling systems.
- **The noise**, normally produced by a gear reducers in operation, must be compatible with the environment in which it is installed. Noise can be reduced by lowering the input speed. For example, where appropriate, by using a 6-pole electric motor instead of a 4-pole one, or by implementing appropriate noise-reduction measures;
- **Vibrations** must be minimised by limiting motor oversizing to what is strictly necessary, minimising sudden start-up or braking torques by using inverters or soft-start systems, and oversizing the gear reducer where necessary.

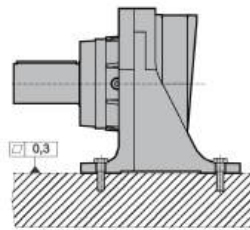


The gear reducer may only be fitted in the mounting position indicated on the plate: Structurally, variations in angle or inclination of up to +/- 5° from the specifications on the nameplate are permitted; where necessary, the oil level must be adjusted, for which you must contact MOTOVARIO TECHNICAL SUPPORT.

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

- Make sure the equipment supplied corresponds to the equipment ordered.
- When installing, check the plate data of the gear reducer and/or electric motor.
- Make sure that the category of the equipment is suitable for the environmental classification in which it will be installed.
- Significant temperature fluctuations can lead to condensation; if this was not taken into account at the time of ordering, suitable anti-condensation systems must be installed.
- Unless expressly agreed with the MOTOVARIO S.p.A. pre-sales service, do not install the unit in an environment with fumes or abrasive and/or corrosive dust, or in environments with ionising radiation, or in any case in environments where there are sources of danger.
- Unless otherwise specified at the time of ordering, if the ambient temperature is below -15°C or above 50 °C, please contact MOTOVARIO TECHNICAL SUPPORT.
- The gear reducers are not designed to be suitable for contact with food: where they are used in a food environment that could affect human health, any contamination arising from the gear reducer or any of its components, oils or paints used must be thoroughly checked by the manufacturer of the machine or plant, in accordance with the relevant standards with which they must comply
- Handle with care and in a safe manner, in accordance with the instructions in the "Handling" section.
- Remove any packaging or packaging residues from the gear reducer, and carefully remove any anti-corrosion protection that may be present on each coupling surface; these surfaces must be thoroughly cleaned of dirt, sludge, grease, oil, paint and even rust, should this have formed as a result of sub-optimal storage.
- Carry out a visual inspection of the areas around the seal rings, checking the integrity, cleanliness and lubrication of the sealing system (shaft-seal-lubricant).
- Lubricate the shaft sleeves, the motor shaft, and solid or hollow cylindrical and splined slow- and high-speed shafts with suitable lubricating greases in order to prevent any fretting corrosion. The use of lubricants is always prohibited on shafts that are connected and coupled using a shrink disc (see the section "Splined shaft").
- Ensure that the mounting of external accessories to the gear reducer (including, but not limited to: pulleys, gear wheels, couplings, tanks, sensors and auxiliary systems) is carried out to the highest standards, without drilling any holes, and taking care to avoid damage or operational problems, handling all components with care and using all the necessary devices and fastenings. For further details, see the section entitled "Specific mounting".
- Before fitting the gear reducer to the machine, the machine must be placed in a safe operating condition, switched off and secured against accidental start-up until the operator guards have been fully installed.
- Where necessary, provide 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.

- Make sure the operating position matches the mounting position reported on the plate.
- Check that the oil level plug is always clearly visible, even after the gear reducer has been mounted to the machine, to allow for the scheduled periodic inspections.
- Where possible, it is advisable to ensure that the drain and fill plugs are as accessible as possible, to prevent unwanted vapours or dripping. If this is not possible, please contact MOTOVARIO TECHNICAL SUPPORT.
- Flanged or foot-mounted gear reducers must be secured to the machine structure on a flat surface machined by a machine tool, which complies with the following tolerances: flatness ≤ 0.05 mm/100 mm, concentricity @ 0.08 mm and perpendicularity $\perp 0.05$ mm; this structure must be both strong and rigid, and not subject to vibrations (which must be assessed in accordance with the general guidelines of standard UNI ISO 20816-1 for power ratings below 15 kW and UNI ISO 20816-3). See the figure below. It is advisable to use couplings capable of compensating for misalignment and/or vibrations in the machine shaft to be coupled.
- In the case of foot-mounted installations, as an alternative to the above, adjustable supports may be used to ensure strength and rigidity, whilst verifying, by means of measurement, that the alignment complies with the parameters mentioned above. The use of couplings or misalignment compensation systems must be specified by the machine/plant designer, with the assistance of MOTOVARIO TECHNICAL SUPPORT where necessary.
- Also check that the support surface is large enough to fully accommodate the base of the gear reducer.
- For foot-mounted versions from size HPL 180 upwards, where it is necessary to maintain precise parallelism between the axes ($// < 0.15 \times 100$ mm), it is advisable to use an additional support alongside the foot-mounted support



supplied by MOTOVARIO S.p.A., utilising a double centring system

- The support surface on which the gear reducer is fixed in the T version (feet) must have a planarity of 0.3 and be sufficiently rigid. This specification applies to all sizes in the HPL series. As an alternative to planarity, the installer or designer can use devices such as calibrated spacers to align the support surfaces of the gear reducer support.
- Ensure that the combination of radial and torsional loads falls within the limits specified in the catalogue.
- To limit deflection of the output shaft, a second support can be added to the HPL180 and higher versions, utilising the dual-centring system.
- For HPL180 versions and above, type F, with position V1 or V3, an oil-level indicator system using a tube is provided. For these configurations, Class 10.9 stud bolts and nuts (of the corresponding strength class) may be used at the fittings instead of screws, in order to simplify mounting. Ensure that the correct tightening torque is applied.
- For high radial loads at the output end (≥ 80 per cent of the permissible radial load at the point of application), double centring must always be used where specified.
- For versions with shaft mounting and an HM shrink disc, it is recommended to use MOTOVARIO torque arms or to adhere to their dimensions, which form an integral part of the design; any changes must be agreed with MOTOVARIO TECHNICAL SUPPORT.
- For fixings, use screws with a minimum strength class of 10.9, and where ambient temperatures are below -15°C , use screws treated for low temperatures. To prevent any indentations in the cast iron caused by high tightening torque and external loads acting on the shafts, it is advisable to fit washers made of hardened material. The bolts must be tightened using a torque wrench or another more accurate device to ensure the correct tightening torque is applied. Please refer to the TABLES OF TIGHTENING TORQUES FOR FIXING SCREWS contained in this manual, bearing in mind that:
 - The screw-in friction coefficient depends on various factors which we cannot specify in this document
 - In flange mountings, the screws are subjected to the torque transmitted by the gear reducer, the peak loads to which it is subjected, and any radial and/or axial loads acting on the output shaft and/or input shaft; therefore, in threaded mountings, the use of thread locker is recommended to prevent loosening caused by vibrations, shocks or reversals. It is recommended that the tightening of all screws be checked following operational tests and, in some cases, periodically during routine maintenance of the machine/system (this assessment is the responsibility of the designer).

- To assemble use screws with max/min 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

HPL	LV min	OF	LVP max	O
HPL 180 CS-SS	M16x180			
HPL 180 HS	M16x140	17 N°12	/	26 n°4
HPL 180 HM	M16x145			
HPL 220 CS-SS	M16x170			
HPL 220 HS	M16x150	17 N°15	/	26 n°4
HPL 220 HM	M16x165			
HPL 380 CS-SS				
HPL 380 HS	M16x165	17 N°24	/	33 n°4
HPL 380 HM				

- The schedule for routine maintenance of the gear reducers must be drawn up and finalised by the machine manufacturer in accordance with the guidelines laid down by MOTOVARIO S.p.A. and set out in this manual.
- A structure subject to torsional movements or deflections requires a shaft mounting (or an “HM” version shaft mounting), in which the gear reducers is rigidly connected to the shaft to be rotated; rotation about the working axis is the only movement against which the torque arm must provide resistance. Avoid over-constraint, which would increase the load on the gear reducer bearings. Any damping components for the torque arms are to be specified and designed by the machine/plant designer.
- Check that the output shaft has the correct direction of rotation, preferably in maintenance mode and always in complete safety.
- Where the gear reducer is supplied complete with lubricant by MOTOVARIO S.p.A., the brand and type of oil are indicated on the gear reducer label. If this is not the case, top up with the correct quantity of oil according to the operational mounting position (see the chapter “Mounting Positions”), which must correspond to the information on the label (if this is not the case, contact MOTOVARIO TECHNICAL SUPPORT, providing all the details from the gear reducer plate).
- The VP series combined worm gear reducers are fitted with separate lubrication systems using different types of oil; in some cases, the worm gear reducer does not require a lubricant change: for the planetary gear reducer, please refer to the section entitled “Lubrication”; for the worm gear reducer, please refer to the NMRV/NMRV-P series manual.
- The lubricant must be selected from those recommended by MOTOVARIO S.p.A. (otherwise, please contact MOTOVARIO TECHNICAL SERVICE).
- Always check that the gear reducer is filled with the correct amount of oil whilst the gear reducer is at a standstill; during initial installation or at every oil change, open several plugs to allow for optimal air venting, fill to the correct level, run the gear reducer for approximately 3–5 minutes at most, at its rated operating speed, and check the level again (always whilst the gear reducer is at a standstill); Due to the internal configuration of the gear reducer, unwanted air pockets may have formed during filling; in this case, the procedure must be repeated until the correct level is stabilised. If the lubricant needs to be drained, this should be done whilst the engine is warm. For further details, see the “Maintenance” chapter, under the heading “Oil change procedure”.
- Do not exceed the correct amount of lubricant; if this happens, the excess lubricant must be drained off before the unit is put into operation.
- Replace the closing plug, if present, with the breather plug in the kit provided with the gear reducer.
- Check that there are no lubricant leaks; if there are, suspend installation, locate the leak and contact MOTOVARIO TECHNICAL SUPPORT, ideally providing photographic evidence to document the issue.
- Ensure adequate cooling by ensuring good airflow all round the gear reducer.
- Protect the surface of the gear reducer from direct sunlight or other sources of heat; the temperature of the coolant entering the gear reducer must not exceed 40°C.
- At the appropriate time (and in any event before the machine undergoes functional testing), install all the protections designed for the rotary parts to ensure the system is safe, in accordance with current regulations.
- For any device or accessory other than the gear reducer itself, always refer to the relevant user and maintenance

manuals and ensure compliance with the specific or general regulatory requirements applicable to these products.

In cases where ambient temperatures are not listed in the “LUBRICANTS RECOMMENDED BY MOTOVARIO” table, please contact MOTOVARIO TECHNICAL SUPPORT. If temperatures fall outside the standard range specified, ensure that suitable sealing rings and oils are used.



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

TCEI screws (UNI EN ISO 4762), TE screws (UNI EN ISO 4017), nuts (UNI EN ISO 4032)

	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



It is the installer's responsibility to determine the most suitable torque setting.
From size HPL 180, version F, the screws used to secure the gear reducer to the machine are the same as those used to fasten the gear reducer in place. In this case, apply the torques shown in the table and use Class 10.9 bolts

Please pay particular attention to ensuring compliance with the following points:

1. **Degrease with care the surfaces;**
2. **Remove any traces of dirt or dust;**
3. **Make sure the supporting surface is flat and large enough to fit the whole gear reducer;**
4. **Ensure that the lead screw, nut and coupling surface are of sufficient strength and do not generate galvanic torques. Please ensure that the length of the screws complies with the requirements.**

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 permitted values. 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.

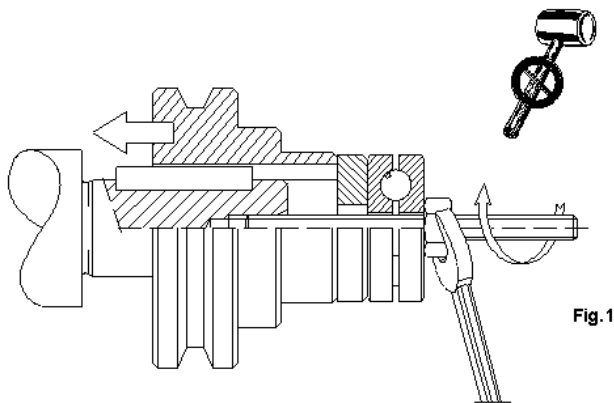
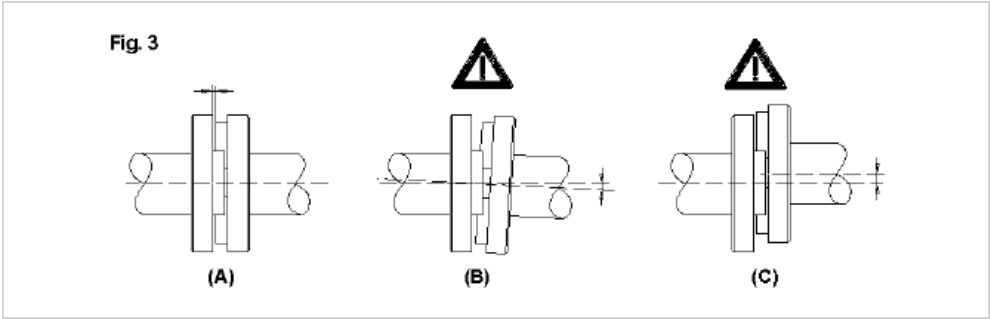
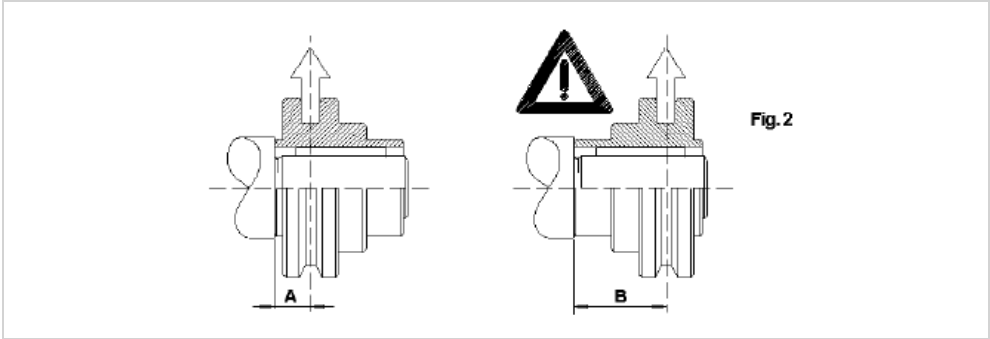


Fig.1

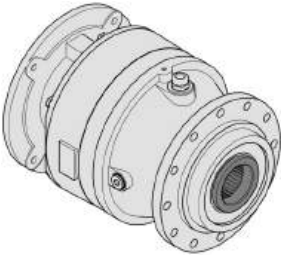
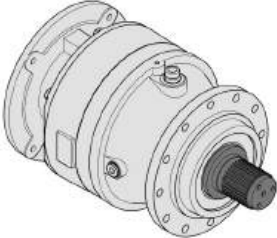
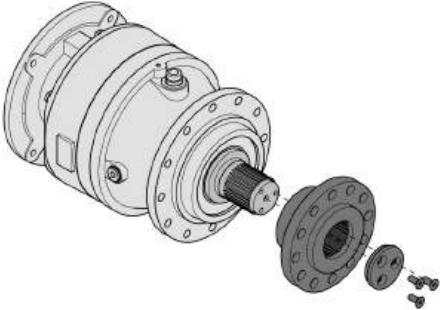
- Fig. 2, 3: Examples of correct and incorrect installation () on the output shaft of the gear reducer.



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
	

Indicative table of FIXING SCREW TIGHTENING TORQUE with resistance class 8.8 - 10.9 - 12.9
TSEI screws (UNI EN ISO 10642)

	Mn [Nm] +5% / -10%		
	8.8	10.9	12.9
M 4	2,4	3,5	4,1
M 5	4,7	7	8,2
M 6	8,2	12,1	14,2
M 8	20	29	34
M 10	39	58	68
M 12	68	101	118
M 14	106	162	190
M 16	172	253	296
M 18	245	348	448
M 20	349	494	579
M 22	480	681	798
M 24	600	851	996
M 27	889	1263	1478
M 30	1206	1711	2003
M 33	1639	2329	2726
M 36	2102	2988	3496
M 39	2734	3886	4548
M 42	3370	4799	5656
M 45	4222	6014	7078
M 48	5093	7254	8487
M 52	6568	9354	10947
M 56	8186	11658	13642
M 60	10181	14500	16968

It is the installer's responsibility to determine the most suitable torque setting.

8.1.3 Mounting with shrink disc series HPL

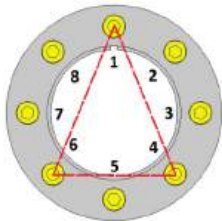
Gear reducers may be fitted with a shrink disc to lock the hollow shaft on the driven shaft. It is essential not to tighten the locking unit on the hollow shaft before inserting the machine pin to avoid deforming it. For the correct dimensioning of the machine shaft, refer to the paragraph “Hollow low speed shaft with shrink disc” in the LOW SPEED SHAFTS section of the technical catalogue.

Ensure that the machine shaft complies with the geometric specifications set out in the Motovario catalogue, including the presence of a double centring mechanism. From size HPL 130 upwards, a radial pilot hole allows the fitting of fluid-powered release mechanisms.

Mounting

For fitting the locking unit proceed as follows:

- If necessary, loosen the screws (without unscrewing them) of the shrink disc, in sequence and gradually;
- Degrease with care the surfaces of the hollow shaft and of the machine pin to couple. The presence of grease in the HM versions may reduce the transmittable torque;
- Check that the locking shaft diameter is correct (refer to the paragraph of the catalogue mentioned earlier);
- Make sure to position the locking unit axially on the gear reducer hollow shaft according to the catalog dimensions, lubricating beforehand the outer surface of the hollow shaft;
- Mount the reducer to the machine 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” for MOTOVARIO shrink disc

HPL	Screw	M _T 12,9 [Nm]
010	n°10 M6	12
020	n°12 M8	12
030	n°12 M8	30
050	n°12 M8	30
080	n°9 M10	59
130	n°12 M10	59
180	n°8 M16	250
220	n°8 M16	290

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, 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, please contact MOTOVARIO TECHNICAL SERVICE.

8.2 INPUT SHAFT CONNECTIONS

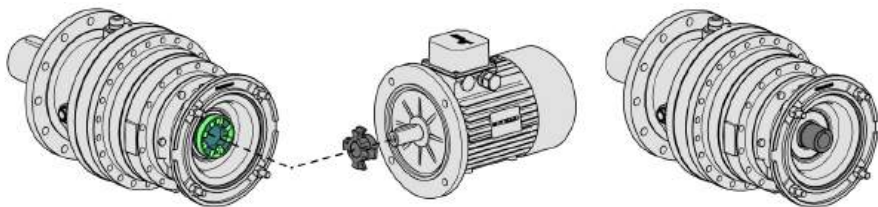
8.2.1 Motor mounting flanges

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

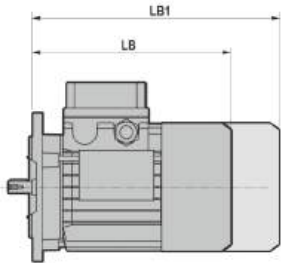
- First of all make sure, by checking the nameplate data of the motor and gear reducer, that the dimensions of the transmission are suitable to install the motor's rated power. Also ensure the motor is suitable for the class of the environment where it will operate;
- Check that the tolerances of the 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.



For information on coupling the HPL gear reducer to the MOTOVARIO motor – including dimensions, weight and relevant performance data – please refer to the catalogue on the MOTOVARIO corporate website.
For information on coupling the HPL gear reducer to another motor, please refer to the table below. These motors must fall within the range of values shown in the table. We accept no liability in the event of the use of motors that do not fall within these ranges.



MOT.	M _n [Nm]	M _s [Nm]	LB	W _T T	LB1	W _T TB
				kg (max)		kg (max)
56	0,68	1,36	177	3,3	-	-
63	1,77	4,956	188	5	249	6,5
71	3,8	12,16	208,5	8,7	276	10,5
80	5	16	232,5 *255,5	13,5	304 **326	17
90S	7,3	23,36	248 *281	18,5	324,5 **372	22
90L	10	33	273 *306	20	349,5 **396	26
100	14,6	48,18	308	25	389,5	32
112	26	88,4	322,5 *347,5	36	419 **446	46
132S	36	136,8	372	64	461,5	78
132M	49	171,5	410	67	513,5	81
160	97	692	530	127	670	157
180	142	1036	598	171	756	211
200	193	1428	711	306	872	331
225	290	2175	739	374	918	408
250	354	2478	744	426	959	472

* TP80B4, HSH80B4, TP90S4, HSH90S4, TP90L4, HSH90L4, TP90S6, TP112M4, TP112M6

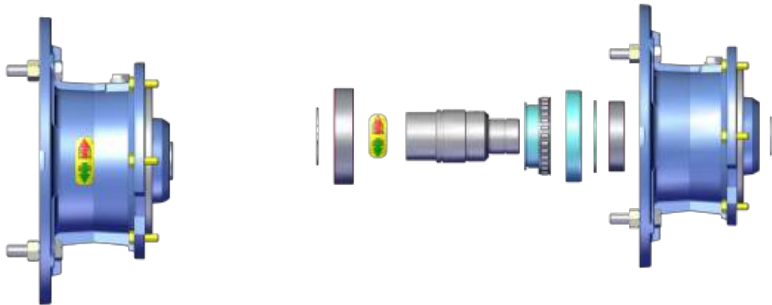
** TBP80B4,TBP90S4, TBP90L4, TBP90S6, TBP112M4, TBP112M6

SYMBOLS AND UNITS OF MEASUREMENT	DESCRIPTION
M _n [Nm]	Nominal torque [Nm]
M _s [Nm]	Starting torque [Nm]
W _T (T-TB) [kg]	Motor weight (version B5) [kg] T - without brake TB - with brake
LB-LB1	Motor length (version B5) [mm] LB - without brake LB1 - with brake

8.3 ACCESSORIES

8.3.1 Backstop device

The gear reducer can be supplied with backstop device on input shaft. Backstop device allows output shaft rotation in only one sense of direction; according to the size, it is available in the input flange or in the motor with the same dimensions. It is important to specify the required sense of direction on the order. The backstop device is not available for mounting position V1/V5 with motor size IEC 100...180. 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.



SENSE OF DIRECTION AVAILABLE

CLOCKWISE SENSE OF DIRECTION REFERRED TO HIGH SPEED SHAFT	COUNTER CLOCKWISE SENSE OF DIRECTION REFERRED TO HIGH SPEED SHAFT

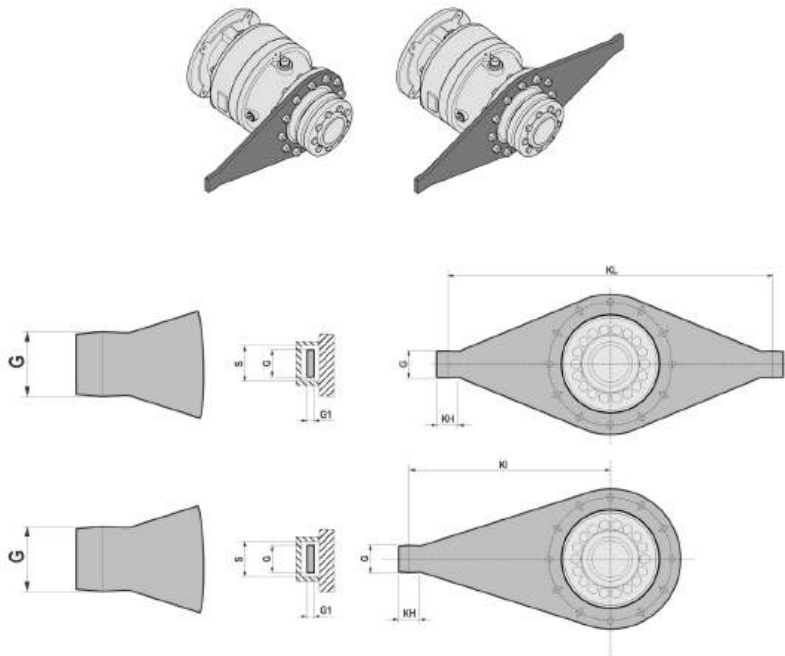
COUNTER-CLOCKWISE ROTATION	CLOCKWISE ROTATION

		71	80	90	100-112	132	160	180	200
		160x14	200x19	200x24	250x28	300x38	350x42	350x48	400x55
HL 1	010	B5	B5	B5	B5	B5	B5	/	/
	020	/	/	/	B5	B5	B5	/	/
	030	/	/	/	B5	B5	/	/	/
	050/080/130/180/220/380	/	/	/	/	/	/	/	/
HL 2	010	B5	B5	B5	B5	B5	/	/	/
	020/030	/	/	B5	B5	B5	B5	/	/
	050	/	/	/	B5	B5	B5	/	/
	080	/	/	/	B5	B5	/	/	/
	130/180/220/380	/	/	/	/	/	/	/	/
HL 3	010	B5	B5	B5	B5	/	/	/	/
	020/030	B5	B5	B5	B5	B5	/	/	/
	050	B5	B5	B5	B5	B5	B5	/	/
	080	/	B5	B5	B5	B5	B5	/	/
	130	/	/	B5	B5	B5	B5	/	/
	180	/	/	B5	B5	B5	B5	/	/
	220	/	/	/	B5	B5	/	/	/
	380	/	/	/	/	B5	/	/	/
HL 4	010	B5	/	/	/	/	/	/	/
	020	B5	B5	/	/	/	/	/	/
	030	B5	B5	B5	/	/	/	/	/
	050/080	B5	B5	B5	B5	/	/	/	/
	130/180	B5	B5	B5	B5	B5	/	/	/
	220	B5	B5	B5	B5	B5	B5	/	/
	380	/	/	B5	B5	B5	B5	/	/

8.3.2 Shaft mounting with reaction arm

The HPL gear reducers in HM configuration can be assembled with an asymmetric or symmetrical torque arm (see figure). The rotation reaction and damping system is the responsibility of the machine manufacturer. This system must be designed in such a way as not to create forces on the arm other than those of pure rotation reaction, which are transmitted to the reducer or to the shrink disk coupling.

Warning: external forces not foreseen by the application/reducer+coupling system, can compromise the integrity of the system.



HPL	KI	KL	KH	G	G1	S
010	325	300	30	40	8	42
020	325	300	30	40	8	42
030	400	360	35	44	12	46
050	400	360	35	44	12	46
080	490	450	45	55	15	57
130	490	500	50	60	20	62
180	600	600	50	60	25	62
220	700	750	60	70	25	72
380	800	850	90	110	30	112

Suggested values.
Materials considered: S355JR

If the values differ from those stated, please contact Motovario Technical Support.

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. <i>Never improvise repairs!</i>
	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. 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.

For assembly/installation, follow the recommendations in the "Installation" chapter.

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.

When changing the lubricant, it must be drained whilst the gear reducer is still warm, immediately after it has been brought to a standstill, with the machine secured and all necessary health and safety precautions in place (for example, there may be slight bursts of oil when the plug is removed), in order to ensure the most effective removal of debris and particulates present in the oil to be replaced, which would otherwise settle dangerously inside the gear reducer. If this is not possible, when changing the lubricant, the gear reducer must be flushed internally using suitable products that are compatible with the components and lubricants inside the gear reducer.

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;
- Clean the magnetic plug of any metal residue;
- 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 change must be within the intervals listed below, valid for closed and uncontaminated environments. In environmental conditions that can pollute the oil, or in temperature conditions other than normal, the change interval must be adequately reduced, and scheduled oil sampling must be planned to ensure its lubrication capabilities.

Table “MAXIMUM OIL CHANGE INTERVAL”

Oil type	Oil temperature			SI operation
	< 65° C	80° C	95° C	
Mineral oil	8000 h	4000 h	2000 h	3000 h / 1 year
Synthetic oil	16000 h	8000 h	4000 h	6000 h / 1 year

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, among which, by way of example:

- 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.

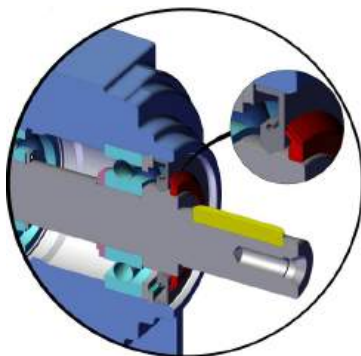
Proceed as follows when fitting the new ring:

- 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 any 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/VR 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.



Replacement of the seal by an unauthorised centre, or without MOTOVARIO's express written authorisation, will invalidate the warranty.

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. Check the gear reducer on a monthly basis to detect anomalous noise and/or vibrations. If even deterioration in the noise or vibration levels is detected, stop the gear reducer and contact Motovario.

When changing the gear reducer oil (see the relevant section), to service the bearings on the gear output shaft, locate the grease nipple and the set screw on the opposite side; this set screw must be unscrewed. Top up with grease of the type indicated in the table "Specifications of GREASE RECOMMENDED BY MOTOVARIO". When done, screw the nut back on using sealant.

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).
3000 h / 1 year	Mineral oil.	None.	Replacement.
6000 h / 1 year	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.	Check the ratio of the gear reducer.	Replace the gear reducer and/or the electric motor.
	Motor with polarity different from the one expected.	Check the polarity of the motor.	
	Faulty sealing ring.	Replace the ring	
Oil leaks from the sealing ring.	Sealing ring damaged .	If the shaft seat is damaged restore it (if possible).	Replace the component or contact MOTOVARIO TECHNICAL SERVICE.
	Damaged shaft seat.		
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.
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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.
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11.1.1 Lubricants

List of LUBRICANTS RECOMMENDED BY MOTOVARIO

HPL		
	* Polyalphaolefin synthetic oil (PAO)	Mineral oil
ENI	BLASIA SX	BLASIA
SHELL	OMALA S4 GXV	OMALA S2 GX
KLUBER	Klubersynth GEM 4-...N Klubersynth EG4	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

* Recommendation

NMRV-P 063 ÷ 110	
	Synthetic oil
T _{amb} °C ISO	(-25) ÷ (+50) ISO VG320
** LAND OIL	GEAR SINT 320
ENI	TELIUM VSF320
SHELL	OMALA S4 WE320
KLUBER	Klubersynth GH 6-320
MOBIL	-
CASTROL	ALPHASYN PG320
BP	ENERGOL SG-XP320
PETRONAS	GEAR SYN PAG 320

** All units are supplied with LAND OIL, unless otherwise requested.

VSF units have separate filling. Consult the relevant use and maintenance manual.

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														
	PAO	320														
	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.

	Unsuitable Temperature Range for typical oil viscosity: - 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.
	Critical Temperature Range based on typical oil viscosity: - 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 _{mb} for the chosen oil is reached; - higher power input is expected when starting.
	Normal ambient Temperature Range for typical oil viscosity.
	Critical Temperature Range for the gear reducer for typical oil viscosity: - 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 M ₂ (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} < M _{N2} *1.5.

Output speed	Oil type	Viscosity grade ISO 3448 VG	S1 operation	Maximum gear reducer casing temperature (T _{rid} max) [°C]
				Operation for intermittent service and/or FS>1.5
n ₂ > 150 rpm	PAO	150	60	70
	MIN	220	55	70
n ₂ ≥ 5 rpm	PAO	220	70	80
	PAO	320	80	95
	MIN	320	65	80
n ₂ < 5 rpm (*)	PAO	320	65	90
	MIN	460	65	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 10 °C lower than the assumed minimum T_{amb};
- perform a soft start with partial load (do not exceed 30% of the nominal torque Mn₂) 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	HPL-1			HPL-2			HPL-3			HPL-4		
	B3/B5 B6/B7 B8	V1/V5	V3/V6	B3/B5 B6/B7 B8	V1/V5	V3/V6	B3/B5 B6/B7 B8	V1/V5	V3/V6	B3/B5 B6/B7 B8	V1/V5	V3/V6
010	0,69	0,77	1,04	0,95	1,31	1,58	1,2	1,85	2,13	1,46	2,39	2,67
020	0,82	0,92	1,04	1,09	1,44	1,72	1,38	1,99	2,26	1,67	2,53	2,8
030	1,21	1,61	1,64	1,32	2,09	1,88	1,57	2,63	2,42	1,82	3,21	2,96
050	1,35	1,82	1,63	1,49	2,21	1,88	1,78	2,75	2,42	2,07	3,29	2,96
080	2,63	2,96	4,03	2,54	4,19	3,88	2,66	4,67	4,12	2,91	5,17	4,67
130	3,63	5,96	6,03	3,54	5,19	5,88	3,66	6,67	6,12	3,91	7,17	6,67
180	/	/	/	4,04	5,69	6,38	4,16	7,17	6,62	4,41	7,67	7,17
220	/	/	/	6,68	12,3	9,5	6,74	12,4	9,56	6,85	13	9,75
380	/	/	/	8,86	16,70	12,20	9,43	16,96	11,34	8,42	17,25	11,50

VP		B3/B5	B6/B7	B8	V1/V5	V3/V6
P613	NMRV-P063			0,33		
	HL2 010	0,95	0,95	0,95	1,31	1,58
P623	NMRV-P063			0,33		
	HL2 010	1,09	1,09	1,09	1,44	1,72
P633	NMRV-P063			0,33		
	HL2 030	1,32	1,32	1,32	2,09	1,88
P653	NMRV-P063			0,33		
	HL2 050	1,49	1,49	1,49	2,21	1,88
P983	NMRV-P090			1,15		
	HL2 080	2,54	2,54	2,54	4,19	3,88
P1133	NMRV-P110			1,6		
	HL2 130	3,54	3,54	3,54	5,19	5,88
P1183	NMRV-P110			1,6		
	HL2 180	4,04	4,04	4,04	5,69	6,38

- The VP combined gear reducers contain two separate oil chambers. The NMRV-P gear reducers of the sizes 063 - 090 - 110, which are the first stage of the VP combined gear reducers, are supplied complete with life-long lubricant, consisting of oil based synthetic polyglycol LAND OIL GEAR SINT.
- For the choice of lubricant for the planetary part of the VP combined gear reducer, refer to the table in the Lubricants section.

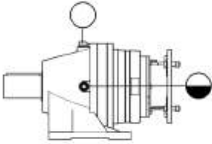
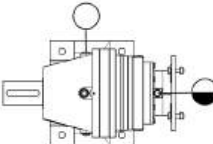
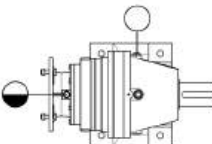
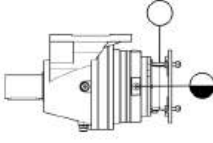
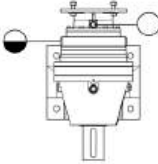
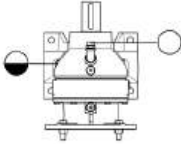
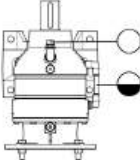
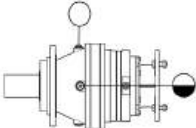
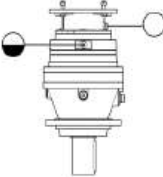
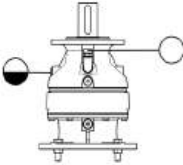
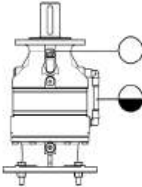
It is necessary, after installation, to replace the closed plug used for transportation with the supplied breather plug.

12. MOUNTING POSITIONS

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

	VENT PLUG
	LEVEL PLUG

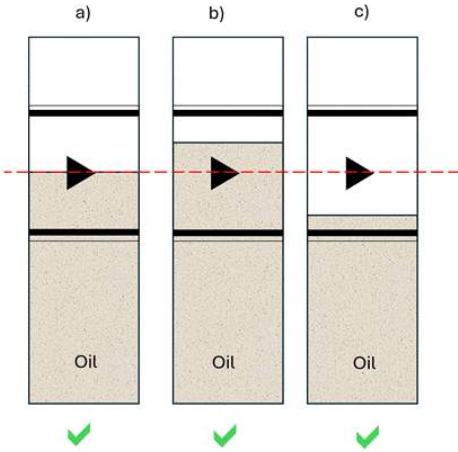
12.1.1 HPL

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

Closing plugs on all other holes.

	VENT PLUG
	LEVEL PLUG

** For positions V3–V6 (2/3/4-stage), Motovario recommends the use of kits comprising elbow fittings and translucent tubing, which allow for optimal filling of the assembled gearbox and ensure the correct oil level is achieved. The optimum oil level is considered to be up to the sticker with the arrow on it. The triangle indicates the ideal oil level. The sticker features two horizontal lines marking the upper and lower limits of the acceptable oil level. The image illustrates the significance and importance of positioning the sticker correctly

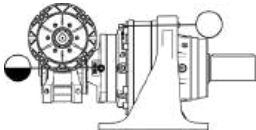
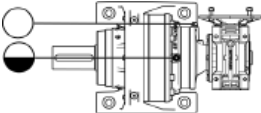
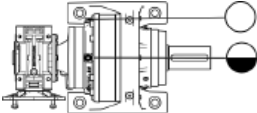
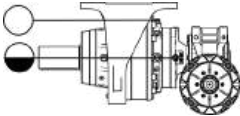
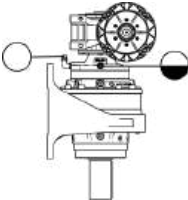
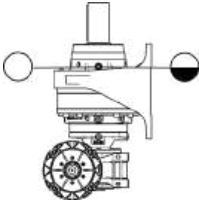
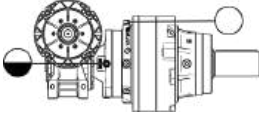
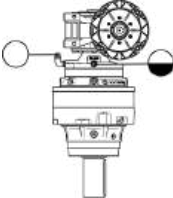
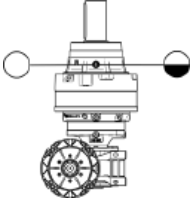


12.1.2 VP

VP P613-P1133		
T	B3	B6
	B7	B8
F	V5	V6
	V1	V3

Closing plugs on all other holes.

	VENT PLUG
	LEVEL PLUG

VP P1183			
T	B3	B6	B7
			
	B8	V5	V6
			
F	B5	V1	V3
			

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 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 wheelie 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, ivi incluse sostituzioni di parti o componenti di usura, non espressamente autorizzati da MOTOVARIO;
- 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.

