



**BREVINI[®]***Motion Systems*


Service Manual


MT-7015-0610


Gear units for environments with potentially explosive atmospheres,
according to ATEX 2014/34/UE


 II 2G Ex h IIC T4 Gb

 II 2G Ex h IIB T4 Gb

 II 2D Ex h IIIC T108°C Db

 II 3G Ex h IIC T4 Gc

 II 3G Ex h IIB T4 Gc

 II 3D Ex h IIIC T108°C Dc

IMM-0011EN**April 2020**

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1 STANDARDS OBSERVED AND TYPE OF MANUAL

Installation and maintenance manual for explosion-proof gear units, in potentially explosive atmosphere according to:

Table 1:

ATEX 2014/34/UE
EN ISO 80079-36:2016
EN ISO 80079-37:2016
EN 1127-1:2011



2 VERSION TRACKING

Table 2:

File name	Revision	Date	Changes description
MT-7015-0610_IT_EN_rev_00	00		First issue
MT-7015-0610_IT_EN_rev_01	01		
MT-7015-0610_IT_EN_rev_02	02		
MT-7015-0610_IT_EN_rev_03	03		
MT-7015-0610_IT_EN_rev_04	04		
IMM-0011EN_Rev.05 MT-7015-0610	05	21/04/2020	Layout update and complete revision

2.1 MANUAL APPLICABILITY AND SUPPORTED MODELS

Table 3:

Models
Plano Helical Gearbox

3 INTRODUCTION

3.1 CONSULTING THE MANUAL

Consulting this manual is facilitated by the table of contents given on the first page, which allows the subject of interest to be located at a glance. The chapters are arranged in a progressive way that facilitates finding the required information.

3.2 SCOPE OF THE MANUAL

This manual provides the gearbox user with the information necessary for its proper installation, use, maintenance and possible storage in compliance with the safety limits laid down by the current regulations.

This manual is produced in English by Dana Motion Systems Italia S.r.l.; on request, it can also be made available in other languages to meet the legislative and/or commercial requirements of the relevant European country.

We decline any responsibility for translations, in other languages, that do not comply with the original meaning.

For better understanding of this manual, given below are the terms and symbols used in it:

Danger Zone

An area inside or near the machine where the presence of an exposed person poses a risk to the safety and health of that person.

Exposed person

Any person who is wholly or partially in a danger zone.

Operator

A person in charge of installing, operating, adjusting, performing routine maintenance and cleaning the machine as a whole.

Qualified technician

A specialised person assigned to perform extraordinary maintenance or repairs that require special knowledge of the machine, its operation, the safety devices and how they work.

WARNING

Possibility of damage to the machine and/or its components.

CAUTION

Accident-prevention regulations for Operator and Qualified Technician.



Specific notes on safety against the danger of explosion.

IMPORTANT:

ADDITIONAL INFORMATION ABOUT THE OPERATION IN PROGRESS.

NOTE:

Provides useful information.

This Manual for installation and maintenance of gearboxes for places with potentially explosive atmospheres, according to ATEX 2014/34/UE,

- II 2G Ex h IIC T4 Gb
- II 2G Ex h IIB T4 Gb
- II 2D Ex h IIIC T108°C Db
- II 3G Ex h IIC T4 Gc
- II 3G Ex h IIB T4 Gc
- II 3D Ex h IIIC T108°C Dc

and its dedicated "Dimensional Drawing SI referred to in the Declaration of Conformity Certificate", must be kept in the immediate vicinity of the gearbox and easy to consult.

For any doubts and in case of damage or loss of the manual, please contact the Dana Motion Systems Italia S.r.l. Technical Service.



INTRODUCTION

3.3 WARRANTY / LIABILITY

Upon delivery, Products shall be free from defects in material and workmanship and comply with agreed technical specifications. The warranty period shall be (i) 12 months or 2000 operating hours (whichever occurs earlier) for Spicer® branded driveline Products, or (ii) 12 months for all other Products, starting in each case from the date of Customer's invoice to the end user or dealer, provided that the warranty period ends in any case latest 18 months after the date of Dana's invoice to Customer. In case of defects, Dana will either (i) if the repair is performed by Customer with Dana's prior written consent, reimburse Customer for costs of spare parts as per Dana's official spare parts list, including the applied discount, and within the limit of the purchase price of the Product in question, or (ii) repair the Product free of charge at its own premises or authorized service center, provided that Customer shall send the defective Product, at its own expense, to the repair location chosen by Dana in its sole discretion. The handling of warranty claims will follow Dana's Standard Warranty Conditions, as updated from time to time, which are available upon request by contacting dana_oh_product_service_support@dana.com. All further claims and remedies with regard to defects of Products, regardless of their nature, amount or legal basis, are hereby expressly excluded unless in case of gross negligence and willful misconduct by Dana. Except as stated herein, there are no representations or warranties, express or implied, with regard to the Products.

The warranty does not cover (a) Products or components thereof not purchased directly from Dana; (b) products supplied as prior to production approval; or (c) Products that have experienced (i) maintenance and/or repairs which are not executed in accordance with Dana's official service manual available upon request by contacting dana_oh_product_service_support@dana.com, (ii) storage or transport conditions which are not in accordance with Dana's requirements available upon request by contacting dana_oh_product_service_support@dana.com, (iii) non-professional installation of the Products or of ancillaries, (iv) damage caused by normal wear and tear, (v) damage caused during reassembly or installation, (vi) operation of the Product or application which is not in accordance with agreed application requirements or agreed Product specifications and/or (vii) the use of components, lubricants or ancillary products that are not approved by Dana.

To the extent permitted by law, neither party shall under any circumstances whatever be liable to the other, whether in contract, tort or restitution, or for breach of statutory duty or misrepresentation, or otherwise, for any loss of profit, loss of goodwill, loss of business, loss of business opportunity, loss of anticipated saving, special, indirect or consequential damage suffered by the other party that arises under or in connection with the contractual relationship between the parties. Nothing herein shall limit or exclude the liability of either party for death or personal injury, or for damages resulting from gross negligence, intentional breach or willful misconduct.

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All rights are reserved to **Dana Motion Systems Italia S.r.l.**

The structure and contents of this manual cannot be reproduced, either partially or totally, without an explicitly written authorization of **Dana Motion Systems Italia S.r.l.** Storage on any kind of support (magnetic, magnetic-optical, optical, micro-film, photocopy, etc.) is also not permitted.

3.4 REVISIONS

Dana Motion Systems Italia S.r.l. is not responsible for any kind of printing error in the manual. This manual is deemed valid at the invoicing date of the product to which it refers. The manual refers to the revision level printed on it. In case of a new revision of this manual, in the parts regarding regulations and spare parts, Dana Motion Systems Italia S.r.l. will update it and indicate a new revision index for the manual, pointing out its non-liability (direct or indirect) for improper use of the manual with revision index not matching in serial number, invoicing date and date of revision.

NOTE:

Images, documents and drawings are introduced for the purpose of instruction, for safe and proper handling of the products and maintenance operations. There may be minor differences between the drawings in this manual and the delivered product.

However, these differences are not significant for the main features of the product, or maintenance instructions.

4 STATE OF SUPPLY

The gearboxes supplied undergo a specific ATEX painting cycle to prevent electrostatic charges, and therefore must not be repainted; in case of supply of gearboxes that are not painted according to ATEX specifications (only possible for Category 3 gearboxes), the customer must take charge of the painting.

Unless otherwise stated in the contract, all the gearboxes are supplied without lubricant.

The machined outer parts of the gearbox, such as the hollow and solid shafts, support surfaces, spigots, etc., are protected with antioxidant oil (tectyl).

NOTE:

Avoid damaging the paintwork (mechanical, e.g. scratches; chemical, e.g. acid solvent; thermal, e.g. flames or sparks) so as not to compromise the protective effect.

5 PACKING, HANDLING, RECEIPT

5.1 PACKING

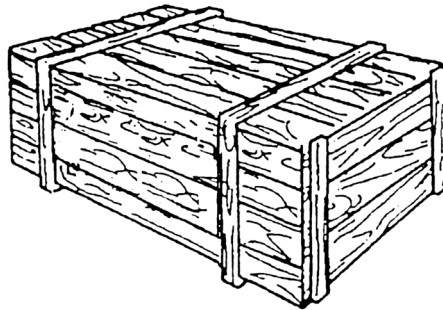


Fig. 1

NOTE:

Depending on the arrangements with the customer at the time of sale, the product can be packed in a wooden box, in completely closed cardboard packing, or on pallets.

To ensure that no part inside the packing can be damaged in any way during transport, the mobile parts are blocked and the more delicate parts are specially protected.

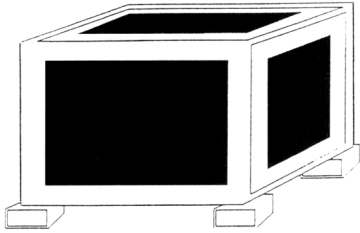
For transport, the product can be protected (in its most exposed parts) with impermeable materials or placed on a wooden pallet and fixed to it by straps or fastenings in order to obtain a single rigid body.

PACKING, HANDLING, RECEIPT

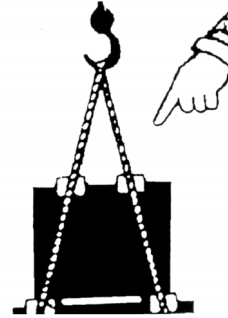
5.2 HANDLING

NOTE:

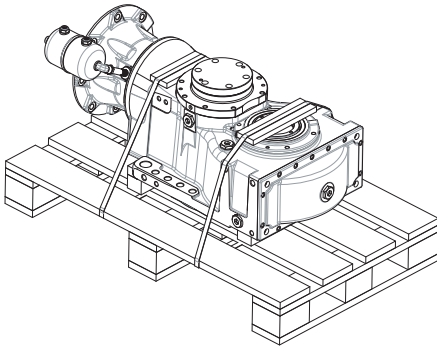
The weight of the packed products is given in the Transport Documents or Packing List.



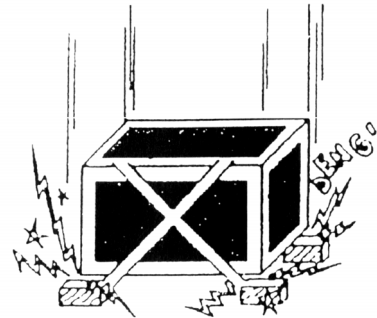
If necessary, place wooden wedges of wood under the package to facilitate lifting.



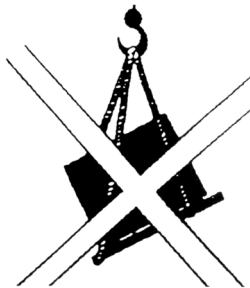
If the packages are unloaded with a hoist or hook, make sure the load is balanced and use approved lifting accessories for the sling. For packages shipped on pallets, make sure the lifting accessories do not damage the products.



For handling, use lifting equipment suitable for the type of packing and of adequate capacity, given on the same.



When lifting and positioning of the package, be careful to avoid violent impacts.



Never tilt or turn over the packing during transport.



IMPORTANT:

THE PACKAGES ARE NOT STACKABLE.



If the packages are unloaded by a lift truck, make sure the weight is balanced on the forks.

PACKING, HANDLING, RECEIPT

5.3 RECEPTION

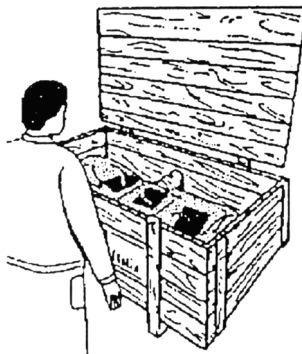


Fig. 2

NOTE:

On arrival of the packages, check the good condition of their contents in the presence of the carrier. Check the supply by means of the packing list enclosed with the product (transport documents), making sure the supply matches the order specifications.

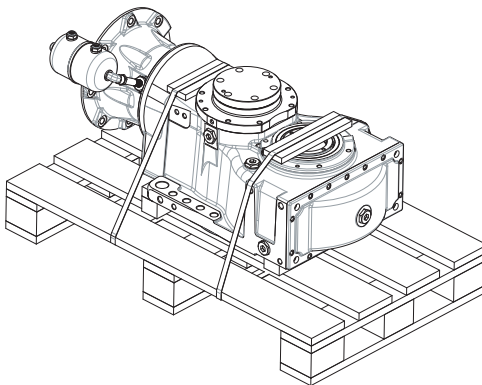


Fig. 3

CAUTION

The strap fixing of the product to the packing is sharp; during unpacking it could strike the operator. The packing must be removed as follows.

- Cut the straps with scissors (pay attention to the ends, which could strike the operator).
- Cut or remove the outer packing.
- Cut the inner strap (pay attention to the ends, which could strike the operator).
- Remove the gearbox from the pallet.

If any damage, defects or shortages are detected, immediately notify the Dana Motion Systems Italia S.r.l. Assistance Service.

WARNING



Do not put damaged gearboxes into service, even if only slightly damaged or if deemed unsuitable for their intended use; in this case contact Dana Motion Systems Italia S.r.l.

PACKING, HANDLING, RECEIPT

5.4 HANDLING THE GEARBOX WITHOUT PACKING

IMPORTANT:

THE WEIGHT OF GEARBOXES TO BE HANDLED MAY BE GIVEN ON DIMENSIONAL DRAWING SI REFERRED TO IN THE CONFORMITY DECLARATION CERTIFICATE.

CAUTION

Lifting, transport and handling operations must only be carried out by the maintenance technician and trained personnel (slingers, crane operators, etc.) coordinated by a qualified person on the ground, able to give the necessary signals.

CAUTION

Make sure the lifting device to be used for transport and handling is adequate for the total weight of the gearbox, given on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.

Any other system used for lifting, transport and handling of the gearbox, not included among those recommended by the manufacturer, invalidates the insurance guarantee for damage to the gearbox and/or optional units linked to it.

If the size of the gearbox obstructs the operator's view during lifting, transport and handling operations, use two operators on the ground who check for possible hazards or hindrances. Also make sure there are no unauthorised personnel in the transport area and that any accessories connected to the gearbox do not hinder movements or make transport manoeuvres dangerous.

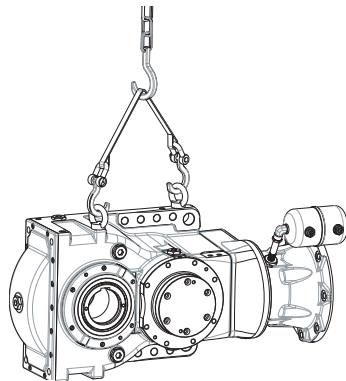


Fig. 4

CAUTION

The gearboxes are components that are not perfectly balanced and must be lifted with suitable devices.

Before removing the gearbox from its packing, secure it with the lifting accessories so that it cannot slip or tip over. Before handling the gearbox, remove the wooden chocks placed in the packing to ensure its stability during shipping.

- Proceed with caution during handling, avoiding sudden movements and violent impacts.
- Lift the machine, being careful not to unbalance the load during manoeuvres. In this phase, two operators must guide the gearbox at the sides during lifting, to avoid sudden movements or swaying which could create extremely dangerous situations.
- In case of excessive swaying, it is advisable to stop and repeat the gearbox lifting operations.
- After lifting the gearbox, take it to the place intended for positioning.

Transport

Always make sure the transported product is balanced, securing it firmly to the means of transport by means of slings, ropes and/or hooks complying with the current standards. During transport, avoid dangerous swaying of the load which could become unbalanced and fall.

Do not place anything on top of the gearbox during transport, as some parts could get permanently damaged.

6 STORAGE

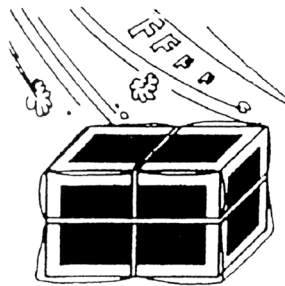
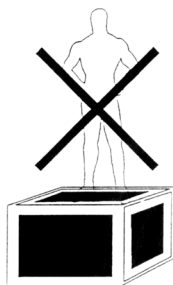


Fig. 5

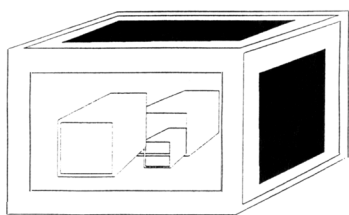
If the product needs to be stored for more than 2 months:

- Protect the shafts and spigots with film of grease and/or anticorrosion protective fluids.
- Fill the gearbox with suitable oils, see Lubrication (pag. 39), and orient the gearbox so that the breather plug is at the top.
- Store in a dry place with temperature between - 5°C and + 30°C.
- Protect the packages from dirt and dust.
- Avoid very damp places or exposed to the weather (no outdoor areas).
- Avoid direct contact of the gearbox with the ground.
- Place the gearbox on a stable support base and make sure there is no risk of sudden shifting.

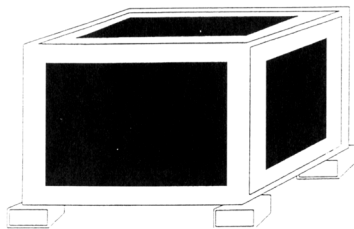


Do not stack gearboxes.

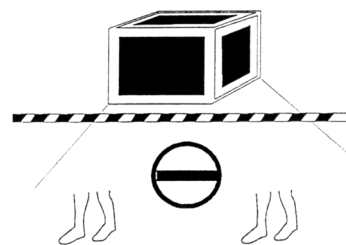
Do not walk on or place weights on the packing.



Do not store any other materials inside the packing.



If possible position wooden wedges between the bottom of the packing and the floor.



Store the packing well away from pedestrian or vehicular traffic routes.

NOTE:

The efficiency of the rotary seals will deteriorate in case of storage exceeding 6 months. It is advisable to do a periodical check by rotating the internal gears by hand, turning the input shaft.

WARNING



Precautions for reinstatement of the gearbox after storage:

- Degrease the outer coupling surfaces and remove the antioxidant using the usual solvents, paying attention to the sealing rings which must never come into contact with the solvent. This operation must be done outside of the explosion risk area.
- If, for storage, it is filled with oil different from that necessary for operation, flush the inside the gearbox before filling it with the required oil.
- After a very long period of storage it is advisable to replace the rotating rings before starting.

7 DATA PLATE

Every gearbox has a **Data Plate** and a **EU Declaration of Conformity** in accordance with Directive 2014/34/EU.

The Data Plate gives the main technical information regarding the functional and construction characteristics of the gearbox; it must therefore be kept intact and visible by providing for regular cleaning.

Use the data given on the plate when contacting the Dana Motion Systems Italia S.r.l. service centres.

 Via L. Brevini 1 / A 42124 Reggio Emilia / Italy					

MARCATURA
MARKING

Fig. 6

- 1 - Bar code
- 2 - Manufacturing date
- 3 - Serial number
- 4 - Max. input rpm (with Duty cycle, see drawing SI)
- 5 - Family name
- 6 - Max. operating power (with Duty Cycle, see drawing SI)
- 7 - Total ratio
- 8 - Input type
- 9 - Atex signature
 - II 3G Ex h IIC T4 Gc
 - II 3G Ex h IIB T4 Gc
 - II 3D Ex h IIIC T108°C Dc
 - II 2G Ex h IIC T4 Gb
 - II 2G Ex h IIB T4 Gb
 - II 2D Ex h IIIC T108°C Db
 - X : Special conditions of use



The operating conditions must not exceed the values of the design duty cycle, given on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.

In case of malfunction of the system that controls the working power delivered, the machine must be stopped immediately and the gearbox sent to the Dana Motion Systems Italia S.r.l. Assistance Service for overhaul.

CAUTION



The gear motors (gear unit with motor) must have two separate rating plates with ATEX-compliant marking.

The marking of the motor must correspond to the design specifications of the system or machine.

For gear motors, the lowest Atex protection rating among those indicated on the gear unit and motor is valid.



DATA PLATE

7.1 CONDITIONS OF USE AND OPERATING LIMITS

The permissible ambient operating temperature is between -20°C and +40°C

WARNING

The rating plate values relevant to maximum surface temperatures refer to measurements in normal ambient conditions and normal and proper installation. Operation of the gearbox in a small compartment considerably reduces the ability to dissipate the thermal power, and therefore has significant effects on the generation of heat.

8 INSTALLATION AND ACCESSORIES

Installation of the gearboxes must be carried out with care and professionalism by technically qualified and adequately trained personnel.

Personnel should be informed about the following matters regarding safety in machine use:

- General accident-prevention regulations or those envisaged by international directives and the laws of the country where the machine is used.
- Specific accident-prevention regulations:
 - 1 - European Directive 2014/34/EU deals with prevention systems to be implemented on equipment and therefore, in the present specific case, it is the reference directive for gearboxes.
 - 2 - European Directive 1999/92/EC (ATEX 153) deals with the safety of personnel during installation, operation or maintenance of potentially explosive systems.
- Accident risks.
- Equipment provided for the safety of operators PPE (personal protection equipment: goggles, gloves, helmet, etc.).

Preparation for operation must occur in compliance with all the technical indications given on the dedicated Dimensional Drawing SI.

All installation operations must ensure maximum safety regarding:

- 1 - the safety of operators and third parties
- 2 - proper working of the gearbox
- 3 - safe operation

Any arbitrary tampering with the gearbox and all the original accessories is strictly forbidden.



The gear units supplied by Dana Motion System Italia are intended to be integrated into complete equipment or systems, therefore they must not be put into operation until the machine or system has been declared compliant with the provisions of the directives in force (Machinery Directive 2006/42/EC and subsequent amendments).



Before starting installation, check the consistency between the data given on the data plate and that regarding the place where the gearbox is to be installed.

The gearboxes do not have to be repainted if already supplied painted by Dana Motion Systems Italia S.r.l.

When it is absolutely necessary to apply an additional protective layer, the risk of ignition caused by electrostatic charges must be prevented.

CAUTION

Any installation or maintenance work must be done with the gearbox stopped, therefore it is advisable to make sure unintentional activation of the driving force cannot occur.



INSTALLATION AND ACCESSORIES

WARNING



The structures the gearboxes are fixed to must be rigid, with flat machined support surfaces free of paint, perpendicular to the driven shaft, and centring with adequate tolerance.

The contact surfaces must be perfectly degreased.

Check that the coupling with the flange of the electric or hydraulic motor (motion input side) is such as to prevent dust or foreign bodies from entering.

As a precaution use Loctite 510 sealant.

Care must be taken with the alignment of the gearbox and the driven shaft, especially with gearboxes with splined female output, which cannot take external radial or axial loads.

For the correct machining tolerances of the structure and machine shaft, comply with that given on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.

Before tightening the bolts connecting the gearbox to the structure and the motor to the gearbox, make sure the coupling between the male shafts and female shafts is precise, but without interference.

The drive parts to be coupled on the output shaft must be machined according to the instructions given in the following sections, for the respective types of fixing and output shafts.

In the connection between the gearbox input shafts and motor it is advisable to use couplings able to recover any misalignment, whereas if mechanical parts unable to recover misalignment are used, pay particular attention to the alignment of gearbox and motor during assembly.

In case of right-angle gear units with male input shaft, the input shaft may be deviated with respect to its ideal position.

To remedy this situation, the following is advisable:

- with connections by means of couplings able to recover misalignments, to measure the existing misalignment, check the misalignment tolerable by the coupling and, if the value is greater, shim the motor to come within the permissible play
- with connection by means of mechanical parts that do not allow the recovery of play, align the motor by shimming.

For mounting, use class 10.9 screws with tightening to 75% yield and plain washers ISO 7089 hardness HV300.

For tightening, refer to Table 4: Tightening torques (p. 19).

NOTE:



For mounting Category 2 GD gearboxes, use LOCTITE 243 on the bolts for fixing to the structure of the machine.

During the assembly make sure to avoid violent axial impacts which could damage the inner bearings.

Lubricate the splined input and output couplings with anti-seize compounds such as LOCTITE 8150, MOLYKOTE GN PLUS, CHESTERTON 710-785.

It is absolutely forbidden to do welding work on the gearboxes.

It is absolutely forbidden to confine the gearboxes inside closed enclosures, in narrow spaces or near heat sources.

Provide for lubrication in accordance with the instructions given in Chap. Lubrication (pag. 39).

INSTALLATION AND ACCESSORIES

Table 4: Tightening torques

Preload and tightening torque for bolts with ISO metric threads											
d x p mm	Sr mm ²	4.8		5.8		8.8		10.9		12.9	
		F kN	M Nm	F kN	M Nm	F kN	M Nm	F kN	M Nm	F kN	M Nm
3 x 0.5	5.03	1.2	0.9	1.5	1.1	2.3	1.8	3.4	2.6	4.0	3.0
4 x 0.7	8.78	2.1	1.6	2.7	2.0	4.1	3.1	6.0	4.5	7.0	5.3
5 x 0.8	14.2	3.5	3.2	4.4	4.0	6.7	6.1	9.8	8.9	11.5	10.4
6 x 1	20.1	4.9	5.5	6.1	6.8	9.4	10.4	13.8	15.3	16.1	17.9
7 x 1	28.9	7.3	9.3	9.0	11.5	13.7	17.2	20.2	25	23.6	30
8 x 1.25	36.6	9.3	13.6	11.5	16.8	17.2	25	25	37	30	44
8 x 1	39.2	9.9	14.5	12.2	18	18.9	27	28	40	32	47
10 x 1.5	58	14.5	26.6	18	33	27	50	40	73	47	86
10 x 1.25	61.2	15.8	28	19.5	35	30	53	43	78	51	91
12 x 1.75	84.3	21.3	46	26	56	40	86	59	127	69	148
12 x 1.25	92.1	23.8	50	29	62	45	95	66	139	77	163
14 x 2	115	29	73	36	90	55	137	80	201	94	235
14 x 1.5	125	32	79	40	98	61	150	90	220	105	257
16 x 2	157	40	113	50	141	76	214	111	314	130	368
16 x 1.5	167	43	121	54	150	82	229	121	336	141	393
18 x 2.5	192	49	157	60	194	95	306	135	435	158	509
18 x 1.5	216	57	178	70	220	110	345	157	491	184	575
20 x 2.5	245	63	222	77	175	122	432	173	615	203	719
20 x 1.5	272	72	248	89	307	140	482	199	687	233	804
22 x 2.5	303	78	305	97	376	152	592	216	843	253	987
22 x 1.5	333	88	337	109	416	172	654	245	932	286	1090
24 x 3	353	90	383	112	474	175	744	250	1060	292	1240
24 x 2	384	101	420	125	519	196	814	280	1160	327	1360
27 x 3	459	119	568	147	703	230	110	328	1570	384	1840
27 x 2	496	131	615	162	760	225	1200	363	1700	425	1990
30 x 3.5	561	144	772	178	955	280	1500	399	2130	467	2500
30 x 2	621	165	859	204	1060	321	1670	457	2370	535	2780



INSTALLATION AND ACCESSORIES

8.1 ⚡ EARTHING

WARNING



Carry out an equipotential connection of the gearbox and possible machine crankcase using one of the free holes of the gearbox casing, making sure to:

- remove the paint in the contact area;
- use wires of adequate section in accordance with the current regulations, see Table 5 of Standard EN 60079-0, considering as a cross-sectional area for the installation phase wires that of the motor power supply cables;
- use anti-loosening and anti-rotation fastening in the connection cables;
- mark the place used for the earth connection on the gearbox with appropriate symbols (⚡);
- check the equipotentiality between the gearbox and systems connected to its input and output.

8.2 GENERAL INSTRUCTIONS FOR SWINGING ANCHOR SYSTEMS

NOTE:

At each stage of the installation, make sure the right type of screws and bolts are used, i.e. compatible with the relative nuts and/or anchoring structures).

The steps listed below must be followed when installing the product:

- During installation, check that the oil, breather, level and drain plugs are in the right position. This will vary depending on the assembly position (see section Gearbox mounting positions (pag. 37)).
- The gear unit is normally supplied with a flange for coupling the electric, hydraulic and air motors.
- The customer is responsible for installing suitable safety guards around the input and output shafts as well as couplings, pulleys and belts etc. in accordance with applicable safety standards in the country where the machine is used.
- For gear units installed outdoors, use rust-inhibitor paint, protect the oil guard and relative sliding guides with water- repellent grease and provide appropriate protection against bad weather.
- It is standard practice to grease both shafts using a rust- inhibitor lubricant.
- Couplings must be made using suitable equipment.
- If the coupling proves difficult, stop and check alignment and tolerance of the driven machine shaft.

The gear unit was built to be supported by the shaft as a radial or axial load, hence it should be secured to prevent rotation using a restriction free to move in the axial plane.

The gear unit must be anchored so that the small radial oscillations present in swinging systems are possible. Elastic components, such as Belleville washers, elastic pads, shock absorbers, articulated stay rods or similar should be used. These are need to prevent any dangerous additional loads on the gear unit.

Appropriate safety precautions should also be foreseen to prevent damage to people or things:

- Breakage of the reaction restrictor and subsequent rotation of the gear unit on the machine shaft.
- Accidental breakage of the machine shaft.
- Lubricate hinges and sliding parts using a suitable lubricant.
- Do not carry out any welding work involving the gear unit, even as an earth point.
- The gearbox must be grounded.

INSTALLATION AND ACCESSORIES

8.2.1 ASSEMBLY WITH REACTION ARM

Clean and degrease all surfaces of the gear unit and reaction arm to be coupled; lubricants or paints reduce the friction coefficient, impeding the efficient operation of the application.

Also check that there are no dents, welding residues, etc.



Do not carry out any welding work that involves the gearbox, or even earthing!

In addition to the holes to attach the reaction arm, there are also two H7 tolerance holes for calibrated journal pins.

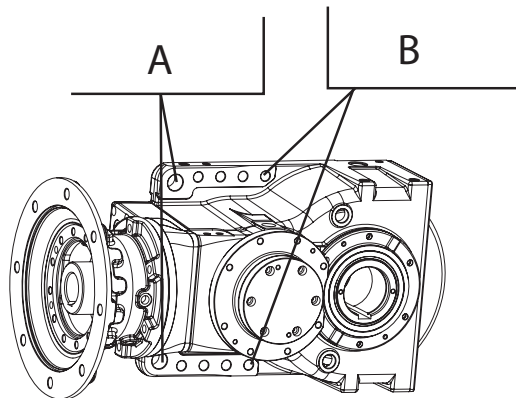


Fig. 7

A - 1+1 H7 Tolerance holes for calibrated jurnal pins

B - 4+4 Holes for anchor bolts with reaction arm

Fit the reaction arm (pos. 1) to the gear unit, securing it with the number of bolts 4) defined at the design stage (minimum recommended class 8.8). Tighten the assembly to the specified torque value shown in the Table 4:Tightening torques (p. 19). Clean gear unit and machine shafts carefully (pos. 3) then lubricate them with precision.

Fit the gear unit onto the machine shaft following the steps outlined in section Gear unit installation on various types of machine shaft (pag. 25).

Secure the reaction arm to the machine structure (pos. 2) and tighten using the anchor bolts (minimum recommended class 8.8) to the torque value indicated in the Table 4:Tightening torques (p. 19) (see Fig. 8 (p. 21)).

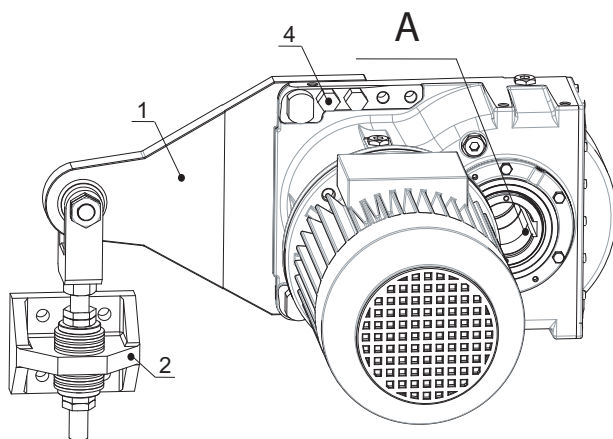


Fig. 8

A - 3 - Machine shaft seat

INSTALLATION AND ACCESSORIES

8.2.2 ASSEMBLY WITH REACTION ROD

In addition to the standard holes to attach the reaction arm, there are also 1 + 1H7 tolerance holes (pos. 5) for calibrated journal pins when fitting gear units with reaction rod.

Take the reaction arm and align it with the mounting pin holes on the fork of the rod (pos. 4) and with hole H7 (pos. 5) on the gear unit. Insert the calibrated journal pin and tighten it with the nut (pos. 1), leaving the rod free to rotate around the calibrated journal pin. Insert the counternut and tighten it against the nut then tighten both the nut and counternut into each other so that they can't come loose.

Clean the gear unit (pos. 3) and machine shafts carefully then lubricate with care.

Fit the gear unit onto the machine shaft following the steps outlined in section Gear unit installation on various types of machine shaft (pag. 25).

Fit the reaction rod with all components defined at the design stage (Belleville washers, elastic pads, etc. etc.) (pos. 4).

Secure the reaction rod to the machine structure (pos.2) and tighten with anchor bolts (minimum recommended class 8.8) to the torque value indicated in the Table 4:Tightening torques (p. 19) Fig. 9 (p. 22)).

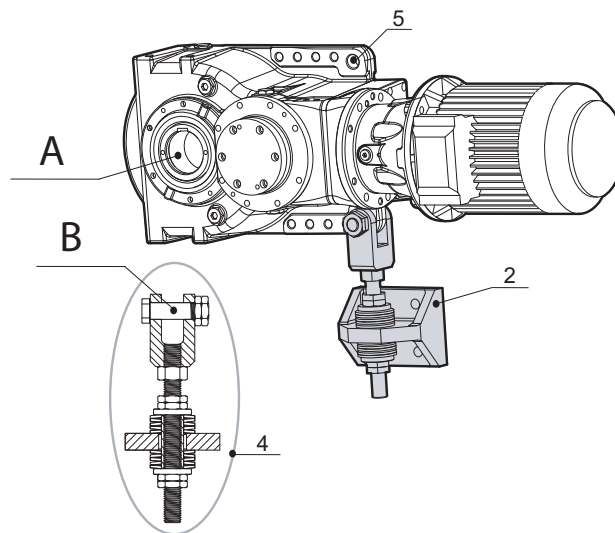


Fig. 9

- A** - 3 - Machine shaft seat
- B** - 1 - Calibrated journal pin

INSTALLATION AND ACCESSORIES

8.2.3 ASSEMBLY WITH SHRINK DISC

- Clean and degrease the internal surface of the gear unit and machine shafts.
- Lubricate the coupling housing (Fig. 10 (p. 23) balloon A).
- If the coupling is new there is no need to disassemble it and grease it.
- When servicing the coupling, disassemble it and grease the zones marked "C" (see Fig. 10 (p. 23)).
- Fit the coupling in its seat on the gear unit shaft without tightening the bolts, positioning it as shown in "a" (see Fig. 10 (p. 23)).

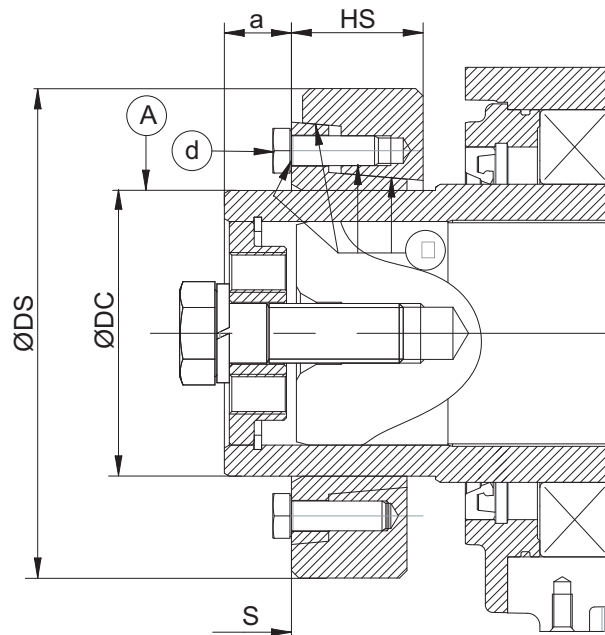


Fig. 10

- If the gear unit works in the vertical plane with the relative output shaft facing downwards, make sure the joint cannot slip off and fall; whatever the case, never tighten the bolts before fitting the shaft in its seat.
- Fit the gear unit on to the machine shaft or vice versa (excessive axial force shouldn't be necessary); there should be no interference when assembling, so make sure the shaft and gear unit are properly aligned.
- Using a torque wrench, tighten all the bolts gradually working your way round them (sequentially, not switching from side to side) until they have all been tightened to the torque value "Ma" shown in Table 1.
- Set the torque wrench to 3 - 5% above the setting given in table 1, then tighten the coupling bolts to the new setting.

Table 5:

Grand Rid.	a [mm]	ØDC [mm]	ØDS [mm]	HS [mm]	d [mm]	Ma [Nm]
13 (PH)	11	90	155	38	M10	29
13 (BPH)	27	90	155	38	M10	70
16	27	90	155	38	M10	70
18	27	100	170	43	M10	70
20	27	115	197	53	M12	121
23	35	130	215	53	M12	121
25	35	155	263	62	M14	193
28	35	175	300	68	M14	295

Ma (Nm.) = bolt torque



INSTALLATION AND ACCESSORIES

- Set the torque wrench again to setting “Ma” shown in Table 5:Table (p. 23) then re-check the torque on the coupling bolts, taking care not to tighten them any further. If this happens, repeat the torque sequence.
- When the coupling has been correctly fitted, visually inspect the assembly to make sure that the front surfaces of the inner and outer rings are on the same plane (see Fig. 10 (p. 23) pto. S).

Disassembling the shrink disc

- Gradually loosen the anchor bolts, working your way round in a circle. Loosen each bolt by just a quarter of a turn to start with to avoid bending and seizing.

CAUTION

On account of the high axial force, if the bolts are unscrewed completely in one or two turns, the two rings in the coupling may spring violently apart, putting the operators in danger.

If the coupling rings don't spring apart naturally after the bolts have been unscrewed, transfer some of the bolts (two bolts at 180° or 4 at 90°) into the internal ring extraction holes (see Fig. 11 (p. 24)), giving them no more than one turn a time to tighten them, alternating if there are 2 bolts and in a circle if there are 4.

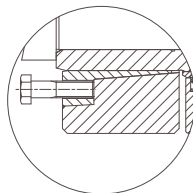


Fig. 11

NOTE:

We recommend you use 10.9 or 12.9 class bolts when the application is subject to strong jolts, frequent stops, changes of direction or when 70% of the maximum permitted torque is exceeded.

9 GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE SHAFT

9.1 GEAR UNITS WITH “K” TYPE SHAFT

9.1.1 MACHINE SHAFT WITH SHOULDER

Assembly:

align the axes of the gear unit female shaft (pos. 2) as much as possible with the machine male shaft (pos. 1), then bring the two shafts together after aligning the connecting spline.

Slot them together without exerting too much pressure on each part.

To make sure the female gear unit shaft is tight against the machine shaft use a threaded rod (pos. 4) of an appropriate size.

Now insert the inner snap ring retaining ring (pos. 5) then the (pos. 3). Now when you tighten the threaded rod, the two shafts will abut against each other (see Fig. 12 (p. 25)).

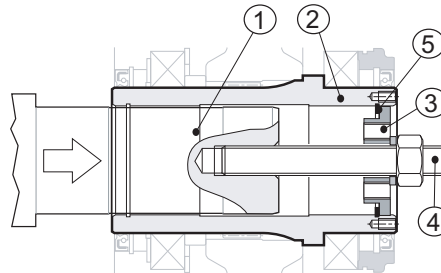


Fig. 12

Securing:

unscrew the threaded rod nut (pos. 4) and take it out of its seat. Replace the rod (pos. 4) with screw (pos. 6), torquing it down fully to the torque value shown in the Table 4: Tightening torques (p. 19), using an intermediate threadlocker (see Fig. 13 (p. 25)).

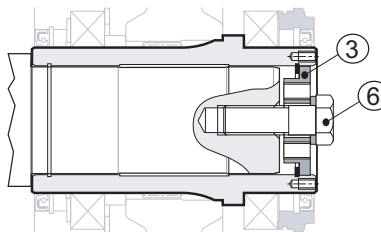


Fig. 13

Disassembly:

remove the anchor bolt (pos. 6), the plate (pos. 3) and retaining ring (pos. 5) from their relative seats.

Turn the plate over (pos. 3) and then return into its seat in the gear unit female shaft (pos. 2) and secure it in position with the inner retaining ring (pos. 5).

Insert 2 bolts (pos. 7) into the two threaded holes on the plate (pos. 3) (and screw them until they touch the machine shaft (pos. 1). Now give them alternately one full turn each (see Fig. 14 (p. 25)).

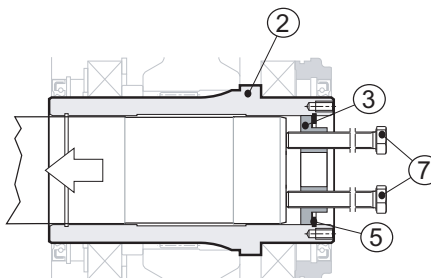


Fig. 14

GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE

9.1.2 MACHINE SHAFT WITH NO SHOULDER

Assembly:

align the axes of the gear unit female shaft (pos. 2) as much as possible with the machine male shaft (pos. 1), then bring the two shafts together after aligning the connecting spline.

Slot them together without exerting too much pressure on each part.

To make sure the female gear unit shaft is tight against the machine shaft use a threaded rod (pos. 4) of an appropriate size.

Now insert the plate (pos. 3) then the inner retaining ring (pos. 5) into their relative seats and tighten the threaded bar to bring the two shafts tight against each other (see Fig. 15 (p. 26)).

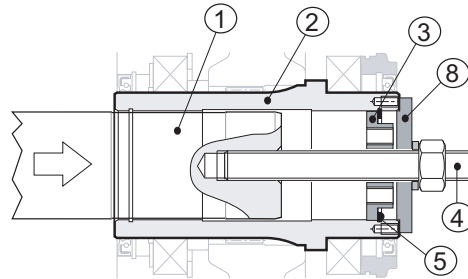


Fig. 15

Securing:

unscrew the threaded rod (pos. 4) and take it out of its seat. Replace the rod (pos. 4) with screw (pos. 6), torquing it down fully to the torque value shown in the Table 4: Tightening torques (p. 19), using an intermediate threadlocker (see Fig. 16 (p. 26)).

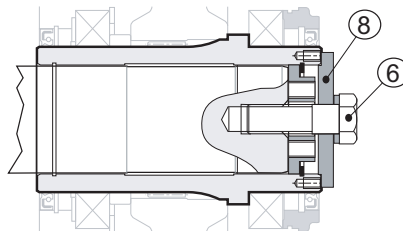


Fig. 16

Disassembly:

remove the anchor bolt (pos. 6) then the end plate (pos. 8) from their relative seats.

Insert 2 bolts (pos. 7) into the two threaded holes on the end plate (pos. 3) (pos. and screw them until they touch the machine shaft (pos. 1). Now give them alternately one full turn each (see Fig. 17 (p. 26)).

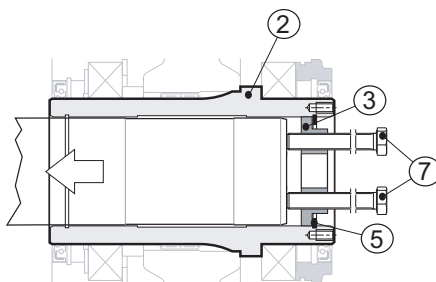


Fig. 17

GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE

9.2 GEAR UNIT WITH “S” TYPE SHAFT

Assembly:

align the axes of the gear unit female shaft (pos. 2) as much as possible with the machine male shaft (pos. 1), then bring the two shafts together after aligning the connecting to thing.

Slot them together without exerting too much pressure on each part.

To make sure the machine shaft rests tight against the plate (pos. 3) to be subsequently fitted, use a threaded rod (pos. 4) of an appropriate size.

Now insert the plate (pos. 3) then the inner retaining ring (pos. 5) securing the plate (pos. 3). Now when you tighten the threaded rod nut, the machine shaft will abut with the end plate (see Fig. 18 (p. 27)).

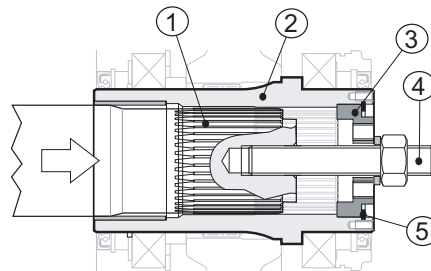


Fig. 18

Securing:

unscrew the threaded rod nut (pos. 4) and take it out of its seat. Replace the rod (pos. 4) with screw (pos. 6), torquing it down fully to the torque value shown in the Table 4:Tightening torques (p. 19), using an intermediate threadlocker (see Fig. 19 (p. 27)).

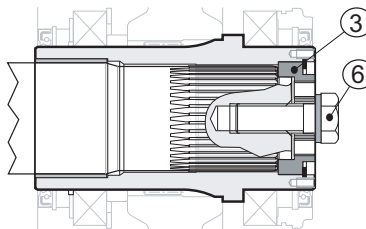


Fig. 19

Disassembly:

remove the anchor bolt (pos. 6) from its relative seat.

Insert 2 bolts (pos. 7) into the two threaded holes on the plate (pos. 3) and screw them until they touch the machine shaft (pos. 1). Now give them alternately one full turn each (see Fig. 20 (p. 27)).

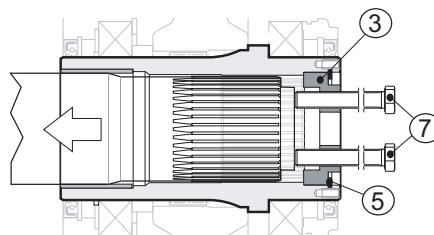


Fig. 20

GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE

9.3 GEAR UNITS WITH “D” TYPE SHAFT

9.3.1 MACHINE SHAFT WITH SHOULDER

Assembly:

Lubricate the coupling seat (pos.9) on the gear unit female shaft (pos. 2), then take the coupling and insert it into its seat without tightening the bolts.

Align the axes of the gear unit female shaft (pos. 2) as much as possible with the machine male shaft (pos. 1), then bring the two shafts together.

Slot them together without exerting too much pressure on each part.

To make sure the female gear unit shaft is tight against the machine shaft use a threaded rod (pos. 4) of an appropriate size.

Now insert the inner snap ring retaining ring (pos. 5) then the end plate (pos. 3). Now when you tighten the threaded rod, the two shafts will abut against each other (see Fig. 21 (p. 28)).

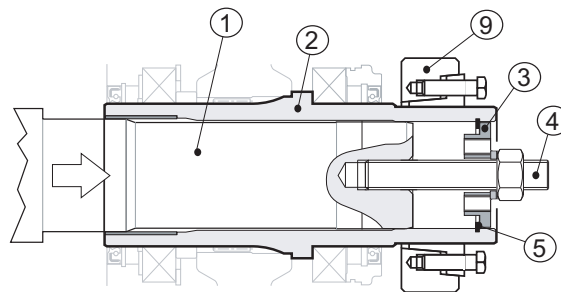


Fig. 21

Securing:

Unscrew the threaded rod nut (pos. 4) and take it out of its seat. Replace the rod (pos. 4) with screw (pos. 6), torquing it down fully to the torque value shown in the Table 4:Tightening torques (p. 19), using an intermediate threadlocker.

For instructions on how to secure the coupling, see section Assembly with shrink disc (pag. 23) (see. Fig. 22 (p. 28)).

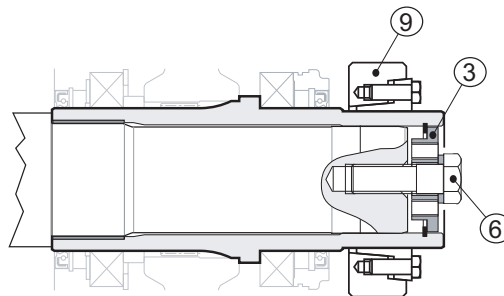


Fig. 22

GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE

Disassembly:

The first thing to do is remove the coupling. For instructions on how to do this, see section Disassembling the shrink disc (pag. 24). Remove the anchor bolt (pos. 6), the plate (pos. 3) and the snap ring retaining ring (pos. 5) from their relative seats. Turn the end plate e over (pos. 3) and return it to its seat in the gear unit female shaft, securing it by inserting the retaining ring (pos. 5).

Insert 2 bolts (pos. 7) into the two threaded holes on the plate (pos. 3) and screw them until they touch the machine shaft (pos. 1). Now give them alternately one full turn each (see Fig. 23 (p. 29)).

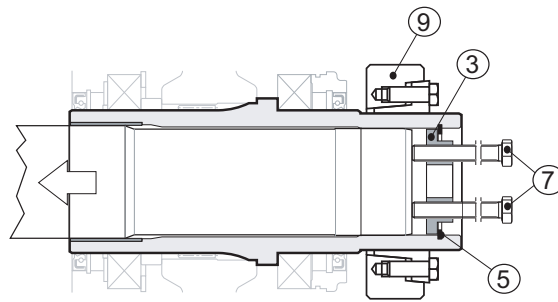


Fig. 23

GEAR UNIT INSTALLATION ON VARIOUS TYPES OF MACHINE

9.3.2 MACHINE SHAFT WITH NO SHOULDER

Assembly:

Lubricate the coupling seat (pos.9) on the gear unit female shaft (pos. 2), then take the coupling and insert it into its seat without tightening the bolts.

Align the axes of the gear unit female shaft (pos. 2) as much as possible with the machine male shaft (pos. 1), then bring the two shafts together.

Slot them together without exerting too much pressure on each part.

To make sure the female gear unit shaft is tight against the machine shaft use a threaded rod (pos. 4) of an appropriate size.

Now insert the end plate (pos. 3), the inner retaining ring (pos. 5) and the end plate (pos. 8). Now when you tighten the threaded rod nut, the two shafts will abut against each other (see Fig. 24 (p. 30)).

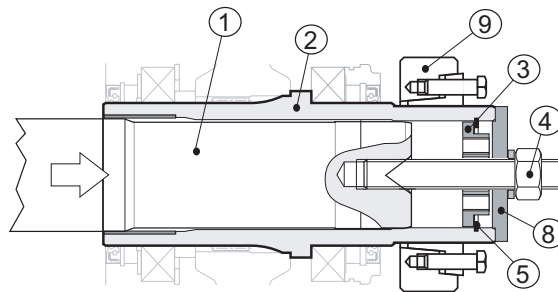


Fig. 24

Securing:

unscrew the threaded rod nut (pos. 4) and take it out of its seat. Replace the rod (pos. 4) with screw (pos. 6), torquing it down fully to the torque value shown in the Table 4: Tightening torques (p. 19), using an intermediate threadlocker.

For instructions on how to secure the coupling, see section Assembly with shrink disc (pag. 23) (see Fig. 25 (p. 30)).

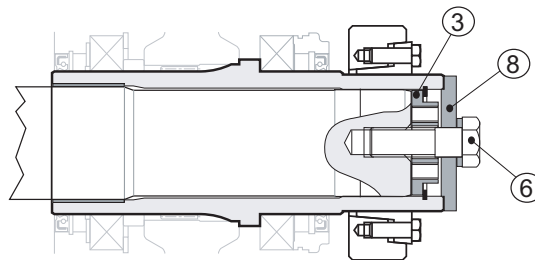


Fig. 25

Disassembly:

the first thing to do is remove the coupling. For instructions on how to do this, see section Disassembling the shrink disc (pag. 24). Remove the anchor bolt (pos. 6) and the end plate (pos. 8) from their relative seats.

Insert 2 bolts (pos. 7) into the two threaded holes on the end plate (pos. 3) and screw them until they touch the machine shaft (pos. 1). Now give them alternately one full turn each (see Fig. 26 (p. 30)).

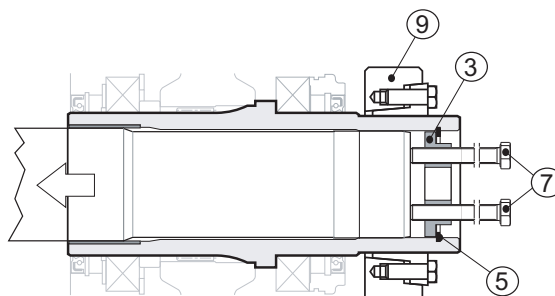


Fig. 26

10 ACCESSORY INSTALLATION INSTRUCTIONS

10.1 MOTOR ASSEMBLY

Remove any traces of paint from the surfaces (S) of the motor and motor flange to be coupled.

Check that there are no dents, machining defects, etc. on surfaces, alignment pins, shafts and holes.

When fitting the gear unit to the motor, lubricate the joint with a thin layer of grease or no-grip lubricant.

10.2 “UNIVERSAL 00” VERSION

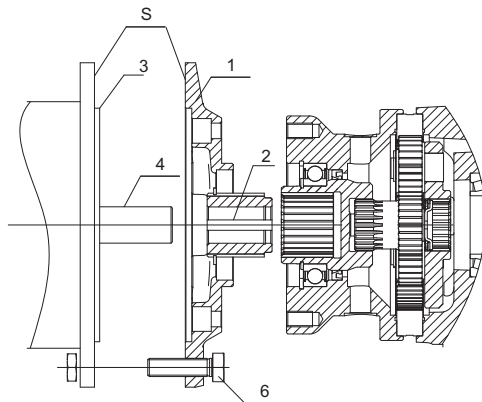


Fig. 27

Insert the coupling half (pos. 2) to the motor shaft (pos. 4), then align the coupling half grooves with the connecting ones on the pinion then fit the coupling half into the pinion, making sure that the motor spigot (pos. 3) is perfectly aligned with the motor flange spigot (pos. 1).

Once you're sure the motor is well-aligned, tighten all the anchor bolts to the torque value listed in the Table 4: Tightening torques (p. 19) (see Fig. 27 (p. 31)).

10.3 “CENTRAL JOINT” VERSION

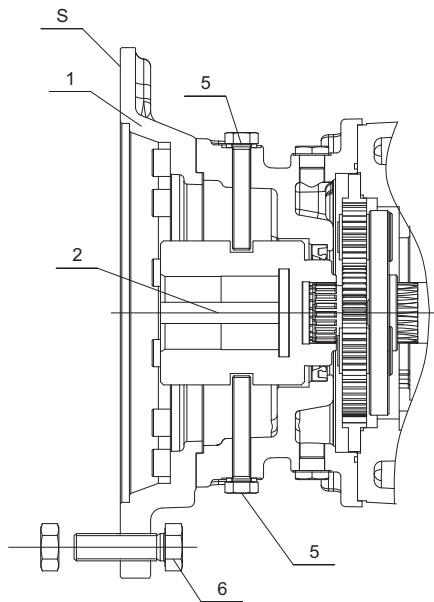


Fig. 28

In this version, if you want to disassemble the coupling half (pos. 2) when connecting to the motor but have already filled the gear unit with oil, you need to be careful because when you remove the coupling half, the oil may escape from the gear unit.

So, to remove the coupling half (pos. 2) you must first loosen the two bolts (pos. 5).

Insert the coupling half (pos. 2) onto the motor shaft (pos. 4), align the central joint grooves with the connecting ones on the pinion then insert the central joint into the pinion, being very careful not to damage the rotating retaining ring and making sure that the motor spigot (pos. 3) is perfectly aligned with the motor flange spigot (pos. 1).

Once you're sure the motor is well-aligned, tighten all the anchor bolts to the torque value listed in the Table 4: Tightening torques (p. 19) (see Fig. 28 (p. 31)).

NOTE:

Dana Motion Systems S.r.l. recommends you assemble the motor with the central joint in position because in refitting it you could damage the rotating retaining ring.



ACCESSORY INSTALLATION INSTRUCTIONS

10.4 NEGATIVE MULTI-DISK PARKING BRAKES IN OIL BATH

These brakes work under the thrust of a number of springs on pairs of fixed and movable alternating disks; release occurs through the hydraulic pressure in the piston. They therefore have a "negative" function and are to be used as parking brakes, and not for dynamic braking. These performance values (accuracy +/- 10%) are always calculated with zero back pressure; otherwise the braking torque is reduced in percentage by the ratio of back pressure/min. opening pressure.

Brake selection is made in the design phase and the technical details of the brake used are specified on the Dimensional Drawing SI referred to on the Declaration of Conformity Certificate.

NOTE:

**The multi-disk parking brake is only used as a parking brake, or in particular conditions as an emergency brake.
Different sizes of brakes fitted on the gearbox input are available according to the following tables:**

ACCESSORY INSTALLATION INSTRUCTIONS

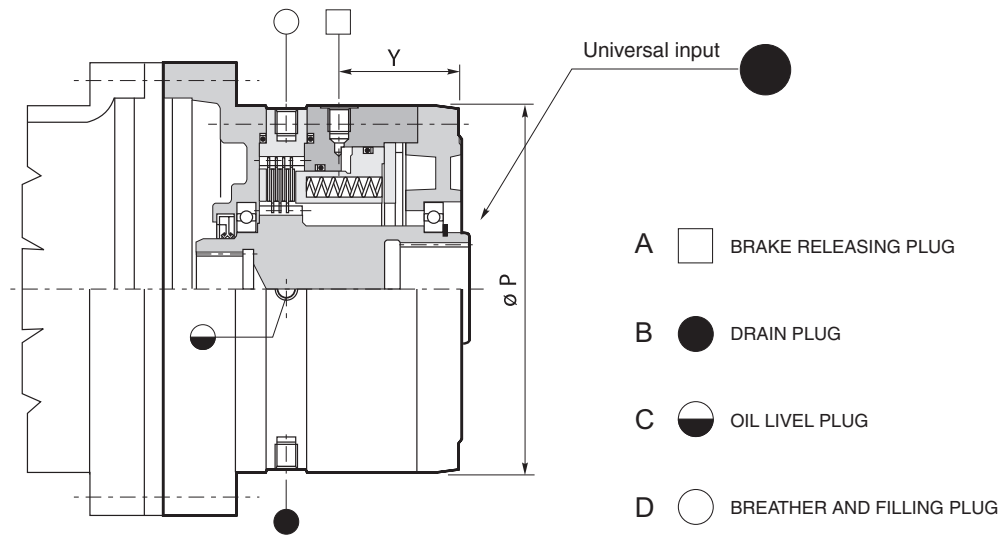


Fig. 29

Table 6:

	P	Y	Plugs				Kg
			A	B	C	D	
FL 250	195	67	M12X1.5	R 1/4	R 1/4	R 1/4	24
FL 350	195	67	M12X1.5	R 1/4	R 1/4	R 1/4	24
FL 450	195	67	M12X1.5	R 1/4	R 1/4	R 1/4	26
FL 650	195	67	M12X1.5	R 1/4	R 1/4	R 1/4	36
FL 750	195	67	M12X1.5	R 1/4	R 1/4	R 1/4	37
FL 960	225	72.5	M12X1.5	R 1/4	R 1/4	R 1/4	42

Table 7:

		T [N·m]	P [bar]	P _{max} [bar]	Vo [l]		Va [cm ³]
					horizontal	vertical	new discs
FL250	FL 250.4C	181	13.28	315	0.3	0.6	15
	FL 250.6C	278	13.28	315	0.3	0.6	15
FL350	FL 350.6C	417	19.92	315	0.3	0.6	15
	FL 350.8C	571	19.92	315	0.3	0.6	15
FL450	FL 450.6C	540	25.59	315	0.3	0.6	15
	FL 450.8C	737	25.59	315	0.3	0.6	15
FL650	FL 650.10C	642	19.92	315	0.5	1.0	15
	FL 650.12C	792	19.92	315	0.5	1.0	15
	FL 650.14C	949	19.92	315	0.5	1.0	15
FL750	FL 750.10C	834	25.59	315	0.5	1.0	15
	FL 750.12C	1027	25.59	315	0.5	1.0	15
	FL 750.14C	1229	25.59	315	0.5	1.0	15
FL960	FL 960.12C	1528	21.98	315	1.2	2.4	22
	FL 960.14C	1783	21.98	315	1.2	2.4	22
	FL 960.16C	2038	21.98	315	1.2	2.4	22
	FL 960.18C	2293	21.98	315	1.2	2.4	22

T: Medium static torque

P: Brake release pressure

P_{max}: Max pressure

Vo: Oil quantity

Va: Oil quantity for brake release control

ACCESSORY INSTALLATION INSTRUCTIONS

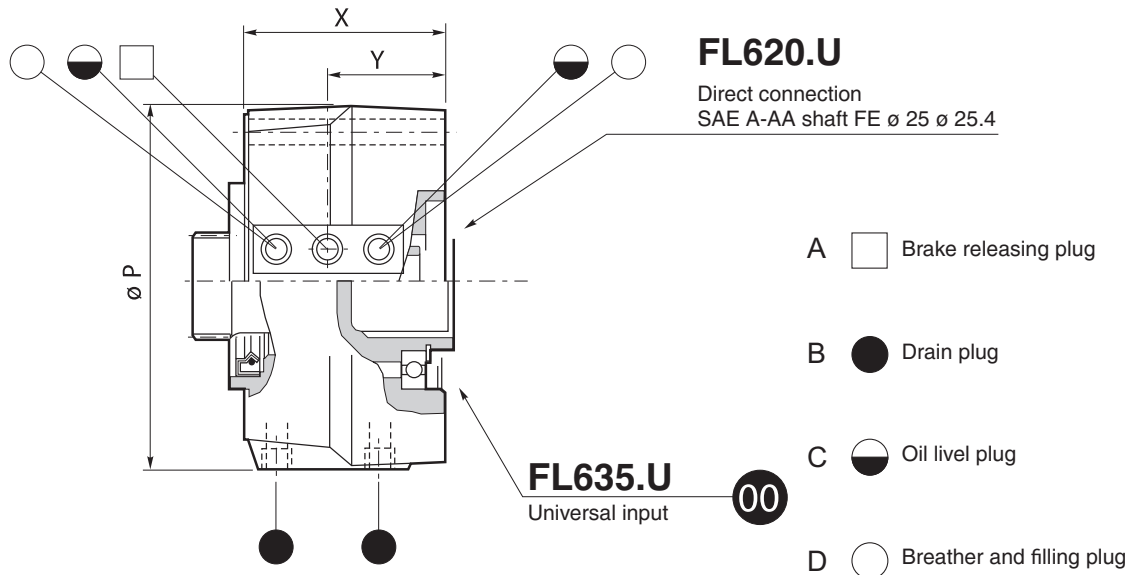


Fig. 30

Table 8:

	P	X	Y	Plugs				Kg	Code
				A	B	C	D		
FL620.U	161	104.5	46	M10x1	R 1/8	R 1/8	R 1/8	8	C1103704120 (alb. FE ø 25) C1103704130 (alb. FE ø 25.4)
FL635.U	165	91	59	M12x1.5	R 1/4	R 1/4	R 1/4	9	C1109200160

Table 9:

	T [N·m]	P [bar]	Pmax [bar]	Vo [l]		Va [cm³] new discs
				horizontal	vertical	
FL620.U	271	24.9	210	0.1	0.2	10
FL635.U	377	13.6	315	0.1	0.2	10

T: Medium static torque

P: Brake release pressure

P_{max}: Max pressure

Vo: Oil quantity

Va: Oil quantity for brake release control

⚠ WARNING



High drive shaft rotation speeds can cause rapid heating of the brake. When selecting the gearbox with brake, with hydraulic and electric motors required to work at high speeds it is necessary include a temperature sensor fitted on the brake, able to stop the gearbox when the set temperature is exceeded.

NOTE:

The implementation of a temperature sensor on the brake must be indicated in the order.

NOTE:

When the temperature sensor on the brake is foreseen, refer to chapter Accessories - gear unit monitoring sensors (pag. 36).

ACCESSORY INSTALLATION INSTRUCTIONS

WARNING



Brake control operating pressures lower than those given in the table for the respective brakes (brake opening pressure) can cause rapid heating of the brake. To avoid this risk, include a control pressure switch on the brake control hydraulic line.

WARNING



Brake control operating pressures higher than those given in the table for the respective brakes (Max. pressure) can quickly damage the brake piston seals. To avoid this risk, include a control pressure switch on the brake control hydraulic line.



ACCESSORY INSTALLATION INSTRUCTIONS

10.5 ACCESSORIES - GEAR UNIT MONITORING SENSORS

When the use of a thermal probe (PT100) and/or "ON-OFF" oil level sensor in the gear unit and/or brake is foreseen and necessary, these accessories can be included in the Dana supply of the gear unit, or are implemented by the Customer. In the latter case, the Customer is responsible for the correct choice of the thermal probe and/or "ON-OFF" oil level sensor mounted on the gear unit.



The thermal probe and/or "ON-OFF" oil level sensor, chosen by the Customer, must comply with ATEX regulations, for the Group, Category and type of atmosphere of the project, specifically approved and marked. The marking of the sensors in accordance with ATEX must correspond to the design specifications of the system or machine.

WARNING



The selection of an inadequate electrical sensor may not perform the correct control for which it is intended, causing damage or breakage to the gear unit and/or the lamellar parking brake.

IMPORTANT:



THE ELECTRICAL CONNECTIONS MUST BE MADE ACCORDING TO EN 60079-14.

10.5.1 TEMPERATURE SENSOR

The temperature sensor (PT100) must be selected with 2 electric thresholds:

- Alarm that indicates an abnormal increase in temperature.
- Stop machine to reach the detected maximum temperature of 80 +/- 3 °C.

NOTE:

The temperature sensor must be installed in the hottest area of the gearbox and/or on the multi-disc parking brake, detected during the first start-up test.

NOTE:

Make sure the temperature sensor is positioned as shown on the Dimensional Drawing SI mentioned on the Conformity Declaration Certificate.

10.5.2 OIL LEVEL INDICATOR "ON-OFF"

The oil level indicator selected, must be installed between the filling and drain oil plugs of the gearbox, positioned at the correct height, to ensure the proper oil level inside the gearbox.

The level indicator should indicate the decrease in oil level more than 5-10mm, of the oil level required for proper operation of the gearbox.

NOTE:

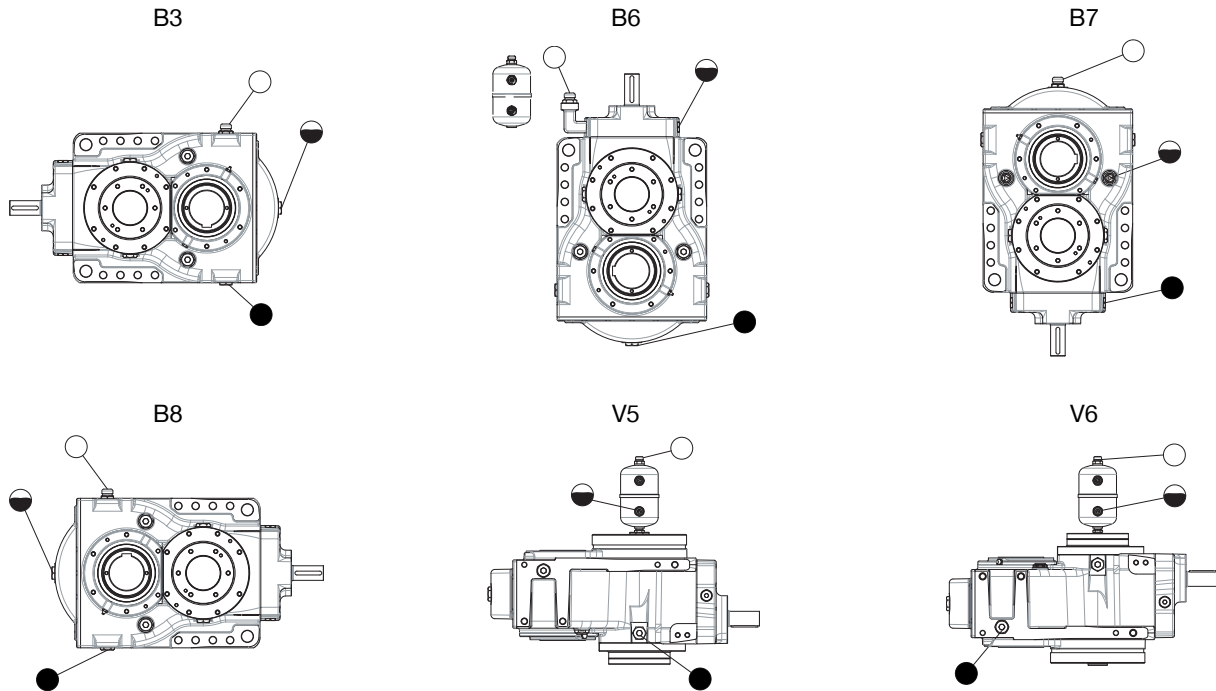
The location of the filling and drain oil plugs and gearbox oil level required, are indicated on the Dimensional Drawing SI, mentioned on the Declaration of Conformity Certificate.

ACCESSORY INSTALLATION INSTRUCTIONS

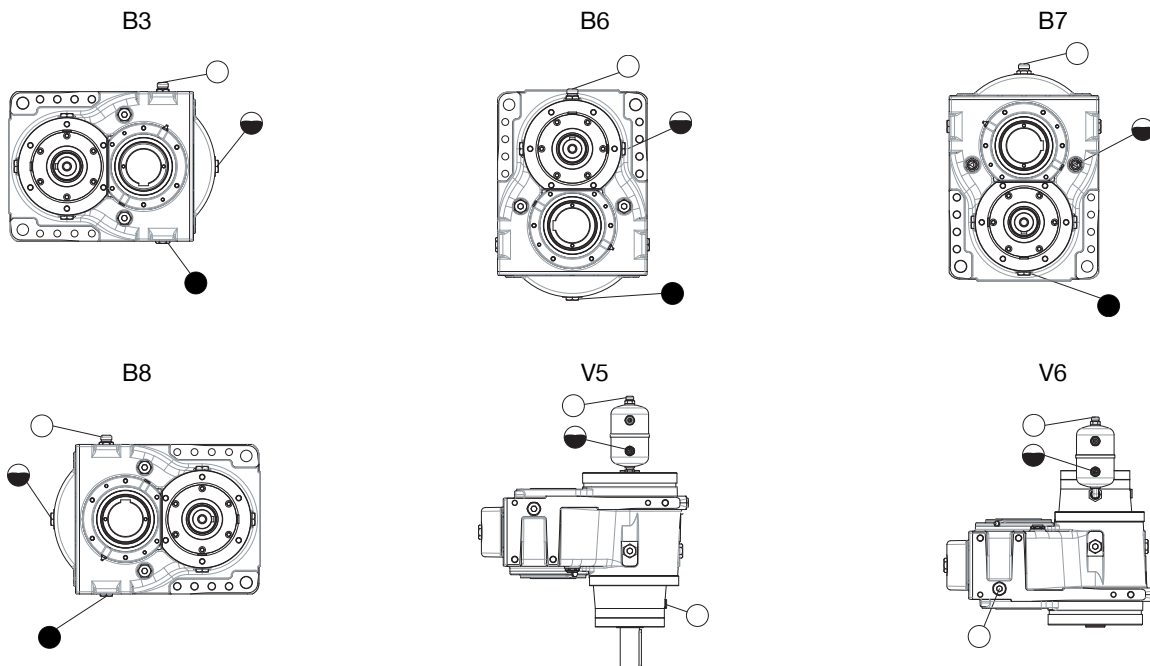
10.6 GEARBOX MOUNTING POSITIONS

The various denominations of possible gearbox mounting positions are given below.

10.6.1 BPH SERIES



10.6.2 PH SERIES



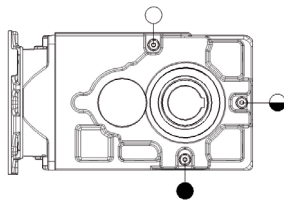
- Filling plug
- Drain plug
- Level plug



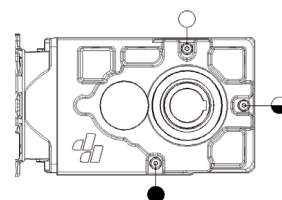
ACCESSORY INSTALLATION INSTRUCTIONS

10.6.3 SIZE 13 SERIES

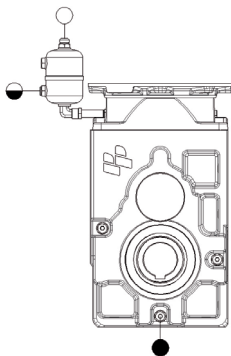
B3



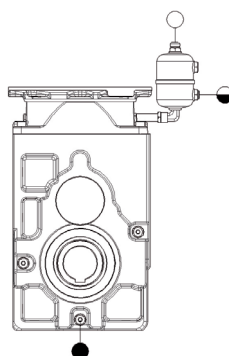
B3A



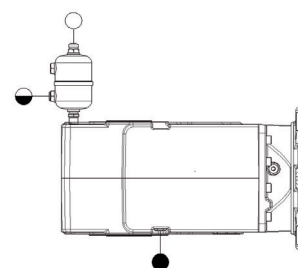
B6



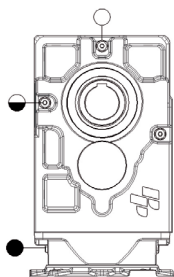
B6B



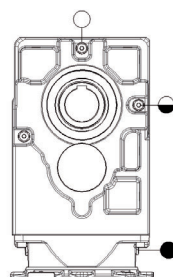
V5



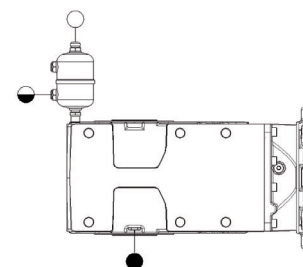
B7



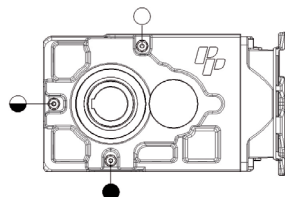
B7B



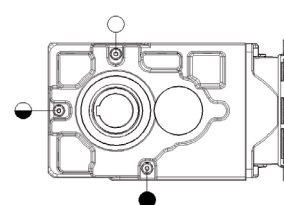
V6



B8



B8B



○ Breather and filling plug

● Drain plug

◐ Level plug

11 LUBRICATION

The important parameters to consider when choosing the type of oil are:

- viscosity at nominal operating conditions
- additives
- flashpoint

The same oil must lubricate the bearings and gears, and all these parts are in the same box, in different operating conditions. Consider the individual parameters.

Viscosity

The nominal viscosity refers to a temperature of 40 °C, but decreases rapidly as the temperature increases. With an operating temperature near 100 °C, a nominal viscosity can be chosen according to the following table.

Table 10:

Output rpm	
> 5 (min-1)	VG 150
< 5 (min-1)	VG 220

Additives

In addition to the normal anti-foam and antioxidant additives, it is important to use oils with additives offering EP (extreme-pressure) and anti-wear properties, according to ISO 6743-6 L-CKC or DIN 51517-3 CLP.

Therefore the slower the gearbox speed, the stronger the EP characteristics required (e.g. MOBILGEAR SHC).

It should be remembered that the chemical compounds substitutive of hydrodynamic lubrication are formed at the expense of the original EP load.

Therefore in case of very low speeds and high loads, it is important to observe the maintenance intervals so as not to lower the lubricating properties of the oil excessively.

Oil types

The available oils generally belong to three large families.

1 - Mineral oils

2 - Polyalphaolefin synthetic oils

3 - Polyglycol synthetic oils

The most appropriate choice is generally linked to the conditions of use.

Gearboxes that are not particularly loaded and with intermittent use, without significant temperature changes, can certainly be lubricated with mineral oil.

In case of heavy use, when the gearboxes are expected to be highly loaded and continuously, with consequent foreseeable rise in temperature, it is best to use Polyalphaolefin synthetic lubricants (PAO).

Polyglycol oils (PG) are to be used strictly in case of applications with heavy sliding between contacts; e.g. in worm screws.

They must be used with great attention, since they are not compatible with other oils and are completely mixable with water.

This phenomenon is especially dangerous because it is not noticed, but rapidly lowers the lubricating properties of the oil.

In addition to those already referred to, there are also oils for the food industry, in being special products not harmful to health.

For better protection of the environment, there are several biodegradable types.

Various manufacturers supply oils belonging to all the families with very similar characteristics.

WARNING

For ATEX certified gearboxes, Dana Motion Systems Italia S.r.l. requires the use of polyalphaolefin oils (PAO), see table in Chap. Lubricants for general use (pag. 40).



LUBRICATION

11.1 LUBRICANTS FOR GENERAL USE

Table 11:

Manufacturer	Poly-Alpha-Olefin synthetic oils (PAO) For gearboxes		
	ISO VG 150	ISO VG 220	ISO VG 320
MOBIL	Mobil SHC Gear 150	Mobil SHC Gear 220	Mobil SHC Gear 320
SHELL	Omala S4 GXV 150	Omala S4 GXV 220	Omala S4 GXV 320
TOTAL	Carter SH 150	Carter SH 220	Carter SH 320

Table 12:

Manufacturer	Poly-Alpha-Olefin oils (PAO) For negative multi-disk brake		
	ISO VG 32	ISO VG 46	ISO VG 68
MOBIL	Mobil DTE24	Mobil DTE25	-
SHELL	Shell Tonna S 32	-	Shell Tonna S 68
TOTAL	Azolla ZS 32	Azolla ZS 46	Azolla ZS 68

Table 13:

Manufacturer	Synthetic Grease - for output support bearing
	Viscosity of Base Oil, ASTM D 445 cSt @ 40°C : 460
SHELL	Shell Gadus S3 460 2

NOTE:

The user can choose oils of other producers with corresponding lubrication characteristics, making sure that the oil has a flashpoint above 200°C.

NOTE:

The user can choose greases made by other manufacturers, with corresponding and adequate lubrication and compatibility characteristics, making sure that the chosen grease has a flash point above 200°C.

WARNING



Do not use oils and greases with a flash point below 200°C.

WARNING



Do not mix oils and greases of different types and characteristics.

WARNING

Fill the gearbox with fresh oil specified in the table, using a filter of max. 25 µm.

12 PREPARING THE GEARBOX

12.1 GEARBOX LUBRICATION

Unless otherwise specified in the contract, all the gearboxes are delivered without lubricant.

The operator must therefore choose the most suitable type of oil from those indicated (or with similar characteristics) and carry out filling and check the oil level before startup, as indicated in point Filling and oil level check (pag. 41).

12.2 FILLING AND OIL LEVEL CHECK

Procedure:

- Check the exact position of the plugs and make sure the oil level plug is in an easy to inspect position.
- Locate the position of the filler+breather and level plugs on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.
- Unscrew both plugs, add oil until it comes out the level hole, refit the level plug, wait until the air bubbles have escaped, then refit the filler plug, start the gearbox in order to eliminate the last air pockets and then check the level again, if necessary adding oil to reach the level.

NOTE:

If there is a multi-disk brake, carry out the same oil filling operation as described above.

In case of expansion tank (reservoir), proceed as follows:

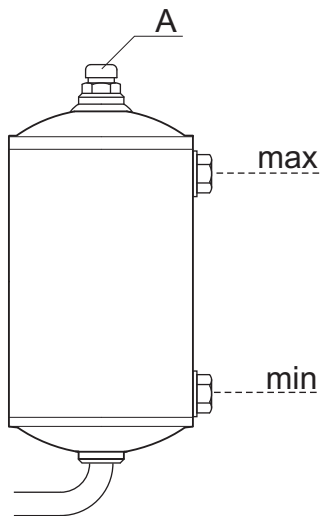


Fig. 31

- Locate the position of the filler+breather and level plugs on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.
- Remove the filler+breather "A" and "min." level plugs.
- To help gearbox ventilation (only during filling), one of the plugs can be removed from the top of the gearbox.
- As the oil rises to the top of the plug opened at the top of the gearbox, refit the plug.
- Continue filling until the oil reaches the "min." level plug on the tank, refit the "min." level plug.
- Refit plug "A".
- Never reach the max. level, in order to leave room for oil expansion.
- Turn the gearbox for a few minutes to eliminate any air pockets inside, then check the level again, if necessary adding oil to reach the "min." level.

NOTE:

Make sure the expansion tank is positioned at the top of the gearbox as shown on Dimensional Drawing SI referred to in the Conformity Declaration Certificate.



PREPARING THE GEARBOX

12.3 DRAINING OIL FROM THE GEARBOX AND MULTI-DISK BRAKE (IF AVAILABLE)

- Locate the oil drain plug of the gearbox and multi-disk brake (if available) on the Dimensional Drawing SI referred to on the Declaration of Conformity Certificate,
- unscrew the drain plug and filler cap to facilitate draining the oil from the gearbox and multi-disk brake (if available),
- after draining the oil, refit the drain plug of the gearbox and multi-disk brake (if available).

13 START-UP

13.1 GENERAL INSTRUCTIONS

AVVERTENZA



Before starting under load, check the following:

- When starting the engine, the output shaft of the reduction unit is turning;
- The direction of rotation is as planned in the design phase;
- For reduction units fitted with a non-return device, check before starting that there is a correspondence between the direction of free rotation and the directions of rotation of the machine to be driven and the engine;
- For reduction units fitted with a negative lamellar parking brake, make sure before starting that the brake control pipe is connected and that the air bleeding operation in the hydraulic circuit has been carried out correctly.

NOTE:

Air in the hydraulic circuit can cause incomplete opening of the brake, resulting in its rapid heating.

- There must be no leakage of lubricant from the plugs or gaskets (during the first few hours of operation there may be a slight leakage of grease from the sealing rings which does not impair proper operation);
- The breather cap must not be obstructed by dirt or paint;
- There must be no abnormal noise and/or vibration;
- The reduction unit must be sufficiently ventilated and there must be no significant source of heat outside;
- The ambient temperature and cooling air must not exceed 40°C;
- All accessories mounted or connected to the reduction units must be ATEX certified, suitable for the area of use;
- Check that all devices designed for protection between operators and rotating parts are effective.

13.2 SURFACE TEMPERATURE CHECK

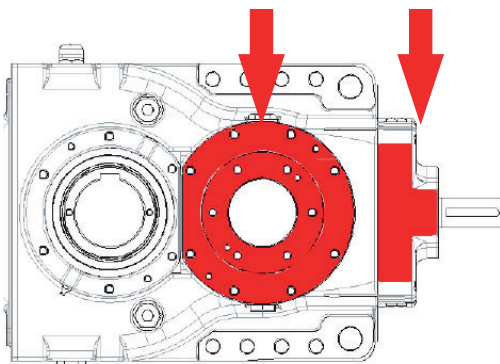
At startup, it is essential to check the surface temperature in normal operating conditions.

The check is to ensure that the requirements relevant to the behaviour of the system, as established in the design stage, are respected.

- The gearbox input area has been identified as the hottest and must be checked with a thermometer at the place indicated in the following figure or otherwise outside of the flanging between the motor and gearbox, on the gearbox side.
- If there is a negative multi-disk parking brake, also measure the temperature on the brake body.
- The temperature measurement must be performed under conditions of maximum load for a period of at least 3 hours.
- If the measured temperature is more than 68 °C above the ambient temperature (e.g. with ambient temperature 30 °C, 30 °C + 68 °C = 98 °C must not be exceeded), stop the testing and contact the Dana Motion Systems Italia S.r.l. Assistance Service.

CAUTION

Hot area





14 CHECKS AND MAINTENANCE

CAUTION

Checking/maintenance operations must be carried out by an expert maintenance technician in compliance with the accident-prevention regulations, to ensure his own safety and that of people in the vicinity.

Before doing any work on the gearbox, make sure the machine is off and cannot be accidentally started.

WARNING



Periodically clean the outer surface of the gearbox of any dust or deposits. In case of use in dusty places, the layer of accumulated dust must not be more than 5 mm. Use equipment suitable for the installation area; do not use compressed air.

CAUTION

It is advisable to change the oil when it is hot, to facilitate the removal of any sludge or deposits. In this case, however, not to exceed 40 °C and always operate with the necessary protective equipment PPE.

WARNING



Do not mix oils of different types and characteristics.

WARNING



Periodically clean the metal filler/breather plug with valve. It must be unscrewed from the gearbox (protecting the gearbox against dust and foreign bodies, etc., entering); check the opening of the valve with spring (it must not be blocked), clean with compressed air and then refit.

WARNING



Check the surface temperature of the gearbox in the area identified as the hottest during startup. The maximum recorded temperature must be lower than that specified on the data plate.

If the measured temperature is above the 108 °C, stop the machine and contact the Dana Motion Systems Italia S.r.l. Assistance Service.

WARNING



At every oil change, check for excessive ferrous material on the magnet in the drain plug. In case of an excessive amount, immediately schedule a machine stop for maintenance purposes.

WARNING



The gearboxes must not be opened for any operation not included in the maintenance and checking activities listed below.

The manufacturer declines any liability for operations carried out and not included in this manual, that have caused injury or damage.

If case of need, contact the Dana Motion Systems Italia S.r.l. Assistance Service.

CHECKS AND MAINTENANCE

14.1 SEALING RINGS

The life of the sealing rings depends on many factors such as operating temperature, sliding speed, oil cleanness, ambient conditions, etc.; therefore they must be replaced periodically to prevent oil leaks which could compromise the parts inside the gearbox and also increase the casing temperature beyond the design values.

For safety reasons, more frequent replacement of the sealing rings is required for gearboxes mounted in vertical and oblique positions (completely or almost completely filled with oil) and less frequent for gearboxes mounted in a horizontal position (filled with oil to the middle).

For mounting positions, refer to Chap. Gearbox mounting positions (pag. 37).

For sealing ring change frequency, refer to Check and maintenance frequency tables (pag. 46).

WARNING



Failure to replace the sealing rings with the frequency specified in Check and maintenance frequency tables (pag. 46), could lead to oil leaks that can completely compromise gearbox operation, with risk of reaching high temperatures on the gearbox.

CHECKS AND MAINTENANCE

14.2 CHECK AND MAINTENANCE FREQUENCY TABLES

Table 14:

Check and operation	Frequency	Notes
Check oil level	Daily and before every startup	See Preparing the gearbox (pag. 41).
Check for oil leaks	Daily	See Troubleshooting (pag. 48) if present.
First oil change	After 100 hours of operation	See Preparing the gearbox (pag. 41).
Subsequent oil changes	Every 2000 hours of operation or once a year	See Preparing the gearbox (pag. 41).
Check the tightening of bolts	After the first 100 hours of operation	For details see Table 4:Tightening torques (p. 19).
Check the tightening of bolts	Every 2000 hours of operation or every year	For details see Table 4:Tightening torques (p. 19).
Water in the oil	Once a year or at every oil change	If present, replace rotating rings and breather plug.
Clean the oil drain magnetic plug	At every oil change	With unusual metal parts on the magnet, see Checks and maintenance (pag. 44).
Clean the breather plug	Every 3 months	See Checks and maintenance (pag. 44).
Check motor absorption	Every 3 months in absence of continuous system	-
Check the surface temperature	Every 3 months	See Checks and maintenance (pag. 44).
Check gearbox noise	Every 3 months	See Troubleshooting (pag. 48) if not normal.
Check gearbox vibration	Every 3 months	See Troubleshooting (pag. 48) if not normal.
Equipotential connection	Every 3 months	See Installation and accessories (pag. 17).
Clean the gearbox	Periodically	See Checks and maintenance (pag. 44).
Data plate readability	Yearly	See Data plate (pag. 15).
Grease seals output support	Every 2000 hours of operation or once a year	See Lubrication (pag. 39) and dimensional drawing SI.
Check the braking torque of the multi-disk brake	Every 2000 hours of operation or every year	See Negative multi-disk parking brakes in oil bath (pag. 32) and dimensional drawing SI.
Replace seals of gearbox and multi-disk parking brake (if available) horizontal assembly, to be carried out at Dana Motion Systems Italia Assistance Service	Every 6000 hours of operation or every 3 years	Mounting pos.: B3, B3A, B8, B8B
Replace seals of gearbox and multi-disk parking brake (if available) vertical or oblique assembly, to be carried out at Dana Motion Systems Italia Assistance Service	Every 2000 hours of operation or every year	Mounting pos.: B6, B6B, V5, B7, B7B,V6
Check gearbox input and output shafts for wear	Once a year	See Installation and accessories (pag. 17) for re-greasing.

CHECKS AND MAINTENANCE

The inspection and maintenance of gearboxes and/or on the multi-disc parking brakes, including electric Sensors, such as temperature sensors and/or oil level indicators "ON-OFF", differ from those above indicated, regarding the seals replacement, as following:

Table 15:

Inspection and measures	Time interval	Notes referred to the Manuals
Replace seals of gearbox and multi-disk parking brake (if available) horizontal assembly, to be carried out at Dana Motion Systems Italia Assistance Service	Each 6.000-10.000 hours of operation or every 3-5 years and during gearbox reconditioning	Mounting positions: B3, B3A, B8, B8B
Replace seals of gearbox and multi-disk parking brake (if available) vertical or oblique assembly, to be carried out at Dana Motion Systems Italia Assistance Service	Each 6.000-10.000 hours of operation or every 3-5 years and during gearbox reconditioning	Mounting positions: B6, B6B, V5, B7, B7B, V6
Inspection of temperature sensors and oil level indicators	Every 3 months	See Note below

NOTE:

It is user responsibility to check with the right frequency, electric circuits control used by the Sensors, to be always working and properly calibrated for intervene to set parameters.

WARNING



The gearboxes are selected for the service life required by the customer for each specific project, with the specified duty cycle, as given on dimensional drawing SI referred to in the Declaration of Conformity Certificate.

When the working hours indicated in the documentation are reached, the gearbox must be replaced with a new one or sent to a Dana Motion Systems Italia S.r.l. Assistance Service for complete overhaul.



15 TROUBLESHOOTING

Use the following table to troubleshoot any faults or malfunctions.

Contact your nearest Dana Motion Systems Italia S.r.l. Service Centre in the event of persistent faults.

Table 16:

Fault	Possible cause	Corrective action
The output shaft does not turn when the motor is running	Incorrect motor mounting	Check the coupling between the motor and the gearbox
	Parking brake blocked/closed	Check the hydraulic system connected to the brake
	Internal fault	Contact the nearest Service Centre
Oil leaks from the breather during functioning	Oil level too high	Reduce the oil level
	Breather in wrong position	Check the position of the breather
	Breather seal worn	Contact the nearest Service Centre
Oil leaks from the seals	Breather plug blocked	Remove and change the breather plug
	Seals gone hard after extended storage	Clean the area and check for leakage again after a few days. If the leakage persists, contact the nearest Service Centre
	Seals worn or damaged	Contact the nearest Service Centre
Excessive noise	Internal fault	Contact the nearest Service Centre
Excessive vibration	The gearbox is incorrectly installed	Check the fixing bolts and coaxial alignment
	Mounting structure too weak	Strengthen the mounting structure
	Internal fault	Contact the nearest Service Centre
Excessive heating	Lack of ventilation	Make sure there are no enclosures or other hindrances to air circulation. Check external cleanness
	Brake opening incomplete	Check the brake opening minimum pressure
	Work cycle longer than design cycle indicated on dimensional drawing SI	Check loads and power required by the machine
	Ambient temperature higher than 40 °C	Stop the machine until the temperature returns to below 40 °C
	Internal fault	Contact the nearest Service Centre
The negative multi-disk brake does not open/release	No pressure at brake	Check the hydraulic connection to the brake
	Disks stuck due to a period of parking	Apply pressure on the brake, making the gearbox/brake input rotate
	Brake seals leak oil	Contact the nearest Service Centre
The multi-disk brake does not close/lock	Back pressure in the brake circuit	Check the hydraulic circuit
	Worn brake disks	Contact the nearest Service Centre

16 GEARBOX DECOMMISSIONING

The gearbox decommissioning operations must be carried out by expert personnel, in compliance with the current laws on safety in the workplace.

It is advisable to proceed as follows:

- Remove all oils present in the gearbox.
- Disconnect the motorisation at the gearbox input.
- Remove the gearbox

Carry out disposal operations in compliance with the current laws on environmental protection, avoiding contamination of soil and water with non-biodegradable products.



17 EXAMPLE OF DECLARATION OF CONFORMITY



Dana Incorporated
Dana Motion Systems Italia S.r.l. (a socio unico) - Power –
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P.I. / VAT 0026275 035 9 REA N° RE75379




DICHIARAZIONE DI CONFORMITA' UE EU DECLARATION OF CONFORMITY

Dana Motion Systems S.r.l.

Dichiara sotto la propria responsabilità che il riduttore **Plano Helical** sotto indicato, è progettato e costruito in conformità alla **Direttiva 2014/34/UE** e idoneo all'impiego in ambienti con atmosfera potenzialmente esplosiva secondo **Gruppo II, categoria 3G**.

*Declares in sole responsibility, that the **Plano Helical gearbox** unit below mentioned, is designed and manufactured in compliance with the **Directive 2014/34/EU** and is suitable for use in potentially explosive atmosphere, according **Group II, category 3G**.*

Marcatura / Marking :  II 3G Ex h IIB T4 Gc

Cliente:

Customer: _____

Riduttore tipo:

Gearbox type: _____

Codice prodotto:

Product code: _____

Conferma d'ordine N°:

Order confirmation N°: _____

Matricola N°:

Serial N°: _____

Disegno dimensionale N°:

Dimensional drawing N°: _____

SI

Norme di riferimento / Applicable standards:

EN ISO 80079-36:2016

EN ISO 80079-37:2016

EN 1127-1:2011

General Manager
Power - Transmission
Matteo Foletti

Head of Engineering
Power - Transmission
Alessandro Vighi

Reggio Emilia, data/date: 01/11/2019

Doc. QCATEX0521 date: 01/11/2019

EXAMPLE OF DECLARATION OF CONFORMITY



Dana Incorporated
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P.I. / VAT 0026275 035 9 REA N° RE75379



DICHIARAZIONE DI CONFORMITA' UE EU DECLARATION OF CONFORMITY

Dana Motion Systems S.r.l.

Dichiara sotto la propria responsabilità che il riduttore **Plano Helical** sotto indicato, è progettato e costruito in conformità alla **Direttiva 2014/34/UE** e idoneo all'impiego in ambienti con atmosfera potenzialmente esplosiva secondo **Gruppo II, categoria 3D**.

*Declares in sole responsibility, that the **Plano Helical gearbox** unit below mentioned, is designed and manufactured in compliance with the **Directive 2014/34/EU** and is suitable for use in potentially explosive atmosphere, according **Group II, category 3D**.*

Marcatura / Marking :  II 3D Ex h IIC T108°C Dc

Cliente:

Customer:

Riduttore tipo:

Gearbox type:

Codice prodotto:

Product code:

Conferma d'ordine N°:

Order confirmation N°:

Matricola N°:

Serial N°:

Disegno dimensionale N°:

Dimensional drawing N°:

SI

Norme di riferimento / Applicable standards:

EN ISO 80079-36:2016

EN ISO 80079-37:2016

EN 1127-1:2011

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Reggio Emilia, data/date: 01/11/2019

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