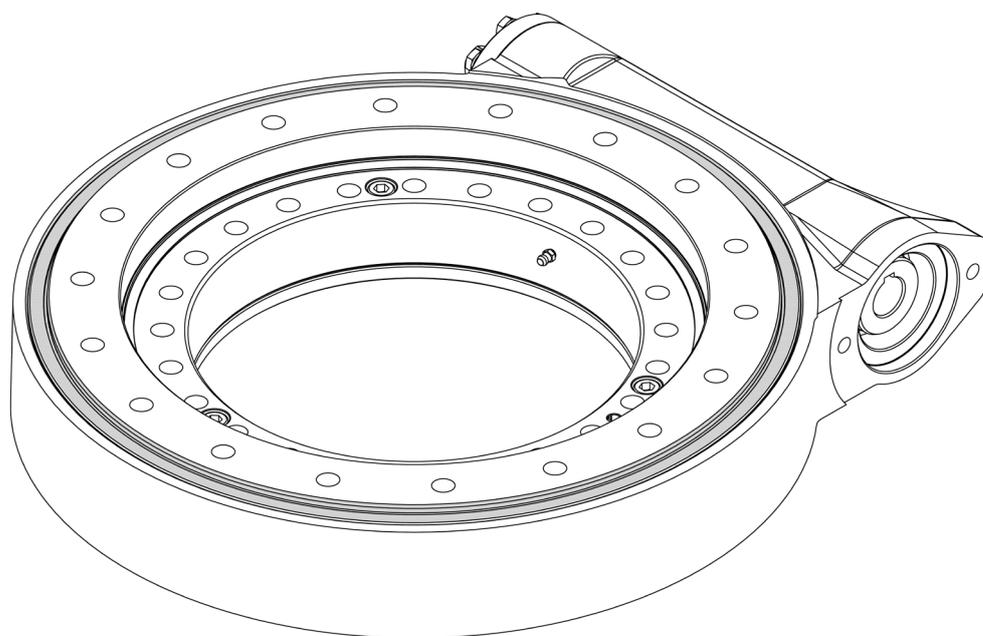


**Use and maintenance manual**

# **WORM DRIVE**

## **GRX Series**



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# WORM DRIVE

## GRX Series

### TABLE OF CONTENTS

<b>1. INTRODUCTION</b> .....	Pag.	2
<b>2. DESCRIPTION OF THE SYMBOLS</b> .....	Pag.	2
<b>3. SAFETY</b> .....	Pag.	2
<b>3.1 Drive input shaft protection</b> .....	Pag.	2
<b>3.2 Retrograde motion</b> .....	Pag.	2
<b>3.3 Positive brake for stopping and positioning</b> .....	Pag.	2
<b>4. TRANSPORT AND STORAGE</b> .....	Pag.	3
<b>4.1 Transport regulations</b> .....	Pag.	3
<b>4.2 Storage regulations</b> .....	Pag.	3
<b>5. ASSEMBLY</b> .....	Pag.	3
<b>5.1 Surface cleaning</b> .....	Pag.	3
<b>5.2 Motor assembly</b> .....	Pag.	3
<b>5.3 Fastening of the slewing ring</b> .....	Pag.	3
<b>5.4 Greasing instructions</b> .....	Pag.	4
<b>5.4.1 Lubrication of worm screw</b> .....	Pag.	4
<b>5.4.2 Lubrication of the rolling balls-raceways</b> .....	Pag.	4
<b>6. ADJUSTMENTS AND SERVICE OPERATIONS</b> .....	Pag.	4
<b>6.1 Backlash of GRX slew drives</b> .....	Pag.	4
<b>6.1.1 Worm screw adjustment</b> .....	Pag.	5
<b>6.1.2 Thrust bearing replacement</b> .....	Pag.	5
<b>6.1.3 Tooth wear adjustment</b> .....	Pag.	5
<b>6.2 Emergency rotation of slewing drive</b> .....	Pag.	6
<b>6.3 Gasket assembly/replacement</b> .....	Pag.	6
<b>6.4 Bearing clearance measurements and inspections</b> .....	Pag.	6
<b>6.4.1 Wear limit</b> .....	Pag.	7
<b>7. WARNINGS</b> .....	Pag.	7
<b>8. GREASES AND LUBRICATION FREQUENCY CHART</b> .....	Pag.	7
<b>9. DEMOLITION AND DISPOSAL</b> .....	Pag.	8
<b>10. DECLARATION OF INCORPORATION</b> .....	Pag.	8

## 1. INTRODUCTION

This manual contains instructions about how to assemble and service the GRX worm drive. It must be read carefully and understood before the worm drive is used.

The worm drive will only function correctly if it is correctly assembled and adequately serviced.

META s.r.l. declines all liability for damage caused by negligence and failure to comply with the instructions in this manual.

Make sure that the worm drive is undamaged and complete as soon as it arrives.

Inform the persons in charge about any faults or discrepancies before the worm drive is installed and used.

## 2. DESCRIPTION OF THE SYMBOLS



### Warning symbol

Indicates a potential danger.



Carefully read the instructions in this manual before proceeding with any operation.



### Danger symbol

Wear protective gloves before proceeding with any operation.



### Danger symbol

Wear adequate safety footwear before proceeding with any operation.

## 3. SAFETY

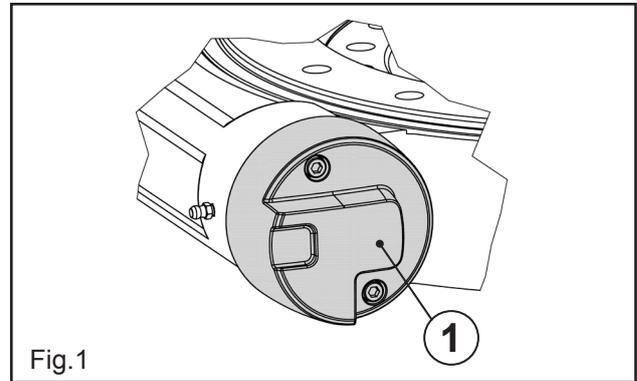
Anyone who assembles or uses rotational equipment must possess the necessary skills, must be familiar with the characteristics of the components he must assemble/use and must take all possible precautions able to guarantee the utmost safety in all operating conditions. No reasonably applicable precaution must be omitted in the interests of safety, either by the installer or by the operator.

### 3.1 Drive input shaft protection

The end of the worm screw shaft has a hexagonal shank to allow operation in the manual mode in emergency situations.

To protect the shaft, since it is a rotating component, META HYDRAULIC provides an easily removable cover as part of the standard equipment.

Customers-installers who incorporate the assembly in a machine can remove this cover (1, Fig.1) as long as the rotating part remains inaccessible or a purpose-made guard is fitted.



### 3.2 Retrograde motion

Irreversibility of motion is not guaranteed in GRX series slew drives, i.e. relative rotary motion between casing and ring gear could occur if external torque were to be applied.



Carefully assess and check that external torque which could accidentally overload the unit does not exceed the stall torque value given in the technical data sheet.

Prevent this value from being exceeded since it could result in damage to the toothing and impair the quality of meshing.

Regarding the other components (casing, flanges, bolted joints), the degree of safety against stalling is rather high.

### 3.3 Positive brake for stopping and positioning

In the case of hydraulic drive, rotation can be stopped immediately by applying a hydraulically controlled positive brake unit in conjunction with the hydraulic motor. In the case of an electric drive, the braking action can be provided by the self-braking motor.



It is absolutely forbidden to install mechanical end stops to limit the angle of rotation of the slewing ring.

The shock impact would create unforeseeable stress which cannot be quantified analytically.

Use of such stops is forbidden.

However, the slewing ring has been chosen to ensure a high safety factor.

Use of end stops connected to the control system is recommended (of the hydraulic or electrical type, with encoder, etc.).



The electrical drives and devices must comply with the requirements set out by 2004/108 EC (Electromagnetic compatibility), 72/23 EC and successive amendments and 93/68 EC.

## 4. TRANSPORT AND STORAGE



### 4.1 Transport regulations

The worm drives must only be transported in the horizontal position.

Take care to prevent jolting and impact during the handling operations.

Use a hoist to handle the worm drive after having screwed 3 equidistant eyelet screws (1, Fig.2) into the holes in the worm drive itself.

Make sure that the screws and fasteners are in a perfect condition.

In exceptional cases, the worm drive can be moved in the vertical position.

In this case, it should be positioned with the seat of the worm screw at the bottom (Fig.2a).

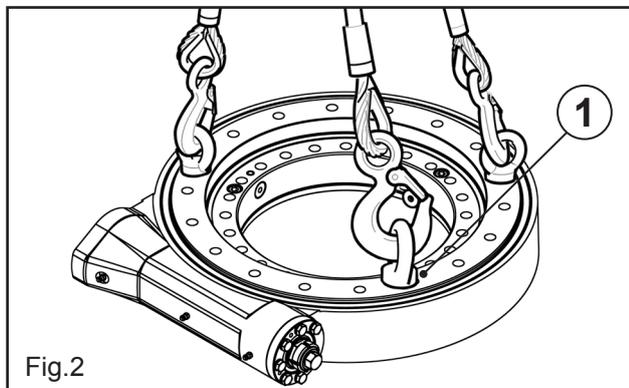


Fig.2

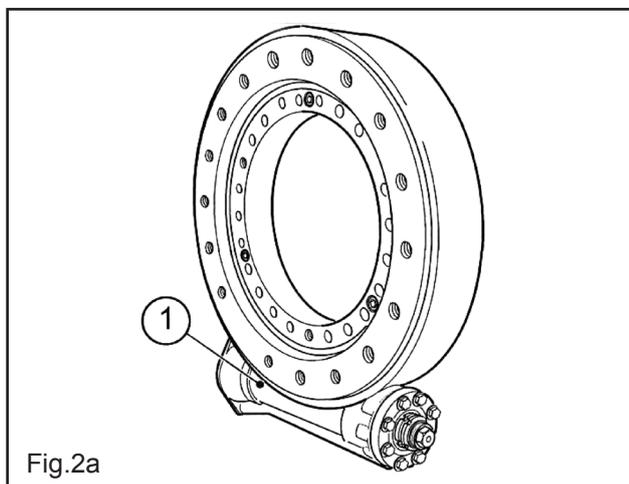


Fig.2a

## 4.2 Storage regulations

GRX worm drives must be stored in the horizontal position, preferably on a wooden pallet and in a dry place.

## 5. ASSEMBLY

### 5.1 Surface cleaning

The fixing surfaces of the worm drive must be perfectly clean.



Only use products that will not damage the operator's health, the environment, the product and particularly, the rubber seals.

### 5.2 Motor assembly

Clean carefully the slewing ring-motor coupling surfaces.

Fill the hollow containing the input shaft with grease (1, Fig.3).

Insert the joint (2, Fig.3) or otherwise seal with appropriate mastics.

Lubricate the driving shaft (3, Fig.3) before inserting it with its key into the housing.

Fix with M12 class 8.8 screws and lock up with the dynamometric key set 75÷85 Nm.

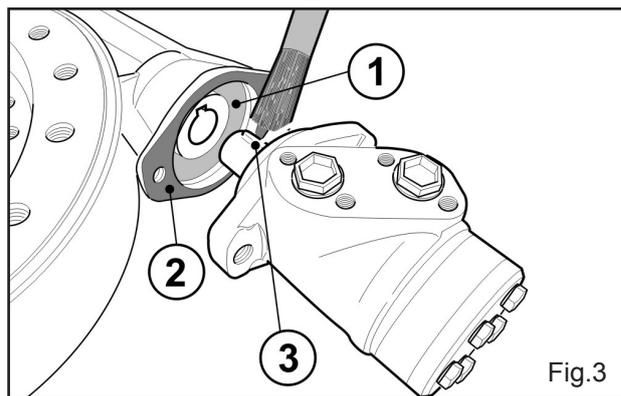


Fig.3

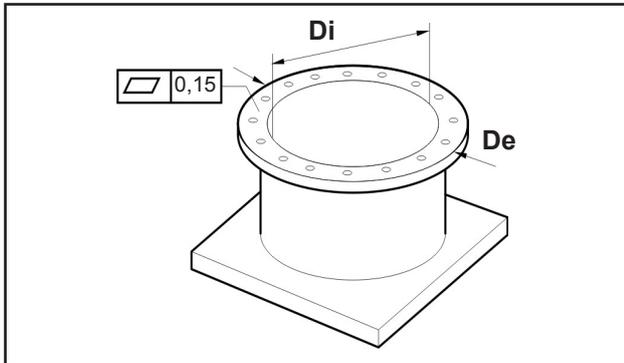
### 5.3 Fastening of the slewing ring

Use of class 10.9 ISO (or grade 8 SAE) screws in all holes guarantees that the maximum tilting moment and torque values can be reached under service and stall conditions, as indicated in the technical data sheet.

A crimping length 5 times the diameter of the screw is recommended.

The customer-installer must perform the required strength tests if fewer screws are used than the intended number.

The dimensions of the flanges **that interface on the casing side** must comply with the values in the table. The surfaces of the flanges must be flat with 0.15 mm maximum flatness error.



Model	Di mm	De mm	Screw	Tightening torque Nm
DK0256	max 90	160 ÷ 240	M12	120
DK0316	max 150	230 ÷ 320	M16	280
DK0437	max 270	350 ÷ 440		
DK0527	max 330	430 ÷ 530		
DK0576	max 380	480 ÷ 560		
DK0630	max 430	530 ÷ 630	M20	560
DK0744	max 525	630 ÷ 720		

## 5.4 Greasing instructions

GRX rotation units must be lubricated with water-repellent grease.

Use the relative grease nipples to lubricate both the worm screw and relative bearings, and the ball race. It is advisable to re-lubricate when the rotary table is moving or, when this is not possible, in several positions of the rotational arc.

See point 8 (pages 7-8) for the lubrication frequencies and type of grease required.

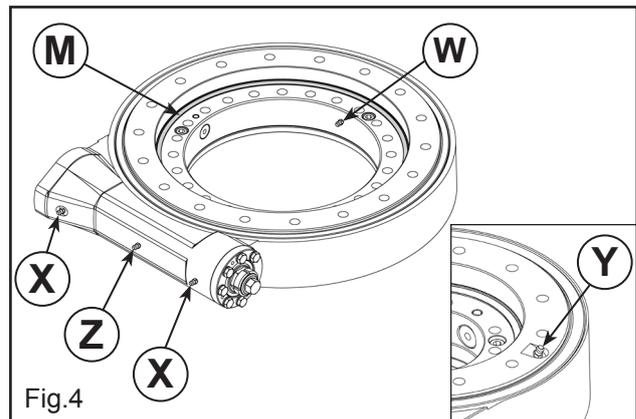
### 5.4.1 Lubrication of the worm screw

The grease nipples installed on a level with the worm screw axis are used for this operation: the central grease nipple (Z) lubricates the worm screw; the side grease nipples (X) lubricate the relative bearings (Fig.4).

### 5.4.2 Lubrication of the rolling balls-raceways

All GRX series rotation units have holes for grease nipples (W) on the inner ring; model DK 0256, the greasing point (Y) of which is on the edge of the ring gear, is an exception to this rule.

Re-lubrication is complete when a slight and uniform ring of grease oozes from the lip seal (M).



## 6. ADJUSTMENTS AND SERVICE OPERATIONS



### 6.1 Backlash of GRX slew drive

Slew drive backlash depends on two factors: clearance between worm/ring gear teeth, end-float on worm screw shaft bearings.

The clearance limit between ring gear and worm screw mainly depends on the precision requirements of the specific installation.

Too much play can impair the quality of the contact between the ring gear teeth and screw and lead to abnormal early wear and damage to the gear.

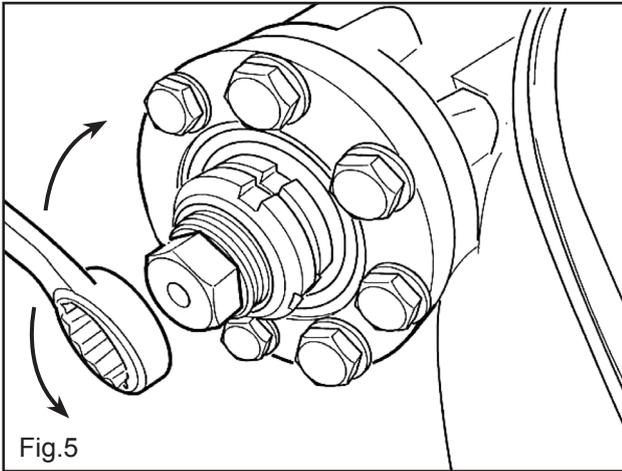
The tolerated maximum clearance between teeth varies from 0.25 mm for mod. DK 0256 to 0.5 mm for DK 0744.

Proceed as described below to assess the amount of clearance in the worm screw/ring gear coupling:

a) first check the worm screw shaft end-float (thrust bearing play) and adjust it to the correct value if necessary, as described in point 6.1.1;

b) apply a box wrench to the hexagonal end of the worm screw shaft (Fig.5) and measure the angular excursion made by the wrench before it turns the ring gear (idle travel): if the angle exceeds 10°, a value valid for all models, it means that the clearance has reached an unacceptable value able to impair the meshing quality, and that adjustment is required.

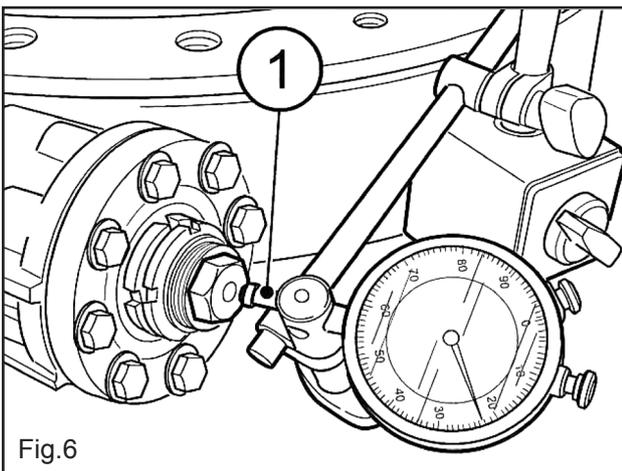
As mentioned previously, adjustments are sometimes required in the case of particular operating situations even when idle travel is much less, e.g. to guarantee positioning accuracy, limit the swing of the structure being driven, etc.



When checking the slew drive installed in a machine it is advisable to disconnect the motor or, in the case of a hydraulic motor, disconnect the supply lines.

### 6.1.1 Worm screw adjustment

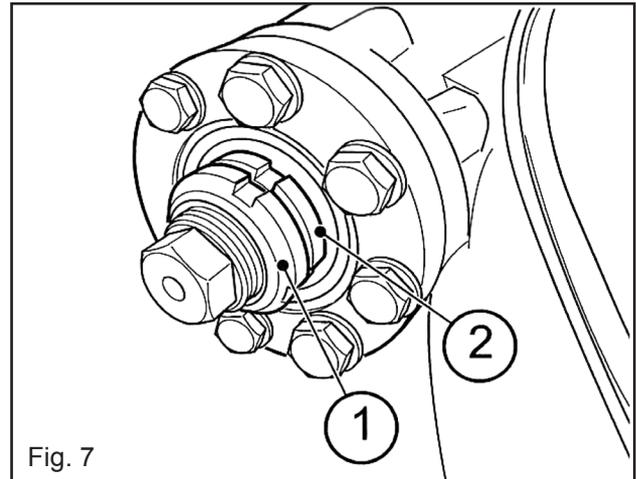
To check for the presence of worm screw end-flaut, which results in idle angular excursion of the ring gear, fix a comparator to the body of the casing (or bearing structure) so that its feeler (1, Fig.6) measures the movement made by the screw once subjected to axial load.



Adjustment is required if this movement exceeds 0.10 mm.

To eliminate the float, loosen the self-locking ring nut (1, Fig.7), then tighten the adjuster ring nut (2, Fig.7) until the play has been completely eliminated.

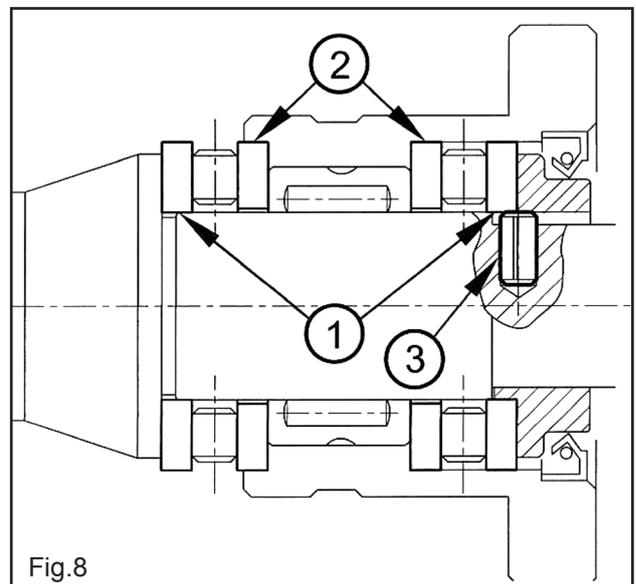
Now lock the position by retightening the self-locking ring nut (1, Fig.7).



### 6.1.2 Thrust bearing replacement (only for models from DK0256 to DK0527)

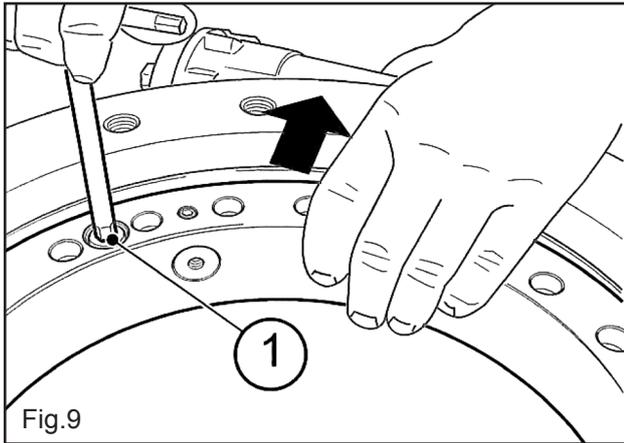
If one of the two thrust bearings must be replaced, pay particular attention during the assembly phase to ensure that centering occurs correctly on the inner diameter of the outer rings of the bearings (1 Fig.8) and on the outer diameter of the inner rings (2, Fig.8).

**Make sure that the pin (3, Fig.8) NEVER projects from the diameter of the shaft.**



### 6.1.3 Tooth wear adjustment

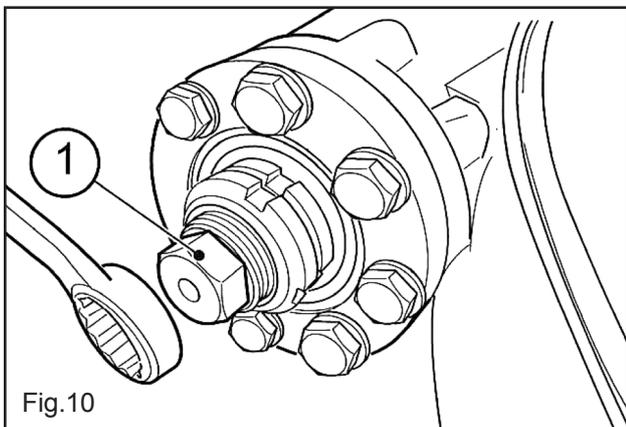
If ring gear backlash is caused by gear wear (screw/ring gear assembly) the play can only be eliminated after having disassembled the rotation unit of the machine. These adjustments must be made by the manufacturer or by authorized technicians.



To adjust the play on the previously disassembled rotation unit, loosen the allen screws (1, Fig.9), pull the ring gear towards the worm screw, then tighten the screws (1) and check the coupling by allowing the ring gear to make a complete turn.

### 6.2 Emergency rotation of slewing ring

In the event of a breakdown affecting the drive system, the slewing ring can be turned by hand by applying a wrench to the end of the shaft (Fig.10); remove the protective cover, make sure the machine is safe to work on, deactivate or disconnect the hydraulic motor.



### 6.3 Gasket assembly/replacement



If the rotation unit is accessible, the gaskets can be replaced on the machine. The original outer gasket is the closed ring type and as such, must be cut in order to be removed. The replacement gasket must also be cut before it can be fitted.

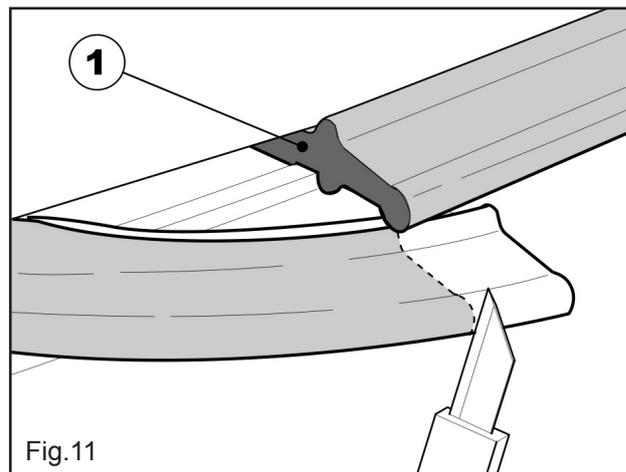
Otherwise use gasket with the same profile available by the meter.

Fit the gasket, when it needs to be replaced, into the dedicated race (1, Fig.11).

Make sure it is seated evenly around the entire circumference.

Once the seal has been applied to the entire circumference, cut off the end of the seal with a sharp cutter so that it perfectly matches the other end.

Seal the two matching edges with sealing compound.

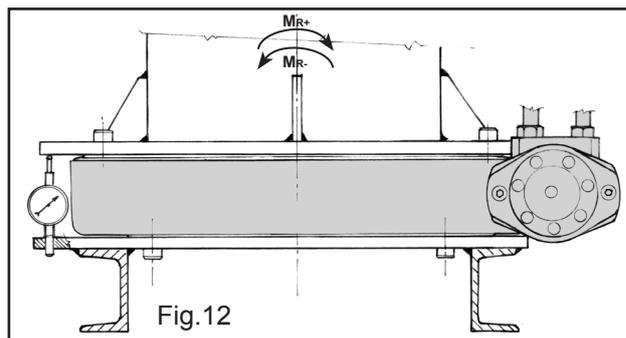


### 6.4 Bearing clearance measurements and inspections

Clearance in the rolling tracks, between the inner ring and ring gear, increases during the life of the bearing owing to wear.

To check the increase in clearance over time for the purpose of checking bearing wear, first measure the reference distances immediately after having assembled the slewing ring and before putting it into service. The measured and recorded values can then be compared with the results of subsequent periodic measurements taken in the same way.

The "measurement of oscillation" method is used when the main load is the tilting moment, i.e. the center of gravity of the loads falls outside the rolling diameter of the bearing.



The measurements are taken by positioning a dial gauge graduated in hundredths of a millimeter as near as possible to the casing and ring gear so as to limit the influence of elastic deformations in the connected bearing structures.

The slewing ring must be at a standstill and is subjected to static load.

The difference in distance is measured by switching from a positive tilting moment condition to one with a negative tilting moment.

This measurement variation represents bearing oscillation in that point.

The points in which the comparator is positioned should be marked as a reference for future measurements.

The oscillation measurement procedure must be repeated after every 500 running hours or every 6 months in the reference points marked when the slewing ring was new.



Make sure that all bolts are preloaded to the prescribed value before performing oscillation tests.

The measured oscillation values must be compared with the reference values of the first measurement to obtain a wear condition index of the bearing.

It is a good idea for the manufacturer to provide fittings and/or access areas for this type of measurement.

#### 6.4.1 Wear limit

An increase in bearing oscillation over time is an indication of bearing wear.

Whenever an inspection is performed, the increase in bearing oscillation is calculated by comparing the current reading with the reference values of the first measurement made when the bearing was installed. Oscillation increases with respect to the initial value must never exceed the limits in the table below.

Type of table	Maximum wear limit *
DK 0256	0,8 mm *
DK 0316	1,0 mm *
DK 0437	1,0 mm
DK 0527	1,0 mm *
DK 0576	1,1 mm
DK 0630	1,1 mm
DK 0744	1,1 mm

\* (Wear values increased by 35% are allowed for slew drives with a double ball race.)



These values represent the maximum wear limit of the bearing within which operating safety will not be compromised.

This means that once this limit has been reached, the bearing will have to be replaced.

For operational reasons or operator comfort, the machinery manufacturer may establish more restrictive limits.

## 7. WARNINGS

1. Never weld any part of the worm drive.
2. Never expose the worm drive to heat sources since this can cause irreparable damage to the unit.
3. Do not allow currents of any kind to pass through the unit.
4. During washing operations please avoid hitting the slew ring with the direct and close jet of a high pressure washer; its strong pressure can raise the lip of the seal with the consequent entry of water (Fig. 13).

Bearings, toothings and rolling body races can be irreparably damaged; if you fear for a possible modest water entry please make immediately a complete lubrication of the slew ring and the rotation screw (see point 5.4).

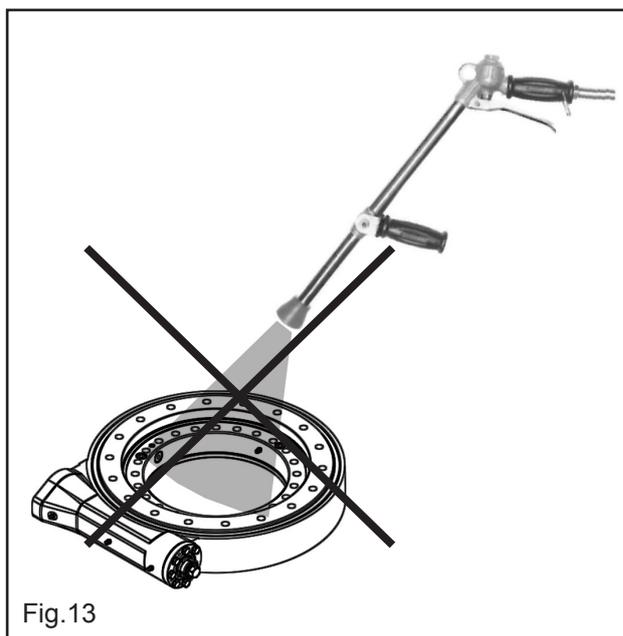


Fig.13

## 8. GREASES AND LUBRICATION FREQUENCY CHART

The GRX slew rings are supplied partially lubricated. The installer must complete the lubrication process before the machine is put into operation.

As for lubrication frequency pls keep to following chart.

/	Type	Operating temperature
Grease	VANGUARD SILEX PLS/3	-35/+130°C

Working conditions	Maintenance and lubrication frequencies
Dry and clean work environments Open countryside	Every 300 hours or every 6 months
Sandy, cold, dirty and marine environments	Every 200 hours or every 4 months
Environments with extreme conditions	Every 70 hours or every 2 months

- the type of rotation unit, motor assembly side, colour;
- the type of hydraulic motor;
- optional equipment (encoder, etc.) if any.

**Alternativa fetter:**

- Mobil Mobilgrease Special
- Total Caloris M/3
- Fina Bentex 5M
- Shell Retinax HDX
- Fuchs Renolit FLM/2
- BP Grease SM/2
- Castrol Moly grease/2

## 9. DEMOLITION AND DISPOSAL

At the end of its working life, the slewing ring must be demolished and disposed of in accordance with the Laws and Regulations in force in the Country or Region having jurisdiction or to which it belongs.

The slewing ring must be disassembled in order to separate the different types of material (ferrous material, aluminium alloy, rubber, plastic, etc.), and to collect the oil and grease.

Once they have been separated, the materials must be taken to an authorized collection center for disposal.

The oil recovered from the pipes and hydraulic motor must be consigned to collection centers authorized to dispose of used oil.

It is strictly forbidden to dispose of scrap and other hazardous materials in the environment.

## 10. DECLARATION OF INCORPORATION

According to Directive 2006/42/EC, the rotation unit is considered to be a component and as such, is not subject to CE marking.

If it is supplied complete with hydraulic motor, the unit becomes a motor-driven slewing ring and falls within the definition of “partly completed machinery” (point “g” of art.2); as such META HYDRAULIC can issue a DECLARATION OF INCORPORATION, a facsimile of which is given below.

The code in the declaration of conformity corresponds to a version of the slewing ring with specifications that include:

**META HYDRAULIC SRL**

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Codice destinatario per fatturazione elettronica: J6URRTW  
[www.metahydraulic.com](http://www.metahydraulic.com) [info@metahydraulic.com](mailto:info@metahydraulic.com)

**DECLARATION OF INCORPORATION**

pursuant to art.13, paragraph 1, sub-section C of Directive 2006/42 EC  
drawn up in accordance with annex II-B

META HYDRAULIC srl with registered office in Via Diogene 3, 42048 Rubiera (RE)

hereby **DECLARES** under its sole responsibility that the "partly completed machinery":

**GRX worm screw rotation unit  
with hydraulic motor GRXM93043700E0V000**

- has been manufactured in compliance with the essential health and safety requirements laid down by Directive EC 2006/42 (particularly those established by Annex I points 1.3.2; 1.3.4; 1.5.4) and that the pertinent technical documentation has been drafted in compliance with Annex VII-B
- cannot be put into service until the machine into which it is incorporated as been declared as conforming to Directive EC 2006/42

also **STATES** that:

- the party authorized to prepare the pertinent technical documentation is META HYDRAULIC srl domiciled at META HYDRAULIC srl Via Diogene 3, Rubiera (RE)

information concerning the "partly completed machinery" will be sent via e-mail upon the reasoned request of the National Authority.

Rubiera, this day

The Legal Representative  
(the Administrator)





