FERROVAC

ULTRA HIGH VACUUM TECHNOLOGY

WMG40
Dual Shaft Wobblestick DN40CF

Instruction Manual

Version 1.2

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Warranty

Ferrovac warrants this product to be free of defects in material and quality for 12 months from the date of shipment.

In case of proof of any defective parts in the product, at our discretion, we will either repair the product or replace it.

Warranty Limitations

The warranty for this product does not apply to defects resulting from the following:

- non-observance of operational and safety instructions
- natural wear of components
- modifications to our products without our written consent
- misuse of any product or part of the product

This warranty stands in place of all other warranties, implied or expressed, including any warranty of merchant-ability implied or fitness for a particular use.

Neither the company Ferrovac nor any of its employees shall be liable for any direct, indirect, incidental, consequential or special damages arising out of the use of its products, even if the buyer advises the company Ferrovac in advance of the possibility of such damages. Such excluded damages shall include but are not limited to: Costs of removal and installation, losses sustained as the result of injury to any person, or damage to property.

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A triangle with an exclamation mark indicates a passage in the manual with information that is crucial for the operator. READ THESE PARAGRAPHS CAREFULLY, or damage to the product can ensue through misuse.

CAUTION! The CAUTION! heading in a manual explains hazardous situations that could damage the product. Such damage may invalidate the warranty.

Normal Use

Always use the product described in this manual:

- With explicitly specified original accessories supplied by Ferrovac for use with the product described in this publication.
- In an indoor research laboratory environment.
- By personnel qualified for the operation of delicate scientific equipment.
- Following this and all related manuals.

CAREFULLY READ THE SAFETY INFORMATION AND ALL RELEVANT MANUALS BEFORE USING THE PRODUCT AND ANY RELATED INSTRUMENTATION!

1. Introduction

Dual shaft Wobblestick (WMG40) manipulators are designed to operate a pincer grip. A variety of pincers are available for almost any type of sample holders. Dual shaft Wobblesticks are fully rotatable and allow for an angular deflection of +/-20 degrees (WMG40) or +/-28 degrees (WMGWA40).

2. Unpacking and Inspection

WMG40 manipulators are clean and ready to use in UHV when shipped. Prepare a sufficiently clean work-space and wear powder-free surgical gloves when unpacking and inspecting the device. Check for any visible damage of the package, manipulator and accessories and compare the contents of the box with the delivery note. Report any damage or missing items to Ferrovac within 48 hours of delivery.

CAUTION!

- Always use powder-free examination gloves during unpacking to avoid contamination.
- Please ensure enough working space for unpacking and inspection.
- Please clean the working table/surface and cover it with aluminium foil or household foil.
- Never hit the knife edge or the bellows.
- Never expose the Wobblestick to physical shocks as **the magnets are very brittle**.
- Never bend the tube or the shaft.
- Never stress the bellows by torsion**.**

3. Overview

Originally, WMG40 dual shaft Wobblestick manipulators are mainly designed to exchange sample plates and tip holders in STM-systems by operating a pincer grip.

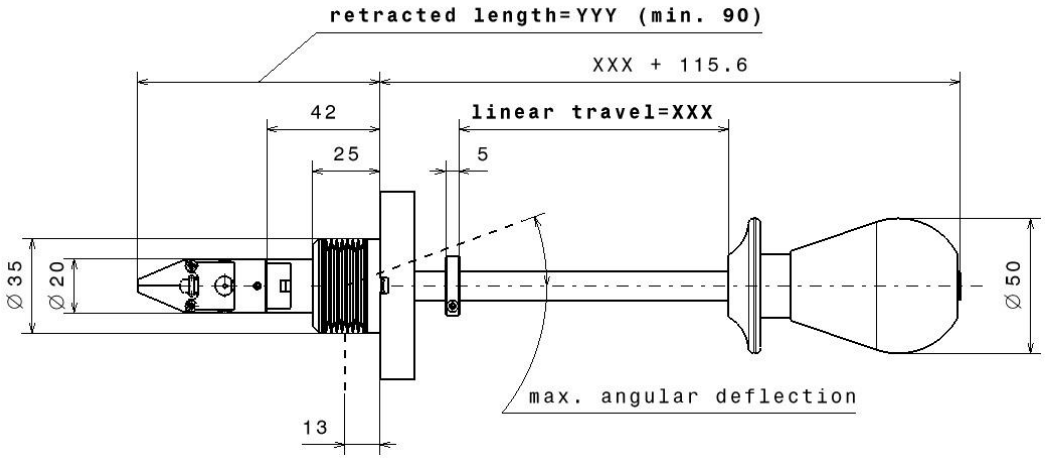


Fig 1 WMG40-XXX-YYY-PGWMS(OM): Dual shaft Wobblestick manipulator with a pincer grip.

3.1 Nomenclature

The main parts of the dual shaft Wobblestick are named as follows:

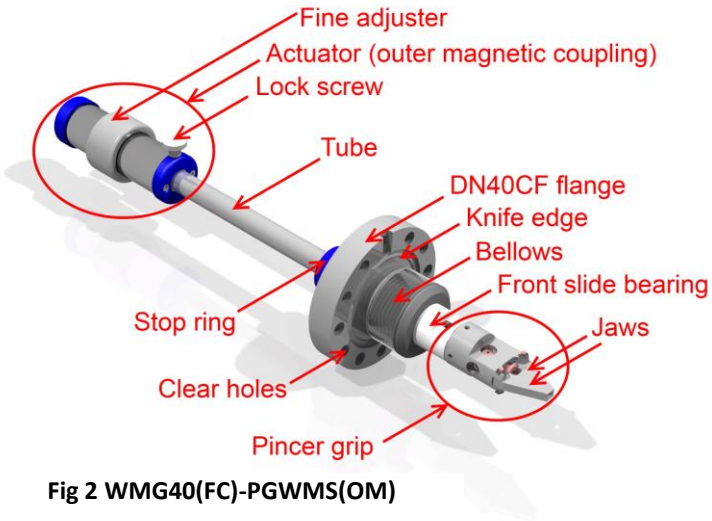


Fig 2 WMG40(FC)-PGWMS(OM)

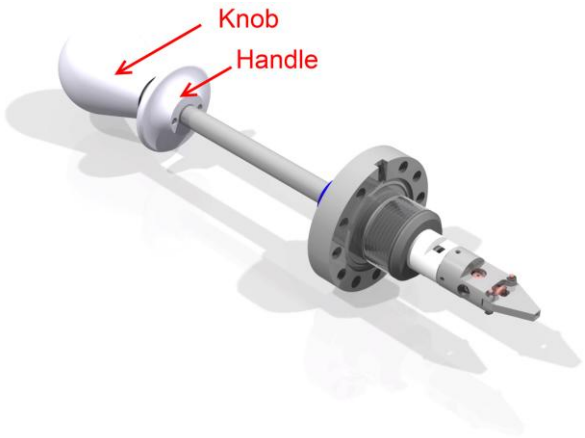


Fig 3 WMG40-PGWMS(OM)

CAUTION!

- **Always** use the tube support parking rail TSWM at any time the Wobblestick is not in use.
- **Never** expose the Wobblestick to physical shocks, **the magnets are very brittle!**
- **Always** use the Wobblestick for its intended purpose.
- **Never** bend the tube or the shaft.
- **Never** pull the knob off the manipulator (maximum linear force is 23N!).
- **Never** over tighten the fine adjuster.
- **Never** apply too much rotational force (maximum torque is 0.4Nm!).

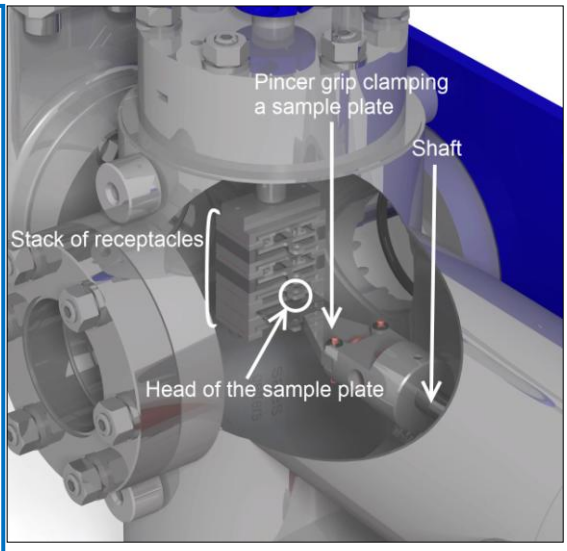


Fig 4 Sample handling in a UHV suitcase (VSN40)

3.2 Handling

The outer magnetic coupling of the WMG40 Wobblestick manipulator opens the pincer grip by slight pressing of the actuator against the knob. For delicate manipulations, the actuator with fine adjuster allows an even more precise opening/closing control of the pincer grips. It is part of the WMG40(FC) Wobblestick manipulator.

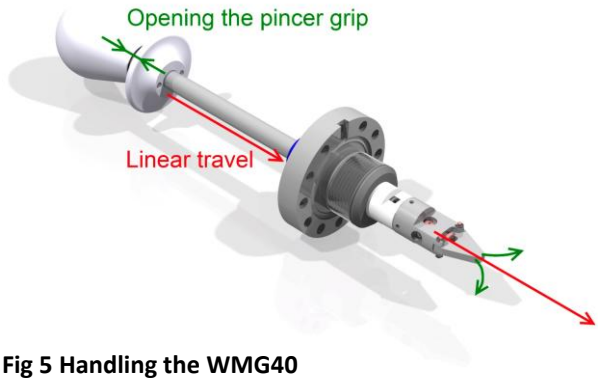


Fig 5 Handling the WMG40

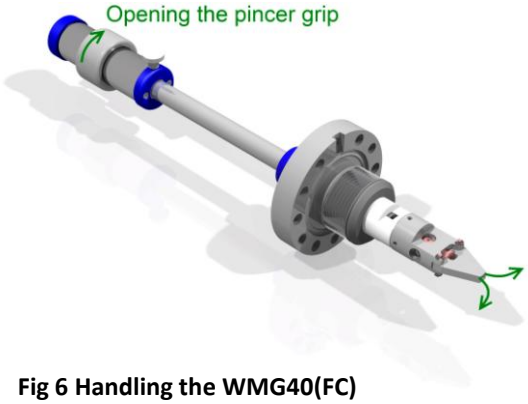


Fig 6 Handling the WMG40(FC)

- WMG40:

1. Realise linear motion by pushing the outer magnetic coupling (nearly force-free) along the "linear travel" arrow.
2. While holding the external magnetic coupling, you are allowed to deflect the tube within its angular deflection range.
3. Position the tip of the pincer grip near to the sample plate.
4. Slightly pressing the actuator against the knob opens the pincer.
5. Position the jaws such that the head of the sample plate lies between them.
6. Release the handle to close the pincer grip.
7. The clamped sample plate is now ready for transfer.
8. To unclamp the sample plate, press actuator against the handle again.
9. Replace the parking rail, if provided, after the use of the Wobblestick.

- WMG40(FC):

1. Untighten the lock screw.
2. Realise linear motion by pushing the outer magnetic coupling (nearly force-free) along the "linear travel" arrow.
3. While holding the external magnetic coupling, you are allowed to deflect the tube within its angular deflection range.
4. Position the tip of the pincer grip near to the sample plate.
5. Turning the fine-adjuster as shown in Fig 6 (CCW from the operators perspective) opens the pincer.
6. Position the jaws, such that the head of the sample plate lies between them.
7. Turn the fine-adjuster in the other direction (CW from the operators perspective) to close the pincer grip.
8. The clamped sample plate is now ready for transfer.
9. To unclamp the sample plate, turn the fine-adjuster CCW.
10. Tighten the lock screw.
11. Replace the parking rail, if provided, after the use of the Wobblestick.

4. Setup and Installation

4.1 Deflection

Ferrovac Wobblesticks cover two different deflection ranges. The bellows allow deflection of +/- 20deg from the central axis of the mounting flange. The "wide angle" Wobblesticks have an even greater range of +/- 28deg (order-code: WMGWA40-XXXX-YYYY).

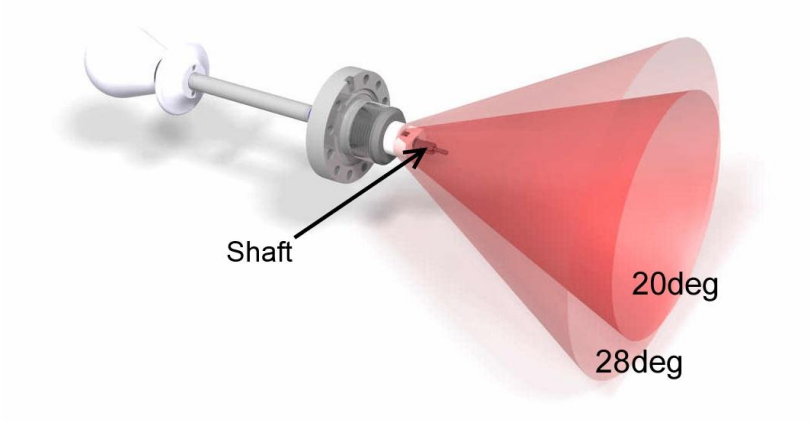


Fig 7 Illustration of the deflection range

CAUTION: To prevent the bellows from being damaged, mount the Wobblestick to DN40CF flanges with oversize tubes (see section 4.2).

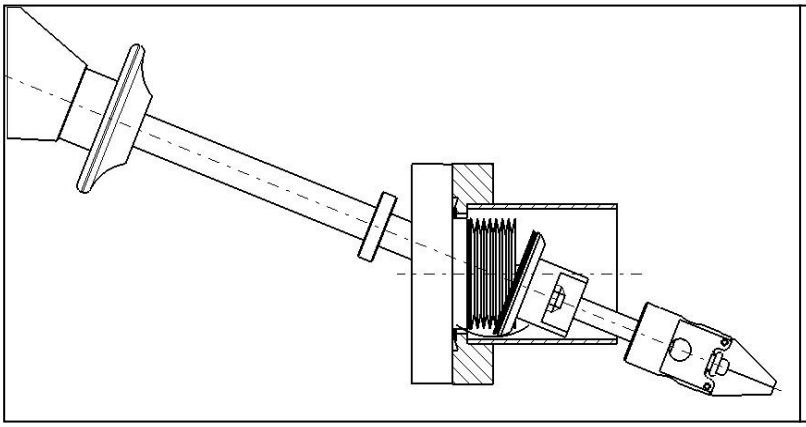


Fig 8 Risk of damaging the wobblestick without oversize tubes

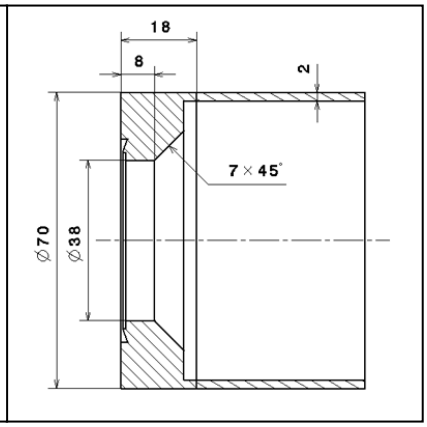
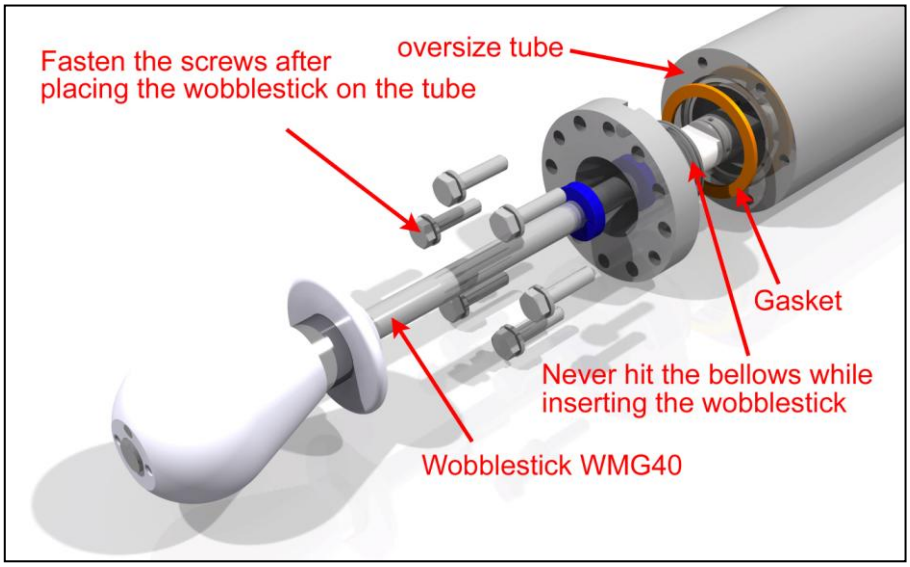


Fig 9 Dimensions of an oversize tube

A standard CF40 flange with an inner diameter of 38mm does, depending on its length, eventually reduces the angular range of the wobblestick. "DN35CF" flanges with an inner diameter of 35mm are not suitable for WM40 and WMG40 Wobblesticks. See section 5.2 Bellows Protection BP40 for a solution to non-oversize tubes.

4.2 Mounting

In delicate situations, the mounting procedure exposes the Wobblestick to the risk of being damaged. Please follow the warning notes and the illustrations below.



Ensure that the bolts go through the larger holes when mounting, as the smaller holes are for the parking rail.

Fig 10 Mounting arrangement, screws used: M6x20 hex-headed or cylindrical, hex (Allen)

CAUTION!

- **Always use powder-free examination gloves during mounting to avoid contamination.**
- **Never expose the Wobblestick to physical shocks.**
- **Always use the tube support parking rail TSWM at any time the Wobblestick is not in use.**
- **Never bend the tube or the shaft.**
- **Never hit the knife edge or the bellows.**

4.3 Tube support

Wobblesticks, especially with longer travel ranges, require that the operators take special care not to accidentally bend the tube while the wobblestick is not in use. The support is directly slotted into the flange of the Wobblestick and is removed during manipulation.

Fig 11 Tube support inline TSWMIL

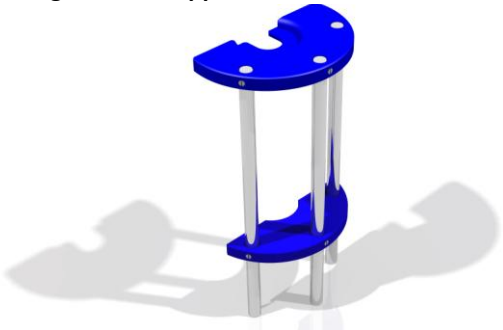


Fig 13 Tube support vertical TSWMV

Fig 12 Tube support TSWM

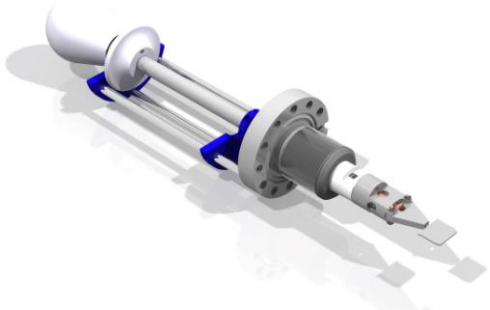


Fig 14 Wide angle wobblestick with a TSWM and a PGWMS(OM) clamping a flag style sample plate

4.4 Bakeout

All Ferrovac UHV manipulators are bakeable up to 150°C, and our latest range is bakeable up to 200°C. Do not remove the magnetic coupling for the bakeout procedure. It is recommended to use the parking rail, if provided, during bakeout. It is helpful to move the coupling back and forth during cooldown of the UHV system to minimise later emission of residual gas after bakeout.

CAUTION! **Never** remove the magnetic coupling for the bakeout procedure. Make sure its temperature never exceeds **150°C** unless stated otherwise on the Product Test Certificate!

5. Accessories

5.1 Pincer grips

5.1.1 Pincer grip straight

The bestseller PGWMS(OM) is made with the appropriate groove to fetch SHOM style sample plates. In its standard version, the angular degree of freedom of the sample plate held by the pincer allows for the dangling of the sample. We offer two jaw-types with different sample plate dangling tolerances (OM) and (OMH):

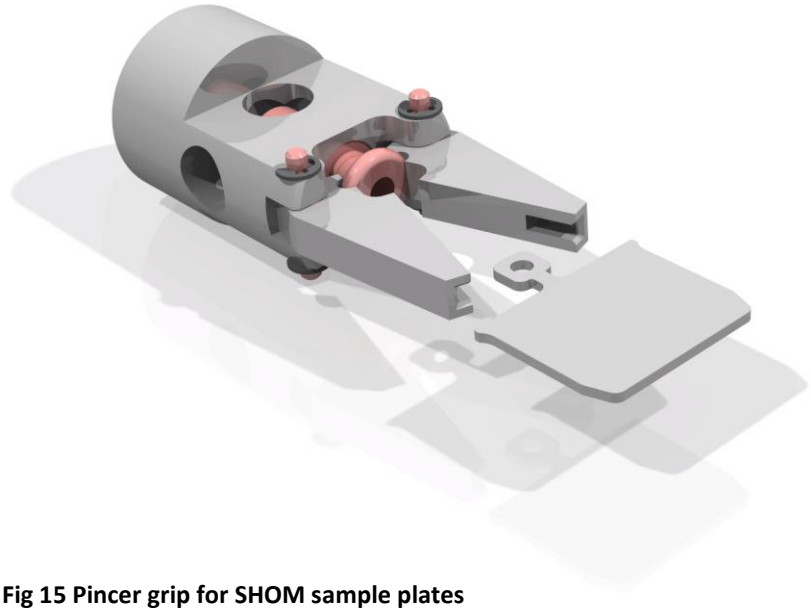


Fig 15 Pincer grip for SHOM sample plates

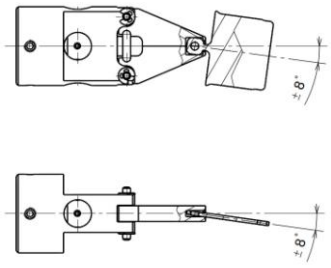


Fig 17 PGWMS(OM)

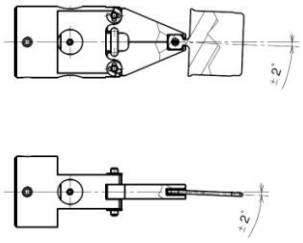


Fig 18 PGWMS(OMH)

5.1.2 Pincer grip orthogonal

The PGWMO(OM)orthogonal pincer grip is 1:1 compatible with the Omicron SA02-1862 gripper for STM1 and similar orthogonally operated sample exchange mechanisms. The pincer grips are made with the appropriate pockets for both inline and perpendicular gripping of a sample plate. These pockets are made with the necessary clearance to allow the sample plate to dangle.

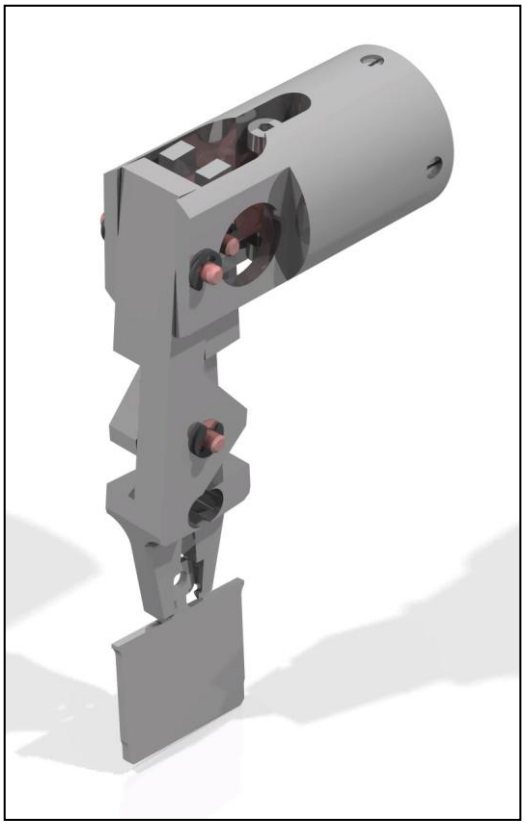


Fig 19 Inline grip

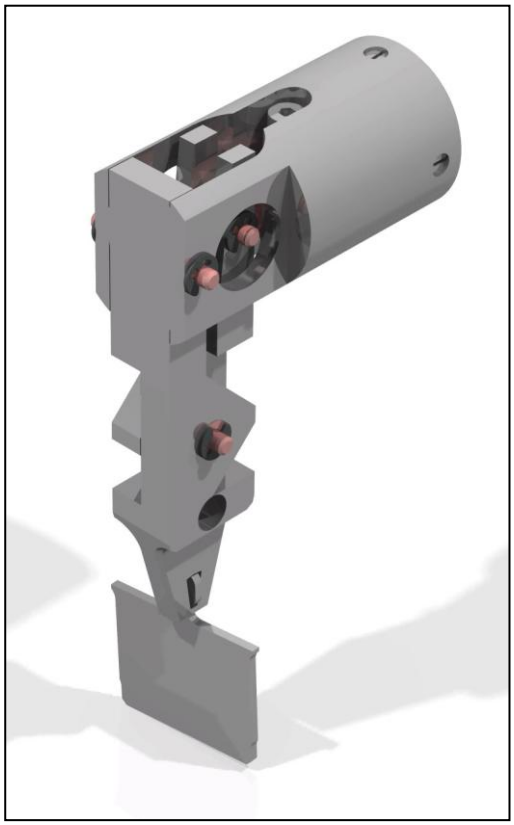


Fig 20 Perpendicular grip

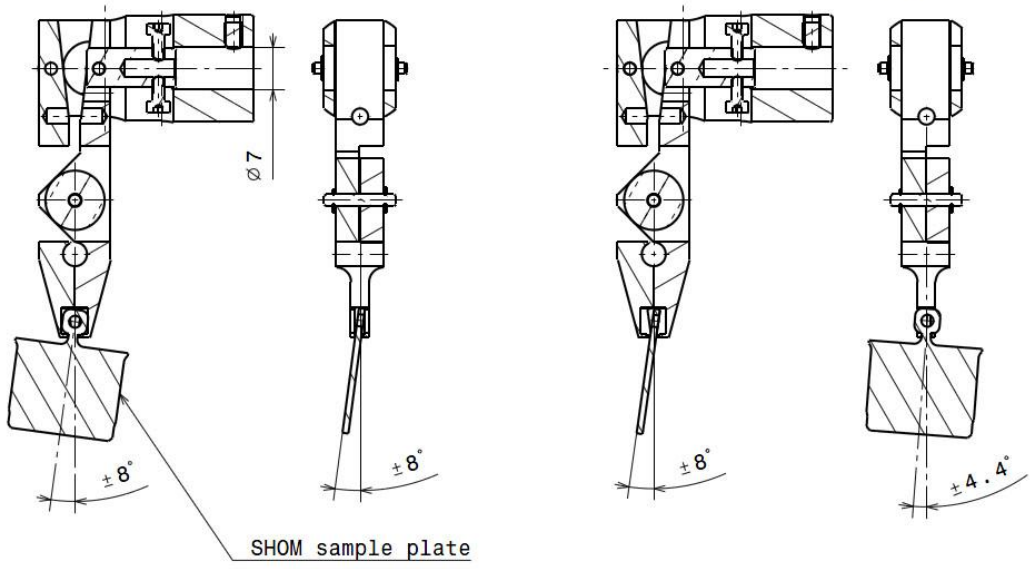


Fig 21 Dangling tolerances

5.1.3 Pincer grip parallel

Mounted to a WMG40 wobblestick manipulator and in combination with the fine-adjuster option MKWMGFC, this pincer can primarily be used as a pair of precise tweezers for performing very delicate manipulations. The PGWMP(OM) is made with the appropriate pockets to fetch SHOM style sample plates. In its standard version, the angular degree of freedom of the sample plate held by the pincer allows for the dangling of the sample.

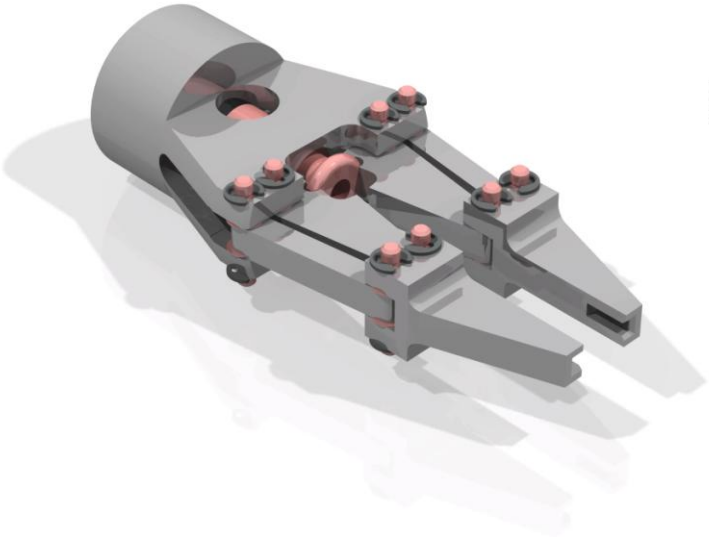


Fig 22 Parallel opening pincer grip

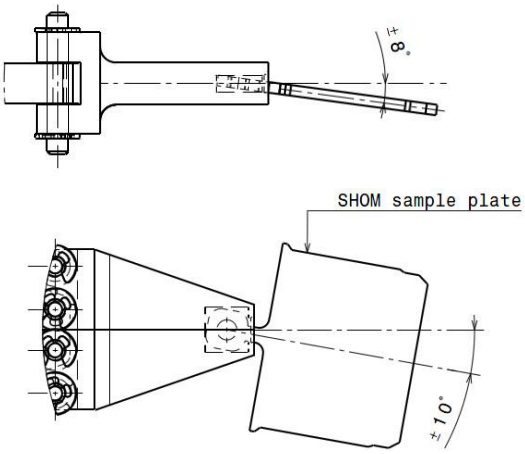


Fig 23 Dangling tolerances

5.1.4 Customized pincer grips

In general, tailored jaws can be created to suit your needs. As an example, the PGWMS-JTAFM-3-A001 allows a direct line of sight onto the sample stage:

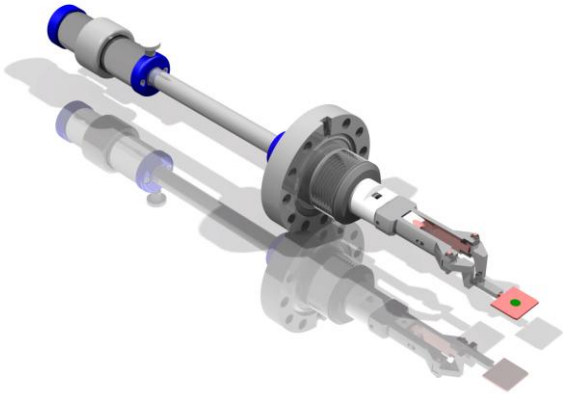


Fig 24 WMG40(FC)-PGWMS-JTAFM-3-A001

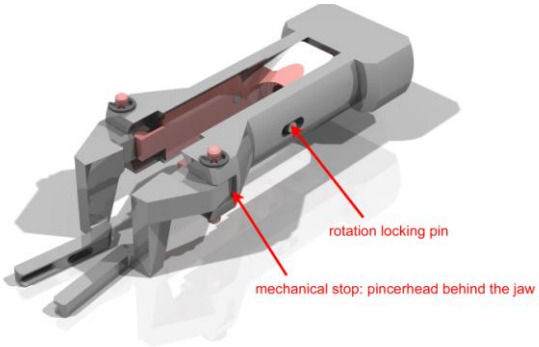


Fig 25 Customized pincer grip

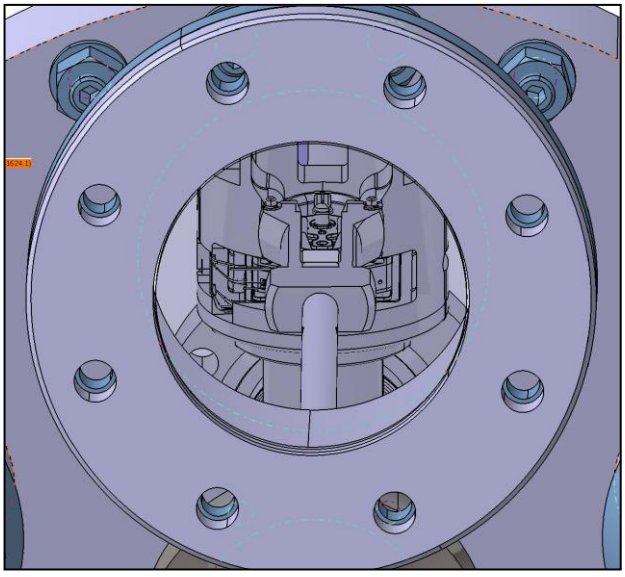


Fig 26 View onto the sample stage

5.2 Bellows protection BP40

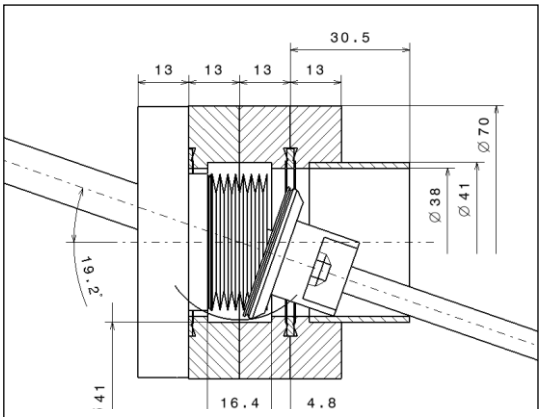


Fig 27 Bellows protection BP40

In case no oversize tube is available, the BP40 protects the bellows from being damaged. Smaller diameter tubes reduce the maximal deflection available, which can be exaggerated by a long tube.

5.3 Wobblestick Aligner TSWMA

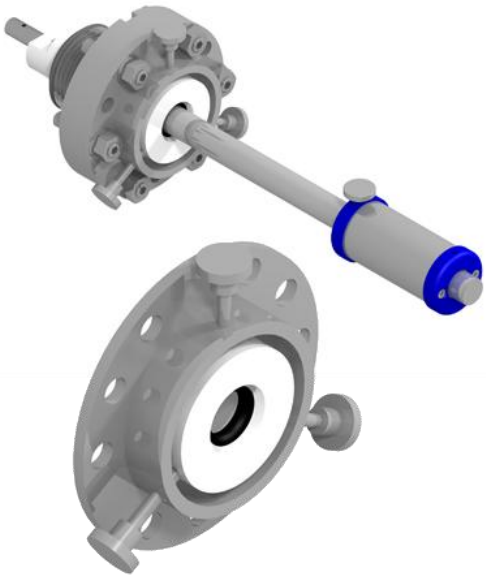


Fig 28 Wobblestick aligner TSWMA

The purpose of the TSWMA is to align the wobblestick and maintain a determined angle. The alignment covers an angle of +/- 4.5 degrees by turning the three knurled screws.

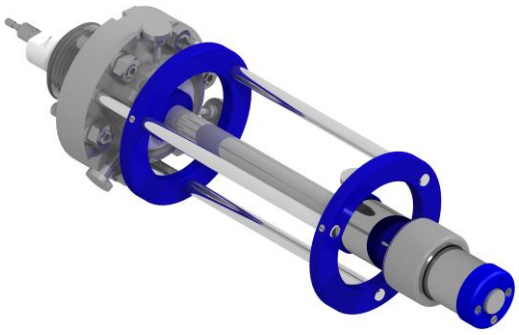


Fig 29 Aligner with external support rail TSWMF

5.4 Adapter for Oxford Instruments pincer grips (former Omicron)

The lifetime of conventional, bellows sealed, Wobblestick manipulators as used in older vacuum systems, is limited by the number of push/pull motions. Thanks to magnetic coupling, Ferrovac Wobblesticks feature a longer lifetime. They are operated nearly force-free and are less sensitive to mechanical damage. The original Omicron pincer, however, is usually in good shape and can be easily dismounted from the old wobblestick and installed onto the Ferrovac WMG40, using the ADOMS, ADOMO or ADOMO2 adapter. Please contact us for a tailored adapter for your pincer grip.

Fig 30 ADOMS - fits to GA02-182

Fig 31 ADOMO - fits to SA02-1862

Fig 32 ADOMO2 - fits to GA02-1810/GA02-1119

6 Problem solving

Please follow the warning notes for this whole section:

CAUTION!

- **Always** use powder-free examination gloves to avoid contamination.
- **Please** ensure enough working space for inspection.
- **Please** clean the working table/surface and cover it with Aluminium foil or household foil.
- **Never** hit the knife edge or the bellows.
- **Never** expose the Wobblestick to physical shocks.
- **Never** bend the tube or the shaft.
- **Never** stress the bellows by torsion.

6.1 Pincer pre-load

Every pincer grip has a factory pre-load of the pincer grip jaws. This pre-load is vital for a proper closed pincer grip while clamping a sample.

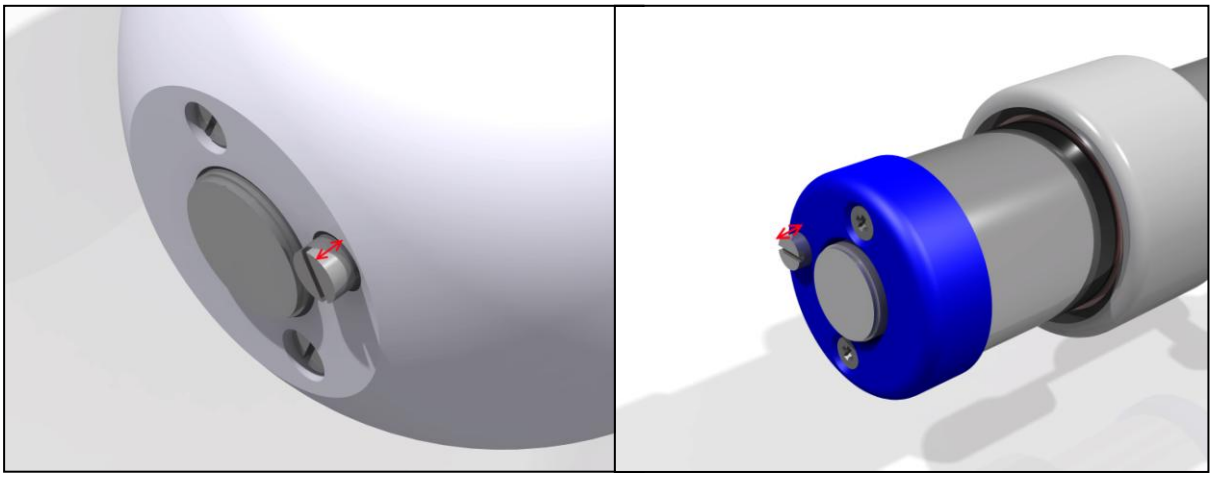


Fig 33 The red arrow points out the distance (measured from the surface of the screw to the surface of the knob) which indicates if the pre-load is still present. If this distance is zero, you need to readjust the pre-load!

In case the pre-load must be readjusted, please follow the instructions:

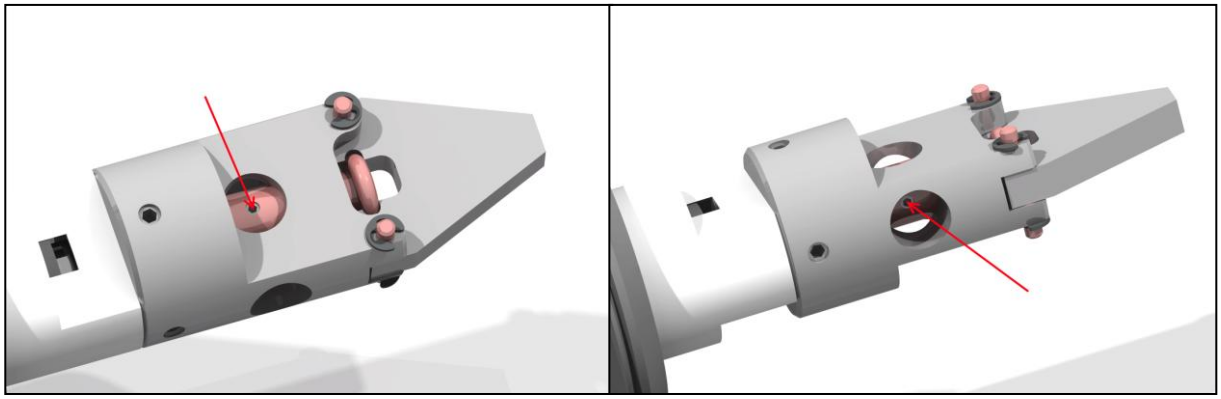


Fig 34 Step 1

- Step 1: Loosen the screws. Use an Allen key (0.9mm) or a screwdriver (00) (depends on the screw-type delivered).

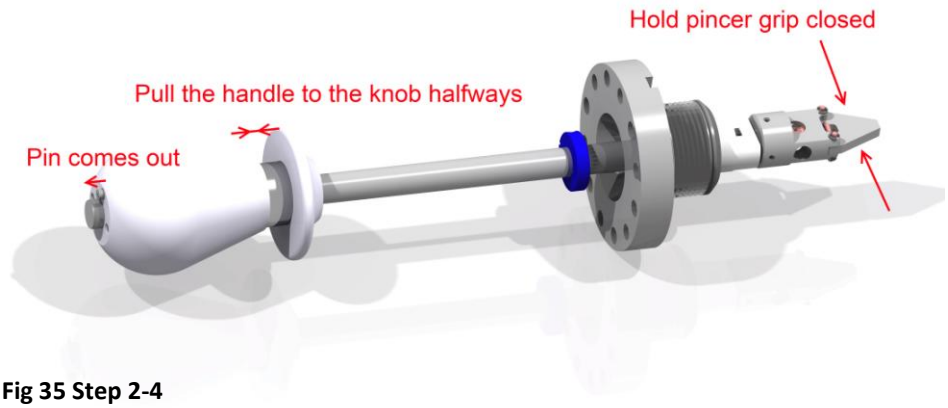


Fig 35 Step 2-4

- Step 2: Pull the actuator to the knob to open the pincer approximately half way. Hold its position until the last step!
- Step 3: Close the pincer grip by hand - this should be nearly force-free because of the loosened screws.
- Step 4: After closing the pincer grip, tighten the screws again according to Fig 34.

Note: For the WMG40(FC), the only working step that changes is step 2: Turn the fine-adjuster such that the pincer grip is half opened.

6.2 Aligning the magnets

WARNING: If you decide to reposition the external magnetic coupling yourself, Ferrovac cannot take any responsibility for damage caused to or by the Wobblestick or by your related actions.

Exceeding the specified linear force of 23N during use of a Wobblestick (external coupling in respect to the internal coupling) will displace the magnets in respect to each other. Each internal and external magnet assembly has several rows of alternately poled magnets. When both halves are in their proper place, the end of the handle is flush to the rear of the tube by about 0.5mm. If it is more than this, then the magnet assemblies are out of place..

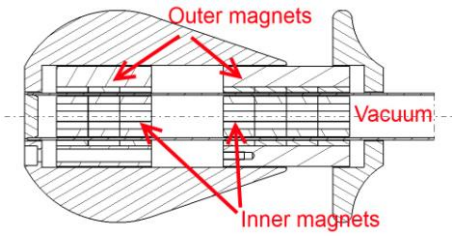


Fig 36 Correct alignment

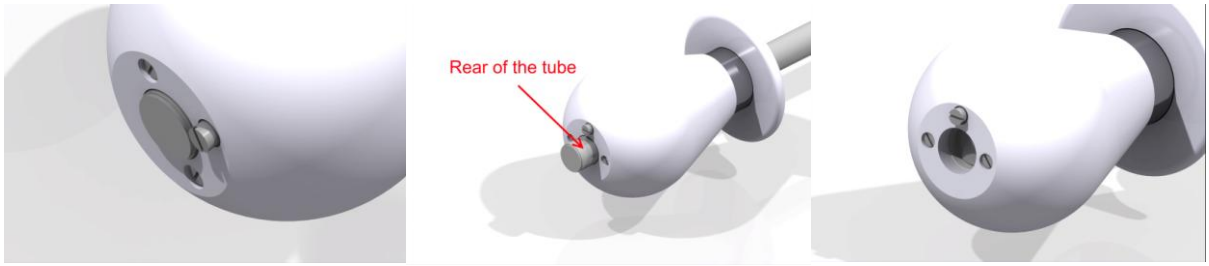


Fig 37 Left: Internal and external magnets are correct aligned. Middle, right: The magnets are displaced!

Repositioning the magnet assemblies*:

- Pull the outer magnetic coupling off the tube.
- With a gloved hand, hold the pincer grip firmly closed with the shaft slightly touching the rear of the tube.
- With the other hand, start pushing the external magnetic coupling onto the tube. Every time a row of outer magnets shifts over an inner one, a firm 'click' is felt when they lock.
- While moving linearly, the magnets will want to rotate 1/8th of a full turn for every row of magnets (due to the eight-fold symmetry of the field), which can be felt. So it is beneficial to push linearly and simultaneously turn a little.
- If the magnet has been pushed one or two rows too far onto the tube:
    - Let go of the pincer grip and put one thumb on the end of tube and two fingers around the rear part of the knob.
    - Pull back until the outer magnetic coupling is flush with the rear of the tube.
    - Push the actuator and the knob together as if to open the pincer grip, to make the actuator magnet also snap into the correct position.

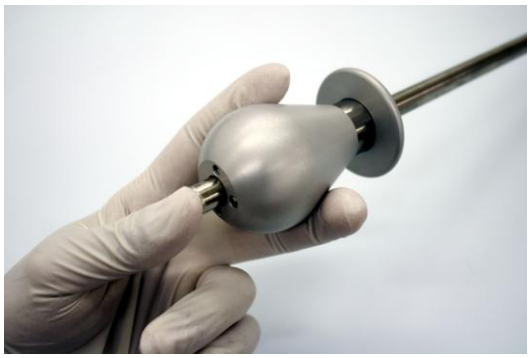


Fig 38 The magnet has been pushed too far

- The Wobblestick should now work correctly again.

Repositioning the magnet assemblies* without venting:

- Put one thumb on the end of the tube and two fingers around the rear part of the knob.
- Pull back until the outer magnet coupling is flush with the end of the tube.
- Push the actuator and the knob together as if to open the pincer grip.
- Should the magnet assembly move too far off the back of the tube (*Fig 37, right*):
    - Find something rigid inside your chamber to press against.

Be very careful when pushing against this rigid part! If the magnet is entirely out of place, the jaws of the pincer grip can move rather freely, and they **could be damaged** if too much pressure is applied.

6.2 Bearing replacement with original Service Kit

The slide bearings are the only parts of the wobblestick that wear out. It is important to check the smoothness of the motion from time to time and please make sure, you don't hear any scratching noise or feel unusual friction while using the wobblestick. Worn out bearings can be responsible for extensive outgassing effects during motion. If any of the above occurs, replace the bearings. We offer a service kit for your dual shaft wobblestick: SERKWMG40

CAUTION!

- **Always** use powder-free examination gloves to avoid contamination.
- **Please** ensure enough working space for inspection.
- **Please** clean the working table/surface and cover it with Aluminium foil or household foil.

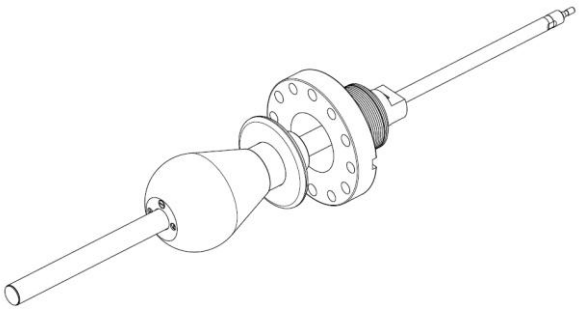


Fig 39 Extract the shaft fully.

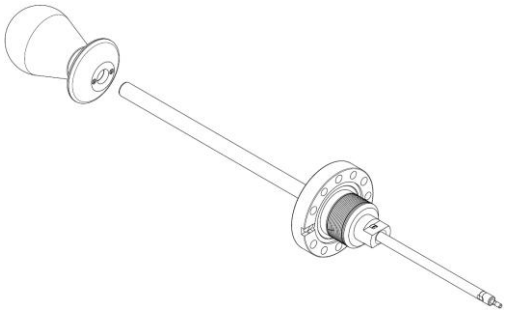


Fig 40 Hold the shaft with one hand, pull off the actuator with the other.

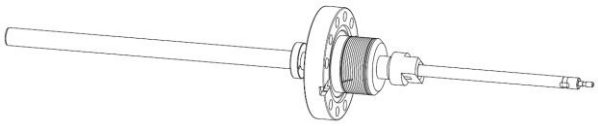


Fig 41 Remove the front slide bearing by turning it counterclockwise.

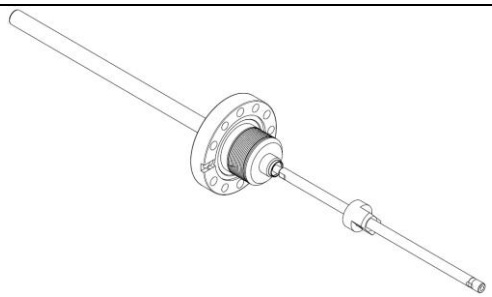


Fig 42 Remove the shaft carefully: Avoid tilting the shaft axis. Tilting may damage the inner magnet assembly.

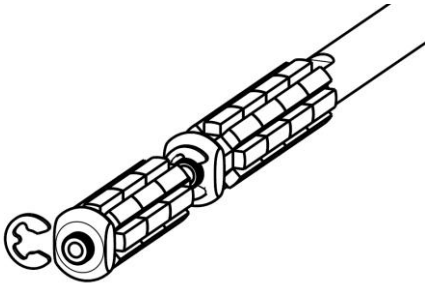


Fig 43 Remove the circlip and replace the inner slide bearing (white) using a suitably small screwdriver. The second slide bearing can't be changed on side! (Only available on a Factory Overhaul)

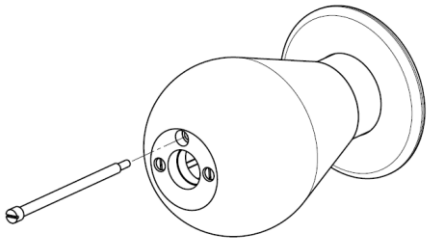


Fig 44 Remove the slotted guide screws on the actuator.

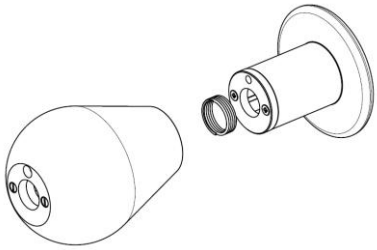


Fig 45 Pull the two actuator parts slowly apart. Don't lose the spring between the two parts!

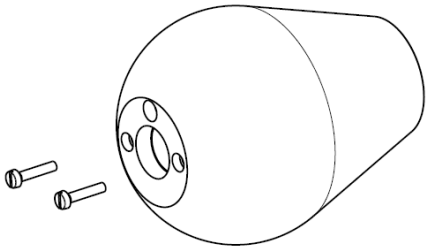


Fig 46 Remove the slotted screws on the actuator part 1

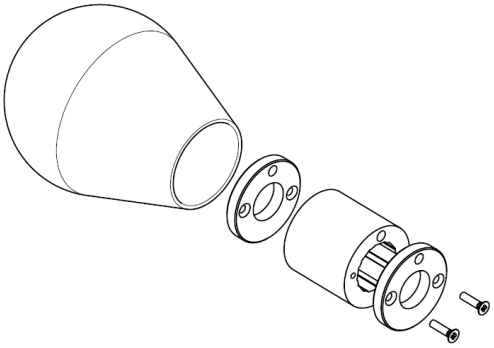


Fig 47 Remove the crosshead screws on the actuator part 1, replace the slide bearings on both side with the new ones.

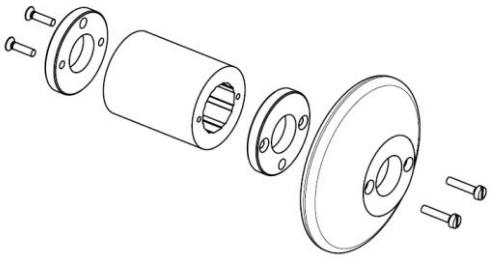


Fig 48 Remove the crosshead & slotted screws on the actuator part 2, replace the slide bearings on both side with the new ones.

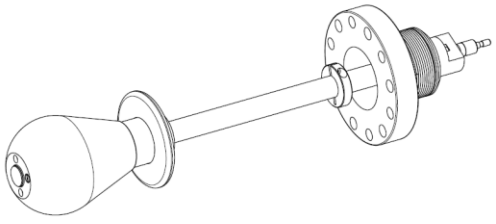


Fig 49 Follow the instructions of Fig 39 to Fig 48 backwards to reassemble the wobblestick. Refer to chapter 6.1 & 6.2 to align the preload & magnets correctly.

6.3 Factory overhaul

The slide bearings are the only parts of the Wobblestick that wear out. Many bakeout periods lead to slight deformation of the slide bearings which can result in disturbances of the motion smoothness and possibly higher outgassing rates. We offer a full factory overhaul for inner and outer bearings and readjustment of any style of pincer grips. Please have a look at our website for more information or contact us directly.

6.4 Declaration of decontamination

In case of returning the Wobblestick to Ferrovac, it is necessary to complete a declaration of contamination and send it to us. Please contact us beforehand. An RMA will be issued and mailed to you.

6.5 Download

This manual is available for download on our website, found in the specifications of each listed dual shaft Wobblestick manipulator.