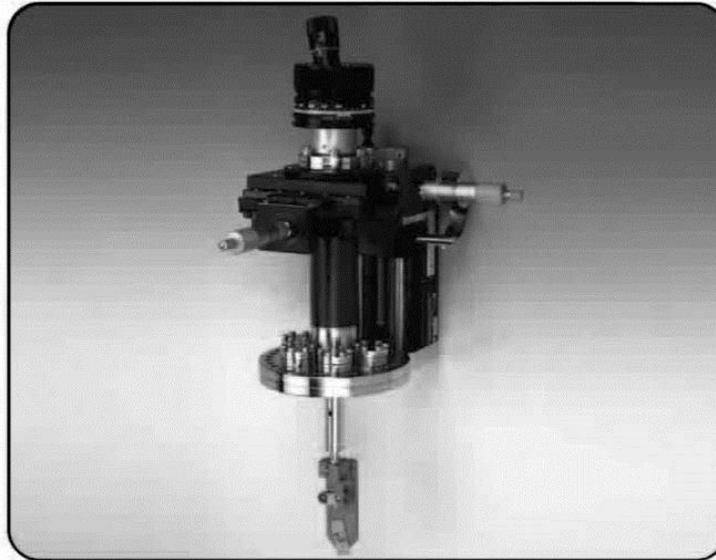


Operating and Maintenance Handbook

HIGH PRECISION TRANSLATOR - HPT



REVISION HISTORY

REVISION	DATE	COMMENTS	INITIALS
1	Jan 1998	Original release	MJD
2	Aug 2015	VACGEN rebrand	AJL

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WARRANTY

Subject to fair wear and tear and the due observance of any installation, user, storage, operating or maintenance instructions the Seller undertakes to replace or at its option repair free of charge to the Purchaser any goods which the Purchaser can establish are defective by reason of defective workmanship or materials and which are returned to the Seller carriage paid within 12 months of the date of dispatch by the Seller. In the event, however, that the Seller supplies spare parts either direct or are fitted or installed or replaced by the Seller's Service Centre such spare parts will be subject to warranty period of six months only.

1. The Purchaser cannot return any product for warranty repair without the prior approval of VACGEN and the issue of a Goods Return Number (GRN). This shall be obtained by contacting the service centre at VACGEN. All returned products must be accompanied by a completed Declaration of Contamination form (see note 2 below). Overseas customers must in the first instance contact the local selling agent.
2. We reserve the right to decline to service equipment we consider is in any way hazardous until a clearance or safety certificate, in a form satisfactory to VACGEN, has been completed and returned by the customer.

SERVICING AND REPAIR

The following additional terms and conditions apply in the event that the customer elects to use the services of VACGEN workshop on a chargeable basis.

- 1 At own cost the customer shall dispatch the equipment to the workshop, carriage paid, suitably packed, protected and insured, bearing a Goods Return Number (GRN) and a completed Health & Safety Certificate (see note 2 below) obtained from VACGEN in advance of shipment.
- 2 During the period the equipment is on VACGEN premises, VACGEN will ensure the equipment against all risks.
- 3 VACGEN will provide an acknowledgement of the receipt together with an estimate of the repair charges. Such estimates are carried out on a visual basis and are therefore intended as a guide only. Formal fixed price repair quotations are available and involve the disassembly of the equipment to determine the full extent of work necessary to restore the equipment to an acceptable standard. In the event that the customer chooses not to proceed with the repair, VACGEN will make a charge to cover this examination effort.

NOTE 1: The above are extracts from VACGEN Conditions of Sale. Complete copies can be obtained from: VACGEN, Maunsell Road, Castleham Industrial Estate, St Leonards on Sea, East Sussex TN38 9NN, England

NOTE 2: This product is exempt from requiring a Declaration of Contamination form, but the user is nevertheless responsible for ensuring that the product is safe for transportation and handling.
Service Department Direct Lines: Tel: +44 (0) 1424 856371 Fax: + 44 (0) 1424 852280

1. INTRODUCTION

1.1 HEALTH AND SAFETY INFORMATION

This equipment is a component for use with vacuum systems. Whilst every effort has been made to eliminate hazards, its safe use is also dependant on the system to which it will be connected.

The owner of the equipment must ensure that all users are aware of the Health and Safety information contained in this handbook. If the equipment is sold or passed to another owner, this handbook must be included with the equipment. If in doubt contact VACGEN.

Warning: This equipment must be installed by qualified personnel.

Warning: It is the responsibility of the user to consider the safety requirements of hazardous materials used with this equipment and the consequence of any leakage, however caused. Consider possible reactions with materials of construction. Any equipment returned to VACGEN must have the correct Declaration of Contamination securely fastened to the outside of the packaging.

Warning: Harmful gases may be evolved if this equipment is heated to temperatures above the maximum specified bakeout temperature.

Warning: Lubricants used in this assembly may cause irritation to sensitive skin. Wear protective clothing.

Warning: Where cryogenic liquids are used with the equipment, it is the responsibility of the user to ensure that the correct safety precautions are taken when handling and storing these materials.

Warning: Safe disposal of the equipment is the responsibility of the user.

Warning: It is the responsibility of the user to fit emergency stops to automated equipment.

Warning: Keep clear of moving pans.

Warning: Do not use this equipment with positive internal pressure above the specified maximum.

Warning: Some equipment may develop extreme hot or cold surfaces. Wear protective clothing.

Warning: Equipment must be fully earthed to prevent dangerous electrostatic charge build-up.

1.2 GENERAL

The HPT is a high precision UHV specimen translator of modular construction, having X & Y motion, with a range of Z motions. The standard system mounting flange is 152mm diameter OD (NW100CF) with mini feedthrough ports. An optional 70mm diameter OD (NW35CF) flanged version is offered on the RX series, however this version does not have feedthrough ports.

HPT-WX series is a 40mm diameter clear bore version of the HPT-RX which has a clear bore of 35mm diameter.

The traveling flange accommodates a series of instrumentation attachments including rotary drives and rotary feedthroughs etc -

X-Y movement is ± 12.5 mm with translatory motion of the slides achieved by the use of precision micrometers for accurate and repeatable positioning. An optional Z only adapter may also be fitted.

A constant tension spring device is used to reduce load applied to the Z drive screw by atmospheric pressure, thus ensuring ease of operation and prolonged life. The zero position on X and Y micro meters is fully adjustable and the Z slide is provided with a linear scale. A tilting mechanism (see figure 7), is an optional feature of the HPT translator, can be fitted to the X slide to tilt the Z axis by up to 7° in any plane, relative to the traveling flange (This item must be fitted by VACGEN).

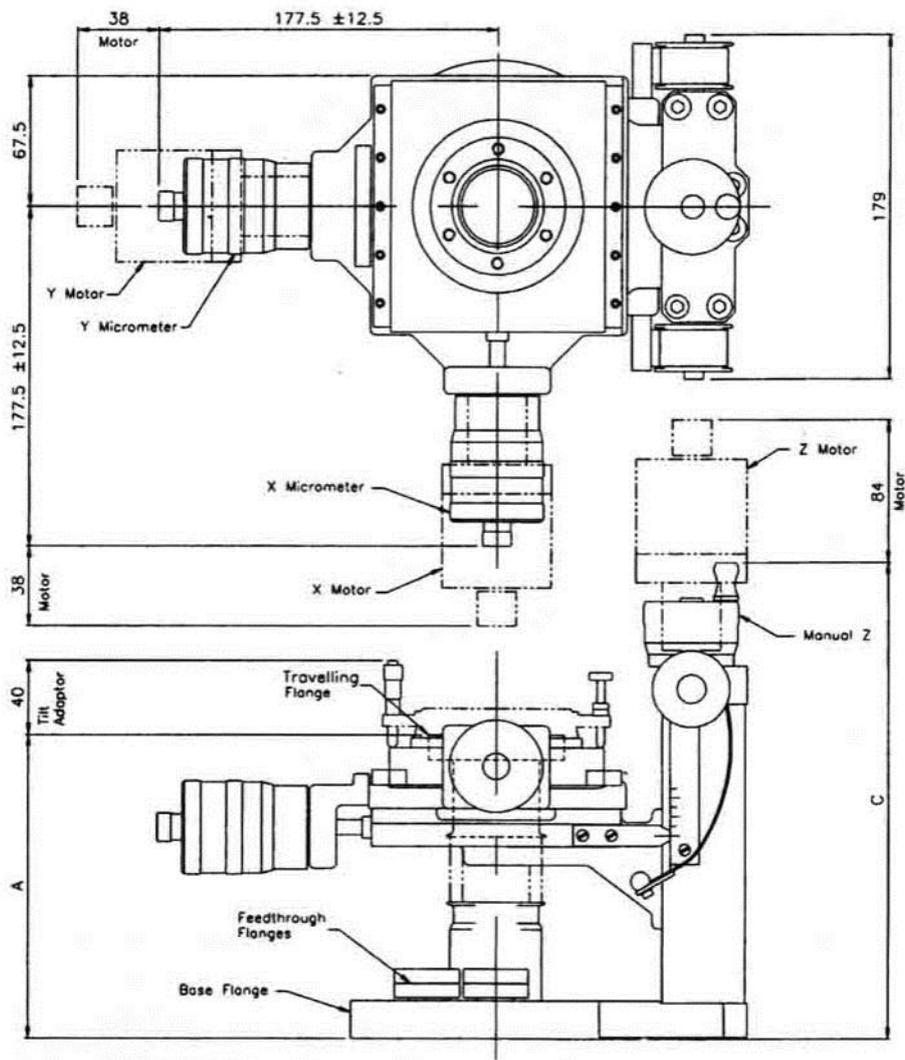
The modular construction (see figure 2) means that the specification may be upgraded or modified simply by the addition of well-defined modules. Likewise, worn or damaged components may be replaced easily and quickly. The translator has been designed for ease and convenience of use. These instructions should be read in conjunction with the user instructions for other incorporated equipment.

1.3 CONSTRUCTION

The vacuum envelope is constructed from stainless steel and all joints are welded. Its superstructure is constructed principally from aluminum alloys specially selected for their superior strength and stability at elevated temperatures. The Z slide guidance system is all steel, employing adjustable linear recirculating ball bearing bushes running on hardened shafts. The X and Y axes use adjustable roller bearing Vee slides.

The guide shafts and slides are machined to extremely close tolerances to ensure a precise relationship between the three planes in all positions.

All moving parts (with the exception of the tilt spherical bearing which is coated with a bonded solid film lubricant) are lubricated with high temperature lubricants, specially selected to ensure smooth and easy operation with a minimum of wear.


Figure 1

Z Travel mm	HPT.RX Bellows bore of 35 A mm	C mm	HPT.WX Bellows bore of 44 A mm	C mm
50	160 to 210	244	210 to 260	294
100	160 to 260	294	210 to 310	344
150	160 to 344	344	275 to 425	459
250	175 to 425	459	226 to 476	510

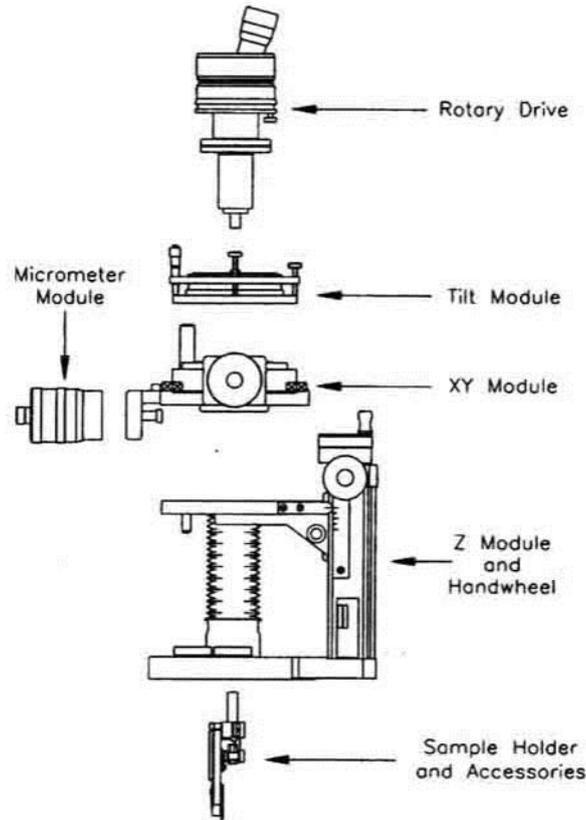


Figure 2

1.5 ORDER CODES

Z Module options

Base Flange	Travel mm	HPT.RX 36 mm bore	HPT.WX 44 mm bore
70 mm (NW3SCF)	50 100 150 250	MRXZ0570 MRXZ1070 MRXZ1570 MRXZ2570	
152 MM OD (NWIOOCF)	50 100 150 250	MRXZ0515 MRXZ1015 MRXZ1515 MRXZ2515	MRXZ0515 MRXZ1015 MRXZ1515 MRXZ2515

XY Module options

Z-only XY adapter +/- 0mm
 Precision XY module +/- 12.5mm
 Tilt module

MRXXY00
 MRXXY12
 MRXTAA

Drive Options	
Large Barrel Micrometer	MRXMIC05
High Resolution Micrometer	MRXMIC01
X axis Stepper Motor Kit	MRXMOTX
Y axis Stepper Motor Kit	MRXMOTY
Z axis Stepper Motor Kit	MRXMOTZ

1.6 Specifications

Motion	Resolution mm	Repeatability mm
X Translation	0.005 manual* 0.0025 motorised*	0.005 manual and motorised
Y Translation	0.005 manual* 0.0025 motorised*	0.005 manual and motorised
Z Translation	0.005 manual* 0.0025 motorised*	0.01 mm
X & Y Vectorial Sum	±12.5 mm providing probe is 10mm diameter for RX and 19mm for WX or less	
System Flange	152mm (NW100CF) (70mm (NW35CF) option for HPT-RX only)	
Mounting orientation	Any	
Accessory Part	4 mini conflat on 84 mm PCD (152mm flange version only)	
Pressure Range	1 bar to below 10. ⁻¹¹ mbar	
Bakeout Temperature	230°C	
Operating Temperature	-20°C to 55°C	
Travelling Flange	70mm OD (NW35CF) tapped M6	

0.001 mm with optional 1 micron micrometer fitted,

* Assuming the use of a VACGEN motor drive controller

1.6.1 Tilt Accessory Specifications

Motion	Extent	Resolution	Repeatability
Tilt Angle	±7° max	0.01°	0.05°
Tilt Plane Selection	360°	1°	1°

2. INSTALLATION

2.1 IMPORTANT - READ BEFORE UNPACKING

Warning: Take care when lifting the unit that the weight and position do not exceed comfortable limits, When installing the device make sure that it is adequately supported at all times.

Warning: Do not operate any of the controls until the X-Y transit pin has been removed. Failure to comply with the installation instructions could result in serious damage to both the translator and the vacuum system.

a. With two or more persons, lift out the translator. DO NOT use bellows, drives or instrumentation as lifting points. Take care not to hit or damage any protruding parts of the translator. Lie the translator on its back.

b. Carefully inspect the translator for visual signs of damage. The packaging is designed to with stand shock and vibration but some of the fixing screws may become loose, more especially with air freight shipment. All parts should be secure and there should be no 'play' in any of the movements. All screws should be securely fastened but not excessively tight.

c. Any damage in transit should be, reported to the carrier and to VACGEN at Hastings, or your local agent, within three days. Retain the packaging.

d. Remove all transit items before operating any of the controls.

2.2 Installation Guidelines

Consideration must be given to the loading imposed on the support vessel by the translator, especially if mounting horizontally. When installing take care to avoid damage to protruding components. Retain the transit pin and support stand on the translator until the time of installation.

The vacuum compensation springs (see figure 3) are factory set for either vertical, horizontal or inverted orientation as requested at time of order.

Warning: If the orientation is changed, it will be necessary to change the springs. Do not attempt to do this without consulting with VACGEN service department as these springs are very sharp, powerful and therefore dangerous.

2.3 Accessory Flanges

When attaching accessories such as the RD1 or the RD2 rotary drive to the traveling flange, care should be taken when, tightening or removing the six flange bolts to prevent any of the tightening torque being transmitted to the bellows.

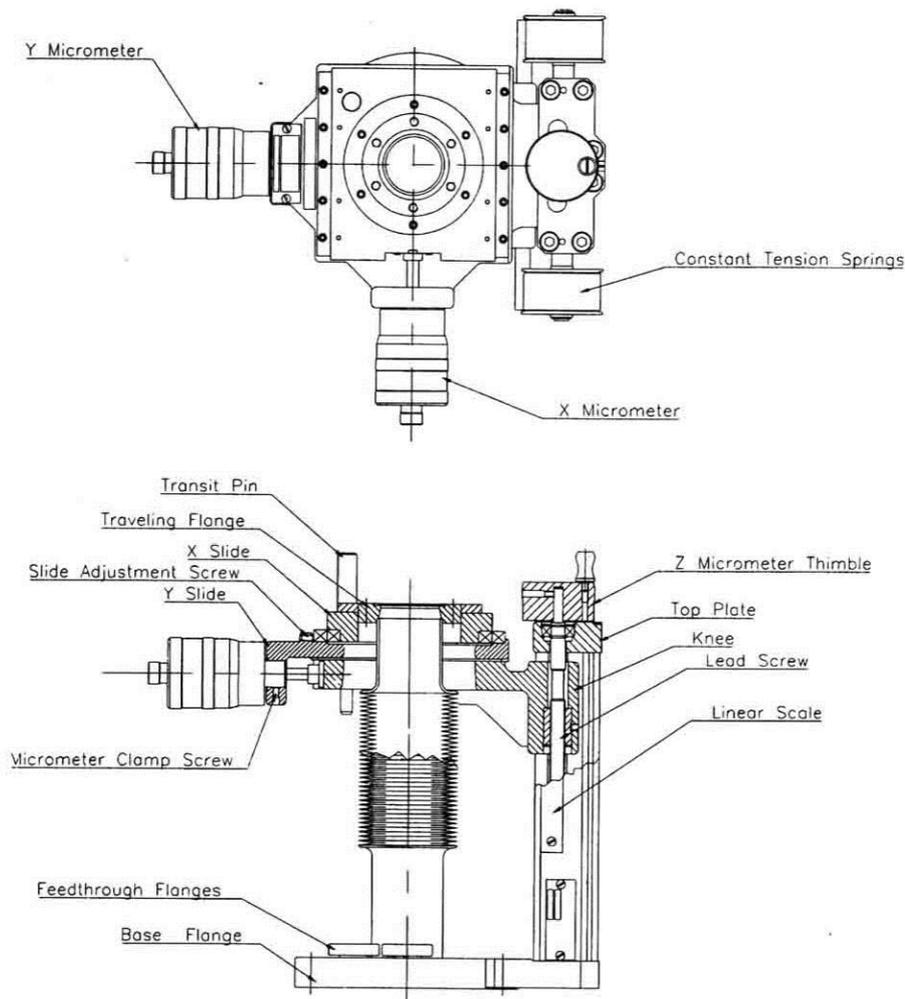


Figure 3

The four 34mm OD (FC919) feedthrough flanges (complete with blanking flanges) are spaced on an 84mm PCD and are provided for introduction of electrical or other services, such as liquid nitrogen, water etc.

2.4 Retro Fitting Motors

Warning: It is the responsibility of the user to fit emergency stops to automated equipment (Note VACGEN stepper motor controllers have a facility for adding emergency stops).

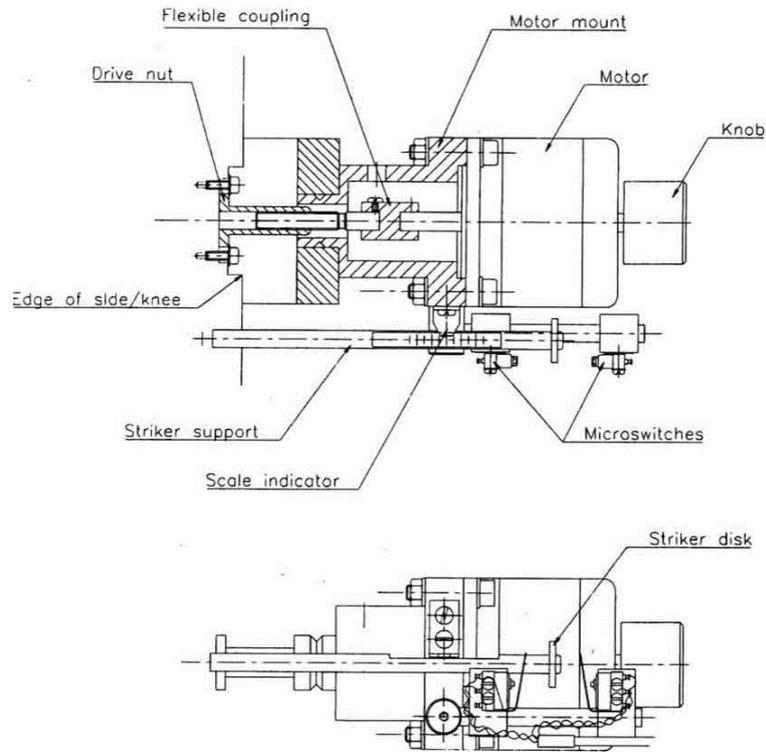


Figure 4

2.4.1 X-Y motor

To retrofit a motor unit to the X or Y slide of the module, proceed as follows:

- a. Motor wiring details are given in Appendix A.
- b. Remove the micrometer as described in section 4.4.2.
- c. Attach the motor mount to the Y slide and secure in position by tightening the micrometer clamp screw (see figures 3 and 4).
- d. Clamp the drive nut to the slide by replacing the coupling screws as shown in figure 10.
- e. Secure the striker support rod to either the Y slide using the M4 grub screw or the knee using the M3 grub screw, depending on the axis the motor is fitted.

2.4.2 Z Slide Motor

The motorisation unit replaces the micrometer thimble and connects directly to the lead screw via a flexible coupling (see below).

To retrofit to an existing translator proceed as follows.

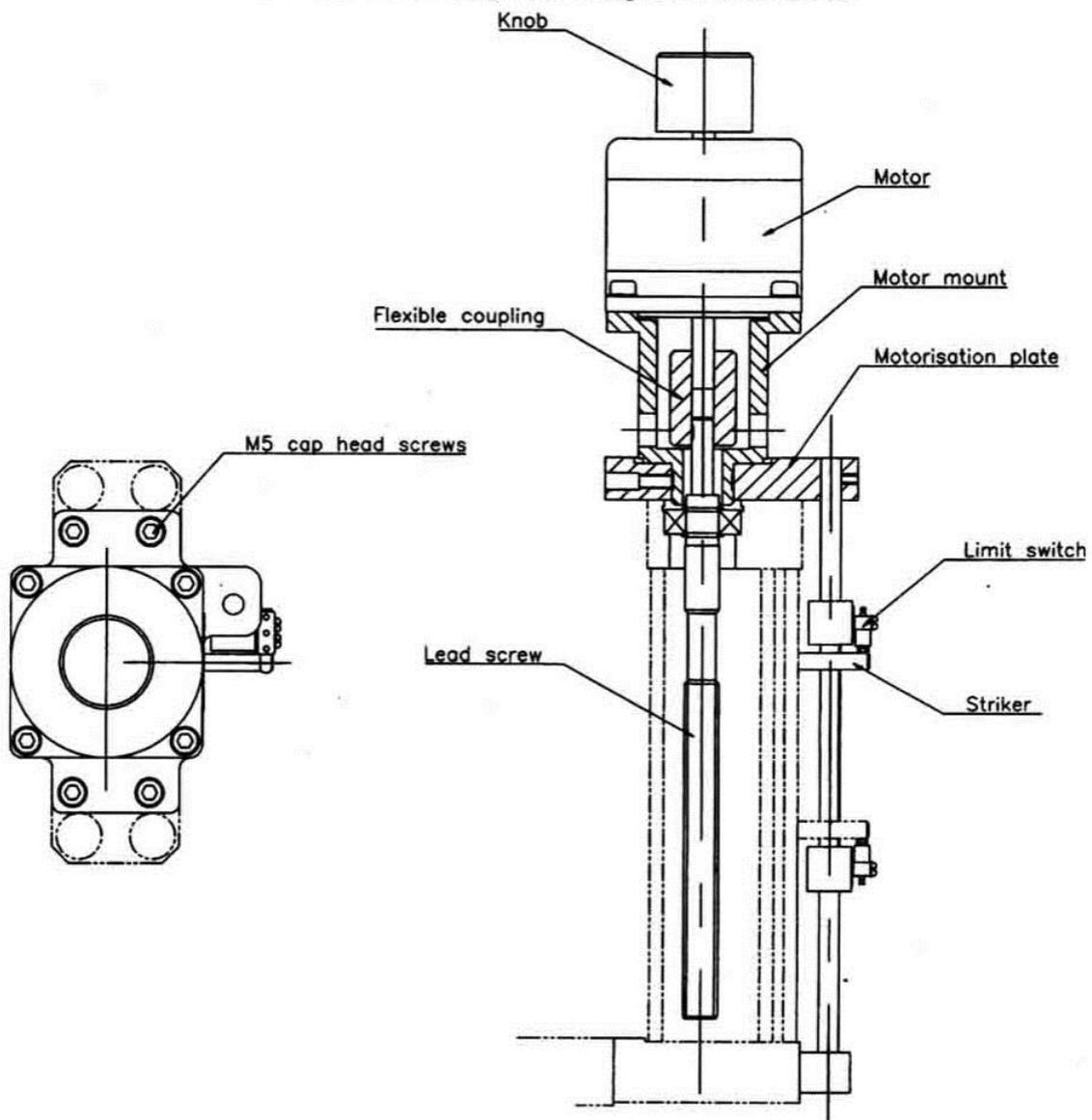


Figure 5

a. Remove the Z Micrometer thimble (see figure 3) and attach the motorisation plate to the top plate of the HPT with MS cap head screws. The flexible coupling couples the motor output shaft to the lead screw by simply tightening the screws in the flexible coupling onto the lead screw.

b. The motorisation plate carries a long rod on to which are mounted a pair of limit switches. The switches are fully adjustable over the Z slide travel. The free end of the rod fits loosely into a boss mounted on one of the extrusions.

The switches are actuated by a striker connected to the knee and projecting through the slot between the extrusions. The Z position is indicated on the scale, but more accurately by the stepper motor count system on the controller.

2.4.3 Limit switches

It is essential that both pairs of micro switches are correctly adjusted so that there is no risk of driving beyond the travel limits, as this is likely to damage both the motor mechanism and the bellows. Be aware of limits imposed by the vectorial sum (see section 3.2) and any other equipment fitted to the HPT. The stepper motor datum will be lost if the micro switches are activated and must be reset in this event.

3. OPERATION

3.1 IMPORTANT INFORMATION

Warning: Keep clear of moving parts.

Caution: Where motors are fitted, the motor connectors must not be disconnected unless the power to the drive has first been switched off. Allow a few seconds for the circuits to discharge.

3.2 XY MOVEMENT LIMITATION WITHOUT TILT

Caution: The HPT is a precision mechanism and care in its use should be exercised at all times, especially at the extremes of travel when contact with a fixed object in the vacuum system or elsewhere, could impose a strain on the mechanism.

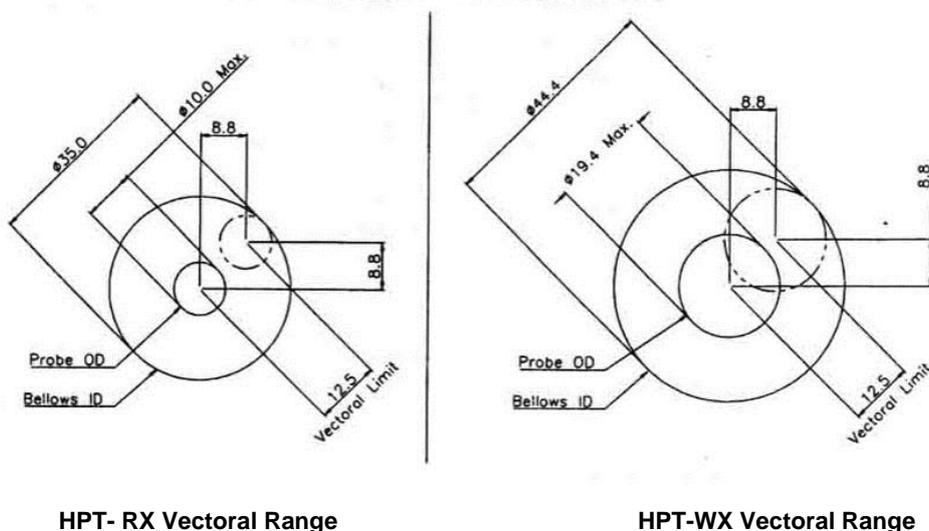


Figure 6

Attention is drawn to the travel limits of the X and V translations which are indicated by the vectorial sum of the X and Y motions (see figure 6). As no stops can be provided, care must be taken not to exceed the vectorial sum of 12.5mm, assuming zero tilt and a maximum probe of 10mm diameter (19.4 mm for HPT-WX) centered on the accessory flange.

3.2.1 XY Movement limitations with tilt.

When the tilt accessory is fitted, the permitted degree of tilt, with X and Y centered is defined by the following table assuming no probe is fitted to the travelling flange.

The tilt angle will be restricted by:

- * The bore of the bellows.
- * The height of the traveling flange with respect to the system mounting flange.
- * The diameter and length of any probe attached to the traveling flange.

3.3 GENERAL OPERATION

The translator must be correctly installed, and the information above followed carefully.

Periodic routine maintenance is required. See section 4.1

When setting a position, the backlash in the mechanism (manual or motorised) can be eliminated if the set point is approached from the same direction each time.

3.3.1 Manual Z Drive

Measurement of Z position is by a scale mounted to the side of the extrusion and the Index dial of the thimble.

3.3.2 Manual X-Y Micrometer Stage

A Transit pin is provided to accurately secure the stage in the central position, providing support during transit to the micrometers, to enable calibration of the micrometers and to zero the motor stage.

Caution: DO NOT attempt to operate the X or Y motions with the transit pin in place.

Adjusting the micrometers will cause the corresponding slide to move in a linear motion.

Dimension A (see figure 1)	HPT-RX Bellows bore of 35mm	HPT-WX Bellows bore of 44mm
160	6.24°	-
175	5.71°	-
210	-	5.98°
226	-	5.56°
260	3.85°	-
275	-	4.57°
310	3.23°	4.06°
425	2.35°	2.64°
475	-	2.64°

3.3.3 The Tilt Accessory (where supplied)

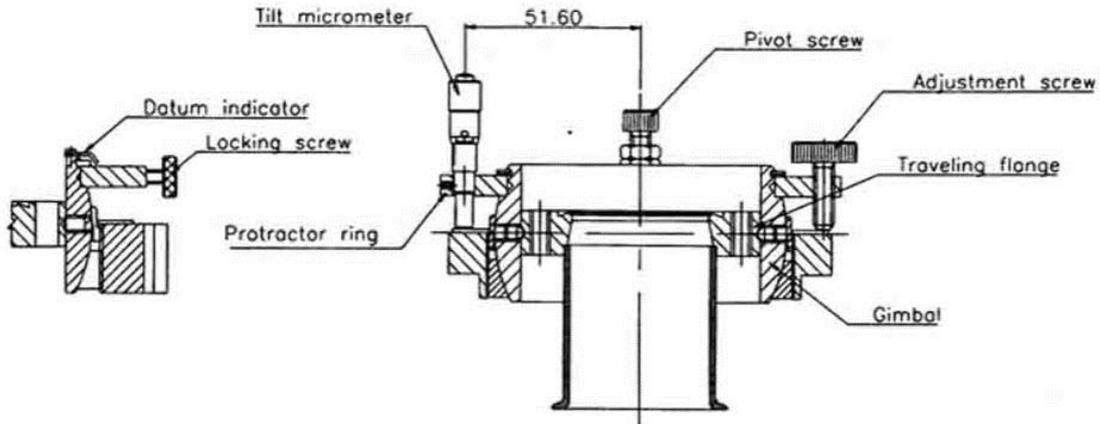


Figure 7

A datum indicator attached to the gimbal may be aligned with either the X or Y micrometer axis, whichever is regarded as the zero datum. Any plane of rotation, relative to the zero axis datum, may be selected by rotating the protractor ring to the required angle.

The tilt angle is achieved by adjusting the tilt micrometer to a required reading causing the protractor ring to tilt about an axis between the two pivot screws (see above).

3.3.4 An example of use

To tilt the traveling flange by an angle of 51, with the protractor ring at an angle of 330° relative to the X axis.

CAUTION: Do not over tighten screws.

- Check that the system imposes no restrictions on the movement required, see section 3.2.1.
- Refer to section 3.3.5 to determine the setting required. In this case, 5° will require a micrometer setting of 2mm.
- Loosen the pivot screws, adjustment screw, locking screw and micrometer on the protractor ring sufficiently to enable rotation of the protractor ring.
- Rotate the protractor ring until the datum indicator attached to the gimbal in the X axis reads 330°, and tighten the protractor ring locking screw.
- Tighten the pivot screws until they make light contact with the X slide (Do not alter the positions of the lock nuts which are factory set).
- Loosen the adjustment screw to allow full adjustment of the micrometer.
- Adjust the micrometer to give a reading of 2 mm.
- Tighten the adjustment screw until light contact is made with the X slide.

To return the tilt back to the horizontal

- Loosen the adjustment screw sufficiently to allow full adjustment of the micrometer.
- Adjust the micrometer to read 6.5mm
- Tighten the adjustment screw until light contact is made with the X slide.

3.3.5 Setting the tilt angle

The micrometer setting required to achieve the desired angle may be found using this calculations:
 $h = 6.5 - (51.6 \times \tan T)$

T = tilt angle in degrees
h = micrometer setting in millimeters

Example -
For T = 0.6°
h = 6.5 - (51.6 x tan 0.6)
h = 6.5 - 0.54

h = 5.96mm

A simple guide can be found in the following table

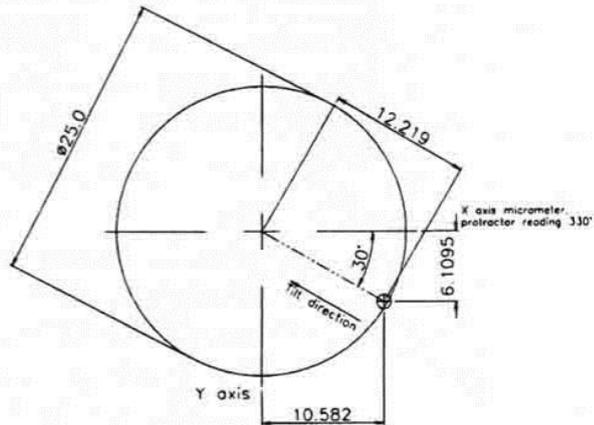
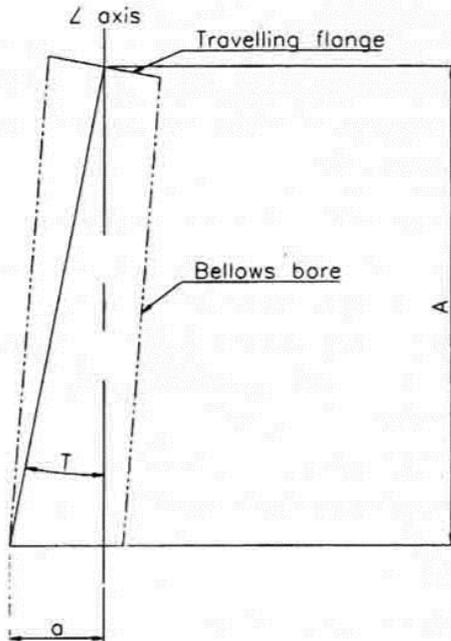


Figure 8.

Figure 9

3.3.6 Example of achieving an angle by offsetting the X-Y module

To achieve an angle of 40° tilt at Z = 0 (bellows fully extended) on an MRX2515 or MRX2570 with the tilt protractor set to 330° in the X axis, assuming no equipment is attached to the traveling flange.

Tilt angle T = 4°
Flange to flange height A = 425mm (see figure 1)
Bellows bore = 35mm diameter

therefore a = A tan T
= 425 tan 4°
= 29.719 mm (see figure 8)

X-Y module displacement = a - (bellows bore/2)
= 29.719 - (35/2)
= **12.219mm**

thus it will be necessary to move the X and Y micrometers by the following-
y = 12.219 sin 30°
= **6.1095mm** (see figure 9).

X = √(12.219² - 6.1095²)
= **10.582mm**

3.4 BAKEOUT

3.4.1 Bakeout guidelines

Warning: Harmful gases may be evolved if this product is heated above the maximum specified bakeout temperature.

Warning: VACGEN cannot accept responsibility for any damage to equipment or injury to personnel arising from failure to observe the requirement as set out in the notes below.

* Heater tape should be avoided as this can cause local hot spots.

* All temperature sensors must be suspended above the unit and within the bakeout zone and must not touch any part of the equipment as this will give a false result that will cause overheating.

* Centralise the XY table and remove all non-bakeable equipment from the bakeout zone including all motors.

* Loosen the pivot screw, adjustment screw locking screw and micrconnector on the protractor ring of the tilt assembly.

3.4.2 Z motor removal before bakeout

a. Drive the Z slide to approximately mid position.

b. Note or zero the motor counts.

e. Loosen the flexible coupling set screws and the M5 cap head screws that secure the motorisation plate. Remove the Z motor assembly complete with wiring and micro switches (see figures 3 and 4).

d. Replace the motor assembly by carrying out the reverse of the above procedure

3.4.3 X-Y motor removal before bakeout

a. Drive the X & Y slides to the centered position and fit the transit pin.

b. Note the motor counts or zero the motor counts at this position.

c. Remove the striker disc from the striker rod.

d. Loosen the screws on the flexible coupling on the drive shaft of the slide. Loosen the micrometer clamp screw which secures motor mount to the slide bracket (see figures 3 and 5).

e. Mark the motor assemblies to identify for future replacement. The X motor must be retained to the X slide and visa versa.

f. Remove the motor and housing assembly complete with the wiring and micro switches.

g. Replace the motor assemblies by carrying out the reverse of the above procedure.

4. MAINTENANCE

4.1 ROUTINE MAINTENANCE

4.1.1 Inspection schedule

The following inspections and procedures should be performed after 150 to 200 hours of accumulated bakeout or when any of the motions appear to require more effort to operate than previously.

4.1.2 Screw fixings

Check that all screws are secure: not slack nor excessively tight. It will be noted during any dismantling that Belville washers (disc springs) have been fitted under certain screw heads. It is important that these washers are refitted in the correct locations.

4.1.3 Gravity compensation springs

Warning: The springs have sharp points.

Visually inspect the springs to check that no springs leaves have broken. Any broken spring must be replaced as soon as possible. Contact VACGEN service department for information.

4.2 LUBRICATION

Warning: Lubricants used in this assembly may cause irritation to sensitive skin. Wear protective clothing. Do not swallow.

Warning: Safe disposal of the equipment is the responsibility of the user.

Warning: Keep clear of moving parts.

Note that Carbaflo grease discolours with time, particularly where regular bakeouts are applied to the equipment. This is normal and does not affect the behavior of the lubricant.

Remove all existing lubricants, and re-lubricate as follows.

- a. All the caged rollers retained in the four roller bearings within the cross slide assembly on the X and Y stage, the micrometer coupling, the ball bearing in the Z slide plate and the four recirculating/linear ball bearings on the support shafts in the Z slide. Lubricate these items with Carbaflo D.
- b. All remaining moving parts (except the spherical tilt bearing) including all micrometers and the four Vee slides, the Z-drive screw and nut, and the Z-slide shafts. Lubricate these with Carbaflo Grease.
- c. The spherical bearing and its spherical seating in the X slide should be assembled clean and dry.
- d. All fixing screws. Lightly coat the threaded portion with VG thread lubricant. On completion all external surfaces should be clean and free from surplus lubricant.

4.3 FACTORY SERVICING

A factory servicing scheme exists for all translators. The translator should be returned to the VACGEN factory with a covering order. The servicing scheme includes the following-

- Complete strip down and clean
- Re-lubrication
- Re-assembly

When shipping the units use the original packing and pack with care to avoid expensive transit damage. Consider that the crate is liable to be dropped on any face or corner. A completed Health and Safety Declaration (See back pages) must accompany any equipment returned for servicing.

4.4 CORRECTIVE MAINTENANCE

4.4.1 Z Adjustments

Adjustments to the Z slide guidance bearings are unlikely to be necessary as the ball bearing bushings run on hardened shafts. If adjustments are found to be necessary, contact VACGEN Service Department.

4.4.2 X-Y Slide Adjustments

If play develops in the X-Y slides, adjustment screws are provided on each axis. The X slide adjustment screws are located above the Y slide micrometer (or motor). The Y slide adjustment screws are located below the X slide micrometer (or motor).

- a. Before making any adjustment, it is first, necessary to loosen the screws that hold the bearing slide closet to the adjustment screws.
- b. Check that the roller cage between the slides is centrally positioned along the length of the slide.
- c. Tighten the middle adjustment screw first, to finger tight only. Then tighten the outer adjustment screws, to finger tight.
- d. Finally tighten the bearing retaining screws.

4.4.3 Removal of micrometers

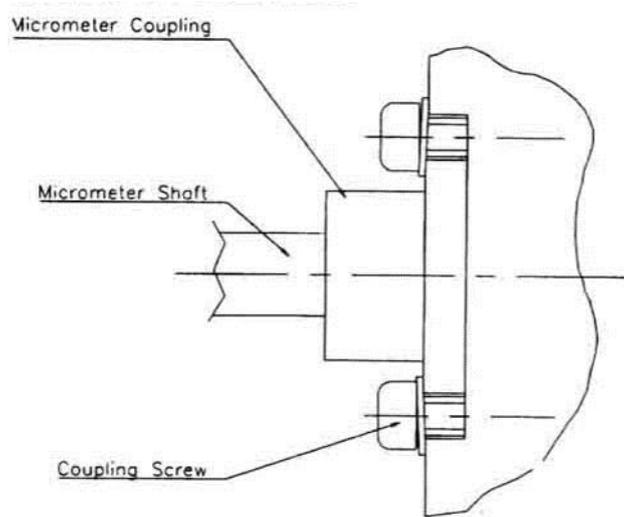


Figure 10

- Center the X-Y stage and fit the transit pin (figure 3).
- Remove the coupling screws.
- Loosen the micrometer clamp screw

Both micrometers are removed in the same manner. To replace the micrometers,

- Set the micrometers to 12.5mm.
- Fit the micrometer to the Y slide and replace the coupling screws.
- Loosen the micrometer clamp screw.

Once both micrometers have been replaced the transit pin can be removed for operation.

4.4.4 Vacuum compensation springs

Warning: DO NOT attempt to service these springs without consultation with VACGEN Service Department as these springs are very sharp, powerful and therefore dangerous.

4.5 SPARES AND ACCESSORIES

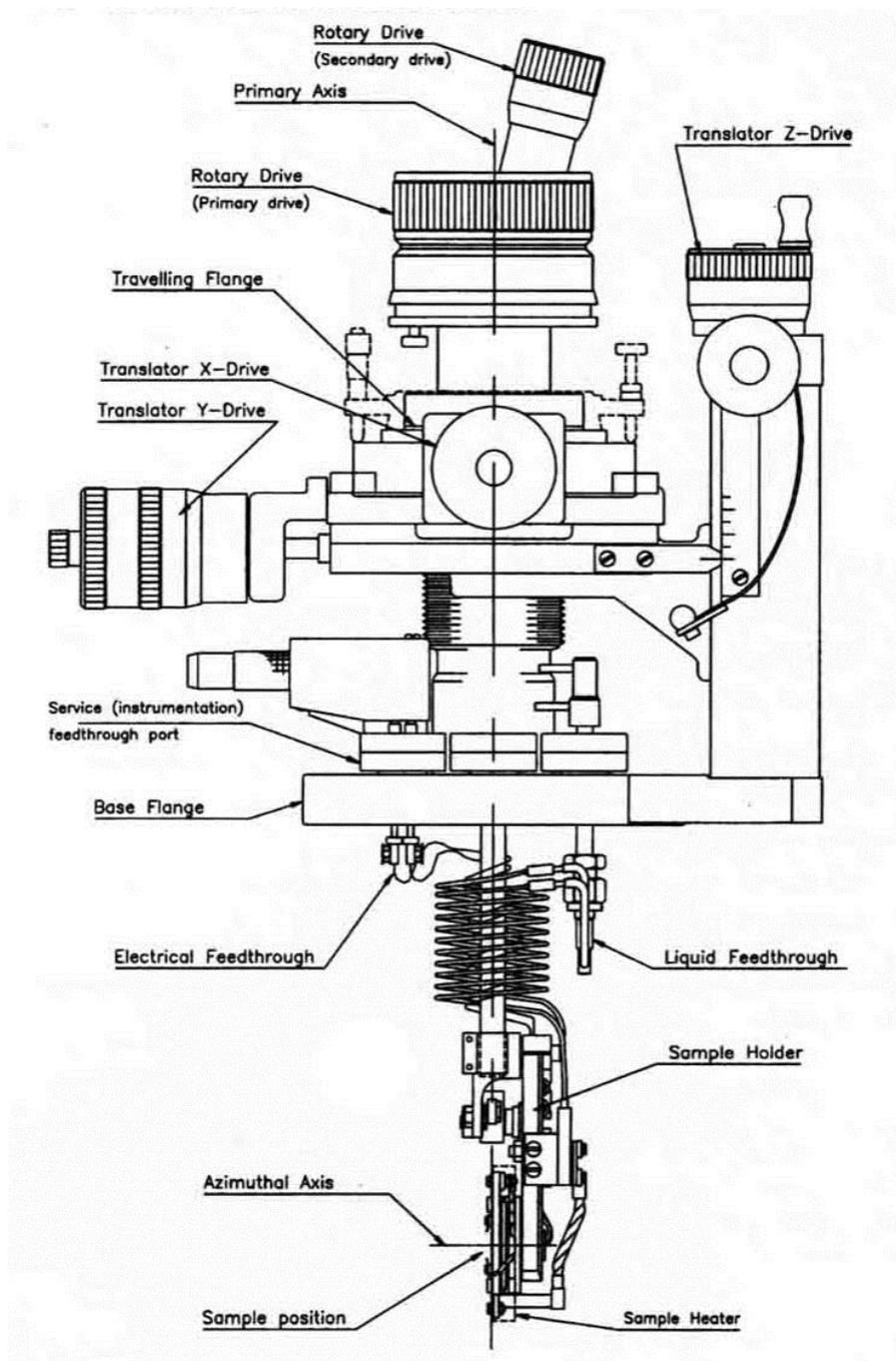


Figure 11

A full range of compatible accessories is available for use with the HPT model translators, including:

Rotary Drives.

- * ZRD1 Primary Drive
- * ZRD2 Primary and Secondary Drive
- * ZRD224 Primary and full Secondary Drive

Sample Holders

- ZSH1 for primary rotation
- ZSH2 for Primary and secondary rotation
- ZSH2F for primary and full secondary rotation (secondary rotation may be restricted if certain services are attached)

Various heating and cooling attachments for use with all VG sample holders.

An extensive range of Feedthroughs on mini flanges

- Electrical
- VACGENcouple
- Liquid

Gaskets

- Super quality copper (CU series)
- Commercial user copper (CUC series)
- Blank copper gaskets (CUB series)
- Annealed high quality copper (CUA series)
- Silver plated copper (CUSP series)
- Viton (VIT series)
- Aluminium (AL series)

Nut, Bolt and Washer sets: Metric sets are available for most flange combinations.

Tool kit: ZTOOLK, including Metric spanners, hexagon keys circlip pliers and gloves.

Lubrication kit: ZLUBEK, including VG thread Lubricant, Carboflo grease, solvent for Carboflo and gloves.

Please contact VACGEN for more information stating your model type and serial number.

APPENDIX A. STEPPER MOTOR CONNECTIONS

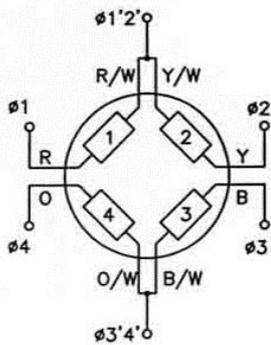
AI. OVERVIEW

Motors and encoders used in VACGEN equipment achieve their intended performance with VACGEN controllers (SDU, SMC or SMC-E) and no responsibility can be accepted should performance be inadequate when other controllers are used.

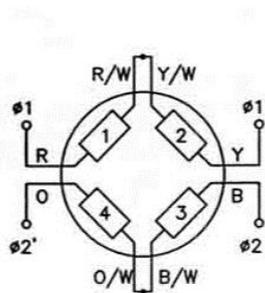
For attachment to VACGEN controllers, the motors (and encoders if applicable) can be supplied wired with suitable connectors. Otherwise, motors are supplied without connectors to allow connection to alternative drive and controller systems.

All motor variants are 4 phase, 8-lead hybrid stepper motors that can be wired up in most normal configurations as shown below. Some motor kits may include micro switches.

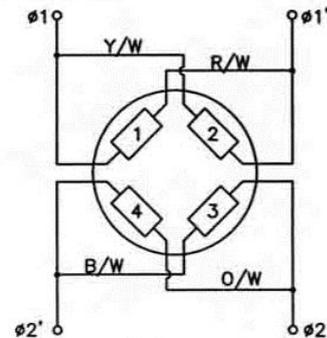
For motors fitted with incremental encoders, the VACGEN SMC-E range of controllers is required to provide passive feedback. If the motor has no encoder fitted, the controller cannot be used in the "Loop Active" mode. Note that encoders cannot be retrofitted to motors.



UNI-POLAR:
Use only where low torque at low speed is sufficient.



BI-POLAR IN SERIES
Provides high torque at low speed.



BI-POLAR IN PARALLEL
Provides moderate torque at low and high speeds.

Key to Colour Coding:

R - Red, W - White, Y - Yellow, B - Black, O - Orange, G - Green

Alternative motors may be used, with alternative colours. Refer to the following sections.

A2. MOTOR SPECIFICATION

Motor Type	Step Angle Tolerance	Step Angle	Rotor Inertia per Phase	Resistance per Phase	Current per Phase	Inductance
23HS-108E	1.8 ^{o(1)}	5%	0.12 kg cm ²	0.33	3.9A ⁽²⁾	0.38mH
23HS-309E	1.8 ^{o(1)}	5%	0.23 kg cm ²	0.40	4.7A ⁽²⁾	0.84mH
23HS-409E	1.8 ^{o(1)}	5%	0.33 kg cm ²	0.48	4.6A ⁽²⁾	1.00mH
34HS-109E	1.8 ^{o(1)}	5%	0.67 kg cm ²	0.45	4.7A ⁽²⁾	1.30mH
34HS-209E	1.8 ^{o(1)}	5%	11.30 kg cm ²	0.55	4.6A ⁽²⁾	2.50mH

Notes:

(1) Step angle quoted for full step drive. VACGEN controllers use half step drives with step angle being 0.9°.

(2) Limit the maximum current to the following values, determined by the drive used. (Note that running at maximum current can cause motor to run hot and can give rise to resonance.)

* Maximum current/phase for unipolar drive = rated current.

* Maximum current/phase for bi-polar in series = 0.70 x rated current.

* Maximum current/phase for bi-polar in parallel = 1.4 x rated current.

A3. COLOUR CODING OF MOTOR WIRES

Key to Colour Coding:

R - Red, W - White, Y - Yellow, B - Black, O - Orange, G - Green

Alternative motors may be used, wire colours as follows:

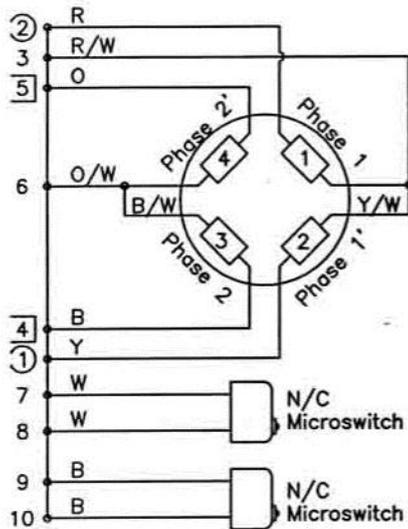
	As drawn	Alternative 1	Alternative 2
Phase 1	R	R	R
	R/W	B	Purple
Phase 1'	Y	R/W	Y
	Y/W	W	Blue
Phase 2	B	G/W	Pink
	B/W	B/W	Grey
Phase 2'	O	G	B
	O/W	O	W

A4. MOTOR WIRING DIAGRAMS

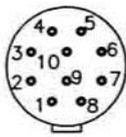
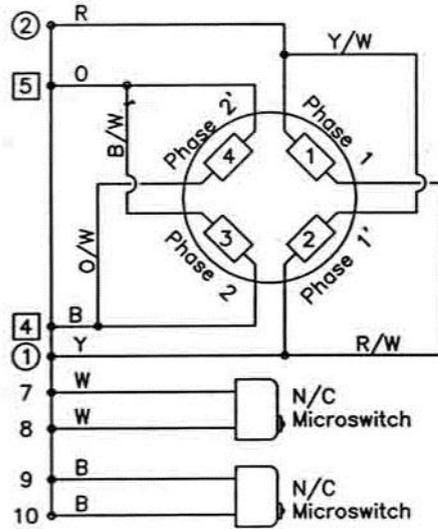
Caution: When wiring motors, care must be taken to make all connections secure. Failure to do so may result in disconnection during use and this can permanently damage the motor drive. For the same reason, never disconnect a motor from its drive unless the power has first been switched off.

Refer to previous section for colour coding of wires.

Series Motor Wiring



Parallel Motor Wiring



These diagrams show connections for compatibility with Vacuum Generators motor controllers.

Socket used is ref. XSOC24 (Series and parallel connection).

Series connection is preferred for high torque at low speed. Parallel connection is used for higher speed applications.

Where microswitches are not used, links must be made between pins 7 and 8, and between pins 9 and 10.

If the rotation direction is opposite to that required, reverse the connections on pins 1 and 2.

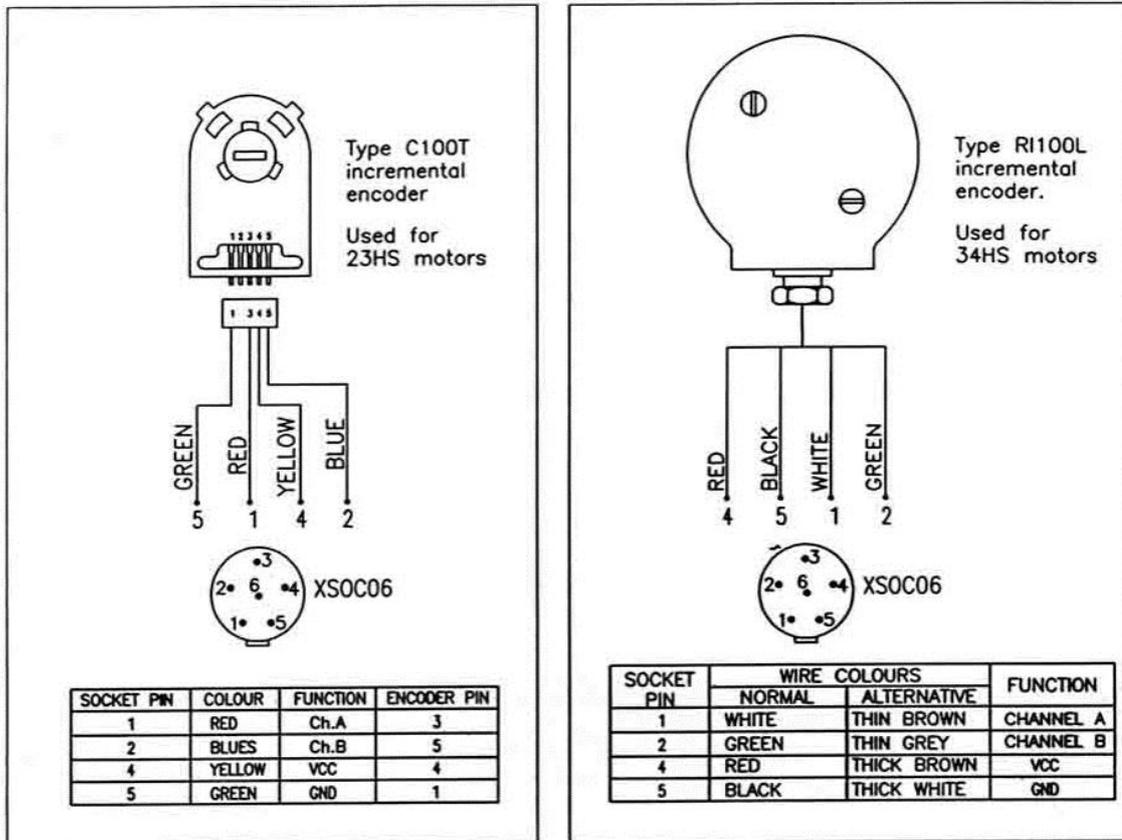
Twist together phase pairs to reduce electro-magnetic emission, i.e.: ① and ②, and ④ and ⑤.

Wiring

motors suitable for VACGEN Controllers

diagrams for

A5. ENCODER WIRING DIAGRAMS



Wiring diagrams for incremental motor encoders

A6. MOTOR SPARES

Order Code	Description
ZSMPC3LH	Cable: Motor to SMC, SME-E or SDU controller.
DB08073	Cable: Encoder to SMC-E controller.
XSOC24	Connector socket. Fitted to motor lad or connection to VACGEN controllers.
XPLU11	Connector plug. Fitted to controllers for connection to XSOC24 motor socket.

APPENDIX B. HEATER AND VACGENCOUPLES

B1. DESCRIPTION

Sample heating is normally by either:

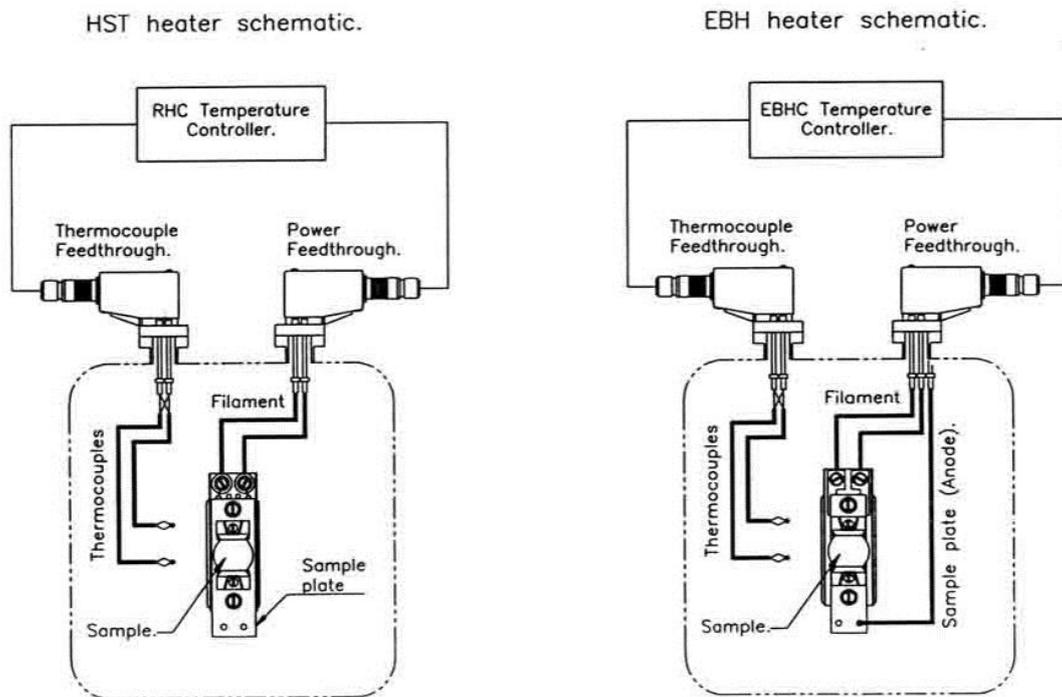
- * Resistance heating (HST option), or
- * Electron bombardment heating (FBH option).

These heaters are intended for mounting onto the standard range of VACGEN sample holders (e.g. SH1, SH1E50, SH2, SH2E50, SH2R64, SH2F, SH2RT, SM2T and SM2VT.)

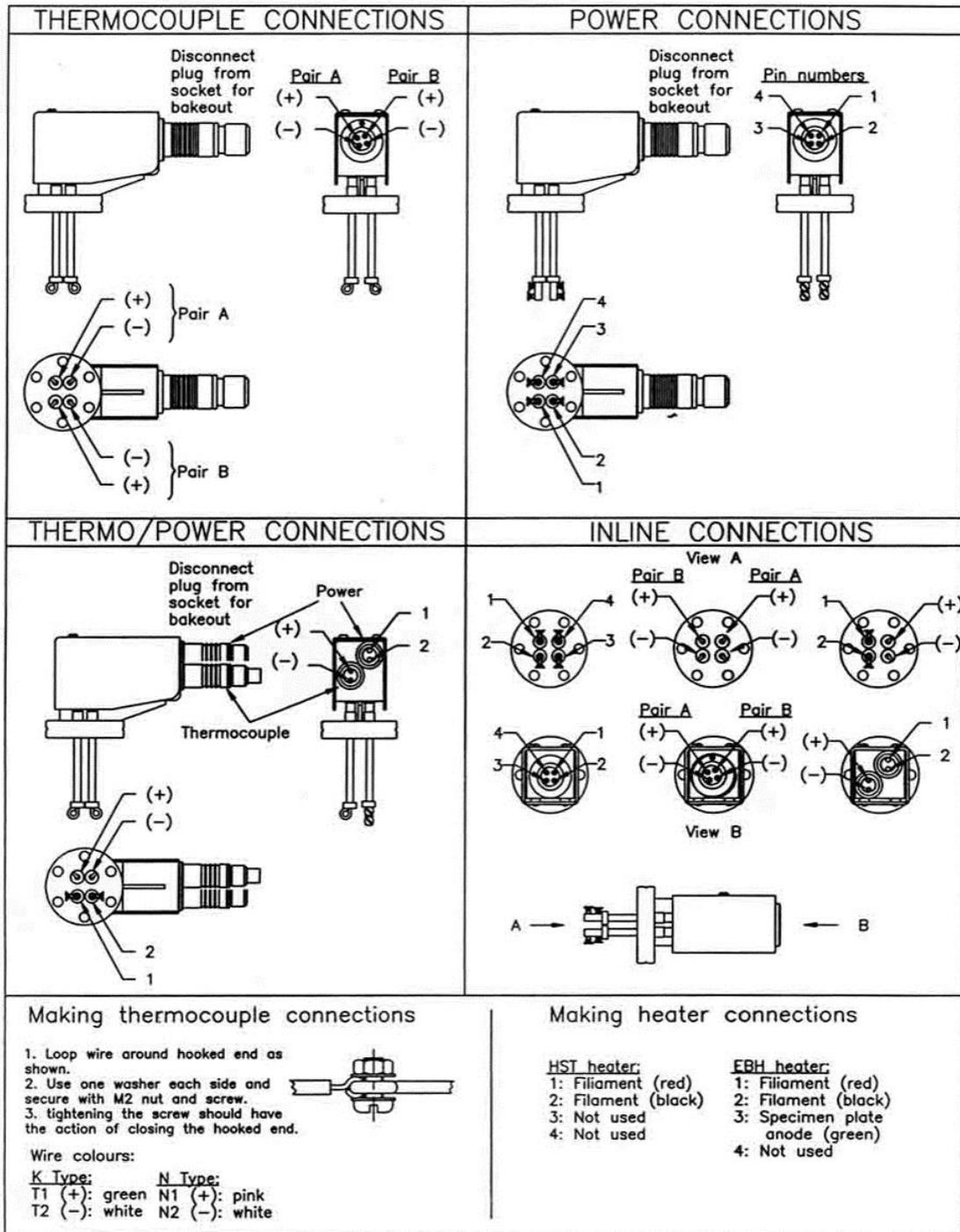
Two VACGENcouples are provided with either heater module. These are available as either Type K (Chromel-Alumel) or Type N (Nicrosil-Nisil). Type N is recommended where low magnetic permeability is important. Temperature control is recommended, using:

- * the RHC controller for the HST and
- * the EBHC controller for the EBH

B2. WIRING DIAGRAMS



WARNING: It is very dangerous to leave feedthrough contacts isolated, especially during bakeout and when high voltages are present near to the sample. It is the responsibility of the user to be aware of electrostatic charge buildup and to provide suitable earthing.



APPENDIX C. LIQUID NITROGEN COOLING

WARNING: VACGEN cannot advise on the safe use and handling of liquid gases which is entirely the responsibility of the user. The use of liquid nitrogen in confined spaces can be extremely dangerous as nitrogen gas levels can build up rapidly. Ensure that the area is well ventilated. Always wear insulated gloves and safety goggles when handling liquid gases and surfaces that may be cold.

C1. REQUIREMENTS

A supply of high purity nitrogen gas from a regulated supply.

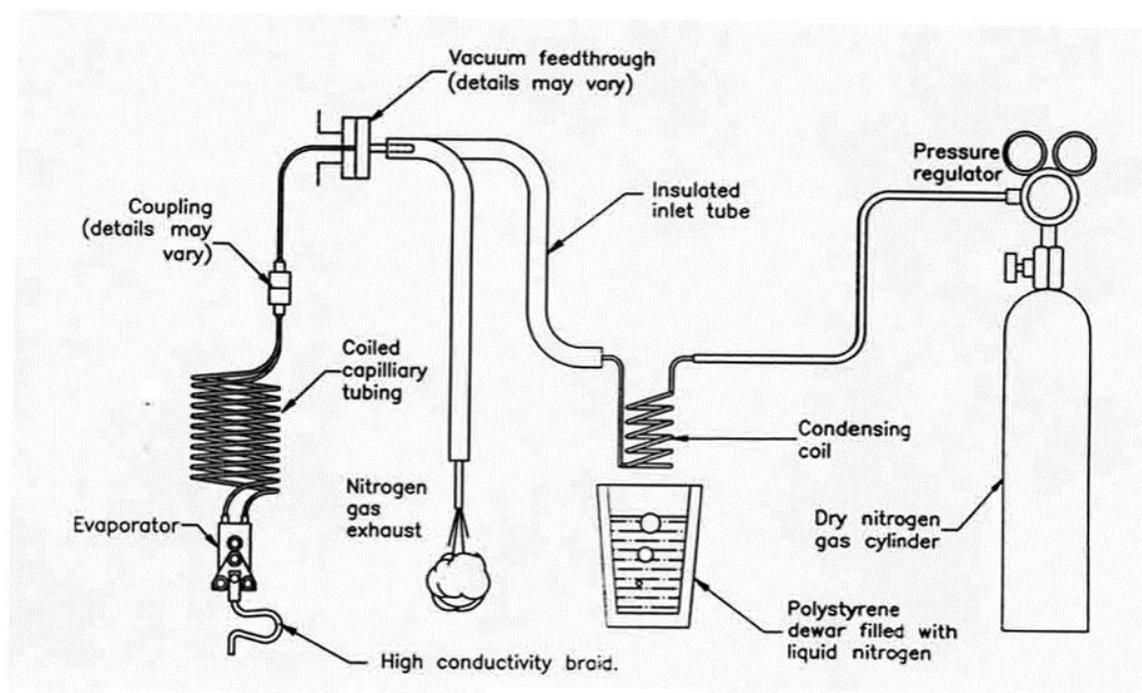
A supply of liquid nitrogen.

A condenser coil, insulated open polystyrene dewar and connecting polythene tubes with insulation (These items are available from VACGEN as an accessory, order code ZLNHX).

C2. DESCRIPTION

Liquid nitrogen condensed from dry gas, enters and leaves the translator through liquid feedthrough connections. In-vacuum capillary tubing extends to the evaporator which should be mounted close to the sample position. The capillary tube is normally coiled to allow movement.

Conductive braid, electrically isolated from the evaporator, is supplied for mounting as near as possible to the sample.



LIQUID NITROGEN COOLING SCHEMATIC

C3. SETTING UP

Position the copper condenser coil and polystyrene dewar as near as possible to the nitrogen entry feedthroughs. Using 6.35mm bore tubing, connect the regulator on the cylinder to the coiled end of the copper coil and secure with hose clips.

Connect the vertical end of the coil using 3mm bore tube to (either) feedthrough port. External insulating tube should cover the tube as completely as possible.

The outlet connection should be made to the other manipulator port. Ensure that the exhaust gas/liquid is well away from equipment that could be affected by moisture.

For horizontally mounted units a simple foil sheet should be fitted under the inlet 1 outlet connections to help to prevent condensation dripping onto the drive screw and bearing shafts.

C4. OPERATION

a. Open the regulator to 0.5 bar to start a flow of gas through the system. Check that flow is coming from the system outlet pipe. Allow the gas flow to continue through the system for at least 2 minutes. This will purge the system of air to avoid formation of ice during cooling.

b. Place the coil in the dewar and fill the dewar with liquid nitrogen. Always maintain at least 25 mm of liquid above the top coil.

c. Increase the pressure to a maximum of 2 bar to start the cool-down cycle.

d. Liquid nitrogen will start to emerge in droplets from the outlet pipe within 10 minutes.

e. Reduce the gas pressure so that occasional droplets of nitrogen emerge. Excessive liquid mixed with the exhaust gas will reduce the cooling efficiency.

f. Once the desired temperature has been reached the gas flow can be reduced further.

g. On the completion of the cooling run, remove the copper coil from the dewar and allow the system to return to ambient temperature with a very gentle flow of nitrogen gas to prevent condensation.

C5. PERFORMANCE

The cooling performance will vary depending on many factors, including the nature of the sample, the sample mounting arrangements, radiated heat from the chamber, vacuum pressure and experimental conditions. The temperature will drop sharply once liquid has reached the evaporator, (when liquid droplets begin to emerge from the exhaust.) The temperature will continue to fall and stabilise after approximately 1 hour.

C6. BAKEOUT

Disconnect all plastic tubes from the liquid nitrogen feedthrough connections before commencing bakeout.

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E.C. Declaration of Incorporation
ref Dol-147 (VGF 4.06d Iss2)

We hereby declare that the following product range:

Part Codes:

MRXZ_70, MRXZ_15, MWXZ_15, having conflat flanges top and bottom:

are, suitable for incorporation or assembly into a vacuum system or other machinery. These products may only be put into service if it has been verified that the system or machinery into which it is incorporated conforms to the provisions of the appropriate EU directives and with the limitations of the equipment specifications.

Applicable regulations:

89/392/EEC Version.93/68/EEC

Appropriate harmonised or national standards.

EN292-1

EN292-2

