Operating and Maintenance Handbook
Linear Motion Drives
LDS, LDP, LDS…M Series

REVISION	DATE	COMMENTS	INITIALS
1	Jan 1996	Original release	MJD
2	Aug 2015	VACGEN rebrand	AJL

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WARRANTY

1. 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 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 that are fitted or installed or replaced by the Sellers' service center such spare parts will be subject to a warranty period of six months only.
2. 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 center at VACGEN. All returned products must be accompanied by a completed Declaration of Contamination form. Customers must, in the first instance, contact the local selling agent.
3. 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.

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 its own cost the customer shall dispatch the equipment to the workshop, carriage paid, suitably packaged, protected and insured, bearing, a Goods Return Number (GRN)and a completed Declaration of Contamination certificate obtained from VACGEN in advance of shipment.
2. During the period that the equipment is on VACGEN premises, VACGEN will insure the equipment against all risks.
3. Vacuum Generator 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
the 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:
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, United Kingdom.

1.0 Introduction

Linear motion drives are used in a wide range of applications in UHV systems. Different applications have different requirements for linear travel and accuracy. VACGEN wide range of 'short' stroke linear drive devices satisfy most requirements for travel distance and accuracy. The devices in this series

have a linear probe which moves in relation to the mounting flange; movement is achieved via edge-welded bellows. There are basically three type of device, namely directly-coupled push rod actuation, and two types of screw driven devices; each permits different accuracies and speed of movement to be achieved. These are described below.

The **LDS Series** of screw-driven linear motion drives provide a simple and accurate means of achieving linear movement within a vacuum system. These drives are supplied mounted in either 34mm OD flanges (LDS9 series) or 7Omm OD flanges (LDS2 series) with a linear travel of 25, 50, 100 or 150mm. A motor drive option is available for remote operation (see sections 2.0 and 6.0).

The **LDP Series** of manual push-pull linear motion drives provide a simple means of achieving linear movement within a UHV system. These drives are supplied mounted on either 34mm OD flanges (LDP9 series) or 70mm OD flanges (LDP2 series), see section 3.0.

The **LDM Series** of micrometer-driven linear motion drives (greater resolution than the screw-driven devices) provide a precise and repeatable means of achieving linear movement within a UHV system. Two travel ranges are available; 0 - 25mm with micrometer graduations of 0.01 mm and 0 - 50mm with micrometer graduations of 0.005mm. These drives are supplied mounted on either 34mm OD flanges (LDM9 series) or 70mm OD flanges (LDM2 series), and can be baked to 400^{o}C with the micrometers removed - see section 4.0.

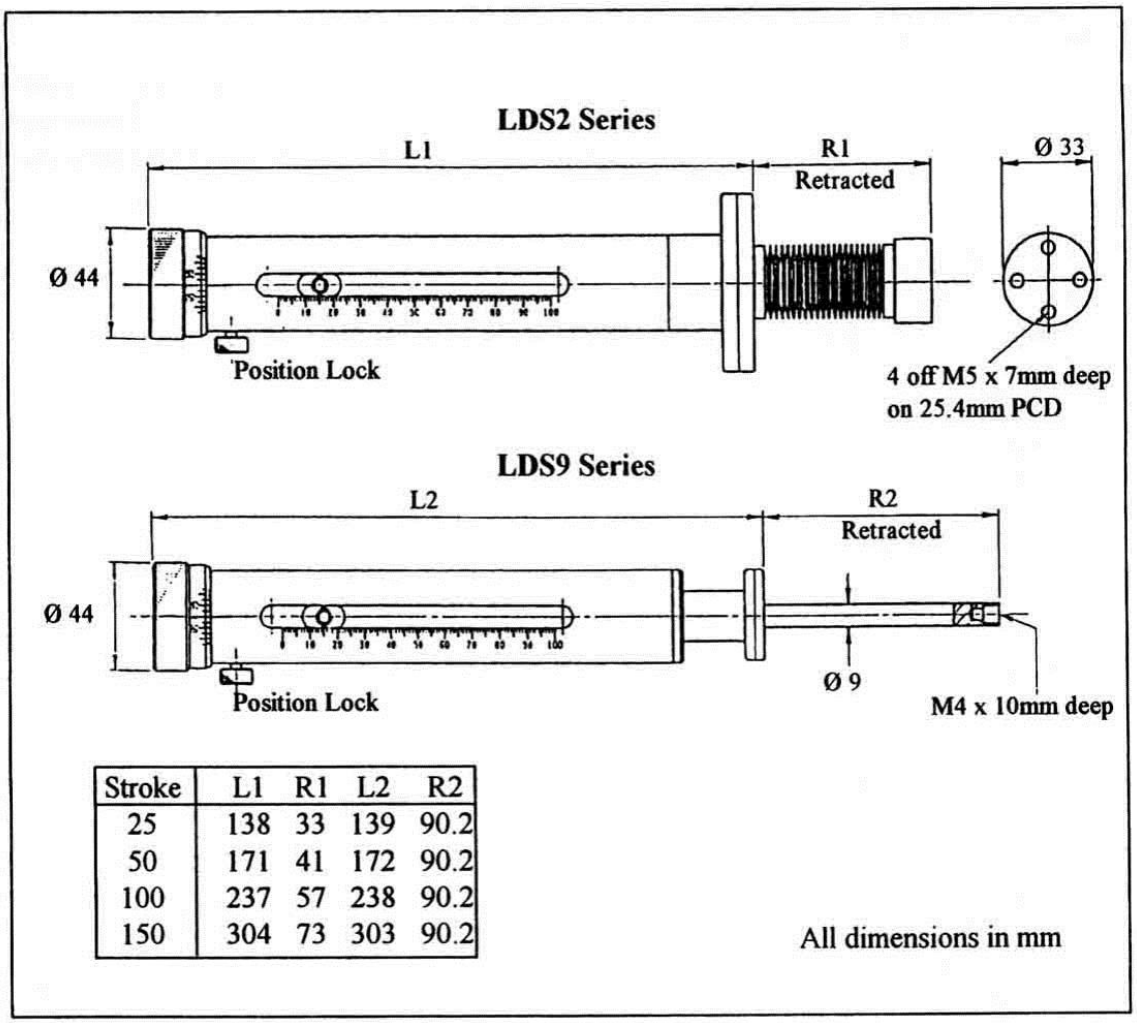
The **LDP ... P Series** of linear motion drives are pneumatic versions of the LDP series manual push-pull linear drives, and are designed for remote operation or for use in hazardous environments. These drives use a double-acting pneumatic cylinder which has a manual back-up facility, The drives are supplied mounted on either 34mm OD flanges (LDP9 series) or 70mm OD flanges (LDP2 series), see section 5.0.

The **LDS ... M Series** of stepper motor-driven linear motion drives provide an accurate and precise means of achieving automated linear movement within a vacuum system. The drives are suitable for remote operation or for use in a hazardous environment. The motor has a through shaft to permit manual operation. The drives are supplied mounted in either 34mm OD flanges (LDS9 series) or 70mm OD flanges (LDS2 series) with a linear travel of 25, 50, 100 or 150mm, see section 6.0.

2.0 The LDS Series of Screw Driven Linear Drives

The LDS series of linear motion drives provide a simple, and accurate means of achieving linear movement within a vacuum system. The drives use stainless steel edge-welded bellows to accommodate the linear motion; linear bearings guide the in-vacuum movement. The drives are supplied mounted in either 34mm OD flanges (LDS9 series) or 70mm OD flanges (LDS2 series) with a linear travel of 25, 50, 100 or 150mm. A motor drive option is available for remote operation.

These linear motion drives have been designed to give trouble-free long life service. They are constructed from the highest quality materials and rigorously tested over many operation cycles.



Stroke	L1	R1	L2	R2
25	138	33	139	90.2
50	171	41	172	90.2
100	237	57	238	90.2
150	304	73	303	90.2

Figure 1- LDS2 and LDS9 Series Linear Motion Drives

2.1 Specification for the LDS Series

LDS2 Series:

70mm OD flange LDS9

Series: 34mm OD flange
Stroke Options: 25, 50, 100, 150mm
Position Lock: Thumb Screw
Linear Movement Scale: 1mm graduations
Thimble Graduation: 1 Division = 0.020 mm, 1 Turn = 1 mm

Sample Mounting:
(LDS2) - 4 holes M5 x 7mm equispaced on 25.4 mm PCD.
(LDS9) - M4 x 6 mm tapped hole in shaft end.

Axial Load: 220 N max.
Bakeout Temperature: 230^{o}C assembled
Bakeout Temperature: 450^{o}C with outer case removed.
Pressure Range: bar to 10^{-11} mbar
Operating Temperature: - 20^{o}C to 200^{o}C

Order Code	Stroke mm	Max Radial Load (N) extended	Deflection at Max Radial Load mm (shaft extended)
ZLDS925	25	40	0.8
ZLDS950	50	30	0.9
ZLDS910	100	15	0.95
ZLDS915	150	7	1.0
ZLDS225	25	50	0.5
ZLDS250	50	40	0.6
ZLDS210	100	20	0.9
ZLDS215	150	10	0.9

2.2 LDS2 Operation and Maintenance

2.2.1 Sample/Component Attachment
When attaching to the four mounting holes, care must be taken to ensure that the screw tightening torques are not applied to the bellows (use a tommy bar inserted in the adjacent hole).
Note: If the above procedure is not complied with, bellows failure may occur

2.2.2 Routine Maintenance
Little routine maintenance is required apart from lubricating the scale indicator slider, drive screw and shaft with "Felpro", VACGEN Order Code, XLUB04

2.2.3 Drive Screw Lubrication
To expose the drive screw, position the linear drive shaft deep into the vacuum system (maximum scale reading). Apply lubricant with a small brush through the slot onto the screw shaft. Apply over entire screw shaft length. Lubricate after bakeout and after every 500 cycles of use.

2.2.4 Shaft Lubrication Procedure
To expose the shaft, position the linear drive, such that the scale indicator reads zero. Apply lubricant to the shaft at the point where it enters the flange. To lubricate opposite side of shaft, unscrew the slotted case anti-clockwise by 180^{o} and repeat. Lubricate after bakeout and after every 500 cycles of use.

2.3 LDS9 Operation and Maintenance

2.3.1 Sample/Component Attachment
When attaching to the M4 tapped hole it is essential that the screw is tightened against a tommy bar inserted through the adjacent hole provided.
Note: If the above procedure is not complied with, bellows failure may occur

2.3.2 Routine Maintenance
Little routine maintenance is required apart from lubricating the scale indicator slider and drive screw with "Felpro", VACGEN Order Code XLUB04

2.3.3 Drive Screw Lubrication Procedure
To expose the drive screw, position the linear drive, shaft deep into the vacuum system. Apply lubricant with a small brush/stick through the slot onto the screw shaft. Apply over entire screw length. Lubricate after bakeout and after every 500 cycles.

2.4 Bakeout Procedure LDS2 and LDS9 Series

The unit is capable of being baked fully assembled up to 230°C. However, it will require lubricating as detailed under the maintenance section (see section 2.2.2 and 2.3.2). For higher temperature bakeouts (230°C to 450°C) the slotted body and actuator must be removed.

2.4.1 230°C - 450°C Bakeout Procedure

The numbers in brackets below refer to figure 2.

1. Ensure that the clamp screw is loose (clamp off). (7)

2. Position the probe/sample holder fully into the vacuum system.

3. Unscrew the position indicator screw (1) and remove the position Indicator (2)

5. To remove the slotted body and disengage the drive screw (8), rotate the hand knob (6) anticlockwise (viewed from knob end towards vacuum system) several turns until the assembly can be withdrawn.

The unit is now ready for high temperature bakeout.

2.4.2 Reassembly Procedure after Bakeout at up to 450°C

1. Lubricate the position indicator screw (1), the position indicator (2), the slotted body tube thread (3) and the motion drive female thread, with a suitable lubricant ("Felpro", VACGEN Order Code XLUB04).

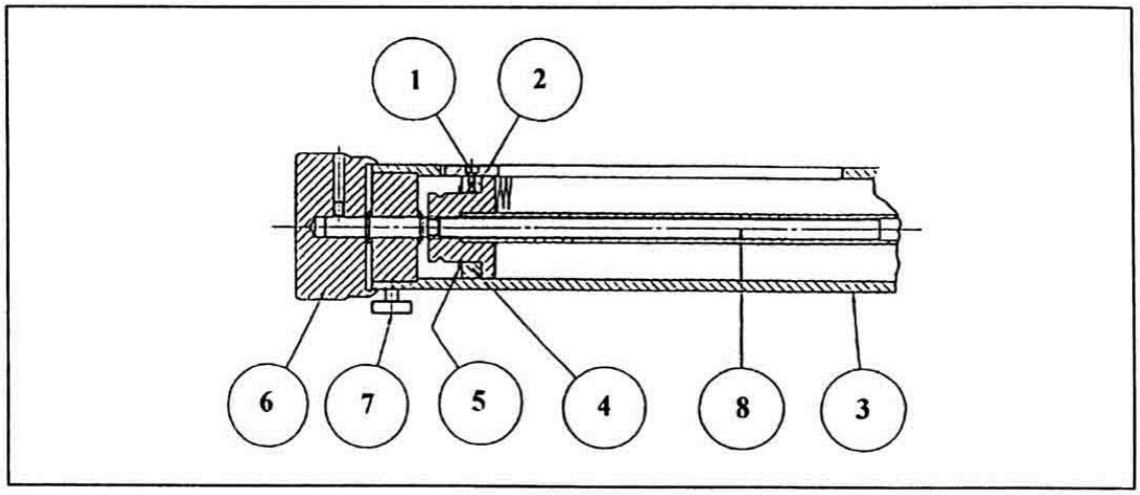


Figure 2 - Components of the Drive Mechanism

2. Ensure that the position indicator carrier ring (4) is able to rotate. If it cannot, it must be removed and cleaned. To remove the ring prise off the retainer ring clip (5) and ease the ring (4) from its location. Clean the ring, re-lubricate (XLUB 04) and re-assemble. Position the tapped hole in ring (4) uppermost with respect to gravity.

3. Locate the drive screw (8) with the female thread. Rotate the hand knob (6) clockwise, this will engage the drive, and also bring the body tube (3) and flange threads together. To engage the body tube (3) and flange threads lock the body tube and knob together (by hand as if they were both one) and rotate them both clockwise until the body tube and flange are face to face. Rotate the knob a further ten turns.

4. To align the body slot with the tapped hole of the mounting ring (4), unscrew the body tube (less than one revolution) until the capped hole lies central within the slot.

5. Insert the position indicator (2) into the body slot such that it aligns with the tapped hole of ring beneath (4). Lightly tighten the fixing screw (I).

6. Hand tighten the slotted body tube.

The unit is now ready for use.

3.0 The LDP Series of Push-Pull linear Drives

The LDP series of push-pull linear motion drives provide a simple means of achieving linear movement within a UHV system. The drives use stainless steel edge-welded bellows to accommodate the linear motion; linear motion bearings are used to guide the in-vacuum movement. The drives are supplied mounted on either 34mm OD flanges (LDP9 series) or 70mm OD flanges (LDP2 series), see figure 3.

3.1 Specification for the LDS Series

LDS2 Series:	70mm OD flange
LDS9 Series:	34mm OD flange
Stroke Options:	25, 50, 100, 150mm
Position Lock:	Thumb Screw
Sample Mounting	(LDS2) - 4 holes M5 x 7mm equi spaced on 25.4 mm PCD
	(LDS9) - M4 x 6 mm tapped hole in shaft end.
Axial Load:	220 N max
Bakeout Temperature:	230^{o}C assembled
Bakeout Temperature:	400^{o}C - LDP2 and LDP9 with outer case removed.
	250^{o}C – LDP9 without dismantling
Pressure Range:	bar to 10^{-11} mbar
Operating Temperature:	- 20^{o}C to 200^{o}C
Linear Movement Scale:	1mm graduations (LDP9 series only).

Note: LDP2 Series does not have a motion scale.

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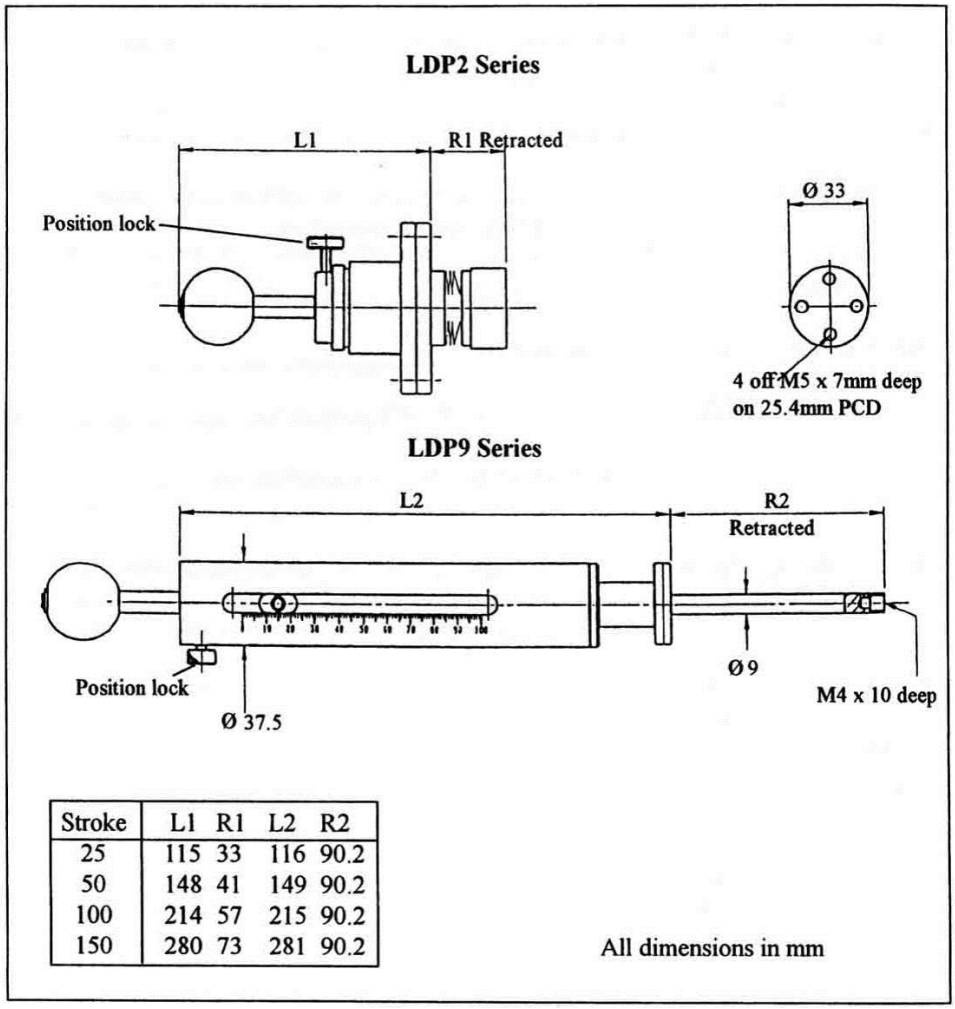

Figure 3 - LDP2 and LDP9 Series Linear Motion Drives

Order Code	Stroke mm	Max Radial Load (N) extended	Deflection at Max Radial Load mm (shaft extended)
ZLDP925	25	40	0.8
ZLDP950	50	30	0.9
ZLDP910	100	15	0.95
ZLDP915	150	7	1.0
ZLDP225	25	50	0.5
ZLDP250	50	40	0.6
ZLDP210	100	20	0.9
ZLDP215	150	10	0.9

3.2 LDP2 Operation and Maintenance

3.2.1 Sample/Component Attachment

When attaching to the four mounting holes, care must be taken to ensure that the screw tightening torques are not applied to the bellows (use a tommy bar inserted in adjacent hole), *Note: if the above procedure is not complied with. bellows failure may occur*

3.2.2 Routine Maintenance
Little routine maintenance is required apart from lubricating the handle shaft with "Felpro", VACGEN Part number XLUB04 after bakeout and as and when required.

3.2.3 Bakeout
This unit requires no special preparation for bakeout and should be baked fully assembled. This unit can be baked to 400^{o}C.

3.3 LDP9 Operation and Maintenance

3.3.1 Sample/Component Attachment
When attaching to the M4 tapped hole it is essential that the screw is tightened against a Tommy bar inserted through the adjacent hole provided. *Note: The above procedure is not complied with, bellows failure may occur*

3.3.2 Maintenance
Little routine maintenance is required apart from lubricating the scale indicator slider with Felpro. (XLUB04)

3.4 LDP9 Bakeout

The unit is capable of being baked fully assembled up to 250^{o}C. However, it will require lubricating as detailed under maintenance section.

3.4.1 250^{o}C - 450^{o}C Bakeout Procedure
Refer to figure 4.
1. Release clamp screw (8), allow linear drive to move to a balanced position (atmospheric load balanced with drive load).

Acceptable Balance Positions Are: - Any position that places the hand knob between the normal working fully extended position and fully retracted position.

Unacceptable Balance Positions Are: - Any position/load that extends the knob out-wards away from the vacuum system beyond its normal working stroke position (consult with VACGEN if this condition exists).

2. Remove the scale indicator screw (1) and indicator (2)

3. Remove the circlip (3) and ball knob (4).

4. Unscrew the slotted body tube (5) (anti-clockwise) and remove. The unit is now ready for high temperature bakeout.

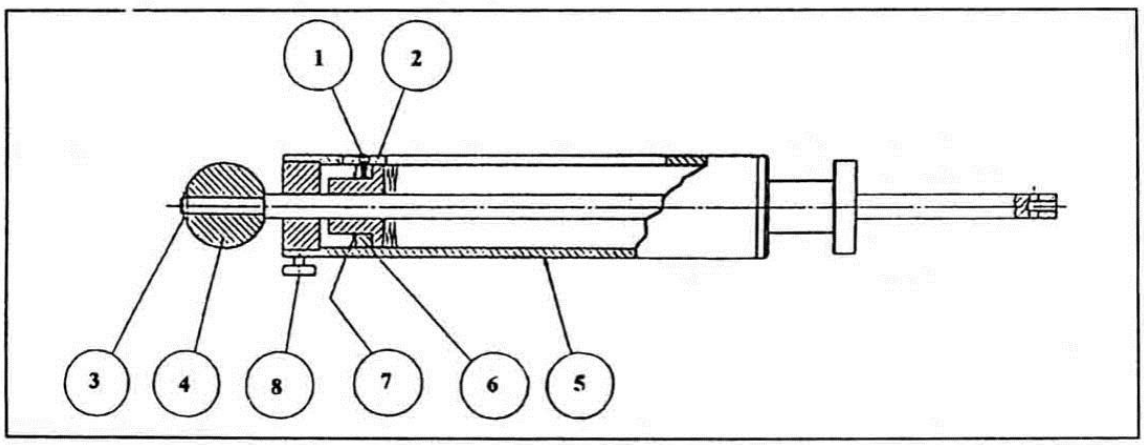

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Figure 4 - Components of the LDP9 Drive Mechanism

3.4.2 Reassembly Procedure after Bakeout

1. Lubricate the position indicator screw (1), the slotted body tube thread (5) and the position indicator (2) with a suitable lubricant ("Felpro" VG Part Number XLUB04).
2. Ensure that the position indicator carrier ring (6) is able to rotate, if it cannot, it must be removed and cleaned. Removal - prize off the retainer ring clip (7) and ease the ring (6) from the bellows end. Clean the ring and bellows end, re-lubricate and re-assemble.

3. Reverse disassembly procedure steps 2 to 4 for re-assembly:
Align the slot with the tapped hole in ring (6) screw the body (5) home, then unscrew it less than one revolution until the tapped hole lies central within the slot. Insert the position indicator (2) into the body slot such that it aligns with the tapped hole of ring (6) beneath. Lightly tighten the fixing screw (1), hand tighten the body tube. Re-assemble the ball knob and circlip.

4.0 The LDM Series Micrometer Driven Linear Motion Drives

The LDM series of micrometer linear motion drives provide a precise and repeatable means of achieving linear movement within a UHV system. Two travel ranges are available, 0-25mm with micrometer graduations of 0.01mm and 0-50mm with micrometer graduations of 0.005mm. The drives use stainless steel edge-welded bellows to accommodate the linear motion; linear motion bearings are used to guide the in-vacuum movement. The drives are supplied mounted on either 34mm OD flanges (LDM9 series) or 70mm OD flanges (LDM2 series), and can be baked to 400^{o}C with the micrometers removed - see figures 5 and 6.

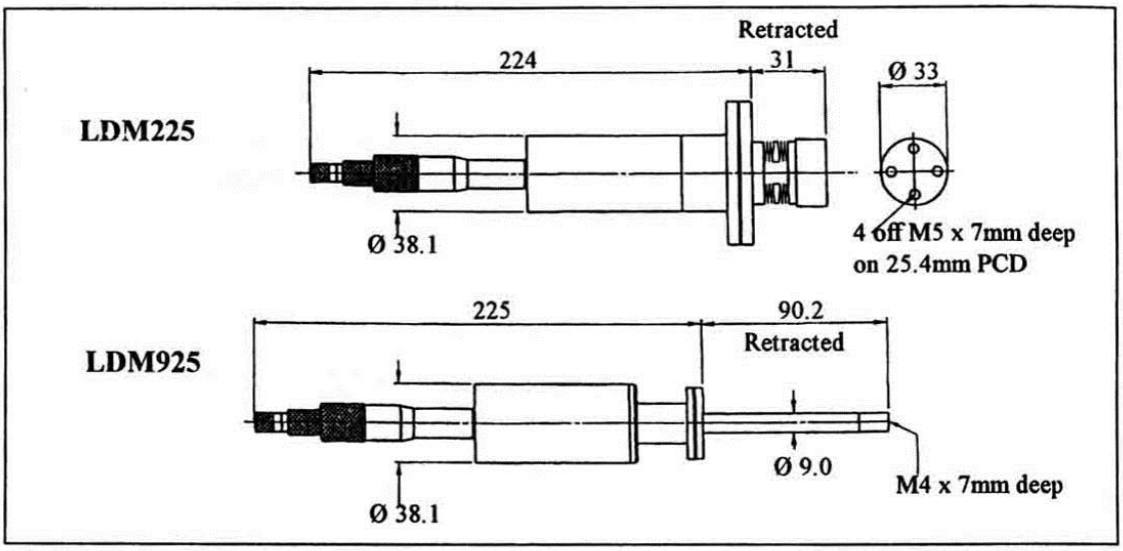


Figure 5. LDM225 and LDM925 Micrometer Linear Motion Drives.

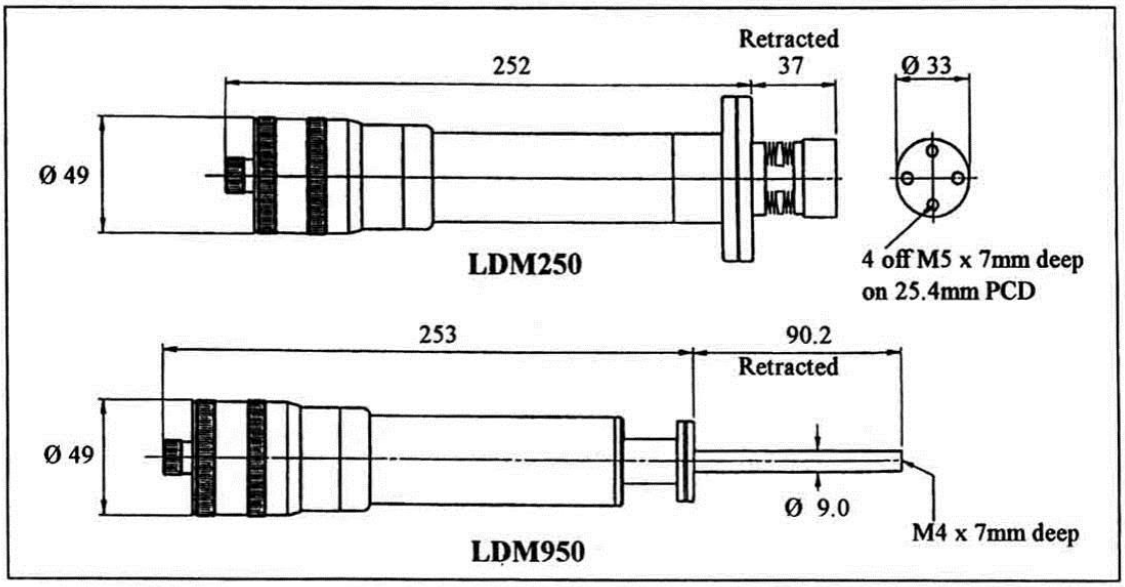


Figure 6 - LDM250 and LDM950 Micrometer Linear Motion Drives

4.1 Specifications for the LDM Series

Order Code	Flange Size	Stroke	Barrel	Thimble Grad'n mm	Axial Load	Maximum Radial Load (shaft ext)
ZLDM925	34FC	25	0.5	0.010	22	40
ZLDM950	34FC	50	0.5	0.005	22	30
ZLDM225	70FC	25	0.5	0.010	22	50
ZLDM250	70FC	50	0.5	0.005	22	40

Sample Mounting LDM9 series: M4 x 6 mm tapped hole in shaft end.
LDM2 series: 4 holes M5x7 equi-spaced on 25.4mm PCD in end face.

Bakeout Temperature: 230^{o}C
Bakeout Temperature: 400^{o}C with outer case removed.
Pressure Range: bar to 10^{-11} mbar.
Operating Temperature: -200^{o}C to 150^{o}C.

4.2 Sample/Component Attachment

4.2.1 LDM2 Series
When attaching to the four mounting holes, care must be taken to ensure that the screw tightening torques are not applied to the bellows (use a tommy bar inserted in adjacent hole).

4.2.2 LDM9 Series
When attaching to the M4 tapped hole, it is essential that the screw is tightened against a tommy bar inserted through the adjacent hole provided. *Note: If the above procedure is not complied with, bellows failure may occur*

4.3 Routine Maintenance
Little routine, maintenance is required apart from adjustment of the coupling pre-load screw. If the unit develops a backlash fault, the micrometer coupling should be examined and adjusted if required.

4.3.1 Adjustment Procedure
1. Remove the micrometer case assembly as detailed In section 4.4.2 (250^{o}C - 400^{o}C Bakeout Procedure).

2. Slacken the three radial M3 set screws situated at the micrometer end of the case, such that the micrometer case end can be withdrawn. *Note.. Do not slacken the M4 set screw situated between the three radial screws.*

3. See figure 7. With finger pressure the coupling should be able to rotate on the micrometer spindle without axial movement. To remove axial play adjust the M3 set screw situated in coupling center. Note the set screw must not be over tightened, it requires only very light turning forces on the key to eliminate play.

4. To assemble, reverse operations 1 and 2.

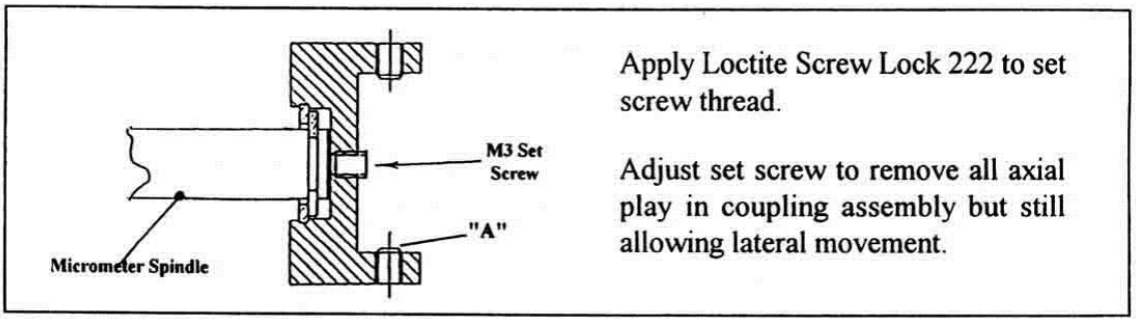


Figure 7 - Coupling Adjustment

4.3.2

Shaft Lubrication Procedure (LDM2 series only)
To expose the shaft, position the linear drive such that the micrometer reads maximum i.e. 25mm for 25 version, 50mm for 50 version. Apply "Felpro", VACGEN Part numberXLUB04, lubricant to the shaft at the point where it enters the flange. To lubricate opposite side of shaft, unscrew the slotted case (anti-clockwise) 180^{o} and repeat. Lubricate after bakeout and after every 500 cycles of use.

4.4 Bakeout

4.4.1 230^{o}C Bakeout
The unit does not require dismantling for 230^{o}C bakeout.

4.4.2 230^{o}C to 400^{o}C Bakeout Procedure.

1. Set micrometer to the zero position.

2. Unscrew the slotted case part of a turn, so that one of the two attachment set screws (labeled "A" in figure 7) can be accessed through the slot. Unscrew the set screw 2 ½ revolutions only. Repeat this procedure for the remaining set screw.

3. Unscrew the slotted case approximately six revolutions and withdraw the micrometer case unit.

4. The unit is now ready for 400^{o}C maximum bakeout.

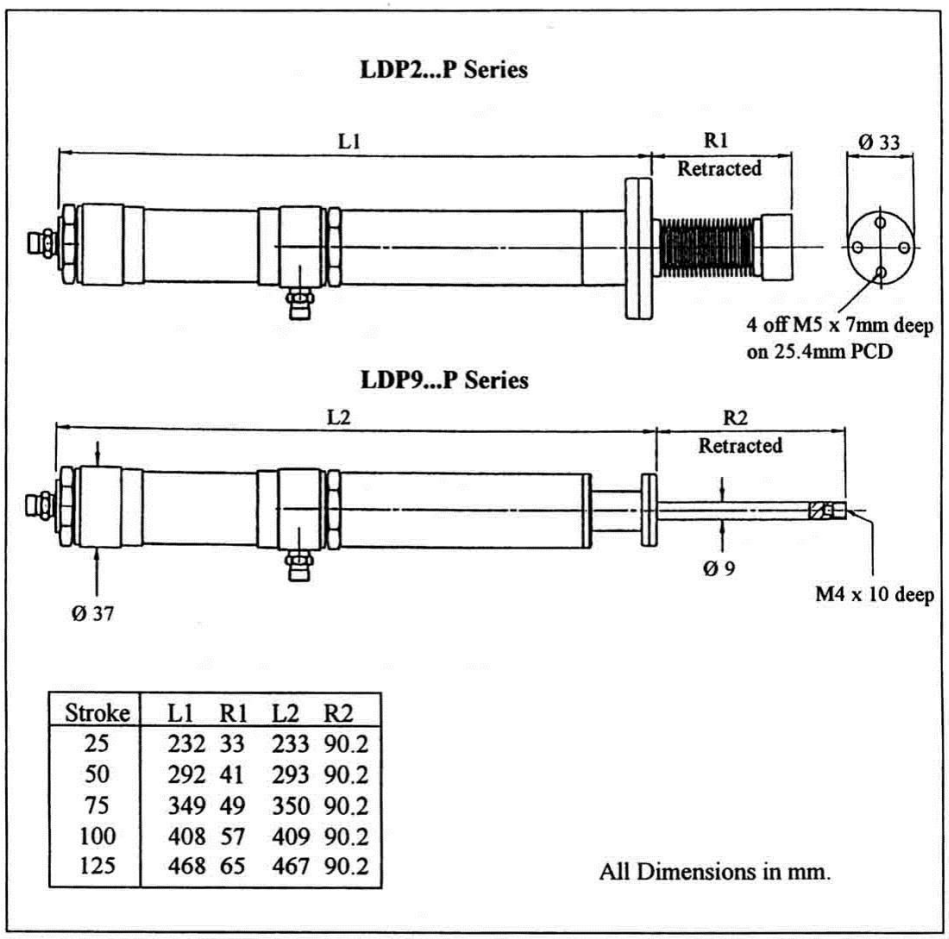
4.4.3 Post Bakeout Assembly Procedure
1. Screw the micrometer case assembly to the flange unit.
2. Unscrew the case part of a turn so that one of the two attachment set screws can be accessed through the slot.
3. Adjust the micrometer to position the attachment set screw over the vee groove, and tighten the screw. Rotate case and align slot over remaining set screw. *Note: this micrometer setting will be beyond the zero set position*.
4. Tighten the set screw.
5. Hand tighten the outer case.

Assembly is now complete.

5.0 The LDP ... P Series Pneumatic Linear Motion Drives

The LDP...P series of linear motion drives are pneumatic versions of the LDP series manual push-pull linear drives, and are designed for remote operation or for use in hazardous environments. These drives use a double-acting pneumatic cylinder which has a manual back-up facility. Stainless steel edge-welded bellows accommodate the linear motion; linear motion bearings are used to guide the in-

vacuum movement. The drives are supplied mounted on either 34mm OD flanges (LDP9 series) or 70mm OD flanges (LDP2 series), see figure 8.



Stroke	L1	R1	L2	R2
25	232	33	233	90.2
50	292	41	293	90.2
75	349	49	350	90.2
100	408	57	409	90.2
125	468	65	467	90.2

Figure 8 - LDP2…P and LDP9…P Pneumatic Linear Motor Drive

5.2 LDP2 ... P Operation and Maintenance

5.2.1 Sample/Component Attachment

When attaching to the four mounting holes, care must be taken to ensure that the screw tightening torques are not applied to the bellows.
Note - The above procedure is not complied with, bellows failure may occur

5.2.2 Shaft Lubricant Procedure LDP2 Series

To expose the shaft , position the linear drive such that the bellows unit is retracted. Apply "Felpro" (XLUB04) lubricant to the shaft at the point where it enters the flange. To lubricate opposite side of the shaft, unscrew the slotted case anti-clockwise 180^{o} and repeat, Lubricate after bakeout and after every 500 cycles of use.

5.3 LDP9...P Operation and Maintenance

5.3.1 Sample/Component Attachment

When attaching to the M4 tapped hole it is essential that the screw is tightened against a tommy bar inserted through the adjacent hole provided.

5.4 Bakeout Procedure

The unit is capable of being baked fully assembled up to l8O^{o}C, However any fittings/restrictors etc. that have been attached to the cylinder should be examined to confirm that they are also capable of 180^{O}C working.

5.4.1 180^{O}C - 450^{O}C Bakeout Procedure

1. Position the motion shaft such that it is fully extended into the vacuum system.
2. Disconnect pneumatic connections to the cylinder.
3. Unscrew the slotted case (1) part of a turn so that one of the four coupling attachment set screws (2) can be accessed through the case slot. Unscrew the set screw approx 2 ½ turns. Repeat this procedure for the three remaining screws.
4. Unscrew the slotted case approximately six turns and withdraw the cylinder/case assembly, the unit is now ready for 450^{O}C bakeout.

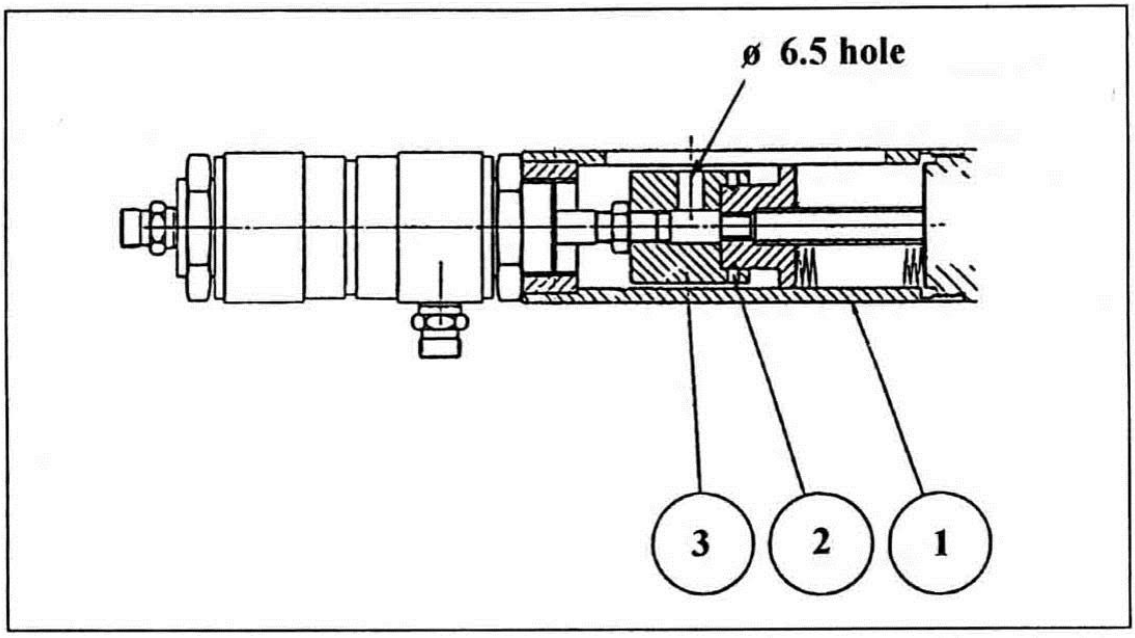


Figure 9 - Detail of Drive Mechanism

5.4.2 Reassembly Procedure after Bakeout

1. Refer to figure 9. Screw the cylinder case assembly to the flange unit.

2. Unscrew the case (1) part of a turn such that the slot aligns with the dia 6-5 hole beneath. Insert a peg approx 6 mm diameter into the 6.5 hole and hand tighten the case.

3. Use the peg to position the coupling so that the set screw (2) (adjacent to the peg) is positioned over the "V" groove beneath and tighten the set screw. Remove the peg.

4. Unscrew the case (1) part of a turn so that one of the three remaining set screws (2) can be accessed through the slot. Tighten the set screw (2) and repeat this procedure for the two remaining screws (2).

5. Hand tighten the case (1), noting that the dia 6.5 mm hole should align with the case slot.

6. Re-connect pneumatic fittings etc, to the pneumatic cylinder.

7. LDP2 ... P series only. Lubricate shaft as detailed under section 5.2.2 above.

8. Reassembly is now complete.

5.5 Operation in the Event of Pneumatic/Electrical Failure
If pneumatic /electrical power is lost, it is possible for atmospheric pressure to cause the motion shaft to extend into the vacuum system. If the vacuum process is put at risk by this remote possibility or if damage could be caused to valuable chamber components etc it is possible to utilise the emergency hand operation facility to construct a simple prop that will hold the shaft retracted.

5.5.1 Emergency Operation on Power Failure
It is possible to push/pull the motion shaft to the required position, proceed as follows:

1. Remove pneumatic fittings from cylinder.

2. Insert a round peg/handle not greater than 6.35 mm in diameter through the slot into the 6.5 mm diameter hole, this can now be utilised as a makeshift handle making it possible to move the drive to the required position. Tape can be used to secure the position.

5.6 Performance

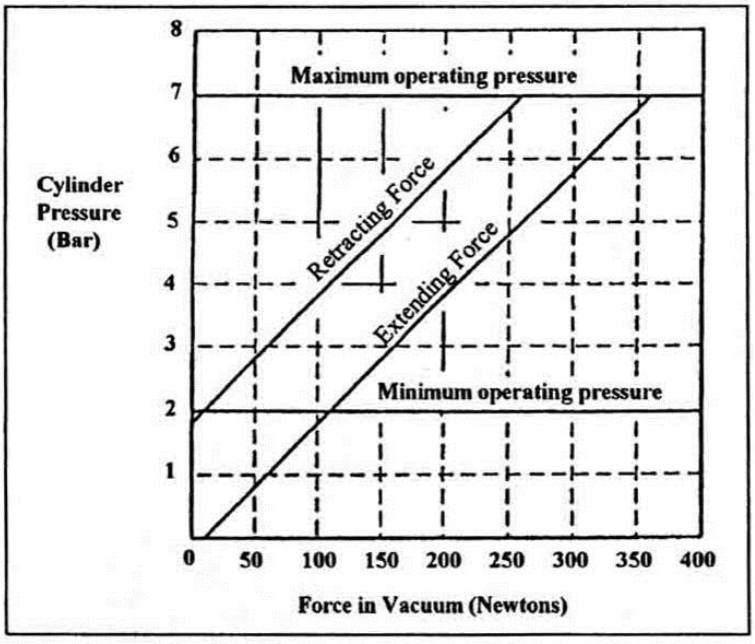


Figure 10 - Pull/push Forces vs. Cylinder Pressure

5.6.1 Forces

With reference to figure 10, it can be seen that with a cylinder working pressure of 3 bar, the extending force (pushing force) = 60N.

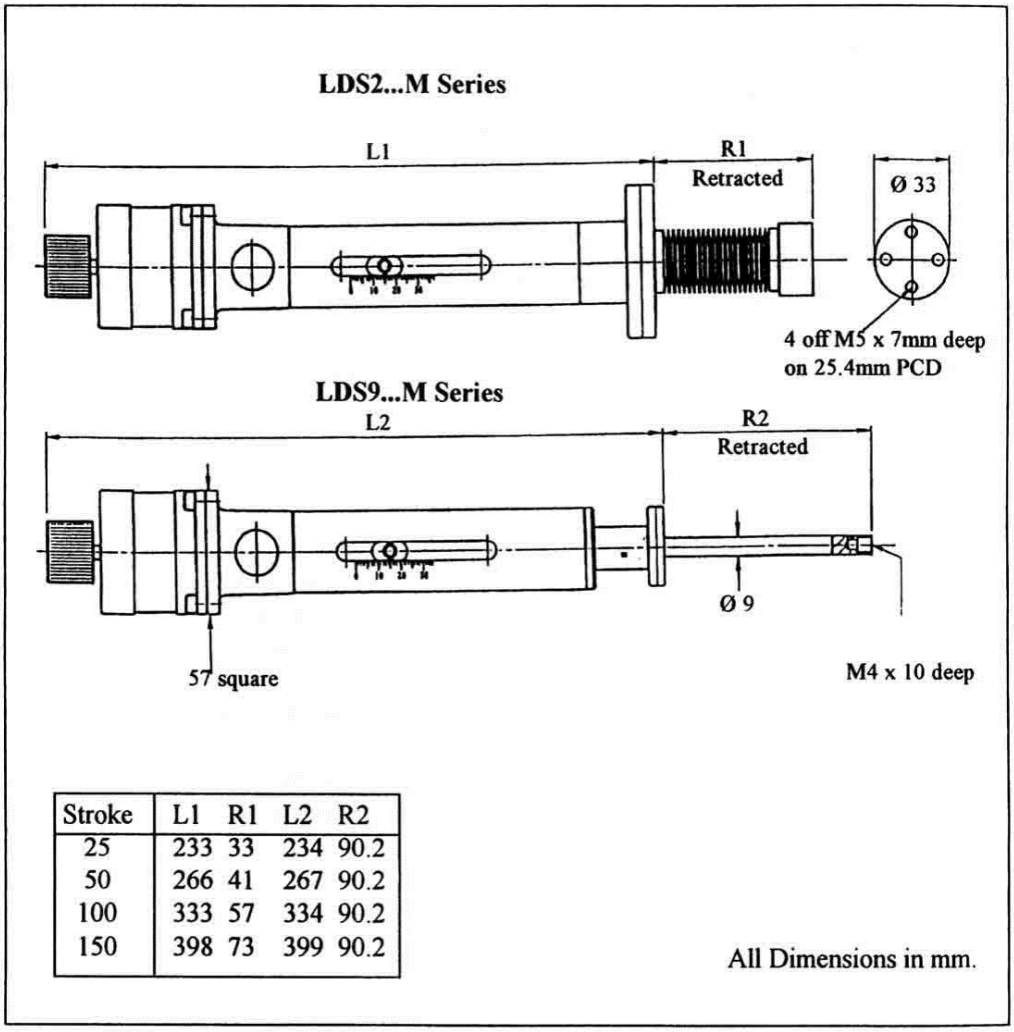
5.6.2 Recommended Cycle Rates (Maximum)

Stroke Length	Cycles/ minute
25	60
50	50
100	40
125	30

Note: Flow restrictors must be fitted to both cylinder ports. For fine speed control, one way variable restrictors are recommended.

6.0 The LDS ... M Motor Driven Linear Drives

The LDS...M series of stepper motor-driven linear motion drives provide an accurate and precise means of achieving automated linear movement within a vacuum system. The drives are suitable for remote operation or for use in a hazardous environment. The motor has a through shaft to permit manual operation. Stainless steel edge-welded bellows are used to accommodate the linear motion; linear bearings guide the in-vacuum movement The drives are supplied mounted in either 34mm OD flanges (LDS9 series) or 70mm OD flanges (LDS2 series) with a linear travel of 25, 50, 100 or 150mm, see figure 11.



Stroke	L1	R1	L2	R2
25	233	33	234	90.2
50	266	41	267	90.2
100	333	57	334	90.2
150	398	73	399	90.2

Figure 11- LDS2…M and LDS9…M Motor Driven Linear Motion Drives

6.1 Specification for the LDS…M Series

LDS2…M Series: 70mm OD flange
LDS9…M Series: 34mm OD flange
Motor Type: Mclennan 23 HS 108 E (VG XMOT05)
Step Angle: 1.8 ^{o}
½ step angle: 0.9^{o} preferred mode of operation

Maximum Motor Speed: 10,000 ½ steps/sec
Rail Voltage (Vdc): 50V
Coils in Series: 2.0AMP
Drive Screw: 1mm pitch M6

Motion/ Revolution: 1.00mm
Motion/step: 0.005mm
Motion/ ½ step: 0.0025mm

Maximum Linear Drive Speed: 25mm/sec @ 1000 ½ step/sec
Maximum Thrust: 110 N max @1000 ½ steps/sec.
60 N max @1000 ½ steps/sec.

Linear Motion Scale: 1mm increments, calibrated at 10mm intervals.
Bakeout Temperature: 250^{o}C - with motor/limit switches removed.
450^{o}C - with outer case removed.

Pressure Range: bar to 10^{-11} mbar
Operating Temperature: - 20^{o}C to 40^{o}C
Stroke Options: 25, 50, 100, 150mm

Order Code	Stroke mm	Max Radial Load (N) extended	Deflection at Max Radial Load mm (shaft extended)
ZLDS225M	25	50	0.5
ZLDS250M	50	40	0.6
ZLDS210M	100	20	0.9
ZLDS215M	150	10	0.9
ZLDS925M	25	40	0.8
ZLDS950M	50	30	0.6
ZLDS910M	100	15	0.9
ZLDS915M	150	7	0.9

6.2 Sample/Component Attachment

6.2.1 LDS2...M Series

When attaching to the four mounting holes, care must be taken to ensure that the screw tightening torques are not applied to the bellows (use a tommy bar inserted in the adjacent hole).

6.2.2 LDS9...M Series

When attaching to the M4 tapped hole, it is essential that the screw is tightened against a tommy bar inserted through the adjacent hole provided. *Note: The above procedure is not complied with, bellows failure may occur*

CAUTIONARY NOTE Ensure that computer software or travel limit switches are set such that the position indicator is not driven into the ends of the case slot.

6.3 Maintenance

Little routine maintenance is required apart from (refer to figure 12):

Lubricate the scale indicator slider (2), drive screw (8) and shaft with "Felpro" VG part no, XLUB04. Also lubrication of the two ball races (9) with a few drops of silicone oil (through the case slot and motor mounting block).

6.3.1 Drive Screw Lubrication Procedure

To expose the drive screw, position the linear drive shaft deep into the vacuum system (max scale reading). Apply XLUB04 lubricant with a small brush through the slot onto the screw shaft. Apply over entire screw shaft length. Lubricate after bakeout and after every 500 cycles of use.

6.3.2 Shaft Lubrication Series (LDS2 Series only)

To expose the shaft, position the linear drive such that the scale indicator reads zero. Apply XLUB04 lubricant to the shaft at the point where it enters the air-side of the vacuum flange. To lubricate the opposite side of shaft, unscrew the slotted case (anti-clockwise) 180^{o} and repeat. Lubricate after bakeout, and after every 500 cycles of use.

6.4 Bakeout

6.4.1 Procedure for Bakeout up to 250^{o}C

1. If the drive unit is fitted with limit switches, position drive to approximately mid stroke.

2. Refer to figure 12. Rotate the motor to a position that permits access to the motor coupling set screw (7). Note that the coupling is fitted with two set screws at each end.

3. Slacken one of the set screws (7) connecting the coupling (6) to the linear drive (8). Rotate the motor through 90^{o} and slacken the remaining screw (7).

4. If the drive unit is not equipped with limit switches, remove the four M5 motor retaining screws (10) and detach the motor coupling assembly. For drive units with limit switches, remove the M4 microswitch mounting screw and mounting rod (item (12) in figure 13), the three motor retaining screws (item (10) in figure 12). Remove the motor and the limit switch unit (attached to the rod).

5. The drive is now ready for bakeout up to 250^{o}C.

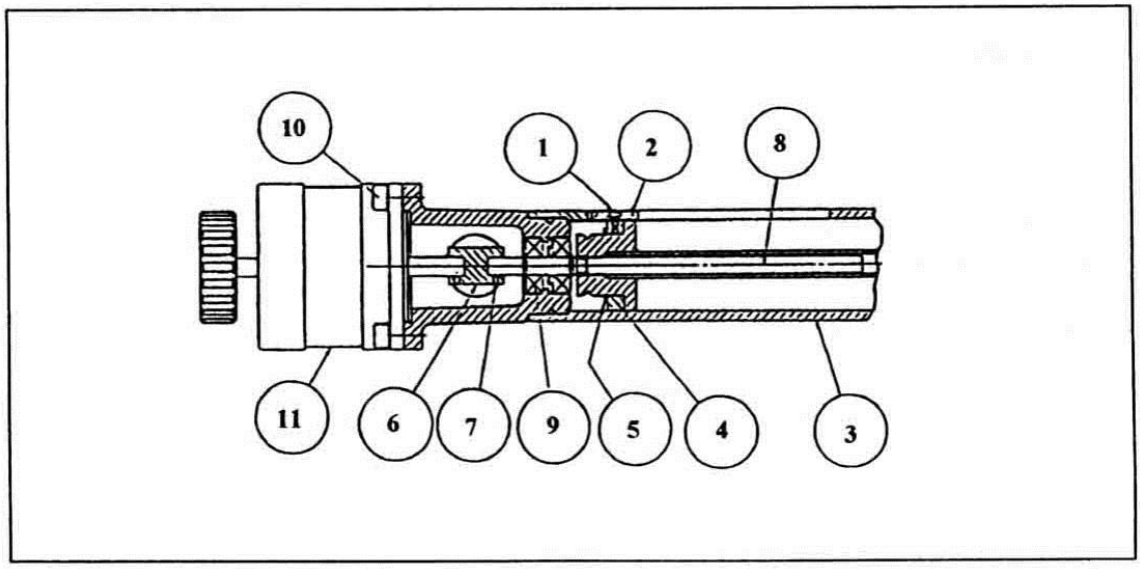


Figure 12 - Drive without Limit Switch Assembly

6.4.2 Reassembly Procedure after 250°C Bakeout

1. Apply a few drops of Silicone oil to both bearings (9) and lubricate as detailed under maintenance section.

2. If the drive unit is not equipped with limit switches (figure 12), locate the motor coupling (6) to the drive shaft (8). Ensure that the motor location spigot is seated properly and tighten the four motor mounting screws (10).

If the drive unit is equipped with limit switches (figure 13), locate the limit switch mounting rod with its support (14). Locate the motor coupling (6) to the drive shaft (8). Ensure that the motor location spigot is seated properly and tighten the three motor mounting screws (10). Align the limit switches with the striker (13) and tighten the M4 fixing screw (12).

3. Rotate the motor to a position that permits access to the motor coupling set screws. Tighten the set screw (7), rotate the motor through 90° and tighten the remaining set screw.

4. If the drive is equipped with limit switches check that they function correctly.

5. Cycle the drive and lubricate as detailed in the maintenance section (section 6.3).

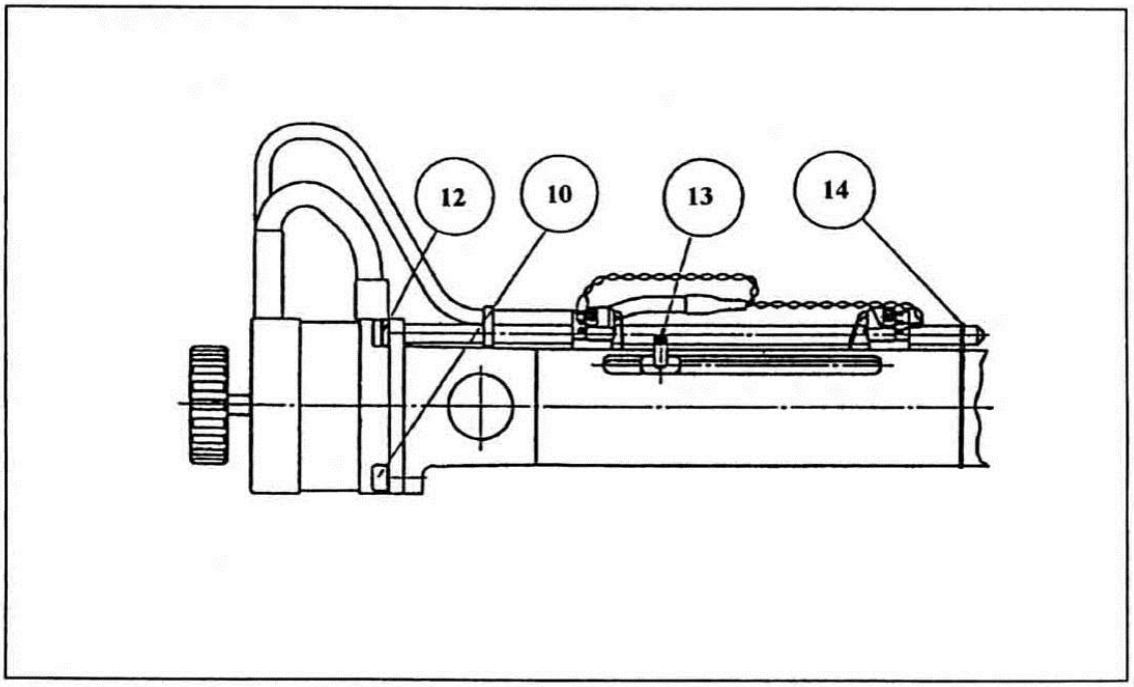


Figure 13 - Drive with Limit Switch Assembly

6.4.3 450°C Bakeout Procedure

1. Set the drive to the maximum in vacuum position (max scale reading). If limit switches are fitted slacken screw (12) and rotate the switch assembly away from the switch striker. See figures 12 and 13.

2. Remove the scale indicator screw (1), indicator (2) and switch striker* (13) (*limit switch version only).

3. Unscrew the slotted tube (3) (anti-clockwise) from the flange, tube concentric to the flange assembly. Continue rotation until the drive assembly is disconnected.

6. The unit is now ready for 450°C maximum bakeout.

6.4.4 Reassembly Procedure after 450°C max bakeout

1. Lubricate the position indicator screw (1), the position indicator (2), the slotted body tube thread (3) and the motion drive female thread with a suitable lubricant ("Felpro") VG part no. XLUB04. Lubricate both ball bearings (9) with a few drops of Silicone oil.

2. Ensure that the position indicator earner ring (4) is able to rotate. If it cannot, it must be removed and cleaned.

To remove prise off the retainer ring clip (5) and ease the ring (4) from its location diameter. Clean the ring and location diameter, re-lubricate and re-assemble.

3. Replace the switch rod support (14) (limit switch versions).

4. Ensure that power to the motor is off.

5. Locate the linear drive screw (8) to the drive nut, to engage the drive rotate the hand knob clockwise several turns.

6. Assemble the body tube (3) to the flange unit.

To screw the tube to the flange, rotate the motor knob and body tube simultaneously clockwise. If the unit is furnished with limit switches, ensure that the switch mounting rod and support plate (14) align correctly. Screw the body tube home but do not tighten.

To decay, slide the fuse carrier as indicated by the arrow to remove the fuse. Do not replace with a fuse of higher value. All unit cabling must be maintained in good condition; replace if damaged, especially if the outer sheathing is cut, cracked or burnt.

7. To align the slot in the body tube with the tapped hole of the mounting ring (4), unscrew the body tube (less than one revolution) until the tapped hole lies central within the slot.

8. Assemble the position indicator (2), limit switch striker tube (13) (if applicable).

9. Hand tighten body tube. Ensure correct alignment of limit switch mounting rod is maintained (if applicable).

10. Power up drive.

11. Check correct functioning of limit switches.

12. Cycle the drive, lubricate the drive screw and shaft as detailed under the maintenance section.

6.5 Spares and Accessories

A range of VACGEN Stepper Motor controller systems (SDU, SMC, and SMC-E Series) is available to control these drives.

6.6 Stepper Motor Wiring

Figure 14 shows the series wiring diagram for the stepper motor, together with the pin connections of the motor socket (if fitted).

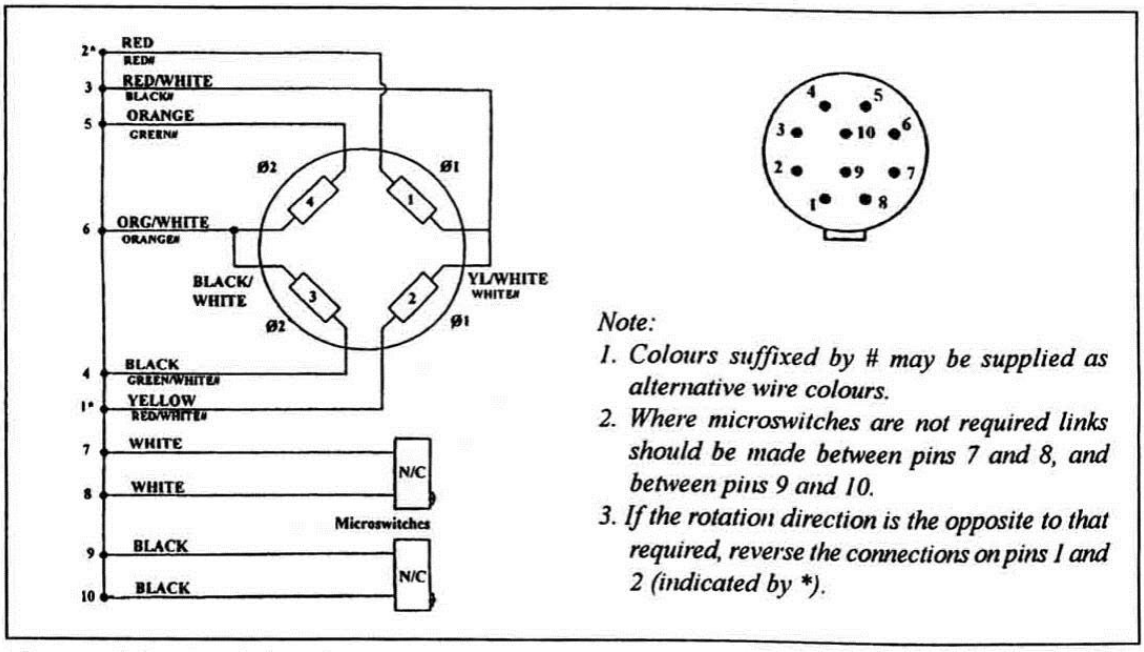


Figure 14 - Series Wiring Diagram

Service and Repair Form

Declaration of Contamination of Equipment and Components
Serving and repairs will only be carried out if the conditions for Servicing and Repair are complied with in full, according to the VACGEN Ltd. Conditions of Sale. A summary of these requirements are included on the inside front cover of the Operating Instructions. The manufacturer will refuse to accept any equipment without a signed declaration attached to the OUTSIDE of the packaging. This declaration can only be completed and signed by authorized and qualified staff.

1 Description of Equipment and Components

Equipment Type……Model Number……
Serial Number…… Your Reference Number……

2 Reasons for return……
……
……
……
……
……

3 Condition of Equipment

YES ( ) NO ( ) Toxic? YES ( ) NO ( ) Corrosive?
YES ( ) NO ( ) Explosive? YES ( ) NO ( ) Biological Hazard?
YES ( ) NO ( ) Radioactive? YES ( ) NO ( ) Other Harmful Substances?

Equipment and Components that have been contaminated, WILL NOT be accepted without written evidence of decontamination.

5 Contamination Materials

List all the substances, gases and by-products that may have come in contact with the equipment, giving trade name, manufacture, chemicals names or symbols.
Please note that any of these listed, must be completely removed, so it is safe to handle and weld, without giving off health threatening gases. Please enter details below and/or attach data sheets
……
……
……

6 Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate.
There by stating that the goods offer no risk to health or safety
Organisation…… Name……
Country…… Job Title……
Post/ZIP code…… Telephone……
Email……
Signature…… Date……

Return goods to: Address at top
Phone: (0) 1424 851291 Fax (0) 1424 851489 (Form VGF33)