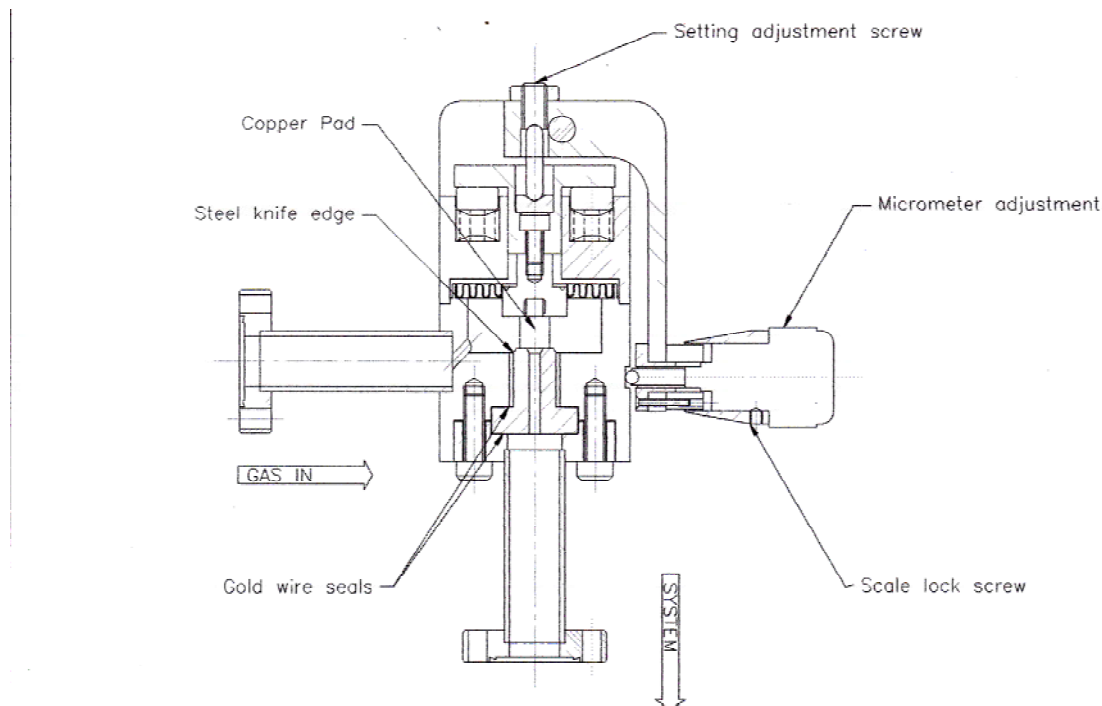


## VML Series All Metal leak valve

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## INTRODUCTION

The VML type of leak valve is a demountable valve, which provides for the easy replacement of both, the Stainless Steel knife-edge and the Copper pad. The operating principle is that a soft metal pad is deformed against a Stainless Steel knife-edge.

The leak rate is varied by adjusting the gap between the knife-edge and pad by means of a fine screw operating a lever having a high mechanical advantage.

The VML valve may be used to control system pressure down to  $10^{-11}$  Torr by adjusting

the dynamic equilibrium between gas admitted through the valve and gas removed by the pump. The leak rate, which for helium can be adjusted between  $10^{-10}$  and  $10^{-6}$  Torr is for a single setting is stable over long periods of time and is fairly reproducible against the position of the numbered indicator on the operating screw. The normal cause of variations in leak rate is that moist gas is admitted and water from this gas freezes in the narrow passage between pad and knife edge, gradually building up a layer of ice which slowly closes the leak. The exclusion of dust from the inlet gas to the valve is essential if fine control is to be maintained.

## VML14 VALVE TEST PROCEDURE

The testing procedure is given below. This procedure should be followed whenever the sealing components are replaced and it also gives an understanding of the operation of the valve for normal use.

1. With valve in the open position, seal the side arm port and connect the bottom port to a leak detector.
2. Leak test the whole valve assembly with particular attention to the two gold wire gaskets that seal the knife-edge to the valve body.
3. Loosen off the adjusting screw until the lever arm is slack.
4. Screw in the knurled operating screw until it touches the operating lever. Screw back 10 divisions of the numbered indicator. Loosen the grub screw that secures the numbered indicator and align the zero position with the line engraved on the lever arm. Retighten the grub screw.
5. Isolate the leak detector and admit air to the side arm.
6. Screw in the adjusting screw to a torque of 3 lbf ft (0.42 kgf m) (See Note below).
7. Leak test
  - a) If the valve is leak tight proceed as under 8.
  - b) If the valve leaks, increase the torque applied to the adjusting screw in steps of ½ lbf ft (0.07 kgf) until the valve seals.
  - c) The maximum torque to be applied to the adjusting screw is 5 lbf ft (0.7 kgf m).
- m). Failure to seal at torque's above 5 lbf ft (0.7 kgf m) is probable due to dirt on the sealing components and these must be renewed.
8. The copper pad has now been formed and subsequent seals can be made at lower applied forces.
9. Open the valve fully by retracting the adjusting screw until the lever arm is slack (do not open the valve by means of the knurled operating screw).
10. Screw in the adjusting screw with a torque wrench to find the minimum position for closure as indicated by the leak detector. This torque will be between 1 and 2 lbf ft (0.14 and 0.28 kgf m). To find this position the setting on the torque wrench is increased in small steps. It is not advised to turn the adjusting screw by hand until the leak detector indicates that a seal has been made.
11. Increase the setting of the torque wrench by 1½ lbf ft (0.14 kgf m) and screw in the adjusting screw to this torque.
12. Hold the adjusting screw with an Allen key and tighten the lock nut.
13. Leak test.
14. The valve is now closed and the numbered indicator is set at zero.

15. Check that the valve opens and closes by operating the valve by means of the knurled operating screw.

**NOTE:** The torque's to be applied to the adjusting screw are small. It is necessary to use a dial-indicating tool such as the MMH type A20 available from Buck and Hickman Limited.

The torque is applied to a hexagon socket screw so that it is necessary to make up an adapter from a short length of Allen key to a piece of hexagon bar stock or out suitable for insertion into the torque wrench socket.

## **NORMAL OPERATION**

The valve is opened by turning the knurled operating screw in an anti-clockwise direction and the valve is closed by returning it to the zero position. About six turns are required to completely open the valve.

Normal operation of the valve involves setting a leak rate against the indication of an ionisation or similar gauge and this leak rate is reproducible if the valve is reopened to the same indicated setting on the control knob. If finer control is required it might be necessary to admit the gas to the valve at reduced pressure and very fine control can be achieved by admitting gas to the valve at reduced pressure. If the closed position has advanced as a result of over-tightening or high temperature bakeout then it can be compensated by repositioning the adjusting screw on the top of the valve. The valve test procedure should be followed from step 10 with the valve connected to a system at low pressure. The indication of the ionisation gauge can be used in place of the leak detector.

## **REPLACING THE SEALING COMPONENTS**

The stainless steel knife-edge is more correctly described as a truncated isosceles triangle. The sealing surface has been carefully lapped and should never be touched. Whenever the 'knife edge' is replaced, the copper pad must also be replaced.

To replace the sealing components:

1. Open the valve by means of the knurled operating screw.
2. Remove the 8 M5 Allen screws that secure the knife-edge. (It may be necessary to shorten the Allen key by grinding.)
3. Lift out the knife-edge and remove the gold wire seals. If the inner gold wire seal sticks it can be broken by closing the valve.

4. Extract the copper pad with the tool provided.
5. Insert a new pad.
6. Clean the gold wire sealing surfaces of the knife-edge assembly valve body and bottom port assembly with a lint-free tissue soaked in isopropyl alcohol.
7. Invert the valve and carefully place a new gold wire ring (17mm diameter) concentrically in the valve body.
8. Replace the knife-edge.
9. Position the second gold wire ring.
10. Position the bottom port assembly taking care to align the marks provided on the valve body and bottom port assembly (this retains the correct bolt hole orientation of the bottom port flange).
11. Apply thread lubricant to the 8 new M5 screws and tighten down evenly to give metal-to-metal contact between the knife edge assembly and the valve body on top and the bottom port assembly below. There should be a gap of approximately 0.25mm between the valve body and bottom port assembly and this should be checked with a feeler gauge to confirm the uniformity of the gap.
12. The valve should then be subjected to the valve testing procedure given above.

## **VML14/S Replacement Part Kit**

The replacement part kit comprises:-

- 1 knife edge
- 1 pad
- 2 gold wire rings Ø17mm
- 8 socket head screws
- 1 pad insertion/removal tool