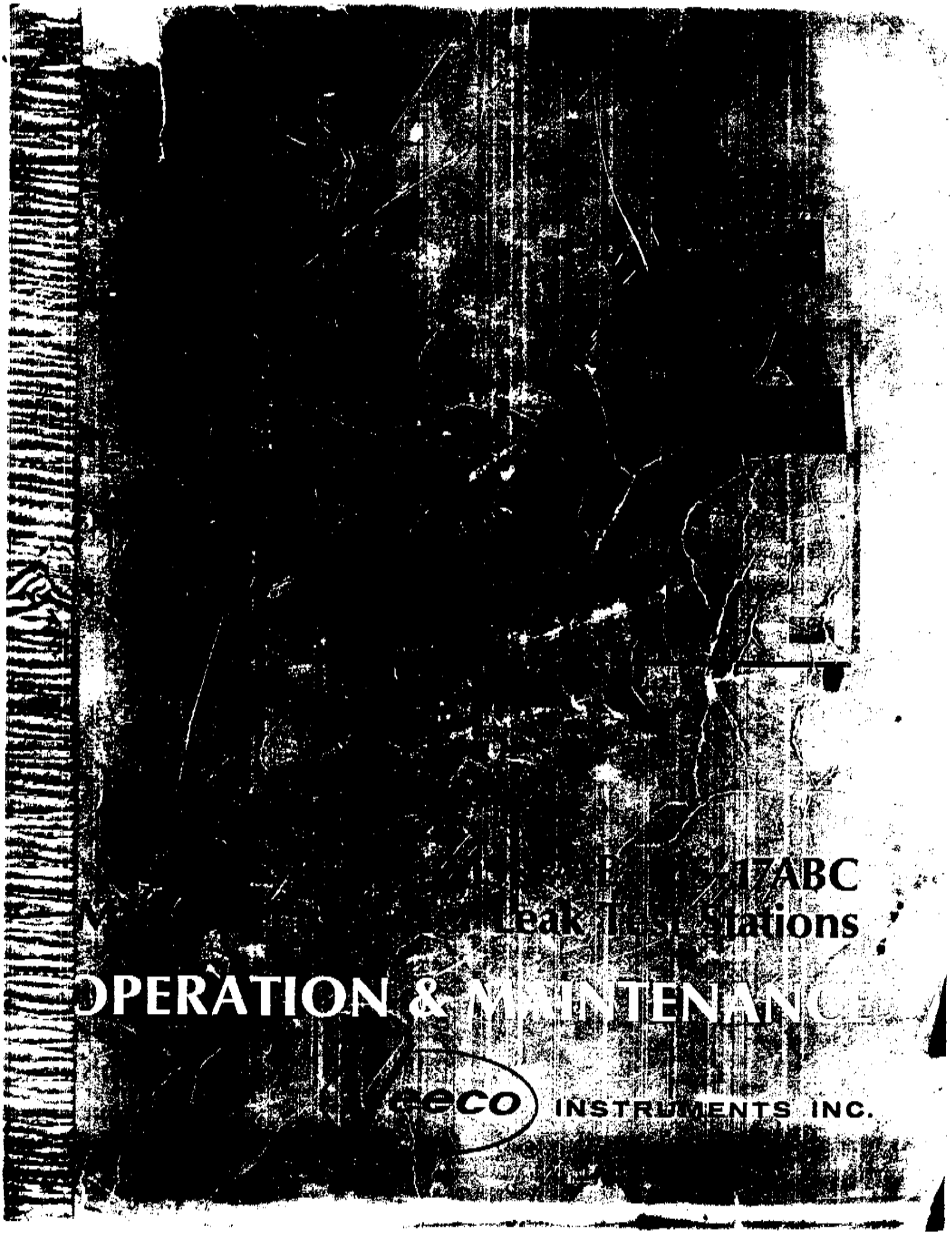
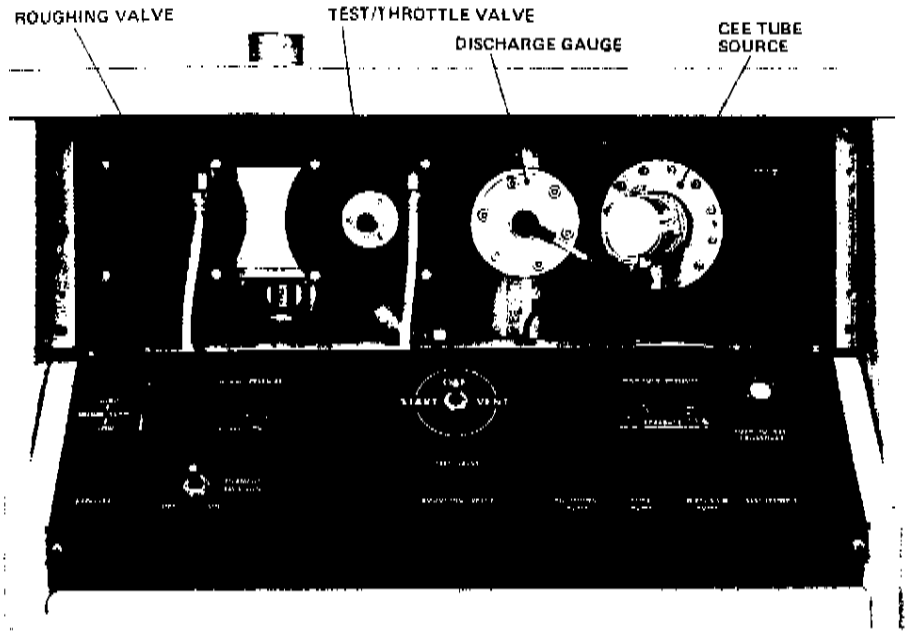


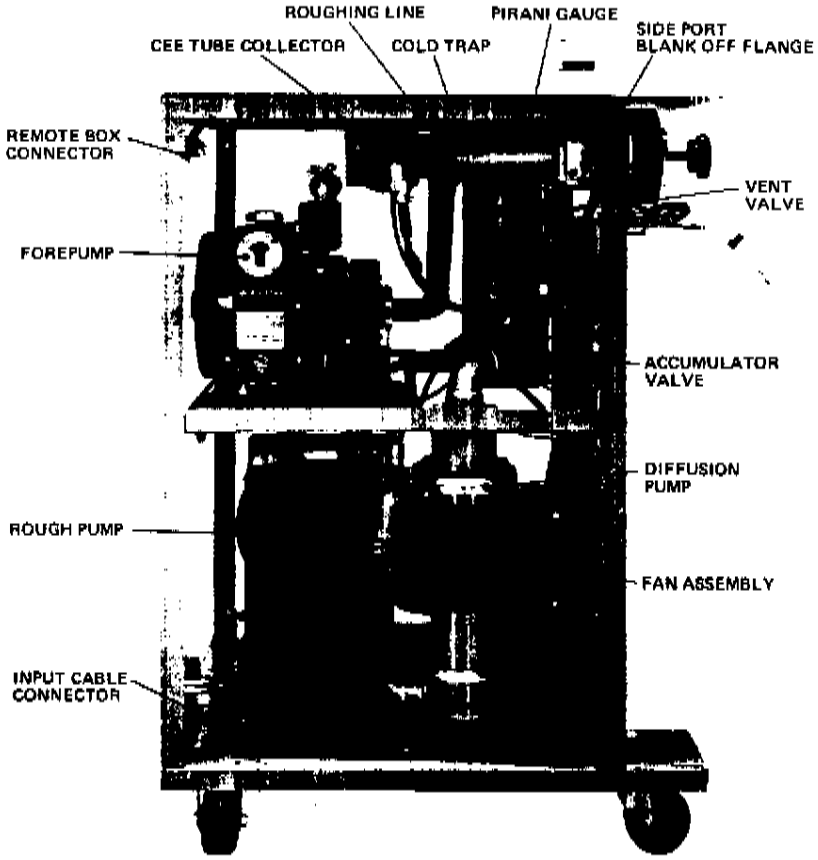
17ABC
Leak Test Stations

OPERATION & MAINTENANCE

eeco INSTRUMENTS INC.



Front View



Left Side View

Figure 2. Major Vacuum Components

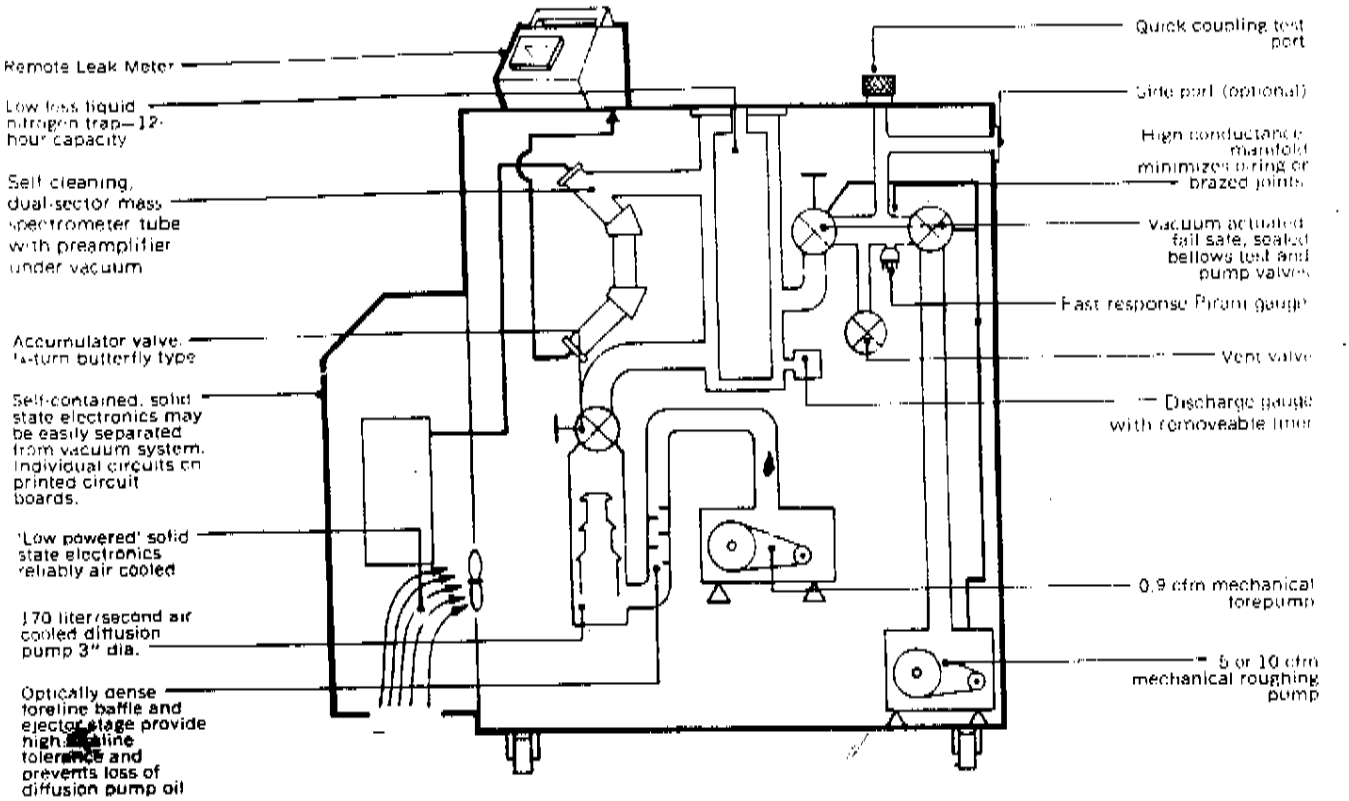


Figure 4. MS-17AB Vacuum Schematic

The operation of the spectrometer tube is divided into three functions: ion production, separation, and ion collection. These three operations are closely integrated to serve the purpose of detecting minute quantities of helium. A general description of the working principles behind these functions follows:

a. Ion Production

Since neutral atoms and molecules of gas cannot be separated by a magnetic mass spectrometer, they must first be converted to positively charged ions. This is accomplished by the ion source. Inside the ion source there is a tungsten filament which is heated by passing an electric current through it. (The source is provided with two separate filaments; should one burn out, the other can be activated simply by actuating a switch on the sub-panel.) The hot filament emits a regulated beam of electrons, when these electrons collide with the atoms and molecules of gas they "knock off" electrons, thus producing the positive ions. Upon formation, these ions encounter the electrostatic fields established within the ion source by the ion repeller, the ion chamber, the focusing plates, and the object plate. The effect of this arrangement is to accelerate the ions in a well-defined, mono-energetic beam.

ened in acetone. Caution should be exercised in the use of acetone. It is highly flammable. After wiping, the bucket should be thoroughly dried (for rapid, efficient drying, the use of a Veeco Degassing Gun, Cat. #QD 12500, is recommended). Once drying has been completed, install the bucket in the cold trap, taking special care to avoid touching vacuum surfaces with fingers. The bucket should be grasped by its top flange only.

C. MS-17AB OPERATING INSTRUCTIONS

1. Starting from Total Shut Down

a. Position of Valves and Control Switches

ROUGHING PUMP . . . . . OFF

FOREPUMP . . . . . OFF

DIFFUSION PUMP . . . . . OFF

THROTTLE VALVE . . . . . Open

ACCUMULATOR VALVE . . . . . Closed

MODE SWITCH (Sub panel) . . . . . MANUAL

START-VENT SWITCH . . . . . START

ELECTRONICS . . . . . OFF

PORTS . . . . . Sealed.

b. Procedure

1. Plug the power cable into 115 volt, 60 Hz source.

2. Plug cord of leak indicator into console. Socket is on upper left, rear side of console.

3. Turn on ROUGHING PUMP and FOREPUMP and wait until both pumps stop "gurgling". Press TEST VALVE OPEN button (this opens the test valve when the mode switch is on MANUAL, allowing quick pump down time) and keep it depressed until the MANIFOLD PRESSURE on the front panel, reads 50 to 70 millitorr.

4. Release the TEST VALVE OPEN button (closing test valve), return the mode switch to AUTOMATIC and the START-VENT switch to the center position. Open the accumulator

valve and turn "ON" DIFFUSION PUMP. Note that REPELLER light goes on at this point insuring self-cleaning action while the diffusion pump is operating. Normally MANIFOLD PRESSURE will rise during warm-up since it is not being pumped during this period.

5. After about 20 minutes, turn on the ELECTRONICS. The ELECTRONICS switch also turns on the Discharge Gauge; therefore, it should not be turned on too early or unnecessary contamination of the gauge will result. If the pressure reading is off scale, shut off the ELECTRONICS and wait a few minutes. After this time the PRESSURE meter should indicate on scale. When the pressure is approximately 1×10^{-4} torr or lower, add a small charge of liquid nitrogen to the cold trap. Use the funnel and allow for displaced air to escape from the cold trap. If this is not done, violent bubbling will result. After about three minutes, add sufficient liquid nitrogen to fill the trap. The pressure in the leak detector should drop to 5×10^{-5} torr or lower in a few minutes.

6. Push the FILAMENT ON switch. Emission lamp on front panel should light. (If pressure rises above 3×10^{-4} torr, the filament is automatically turned off.)

2. Sensitivity Check

Before using the MS-17AB for leak testing, a sensitivity check must be made (it is assumed the system is in operation). During the day, this check should be repeated.

a. Procedure

1. Place the mode switch in the AUTOMATIC position.

2. With FILAMENT OFF, set the leak indicator meter to zero by means of its ZERO ADJUST knob. The ZERO should be set on the most sensitive scale (3×10^{-9}). If necessary use the COARSE ZERO ADJUST BALANCE control located on the rear of remote box. Push FILAMENT ON switch. It is impossible to perform a test unless the filament is on and the throttle valve is open.

3. Press START-VENT switch to VENT for a few seconds until the MANIFOLD PRESSURE meter moves up-scale, then release. This switch is spring loaded and will return to neutral. Set the crossover point to a safe pressure (20 millitorr or lower). This setting determines when the test valve will open, tying the test manifold in with the spectrometer tube.

4. Remove plugs from the port and the sensitivity calibrator, and insert the sensitivity calibrator into the Test Port. Check to see that the valve on the Sensitivity Calibrator is open.

5. Place the START-VENT Switch in the START position. The calibrator is evacuated until the manifold pressure reaches crossover. At this point the Test Valve opens, the TEST Light goes on, and the Roughing Valve closes.

NOTE

If, while in this position, high pressure due to outgassing, external leaks, etc. is inadvertently introduced to the leak detector the filament protective interlock with the discharge gauge will be actuated and the filament will be turned off, the test valve will close, and the roughing valve will open. The roughing valve will remain open unless the START-VENT Switch is moved to its center position. Testing can be resumed when the difficulty is cleared and the filament is operating. The filament must be manually reset by pushing the FILAMENT "ON" switch.

6. When the TEST light is on, the machine is ready for a sensitivity check. Proceed as follows:

   a. Read leak indicator meter and set for direct readout using the air leak rate figure on the sensitivity calibrator. If necessary, adjust using the calibration potentiometer on rear of remote box. If direct reading cannot be obtained with the gain potentiometer, the mass spectrometer tube should be retuned for maximum signal and the calibration reset.

   b. Close sensitivity calibrator valve.

   c. The leak indicator meter should return to zero, or near zero. The difference between the two readings is the output due to helium in-leakage from the sensitivity calibrator.

NOTE

By performing this sensitivity check daily with a known input of helium, a constant check on the sensitivity of the machine is obtained.

7. Upon completion of sensitivity check, move the START-VENT Switch to the VENT position. This will vent the calibrator and the manifold. Remove the sensitivity calibrator from the port. Plug the sensitivity calibrator with the plastic stopper provided and open the valve on the sensitivity calibrator.

3. Leak Testing With Mode Switch In AUTOMATIC

Once the sensitivity check has been accomplished, the MS-17AB is ready to perform leak testing. Connect the object to be tested to the port. Press the FILAMENT "ON" switch if the filament is not already on, and move the START-VENT switch to START. The Roughing Light will go on, indicating the object is being evacuated. When the TEST light goes on, proceed to spray the object with helium and observe the leak indicator for deflection (or audible indication). At the completion of the leak test, move the START-VENT switch to VENT, hold for 2 seconds or more (depending on the volume of the piece being tested) and release, remove the object under test.

4. Leak Testing With Mode Switch in MANUAL (Throttle)

This position is provided to allow manual control of the vacuum valves for special testing conditions. It is employed when either excessive leakage or outgassing of the test object will not permit automatic operation of the Test Valve.

a. Procedure

1. Shut the Throttle Valve. It is essential that this step be performed first, since placing the mode switch in MANUAL (Throttle) position bypasses the MANIFOLD PRESSURE controller interlock, allowing the Test Valve to open immediately when the START-VENT Switch is placed in the START position and the filament is turned on. As an added safety the filament turns off automatically when the mode switch is put in MANUAL, if the START-VENT switch is in the center position.

2. Place mode switch in MANUAL (Throttle) position.

3. Connect test object to one of the ports.

4. Place START-VENT Switch in START position, and turn on the filament. Note that the TEST VALVE Light goes on. This indicates that the test valve can open. The test valve will not open until the THROTTLE VALVE is operated since the THROTTLE VALVE is a manual override of the test valve and the THROTTLE VALVE is closed at this point. Should the filament go off due to high pressure, the test valve will shut, thereby protecting the diffusion pump oil from oxidation through exposure to atmospheric pressure.

5. When the Pirani gauge reads 100 millitorr or less, slowly open the throttle valve while maintaining the HI-VAC PRESSURE reading at 10^{-4} torr or lower. (If the

pressure accidentally rises above 3×10^{-4} torr and the filament goes out, close the Throttle Valve slightly and reset the filament by pressing the FILAMENT ON switch). When the Filament goes on, the test valve simultaneously opens allowing the test to proceed.

When the Throttle Valve can be opened no further, as indicated by the pressure meter rising to 3×10^{-4}, testing may proceed. Spray the object with helium, and observe the leak indicator.

6. After testing, place the mode switch back in AUTOMATIC and open the throttle valve fully if normal testing is to be resumed. If checking other large, "gassy" volumes, or suspected large leakers, leave the mode switch in MANUAL, and close the Throttle Valve before venting. The filament will turn off when the machine is vented so that the test valve will not open, the filament must be turned on during each manual test.

7. Move the START-VENT Switch to VENT and release.

8. Remove object under test.

5. Temporary Shut-Down

a. Procedure For Overnight Shut-Down (Standby) with Leak Detector Pumps Running (THROTTLE VALVE Open)

1. Seal off the test port.

2. Place START-VENT switch in START position, as in normal testing, (switch in AUTOMATIC position) until the test valve opens.

3. Turn off the ELECTRONICS. The test valve will stay open. If for some reason the pressure should rise above the crossover point, the test valve will close, thus protecting the diffusion pump.

6. Starting Up From Overnight Shut-Down With Leak Detector Pumps Already Running

a. Procedure

1. Turn on ELECTRONICS.

2. Put liquid nitrogen in cold trap if pressure is below 10^{-4} torr on HI-VAC pressure meter.

3. A sensitivity check must be made at this time.

4. Follow testing procedure for specific type of testing desired.

7. Complete Shut-Down

It is recommended that the high vacuum section between the ACCUMULATOR VALVE and the THROTTLE VALVE be left under vacuum to keep the system as clean as possible.

a. Procedure

Initial condition is in the AUTOMATIC mode, with the system vented (Throttle valve open)

1. Place the MODE switch in MANUAL.
2. Close the ACCUMULATOR VALVE by pushing the knob in.
3. Turn off the ELECTRONICS.
4. Turn off the DIFFUSION PUMP - Note time.
5. If the cold trap bucket is at room temperature, proceed to step 10. If the bucket is cold, it must be removed and cleaned. Remove the bucket bolts to facilitate its removal when the system is vented.
6. Press the START-VENT switch to VENT and hold, while also pressing the TEST VALVE - PUSH TO OPEN switch. This opens the test valve and the vent valve to vent the system up to the accumulator valve. Release both switches.
7. Immediately remove the cold trap bucket by lifting straight up. Pour off the remaining liquid nitrogen. Heat to melt the ice on the outside of the bucket. Wipe bucket dry and then clean with solvent (acetone). After cleaning, handle the bucket by the top flange only to avoid fingerprinting the surfaces exposed to high vacuum. Dry the bucket with a Veeco heat gun. Lightly grease the cold trap "O-ring" and install the bucket back in the cold trap. Replace bolts.
8. Blank off the port if it is not already blanked.
9. Place the START-VENT switch in the START position. Press the TEST VALVE-PUSH TO OPEN switch until the MANIFOLD PRESSURE reads 50 millitorr, then release.
10. Place the START-VENT switch in VENT position for a few seconds, then release.
11. Remove the port plug.
12. Close the THROTTLE VALVE, thereby isolating the high vacuum section.