Chapter 5 - Maintenance

Maintenance

User maintenance on this series of instruments is very limited, and is restricted to items that do not require any panels to be removed in order to gain access to them.

THERE ARE NO USER SERVICEABLE PARTS BEHIND THE PANELS, AND REMOVAL OF A PANEL EXPOSES HIGH VOLTAGES AND HIGHLY SENSITIVE ELECTRONIC CIRCUITRY.

User serviceable items are as follows:-

- Firing Unit
- Anode Cleaning
- Final Aperture replacement
- Desiccator Silica Crystal replacement
- Anode support and polepieces
- Rotary pump oil changes

ALL other maintenance operations, including these, if required, should be carried out by Leica Service Engineers, or authorised agents, and will be done on Service and Period Maintenance visits. These include:-

- Turbo pump maintenance (as well as the rotary pump)
- Collector system maintenance (including light pipe change IF required)
- Cleaning of fans
- Full column cleaning - if necessary

5.1. Routine Basic Maintenance

5.1.1. Rotary Pump Oil Level

Check the oil level in the sight glass on the pump. The minimum oil level is the lower edge of the sight glass. The maximum level is 25mm below the top of the glass. When necessary top up with oil of the type specified for the particular pump in use (ie Edwards no 15 for Edwards pump, or Alcatel VP1 for Alcatel pumps).

5.1.2. Air Admittance Drier Assembly

If the air drier is allowed to become ineffective the pump down time of the *Stereoscan 430* will become longer than normal. The assembly is mounted on the rear panel of the plinth. The colour of the desiccant in the assembly should be checked daily and if it shows signs of becoming saturated ie turning from to pink or white, it should be replaced or reactivated. To renew the desiccant:-

1. Unclip the drier from the rear of the plinth.

2. Unscrew the large knurled retaining ring from one end of the assembly and remove the end cap. Remove the filter washer beneath it. The desiccant can now be poured out and either dried or discarded. Remove the remaining filter washer and the perforated metal support.

3. Clean the parts by washing in a suitable solvent, eg diluted liquid detergent, after which each part must be thoroughly rinsed and dried.

4. Replace the perforated metal support with the concave side facing away from where the desiccant will be. Cover with two filter washers (shiny side away from the desiccant). Fill the assembly with new or reactivated desiccant. Fit a filter washer with the shiny side towards the desiccant. Fit the end cap and knurled clamp ring.

5. Refit the assembly to the rear of the plinth.

5.2. Six Monthly Maintenance

5.2.1. Changing the Rotary Pump Oil

It is recommended that the rotary pump oil is changed after the first 100 hours operation and thereafter at 6-monthly intervals, with intermediate checks on the oil level.

To change the oil:-

1. Select CHAMBER vacuum vent and wait for the rotary pump to stop.

2. Place a container of not less than 2.5 litres capacity under the oil drain plug at the bottom of the pump. Remove the plug and drain the oil.

3. Replace the drain plug and remove the filler plug at the top of the pump. Refill the pump with the oil recommended in the pump manufacturers handbook. Edwards No. 15

4. Replace the filler plug. Refit the 'O' ring carrier, 'O' ring, pump hose manifold clamp ring and 2 screws.

5. While pumping the system down, check the condition of the oil mist filter (if fitted). If a strong smell of oil vapour can be detected the elements of the filter must be changed. In addition if the oil within the filter reaches

the maximum mark, it should be drained. The pump should be switched off for both of these operations.

5.3. Column Servicing

The periods between cleaning will depend on the frequency of use, type of specimens and environmental conditions, etc. As a general rule, if the required performance can be achieved then leave well alone. Cleaning is only necessary if the resolution deteriorates and cannot be improved by adjustment. The degree of cleaning needed can only be determined by inspecting the column components.

Routine cleaning consists of cleaning the grid and anode and inserting clean apertures. If this does not restore the performance, then the whole column must be dismantled and cleaned. The extent of this depends on the severity of contamination, which can only be found by inspecting the column as it is dismantled.

5.3.1. Cleaning Recommendations

All swabs should be made from clean, absorbent, lint free material which will leave no dust or particles on the cleaned surfaces. A low power binocular microscope is useful to enable dust particles to be seen. All cleaned components must be covered to protect them from dust in the atmosphere. Great care must be taken when handling any part of the column since all parts are machined to close tolerance. Nylon gloves must be worn when handling all polepieces, gun parts and other components exposed to the electron beam.

An aerosol of compressed gas is very useful for blowing the dust off each component as it is replaced in the column. Commercial compressed air should not be used as it contains oil vapour.

Do not allow any liquid to come into contact with the gun ceramic. It is essential to avoid magnetising any part of the column. The steel used for components in the magnetic circuits (ie polepieces) is of a very soft type and will rust very quickly if left in the atmosphere. Where possible the column should be kept under vacuum.

1. STEEL AND STAINLESS STEEL, COPPER AND HIDURAL COMPONENTS. (Hidural is the coppery looking metal.)

   ALUMINIUM AND ALUMINIUM ALLOY COMPONENTS

   These components may be cleaned with Hyprez diamond compound grade 1-W-47 or, in the case of severe contamination, grade 6-W-47. Wash off all Hyprez with the solvent recommended by the local Service Centre (see *Appendix D*), preferably in an ultrasonic cleaner, and dry off using a hot air blower.

   DO NOT USE QUADRALENE ON ANY COMPONENTS CONTAINING ALUMINIUM.

2. MOLYDENUM SPRAY APERTURES AND PLATINUM FINAL APERTURES

   Molydenum spray apertures may be cleaned by Method 1 above. It is recommended that the platinum final apertures are replaced when they become dirty or discoloured.

3. MU METAL These components should not be cleaned except for the removal of dust. It is important that the metal is not strained or dropped as this will reduce its effectiveness as a magnetic screen.

4. 'O' RINGS may be cleaned with, a lint free tissue. The use of 'O' ring grease is not recommended on any 'O' rings, but a small amount may be used, if necessary, on moving seals eg in the specimen stage and aperture changer micrometers. The grease must be applied with a lint free tissue to avoid contamination with natural oils, using only enough grease to just put a shine on the 'O' ring. High vacuum (eg FOMBLIN) grease is recommended.

5. 'O' RING GROOVES AND FACES should be cleaned using the appropriate method for the particular material.

Any component with 'O' ring grooves and/or mating surfaces, and which is to be ultrasonically cleaned, should be placed in the cleaner tank in such a way that the groove or face does not touch the walls of the tank, or any other components.

5.3.2. Routine Column Cleaning

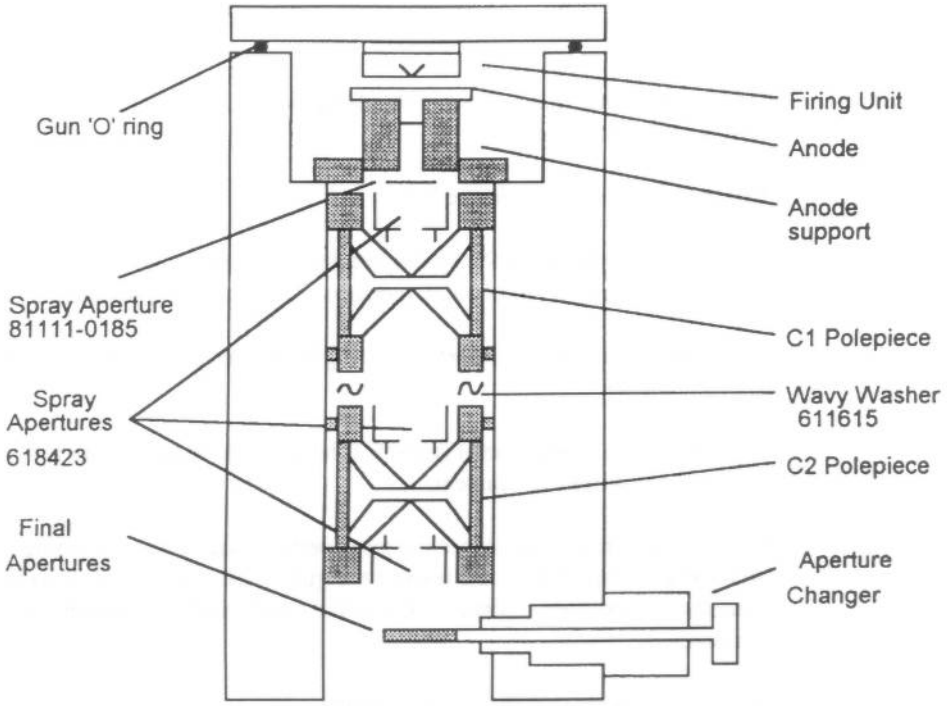

Figure 5.1 The Column

Cleaning the Gun Assembly

1. Vent the column and chamber to air.
2. Open the gun.
3. Loosen the three filament assembly clamp screws (see Figure 5.2) and remove the firing unit.
4. Lift out the anode (see Figure 5.1).
5. Close the gun and pump the system while the components are cleaned. Take the filament assembly and anode to a clean area for cleaning.
6. Using the flat metal key unscrew the height adjustment ring and remove the filament carrier.
7. Loosen the four screws (see Figure 5.2) holding the filament into the carrier and remove the filament.
8. Using thumb pressure push out the gun aperture disk and its retaining clip from the grid cap. Clean and inspect the gun aperture disk, if it is badly scratched or distorted replace it. Clean the anode and the filament carrier (if removed).
9. Replace the anode into the anode support.
10. If necessary change the filament, centre it in the grid and replace the assembly in the gun (as described in Section 2.2.4 *Changing the Filament*).
11. Pump down the column and chamber and run up the gun, not forgetting to check the filament saturation and gun alignment, as these may have changed with the new filament.

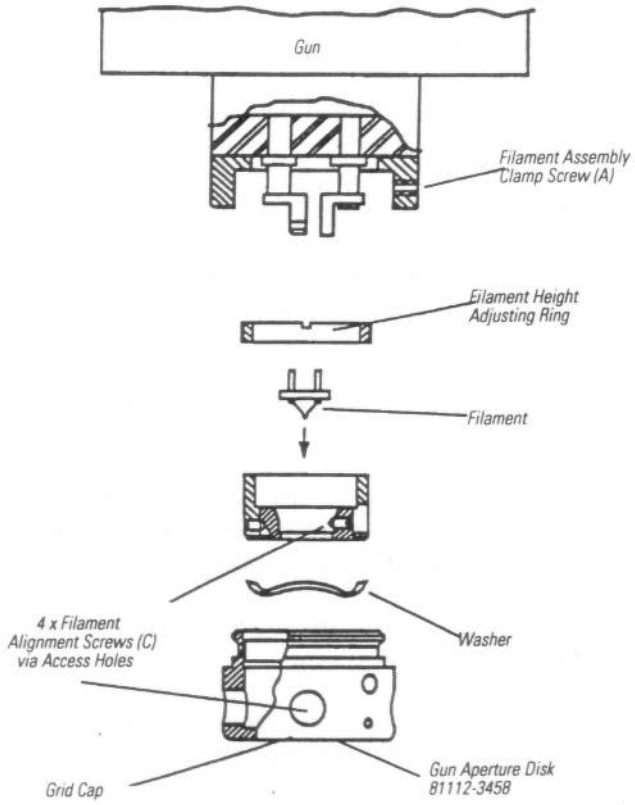

Figure 5.2 The Firing Unit

Cleaning the Aperture Assembly

1. Vent the column and chamber to air.

2. Remove the four screws holding the aperture changer into the column and remove this assembly from the column.

3. Take the aperture assembly to a clean area for cleaning.

4. Remove the two screws holding the aperture clamp plate onto the aperture blade (see Figure 5.3). Lift off the clamp plate and remove the final apertures.

*The aperture blade must **not** be removed from its mounting arm.*

5. Clean the aperture clamp plate. The aperture blade should be carefully polished ensuring that the mounting arm does not become distorted. The aperture blade can be cleaned by agitating it in a shallow beaker of solvent.

6. Insert new apertures into the aperture blade and fit the aperture clamp plate and screws.

7. Clean the 'O' ring on the aperture changer and replace the assembly into the column and secure with the four screws.

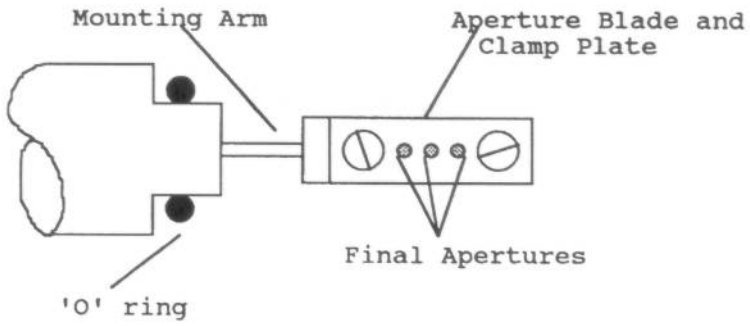

Figure 5.3 Final Aperture Changer

The apertures have one flat side, the other side being shaped like a funnel. The apertures must be mounted in the blade with the flat side upwards when the aperture changer is mounted in the column.

5.3.3. Basic Column Dismantling, Cleaning and Reassembly

If the routine column cleaning section is not sufficient, the second stage of column cleaning is detailed below:-

1. Remove and clean the filament assembly, grid and final apertures as detailed in *Routine Column Cleaning* section.

2. Switch system to hardware standby.

3. **Column Dismantling**

   (a) Remove the anode from the anode support. Undo the four screws securing the anode support and remove it vertically.

   (b) Insert the special tool (Pt No 719951) into the C_1 polepiece assembly and remove by lifting vertically. Write down the serial number of this polepiece assembly.

   Remove the C_2 polepiece assembly in the same manner also noting its serial number. Lift off the wavy washer from the top of the C_2 polepiece assembly and store safely. Replace the gun lid on the column and pump the system.

4. **Dismantling and Cleaning of Anode Support**

   (a) Place the low kV anode into the anode support and measure the Gap 'A' between the top of the anode support and the bottom of the anode (see Figure 5.4).

   (b) Remove the two screws holding the spray aperture from the bottom of the anode support and extract the spray aperture.

   Loosen the liner securing screw and remove the liner tube from the anode support. Carefully clean all of the components ensuring that all traces of contamination are removed. After cleaning inspect the spray aperture using a low power magnifier. Replace it if it is distorted or scratched near the orofice.

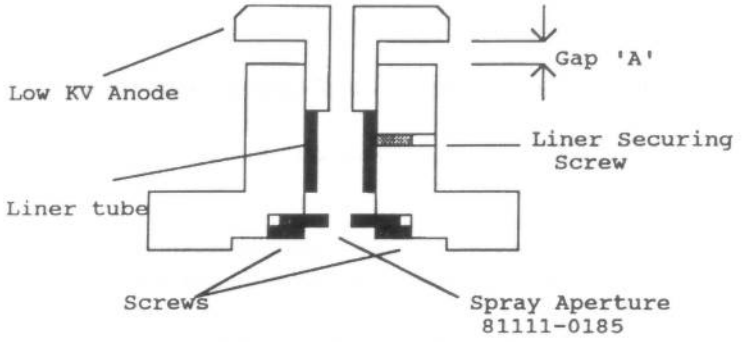

Figure 5.4

(c) Reassemble the anode support. Adjusting the hinge tube position that the Gap 'A', using the low kV anode, is the same as before. Insert the spray aperture and secure with two screws.

5. **Cleaning the Polepiece Assemblies**
Carefully remove the spray apertures (3) from the bores of the polepiece assemblies. These must be pulled out evenly so as not to distort them.

*The **minimum** amount of lapping compound must be used when cleaning the polepieces.*

All traces of lapping compound must be removed from each polepiece and they should then be washed several times in a recommended solvent.

Clean and inspect the spray apertures. If they are badly scratched or distorted replace them.

6. **Reassembly**
Vent the system and refit the spray apertures into the polepiece assemblies.

Refit the C_2 polepiece assembly into the column bore using the special tool.

Refit the wavy washer onto the top of the C_2 polepiece.

Replace the C_1 polepiece assembly into the column bore using the special tool. Refit the anode support and secure using four screws. Replace the firing unit and the high or low kV anode as required.

Pump the system and then check the system performance. If the resolution of the SEM remains poor contact your local service agent.

5.4. Looking for Vacuum Leaks

The first requirement is a method of measuring the vacuum. Some methods, starting from the simplest, are:-

1. Use the built in vacuum indicator, this may not be sensitive enough for leak hunting.

2. A better method is to disconnect the Penning gauge from the vac interlock PCB and connect to a commercially available Penning gauge box, eg a Penning 8 gauge box available from Edwards High Vacuum Ltd.

3. The best, and most expensive method is to fit a commercial leak detector system to the chamber, eg a mass spectrometer. This only proves to be required in very rare cases.

The second thing you need is to find the leak. This is done by putting some liquid or gas onto the leak. The liquid or gas used must do two things. It must quickly find its way through the leak and it must cause a reaction on the vacuum gauge.

If using a mass spectrometer leak detector the normal gas to use is helium.

To find a vacuum leak:-

1. Set up the vacuum measuring equipment.

2. Get some leak detecting fluid.

3. Put a small amount of leak detecting fluid on a place in the vacuum system that is vacuum sealed.

4. Look for some reaction on the vacuum gauge. This reaction is normally an increase in pressure but it can sometimes be a decrease in pressure. (If the fluid washes a piece of dust, or some 'O' ring grease, into the hole causing the leak it may seal it.)

5. If no leak is found, test each vacuum seal in the system in turn. Do this slowly as it may take the vacuum gauge several seconds to respond.

6. If a leak is found, take the vacuum joint apart and renew the seal.