# JEOL 2010F MANUAL

## Quick check list

1. Check the accelerating voltage, must be at 200 kV (right screen), HT (µA) (left panel) at 0.96-0.97 and Emission (left panel) at 155-160.

2. Check the vacuum sequence (left drawer), V17, V13, V5B and V2 on. Vacuum measured on SIP (SIP unit, second vacuum meter from the top) must be better than 2 x $10^{-5}$ Pa (blue numbers, 150 l/s). The vacuum in the gun (SIP unit, vacuum meter at the top) must be better than x $10^{-6}$ Pa.

3. If needed, fill the reservoir with LN2. Be sure that the viewing screen cover is on before filling the trap.

4. Insert specimen holder into TEM (*Insert holder in airlock, set air/pump switch to pump (yellow light turns ON), when green light turns ON, rotate fully clockwise in two stages and push in completely*)

5. Check the vacuum sequence again, (left drawer), V17, V13, V5B, V8, V21 and V2 on. Vacuum measured on SIP (SIP unit, second vacuum meter from the top) must be better than 2 x $10^{-5}$ Pa (blue numbers, 150 l/s). The vacuum in the gun (SIP unit, vacuum meter at the top) must be better than x $10^{-6}$ Pa.

6. If vacuum is ok, open the valve between the column and the gun by clicking button **VALVE** (left panel controls).

7. If needed, align the microscope. Work!

## 1. Initial check

1. Check the vacuum sequence (left drawer), V17, V13, V5B and V2 on. Vacuum measured in SIP (SIP unit, second vacuum meter from the top) must be better than 2 x $10^{-5}$ Pa (blue numbers, 150 l/s). The vacuum in the gun (SIP unit, vacuum meter at the top) must be better than x $10^{-6}$ Pa.
2. Check the cooling water flow meters on the back wall in the maintenance room.
3. If needed, fill the anti-contamination device (ACD) (cold trap) with LN2. Be sure that the viewing screen cover is on before filling the trap.
4. ***Caution:*** *The Dewar should be re-filled every 4-6 hours.*

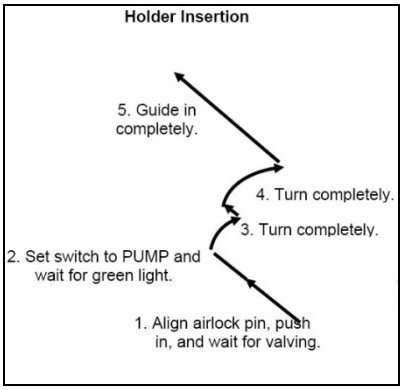
## 2. Inserting thespecimen holder in the TEM column

### Load the sample

- Use Gloves! Load your sample on the specimen holder.
- Carefully check the o-ring and sample area for dust and lint.

### Insert the holder

- Make sure that the **stage position is neutral** and that the airlock switch is set to AIR position.
- Align the specimen guide pin with the guide groove on the TEM goniometer. Push the holder into the airlock system until it stops and set the PUMP/AIR switch to pump. *(The yellow lamp lights up)*
- When the green lamp lights up, turn the holder a bit clockwise, push the holder until it stops, and turn it fully clockwise, you will feel that the vacuum is trying to pull the holder in. Gently let the holder slide into the TEM until it stops. **Do not let go of the holder while it is going into the TEM column.** If it goes too fast the holder and/or the stage can be damaged.



### 3. Electron Beam Generation

1. Check the vacuum sequence (left drawer), V17, V13, V5B, V8, V21 and V2 on. Vacuum measured on SIP (SIP unit, second vacuum meter from the top) must be better than 2 x $10^{-5}$ Pa (blue numbers, 150 l/s). The vacuum in the gun (SIP unit, vacuum meter at the top) must be better than x $10^{-6}$ Pa. If vacuum is ok, click **VALVE** button to generate the beam. HT button should be always illuminated. Never touch this button!
2. Turn BRIGHTNESS knob to see if the electron beam appears on the fluorescent screen. Adjust the BRIGHTNESS knob and the SHIFT X and Y knobs to make the beam bright.
   If you cannot find the beam, the specimen or grid may be in the way. Try moving it around. Use LOW MAG.

## Aligning the TEM

### 4. Condenser lens (CL) Aperture

1. Select MAG1 and a suitable magnification, e.g. 40k.
2. Insert the largest CL aperture into the column and center it as follows:
   - Obtain the smallest electron beam using the BRIGHTNESS knob and center it using the SHIFT X and Y knobs.
   - Slowly widen the electron beam using the BRIGHTNESS knob. If the beam moves off the screen center as you widen it, center it using the aperture knobs.
   - Adjust the aperture knobs so that the beam expands and contracts coaxially when you turn the BRIGHTNESS knob back and forth around the focus position.

### 5. Correcting CL Astigmatism

If astigmatism is present in the CL, the beam, when brought to a focus on the screen, is elongated. Correct astigmatism of the CL lens to make the shape of the electron beam spot round.

1. Focus the beam using the BRIGHTNESS knob.
2. Press COND STIG switch.
3. Slowly turn the BRGHTNESS knob back and forth around the focus position and adjust the DEF/STIG X and Y knobs so that the shape of the electron beam spot becomes round just before and after the focus position.
4. Press the COND STIG switch to deselect it.

### 6. Adjust Eucentric Height (Wobbler)

1. Locate the specimen *(or carbon network on grid)* screen at a magnification of 50-100k.
2. Be sure that the FOCUS is set to 0 (DV = 0).
3. Press IMAGE WOBB X or Y knob
4. Use the Z height controls to focus the image (minimum contrast).
5. Deselect the IMAGE WOBB knob
6. After this alignment all coarse focusing should be done with the Z height adjustment.

### 7. Gun Shift and Condenser Shift Correction

1. Select the MAG mode and set the magnification to 100k.

2. Set the SPOT SIZE switch to 1 and focus the beam using the BRIGHTNESS knob.
3. Click **Gun button** in the **right-hand drawer**.
4. Center the beam on the fluorescent screen using the SHIFT X and Y knobs.
5. Click **Gun button** again to deselect it.
6. Set the SPOT SIZE switch to 5 and focus the beam using the BRIGHTNESS knob.
7. Click **Bright tilt button** in the **left panel control**.
8. Center the electron beam on the screen using the SHIFT knobs.
9. Click **Bright tilt button** to deselect it.
10. Repeat steps above until the electron beam stays at the center of the fluorescent screen when you change the SPOT SIZE.

## 8. Adjusting CL Deflection Coil (Pivot points)

### A. Adjusting the Tilt X and Y

This adjustment consists of adjusting the ratio of the currents in the 1st and 2nd CL deflection coils so that the electron beam spot remains stationary when you tilt the electron beam.

1. Focus electron beam using the BRIGHTNESS knob
2. Click on the **right-hand drawer, COND DEF ADJ, Tilt**.
3. Use the **TILT X/Y switch** in the right-hand drawer. Place it to TILT X and unless the ratio of the currents is adjusted properly, the electron beam spot splits into two parts in the X direction.
4. Unify the split spot using the SHIFT X knob *(when the beam spot moves off the screen, lower magnification and continue adjustment).*
1. If the beam spot splits into two parts in the Y direction, then unify the split spot using the DEF X knob. After unifying the spot, click the compensator angle to turn it off.
5. Place **TILT X/Y switch** in the right-hand drawer to TILT Y. Unless the ratio of the currents is adjusted properly, the electron beam spot splits into two parts in the Y direction.
6. Unify the split spot using the SHIFT Y knob. (If the beam moves off screen, lower magnification and continue adjustment)
2. If the beam spot splits into two parts in the X direction, then unify the split spot using the DEF Y. After unifying the spot, click the compensator angle to turn it off.
7. Place **TILT X/Y switch** to central position to turn it off

### B. Adjusting Shift X and Y

This adjustment consists of adjusting the ratio of currents in the 1st and 2nd CL deflection coils so that the caustic spot tilt remains unchanged when you shift the caustic spot.

1. Select diffraction mode.
2. Turn BRIGHTNESS knob fully clockwise.
3. Adjust the DIFF FOCUS knob to obtain a caustic spot on the fluorescent screen.
4. Click on the **right-hand drawer, COND DEF ADJ, Shift**.
5. Activate **SHIFT X,** unless the ratio of the currents in the 1st and 2nd deflection coils is adjusted properly, the caustic spot splits into two parts in the X direction.
6. Unify the split spots using the SHIFT X knob. (When the caustic spot moves off screen, shorten the camera length and continue adjustment).
7. If the electron beam spot splits into two parts in the Y direction, then unify the split spot using the DEF X knob.
8. If the caustic spot is shifted from the screen center, press PL and center it using the SHIFT X and Y knobs.

9. Select **SHIFT Y**. Unless the ratio of the currents in the 1st and 2nd deflection coils is adjusted properly, the caustic spot splits into two parts in the Y direction. Unify the split spot using the SHIFT Y knob.
10. If the electron beam spot splits into two parts in the X direction, then unify the split spot using the DEF X knob.
11. Place **SHIFT X/Y switch** to central position to turn it off
12. Press MAG1 to return to TEM mode.

## 9. Centering the Voltage Axis (HT Wobb)

1. Find a sharp specimen edge and decrease BRIGHTNESS until the specimen is still visible. The image should be in focus.
2. Press the HT WOBB switch. The image then expands and contracts periodically.
3. Manipulate DEF/STIG (X,Y) knobs so that the image expands and contracts around the center of the screen.
4. Press the HT WOBB switch to turn it off.

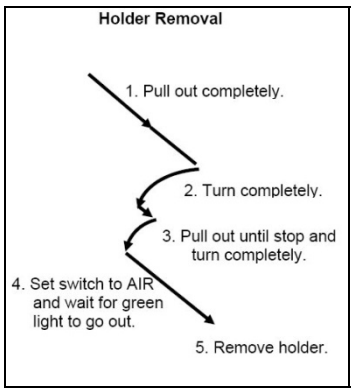
## 10. Objective Lens (OL) Astigmatism Correction

1. Find an amorphous area.
2. In MAG1, set magnification to 200k or higher.
3. Lift the screen.
4. Insert the CCD camera, click start view in Digital Micrograph window to view the image of the amorphous material. Select the ROI by press alt + ⬚
5. In the Digital Micrograph Window, Click Process → Live → FFT.
6. A correct objective stigmatism corresponds to a thon rings circularly symmetric.
7. Click OBJ STIG switch.
8. Adjust DEF/STIG (X,Y) knobs to get a better sphere.
9. Click OBJ STIG switch to deselect it.

# 11. ENDING TEM SESSION

## A. Removing Holder from TEM

1. Close the VALVE.
2. Press the **N** button on the microscope (neutral position of the holder).
3. Pull the Holder until it stops, turn it fully counterclockwise, pull it a bit until it stops, and then turn it fully counterclockwise until it stops.
4. Set the PUMP/AIR switch to AIR, wait 30 seconds, and then pull out the specimen holder from the TEM.




## B. Returning ACD to Room Temperature

If you are the last user of the day and cold-trap was used, heat the trap up to ambient temperature.

1. Remove all the apertures!
2. Insert the heater assembly into the coolant reservoir and insert the heater plug into the HTR socket on the connector box.
3. Select **ACD** button on the **lower-left panel**. The evacuation system enters ACD mode (SIP if OFF).