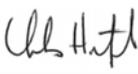


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Title: 8-BM (TES) M1 and M2 Front End Mirror Vacuum Bleed-up and Bake-out	

Prepared By: <div style="text-align: right;">8/4/2016</div> <input checked="" type="checkbox"/> Edwin Haas <hr/> Ed Haas Beamline Engineer Signed by: Haas, Edwin	Reviewed By: <div style="text-align: right;">8/5/2016</div> <input checked="" type="checkbox"/>  <hr/> Charles Hatzel Vacuum Group Leader Signed by: Hetzel, Charles	Reviewed By: <div style="text-align: right;">8/5/2016</div> <input checked="" type="checkbox"/> Gary Nintzel <hr/> Gary Nintzel Program Technician Signed by: Nintzel, Gary A	Approved By: <div style="text-align: right;">8/4/2016</div> <input checked="" type="checkbox"/> Paul Northrup <hr/> Paul Northrup 8-BM Lead Beamline Scientist Signed by: Northrup, Paul
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1 WORK SCOPE

This work instruction provides specific instructions for the bleed-up and bake-out of the Tender Energy Spectroscopy (TES) M1 and M2 Mirrors located in NSLS-II 8-BM Front End (FE). The TES M1 and M2 Mirrors are optically centered at approximately 11.0 m and 12.3 m respectively, from the bending magnet (BM) source point. This procedure supplements existing vacuum bake-out and bleed-up procedures referenced herein and includes additional specific information needed to bleed-up components located between the manual gate valve (GV) at $Z = 9.476$ m and the Front End gate valve located at $Z = 13.716$ m. For bleed-up only, this also includes the FE collimator upstream of the M1 Mirror and the fixed mask downstream of the M2 Mirror. Bake-out information for these two FE components shall be provided by the FE Group. Supplementary bake-out information is only provided for the TES M1 and M2 Mirrors.

This bleed-up and bake-out procedure does not specify when bleed-up and bake-out shall be required. Initiation of bleed-up and bake-out shall be done only in consultation with the TES Lead Beamline Scientist and the Lead FE Vacuum Engineer.

2 PREREQUISITES

- 2.1 Authorized Personnel shall have access to, and be knowledgeable in the safe operation of all equipment used for bleed-up and bake-out of the TES M1 and/or M2 Mirrors (reference sections 4 and 5 of PS-C-XFD-PRC-001, *NSLS-II Beamline Vacuum System Venting Procedure*, PS-C-XFD-PRC-013, *Beamline Vacuum Bake-out Procedure*, PS-C-ASD-PRC-105, *NSLS-II Vacuum Systems Bake-out Procedure* and PS-C-ASD-PRC-106, *Vacuum System Venting Procedure – Gaseous Nitrogen*).

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2.2 Authorized Personnel shall be current in the following training:

- Electrical Safety I (TQ-ELECSAF1)
- Compressed Gas Safety (TQ-COMPGAS1)

2.3 Authorized Personnel shall have all equipment-specific training required, all required Personal Protective Equipment (PPE), and be authorized by their supervisor to operate the equipment used.

2.4 Authorized Personnel shall perform pre-use checks of all equipment to assure safe operation.

3 HOLD POINTS

If there are any known hold points during the execution of the work, list them here (i.e., any steps that require specific approval prior to performance).

4 PRECAUTIONS/WARNINGS

4.1 The maximum bake-out temperature for the TES M1 and M2 Mirrors is 80°C. Do not disconnect the Equipment Protection System (EPS) temperature monitors on either of the TES M1 or M2 Mirrors.

4.2 All M1 and M2 Mirror bleed-up and bake-out shall be performed in coordination with the TES Lead Beamline Scientist and the Lead FE Vacuum Engineer. Neither bleed-up nor bake-out shall be undertaken without approval from the TES Group Leader / Chief Beamline Scientist and the Lead FE Vacuum Engineer.

4.3 Follow NSLS-II Vacuum Group UHV handling and cleaning procedures and Precautions and Limitations from Section 5 of PS-C-XFD-PRC-013, *Beamline Vacuum Bake-out Procedure*.

4.4 Ion pumps and other components utilize high voltage connections. Follow proper Lockout/Tagout (LOTO) procedures as required for all components having hazardous energies and wear appropriate PPE as required for each task performed.

4.5 All equipment shall be operated in accordance with manufacturer's instructions.

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5 INSTRUCTIONS

Note: The M1 and M2 Mirrors operate in the 1 – 8 keV range and are extremely sensitive to contamination. Best UHV practices are required for cleaning, handling, all fittings and connections, bleed-up, and bake-out operations. All components shall be UHV cleaned and pre-baked prior to installation.

5.1 Preparation for Bleed-up and Bake-out:

- 5.1.1 In coordination with the TES Group Leader / Chief Beamline Scientist and the Lead FE Vacuum Engineer and prior to bleed-up, close GV1 (located at Z = 7.398 m), the manual gate valve at Z = 9.476 m, and the FE gate valve located at Z = 13.716 m and disable the FE fast valve sensor located on top of the M1 Mirror vacuum vessel (see figure 2).
- 5.1.2 If baking out, disconnect the gate valve control cables to isolate the section to be baked.
- 5.1.3 For bake-out, disconnect M1 and M2 clamped water-cooling heat exchanger (HX) blocks from the M1 and M2 Mirror heat exchange port feedthroughs (four places total, two each on the M1 and M2 Mirror assemblies) and RGA gauge head.
- 5.1.4 Disconnect components and systems that may be damaged during bake-out and check to see that all components are de-energized.

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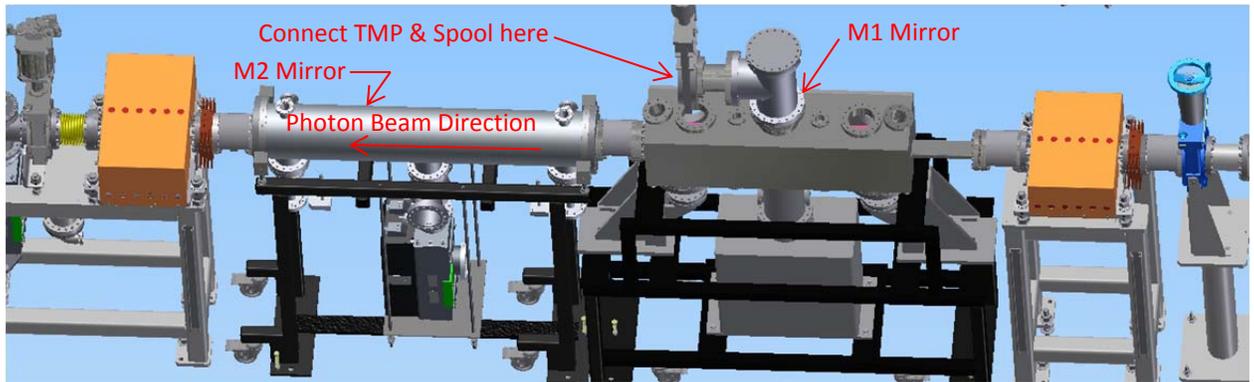


Figure 1: TES M1 and M2 Mirrors in 8-BM Front End

5.2 Bleed-up Procedure:

- 5.2.1 With the upstream and downstream gate valves closed as indicated in the “Preparations for Bleed-up and Bake-out section above, monitor pressure upstream of the manual gate valve at $Z = 9.476$ m and downstream of the gate valve located at $Z = 13.716$ m.
- 5.2.2 Turn off M1 and M2 Mirror ion pumps.
- 5.2.3 Turn on M1 and M2 Mirror Cold Cathode Gauges (CCGs, see figure 2).
- 5.2.4 Confirm SAES[®] NEG pumps (one each on M1 and M2 Mirror assemblies) are at room temperature. The NEG pump on the M1 Mirror Assembly is shown in figure 2, and the M1 Mirror NEG pump is located on the lower outboard side of the M2 Mirror assembly.
- 5.2.5 Remove blank flange on gate valve above M1 Mirror vacuum vessel. Install TMP and pumping cross.
- 5.2.6 Bring in and attach N_2 or compressed air source to TMP gate valve (on top of M1 vacuum vessel).
- 5.2.7 Install backing system for TMP.
- 5.2.8 Prior to opening TMP gate valve, pump down TMP side of gate valve using vacuum roughing pump connected to KF25 port.

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- 5.2.9 Connect high-purity ($\geq 99.999\%$) N₂ to right angle valve using approved vent manifold.
- 5.2.10 Isolate TMP from roughing pump using foreline valve.
- 5.2.11 Open TMP isolation gate valve.
- 5.2.12 Spin down TMP.
- 5.2.13 Vent system and monitor pressure on bleed-up manifold.

5.3 Procedure for Pump-down without Bleed-up:

- 5.3.1 Confirm all vacuum ports are closed.
- 5.3.2 With TMP, pumping cross, backing pump, approved vent manifold, and N₂ source connected to right angle valve (as indicated in above Bleed-up Procedure), close N₂ source and right angle valve on N₂ source.
- 5.3.3 Restart backing system.
- 5.3.4 Open foreline valve
- 5.3.5 When roughing line reaches 1×10^{-2} torr, connect TMP fan (using 115VAC plug on TMP) and start TMP.
- 5.3.6 Monitor TMP acceleration until TMP achieves normal operation.
- 5.3.7 Monitor pressure on TMP spool using cold cathode gauge on TMP control cart.
- 5.3.8 Pump-out M1 Mirror vacuum vessel double O-ring seal using TMP cart pump and isolate (reference figure 2).
- 5.3.9 When vacuum pressure reaches the 1×10^{-7} torr range, de-gas ion pumps and RGA head (if used).

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5.3.10 When vacuum pressure in the M1 and M2 Mirror vacuum vessels reaches the low 10^{-8} torr range, recondition both NEG pumps on the M1 and M2 Mirror vacuum vessels simultaneously

5.3.11 Record RGA scan.

5.3.12 When closure of the TMP gate valve does not reduce internal pressure further, isolate TMP by closing TMP gate valve.

5.3.13 Turn on ion pumps on M1 and M2 Mirror vacuum vessels.

5.3.14 Spin down TMP.

5.3.15 Turn off cold cathode gauge

5.3.16 Isolate TMP from foreline.

5.3.17 Bleed-up TMP by using high-purity ($\geq 99.999\%$) N_2 and approved vent manifold.

5.3.18 Remove TMP from gate valve and reinstall blank cover.

5.4 Bake-out Procedure:

Warning: Maximum bake-out temperature = 80°C . Do not disconnect the EPS monitors on either the M1 or M2 Mirror assemblies.

5.4.1 Follow steps 5.3.1 through 5.3.8 inclusive for Pump-down.

5.4.2 Install heater tape and insulation per PS-C-ASD-PRC-105, *NSLS-II Vacuum System Bake-out Procedure*) and PS-C-XFD-PRC-013, *Beamline Vacuum Bake-out Procedure*, as applicable.

5.4.3 Connect ion pump heaters and connect heater tapes to power supplies and connect temperature monitors according to PS-C-ASD-PRC-105, *NSLS-II Vacuum System Bake-out Procedure*.

- Ensure that M1 and M2 Mirror thermocouples are providing accurate temperature readout before beginning bake-out.

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- 5.4.4 Monitor temperature of internal mirrors using EPS temperature monitors.
- 5.4.5 Disengage cooling blocks from M1 and M2 Mirrors (four places total, see figure 2).
- 5.4.6 While continuously monitoring M1 and M2 Mirror temperatures to ensure mirrors do not exceed 80°C, perform bake-out to required pressure using bake-out procedure PS-C-ASD-PRC-105.
- 5.4.7 Cool down and disconnect bake-out power supply.
- 5.4.8 Remove heater tapes and insulation as required by bake-out procedure PS-C-ASD-PRC-105.
- 5.4.9 When M1 and M2 assemblies are at room temperature, perform pump down steps 5.3.8 through 5.3.15 inclusive sequentially, reconnect all gate valves, heat exchangers and removed equipment, and follow applicable steps from bake-out procedure, PS-C-ASD-PRC-105.

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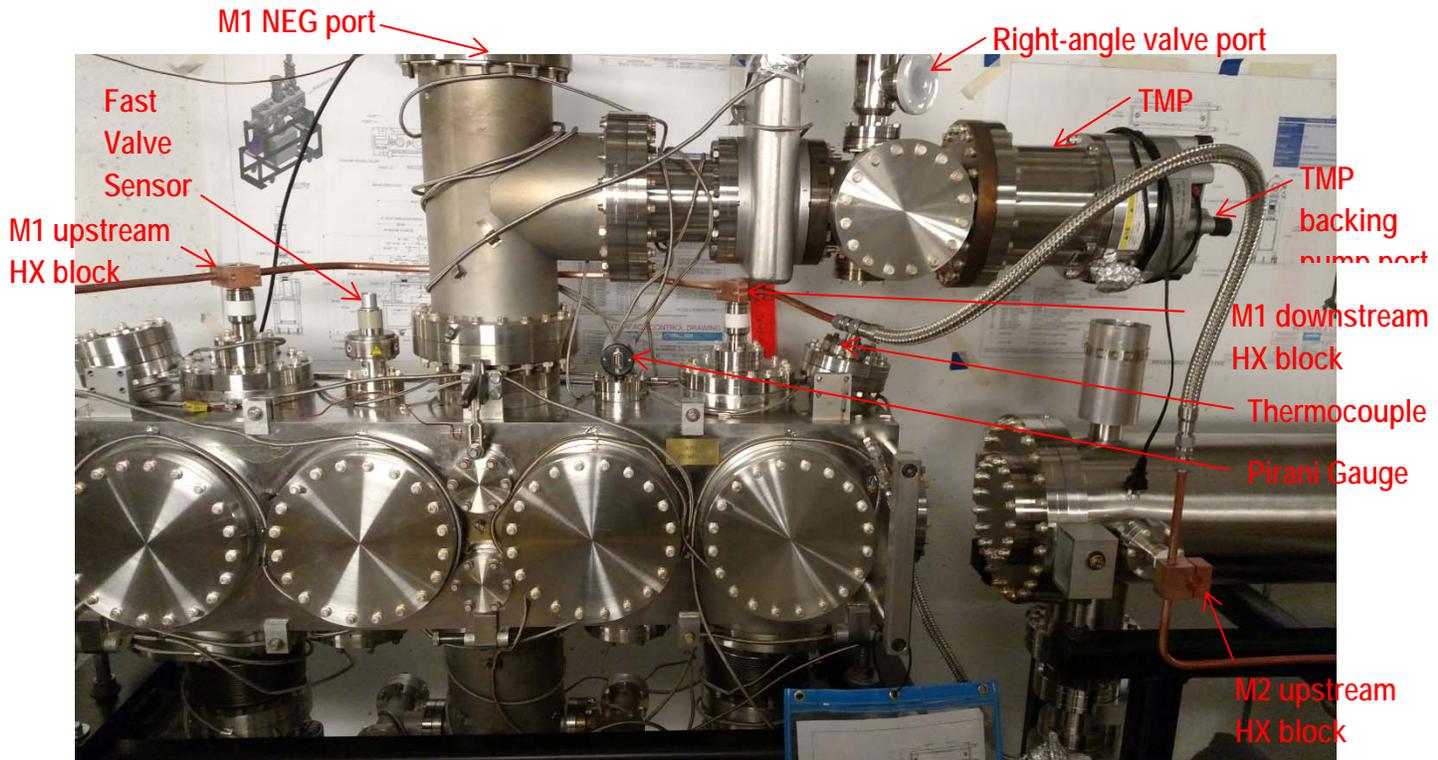
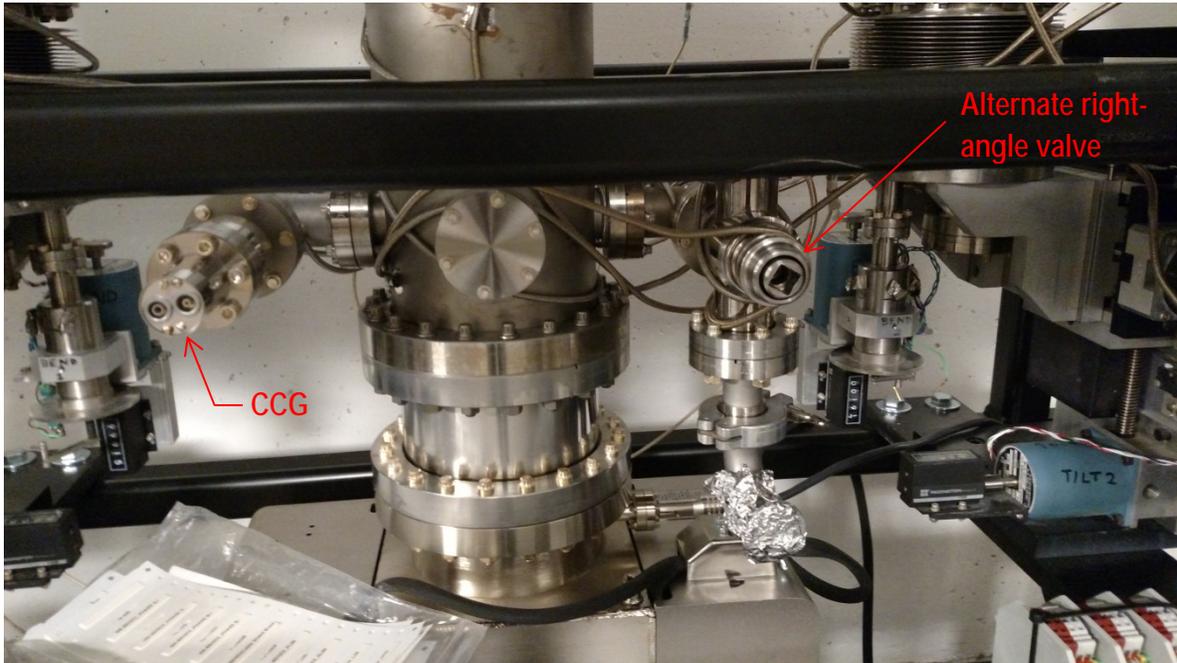
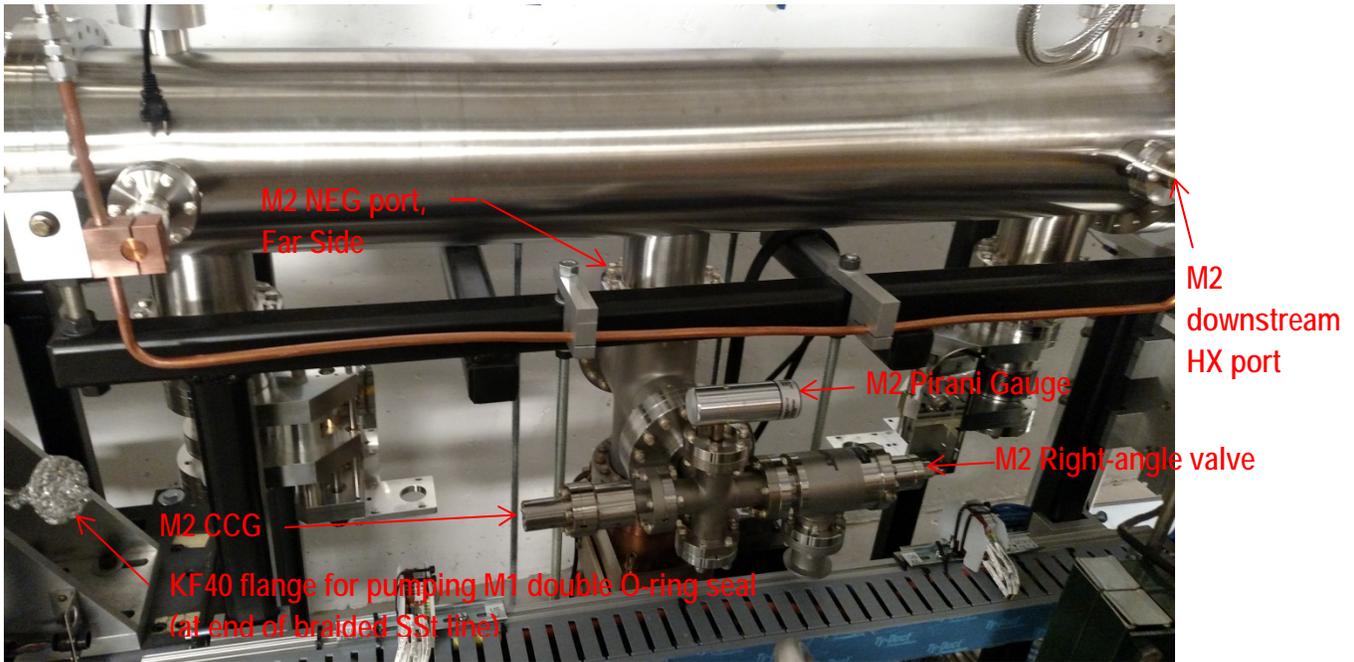


Figure 2: (a) 8-BM Front End; View looking outboard at M1 Mirror with TMP and pumping cross connected

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(b) Lower section of M1 Mirror system showing additional connections



(c) M2 Mirror connections and M1 Mirror O-ring seal connection

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REVISION HISTORY

REVISION	SECTION(S)	PAGE #	DATE	List of Reviewers	DESCRIPTION
1	All	All	05AUG2016	See Cover.	First Issue.

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