HESSI SPACECRAFT

SPECTROMETER PUMP INSTALLATION

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DOCUMENT REVISION RECORD

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Western Range/NASA Safety:_____ _____
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Project Manager: _____ _____
Peter Harvey Date

System Engineer: _____ _____
David Curtis Date

QA: _____ _____
Ron Jackson Date

1.0 INTRODUCTION

This procedure provides the necessary instructions for attaching the Spectrometer Vacuum pump to the HESSI Spectrometer. This pump must always be attached to the spacecraft except during transport. The document describes the equipment, personnel, and steps necessary to safely connect the pump.

1.1 Reference Documents

1. NHB5300.4(3L) Requirements for Electrostatic Discharge Control
2. FED-STD-209 Airborne Particulate Cleanliness Classes in Clean Rooms and Clean Zones.

2.0 APPLICATION

The HESSI payload will be transported several times while at VAFB and KSC. Each time, the pump will require removal and installation. Pump installations will occur after:
[1] Spacecraft delivery to VAFB 836;
[2] Spacecraft rotation for Spectrometer Warmup;
[3] Spacecraft delivery to VAFB 1555;
[4] Spacecraft rotation for PAF integration;
[5] Spacecraft integration to LV;
[6] Fairing installation;
[7] LV mate to OCA;
[8] Delivery to KSC;
[9] Any Return-to-Base Operations.

3.0 CLEANLINESS AND ENVIRONMENT

The HESSI payload should be treated as ESD sensitive, and handled per MIL-STD-1686 Class 1, and NHB5300.4(3L) Requirements for Electrostatic Discharge Control.

The HESSI payload is contamination sensitive, and must be handled with appropriate care. At all times, the payload will be handled per FED-STD-209 Airborne Particulate Cleanliness Classes in Clean Rooms and Clean Zones.

The payload will be handled only by personnel wearing attire appropriate for a FED-STD-209 Class 100,000 cleanroom, including gloves. Gloves and wrist straps will be required.

4.0 REQUIRED PERSONNEL

Only the Project Manager, System Engineer or Quality Assurance have the authority to make changes in this procedure if the need arises.

Whenever the spectrometer pump is to be connected or disconnected, the Spectrometer Engineer must be present.

5.0 SAFETY

There are no safety issues in this procedure.

6.0 PRECAUTIONS

The pump cart shall be grounded with a heavy braid prior to connection to the spectrometer.

7.0 PROCEDURE

1. Placing the Pump Cart

   The pump cart must be placed so that the hose forms a smooth, low-stress path to the valve, and the actuator *must be very close to coaxial* with the valve before it is screwed to it to avoid imposing any moments on the valve tube. The hose must lie such that there is a *minimum of 3" clearance* between the valve actuator and hose and the S/C connectors the left of it. If possible, the cart should be perpendicular to the S/C so that the hose makes a straight run to the actuator. The height of the blue hydraulic platform must be adjusted as well to *keep the hose path as straight as possible* in the vertical plane. When the hose is evacuated, it contracts a few inches in length. The cart must be positioned so that when the valve actuator is on the valve, the *turbopump slider has a minimum of 3" of travel remaining* so that the hose contraction can be accommodated without pulling on the valve.

2. Preparing the Cryostat Valve

   Remove the green valve cover and place threads down on a clean wipe.
   Inspect the Viton seal for any lint or other dirt, and clean by wiping with a clean wipe. *This seal must be perfectly clean on its sealing faces*. Do not use alcohol on seal.

3. Preparing the Valve Actuator

   Unscrew the brass collar from the red end plug. Screw the plug onto the green valve cover to keep the seal clean. *Wipe the actuator sealing face* with a clean wipe and inspect for lint or dirt. Alcohol may be used if necessary. This surface must be perfectly clean.

4. Attaching the Actuator

   Once the cart placement is correct, *attach the actuator to the valve*. Retract the black knob marked MDC such that the brass valve-core remover is inside the actuator body at least an inch. Place the actuator onto the valve, being careful not to scrape or knock the sealing surfaces. Screw the brass hand nut onto the valve, being very careful not to cross thread it. If it doesn't go on easily, don't force it. The actuator and the valve body MUST be coaxial for the nut to screw on properly. If it binds, try rocking the actuator slightly to find a position that eliminates the binding. Tighten the nut snugly by hand. There is a spanner wrench that fits into the holes in the nut, but it must be used with great caution. The object is to tighten the nut until the metal parts are in snug contact only. Over tightening will not improve the seal, only gall the parts.

5. Starting the Pump

   If the turbopump has been run in the last hour, it must be spun down before starting to pump (see *spin-down* procedure below. Verify that there is 60 to 80 psi on the valve gas supply regulator. *Open the gate valve* by pushing the green "open" button on the pump control panel. The valve will make a clank when it opens and should actuate in under one second. *Start the pump* by pushing the "Start/Stop/Reset" button on the pump control panel. This starts the pump in "soft start" mode, which steps up the pump speed over a 5-10 minute period to its full speed operation of 56K rpm. The start up can be monitored by pushing the "pump current/temp/power" button.

6. Start the Nude Ion Gauge

   Wait for the "high vac" thermocouple gauge to read 1 x 10^{-3} torr (the minimum reading). *Push the "emmision" button* on the gauge controller until it beeps. The readout will read the pressure after a ~5 sec initialization.

7. Pump to Operating Pressure

Allow the pump to *evacuate the hose* to a pressure below that of the cryostat before opening the cryostat valve. If the detectors are cold, the max pressure is 2×10^{-6} torr. If the detectors are warm, the max pressure is 2×10^{-5} torr.

8. Start the Differential Seal Pump

Do not move the actuator shaft when the system is under vacuum without the differential pump running. Open the ballast gas valve (small knurled brass knob on top of the pump – not the fill port) on the differential seal pump (the pump mounted above the turbo pump) one half turn. *Turn the pump on* via the switch on its rear. *Close the gas ballast valve*.

9. Engage the Valve Actuator

Push the black knob marked MDC slowly *into the valve plug* while twisting it back and forth. The actuator should always be moved in this fashion, and you should watch the nude ion pressure gauge to verify that moving the shaft does not cause a pressure jump due to gas leaking around its seals. When it reaches bottom, push lightly and turn it until it drops into and engages the ears on the valve plug.

10. Open the Cryostat Valve and Commence Pumping

Turn the knob counterclockwise about 12 turns to *open the valve*. You can tell if its all the way out by pushing it in lightly while turning it and feeling for a click and a slight drop of the handle as the thread skips at its end of travel. Pull the knob slowly out while twisting back and forth until it reaches the end of its travel. Expect to see a small pressure rise as the valve opens and gas comes out of the cryostat. Clip the valve retainer tube onto the shaft to prevent it from retracting. The cryostat is now pumping down.

11. Shut down Differential Seal Pump

Open the ballast gas valve (small knurled brass knob on top of the pump – not the fill port) on the differential seal pump one half turn. Wait 3 seconds *Turn the pump off* via the switch on its rear. *Close the gas ballast valve*.

12. Spin-Down Procedure

If the pump has been run in the previous hour, it is probably still spinning too fast to dump 1 atm. into. Crack open the spin-down valve (small, cylindrical knurled knob at the rear side of the turbopump) a fraction of a turn for a ¼ second or so to allow a small burp of air into the backside of the pump. You should hear the air suck in, and the turbine blades begin to whine in a decreasing pitch as they load up and slow down. Allow to slow down for 5-10 minutes.

8.0 CONTINGENCIES / OTHER

What to do if the Pump Won't Reach Operating Pressure Before Opening Valve

This means either A) there is a lot of water adsorbed onto the interior surfaces, in which case it needs to pump longer, or B) there is a leak. The time required to reach 2×10^{-6} torr should not exceed 1 hour; the time required to reach 2×10^{-5} torr should not exceed 1/2 hour. If a leak is suspected, the greatest likelihood is that the seal on the valve is contaminated.

To clean the seal:

Close the gate valve, backfill the hose with N_2 by dialing the purge regulator to 2 psi and opening the green-handled valve at the base of the hose. Unscrew the brass hand nut, remove the actuator, and remove the seal. If you can't get it out by hand, pry it out gently with a smooth tool. Clean the seal by wiping it with a clean wipe and remove all visible dust and lint. Do not use alcohol on the seal. The clean wipe may be moistened with water if necessary. Clean the seal gland with a folded clean wipe moistened with alcohol; repeat for the sealing surface on the actuator. A very thin coating of Apiezon L may be wiped on with a clean wipe if the seal seems dry or if the pump still won't reach operating pressure.