GRAVITY PROBE B
PROCEDURE FOR
SCIENCE MISSION DEWAR

INSTALLATION OF
FEE GUARD TANK VENT LINE
AND LEAK CHECK WITH SV VERTICAL

P0916 Rev-

May 16, 2002

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REVISION RECORD

REVISION	ECO	PAGES	DATE
Original	-	All	May 16, 2002

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LIST OF ABBREVIATIONS AND ACRONYMS

AG-x	Gauge x of Gas Module auxiliary section
AMI	American Magnetics Inc.
ATC	Advanced Technology Center
APR-x	Pressure regulator x of Gas Module
AV-x	Valve x of Gas Module auxiliary section
CG-x	Gauge x of portable helium pressurization source
CPR-x	Pressure regulator x of portable helium pressurization
CV-x	Valve x of portable helium pressurization source
CN [xx]	Data acquisition channel number
DAS	Data Acquisition System
EFM	Exhaust gas Flow Meter
EG-x	Gauge x of Gas Module exhaust section
EH-x	Vent line heat exchanger in Gas Module
EM	Electrical Module
ERV-x	Relief valve of Gas Module exhaust section
EV-x	Valve number x of Gas Module exhaust section
FCV	Fill Cap Valve
FEE	Forward Equipment Enclosure
FIST	Full Integrated System Test
FGTVL	FEE Guard Tank Vent Line
GHe	Gaseous Helium
GM	Gas Module
GP-B	Gravity Probe-B
GSE	Ground Support Equipment
GT	Guard Tank
GTVC	Guard Tank Vent Cap
GTVC-G	Guard Tank Vent Cap pressure gauge
GTVC-RV	Guard Tank Vent Cap relief valve
GTVC-V	Guard Tank Vent Cap valve
GTV-G	Guard Tank vent pressure gauge
GTV-RV	Guard Tank vent relief valve
GTV-V	Guard Tank vent valve
GTV-Va	Guard Tank Vent auxiliary valve
KFxx	Quick connect o-ring vacuum flange (xx mm diameter)
LHe	Liquid Helium
LHSD	Liquid Helium Supply Dewar
LHV-x	Liquid Helium Supply Dewar valves
LLS	Liquid level sensor
LM	Lockheed Martin Co.
MT	Main Tank
MTVC	Main Tank Vent Cap
MTVC-G	Main Tank Vent Cap pressure gauge
MTVC-RV	Main Tank Vent Cap relief valve
MTVC-V	Main Tank Vent Cap valve
NBP	Normal boiling point
ONR	Office of Naval Research
FCG	Fill Cap assembly pressure Gauge
PFM	Pump equipment Flow Meter
PG-x	Gauge x of Pump equipment
PM	Pump Module
Psi	pounds per square inch
Psig	pounds per square inch gauge
PV-x	Valve x of the Pump equipment
QA	Quality Assurance
RAV-x	Remote Actuated Valve-x
RGA	Residual Gas Analyzer
SMD	Science Mission Dewar
STV	SMD Thruster vent Valve
SU	Stanford University
SV-x	SMD Valve number x
TG-x	Gauge x of Utility Turbo System
TV-x	Valve x of Utility Turbo System
UTS	Utility Turbo System
Vac	Vacuum
VCP-x	Vent cap pressure gauge
VCRV-x	Vent cap relief valve
VCV-x	Vent cap valve
VDC	Volts Direct Current
VF-x	Liquid helium Fill line valve
VG-x	Gauge x of Vacuum Module
VM	Vacuum Module
VV-x	Valve x of Vacuum Module
VW-x	Valve x of Dewar Adapter

A. Scope

This procedure describes the steps to effect the removal and replacement of the Guard Tank Short Vent Line with the FEE Guard Tank Vent Line. This process assumes liquid helium in the Guard Tank and the SV in a vertical orientation. The steps for installing the FEE Guard Tank Vent Line are given in a LM Operations Order No. INT-251 and will be carried out by LM personnel.

B. Safety

B.1. Potential Hazards

Liquid helium used in the SMD represents a hazardous material for the personnel involved in the operations. Cryogenic burns can be caused by contact with the cold liquid or gas, high pressures can result if boiling liquid or cold gas is confined without a vent path, and asphyxiation can result if the vent gas is allowed to accumulate.

The SMD Safety Compliance Assessment, document GPB-100153C discusses the safety design, operating requirements and the hazard analysis of the SMD.

B.2. Mitigation of Hazards

B.2.1. Lifting hazards

There are no lifting operations in this procedure

B.2.2. Cryogenic Hazards

Temperature and pressure alarms, provided by the DAS, warn of potential over-pressure conditions. Emergency vent line deflectors are installed over the four burst disks on the SMD vacuum shell.

Only authorized and trained LM and SU personnel are allowed in proximity to the SV without escort. All personnel working at a height 30 inches or more off the floor are required to have a LM approved air tank within easy reach. In the unlikely event of a large LHe spill all employees have been instructed to evacuate the room and contact LM safety.

The following additional requirements apply to all personnel involved directly in cryogenic operations. Gloves that are impervious to liquid helium and liquid nitrogen are to be worn whenever the possibility of splashing or impingement of high-velocity cryogens exists or when handling equipment that has been cooled to cryogenic temperatures. Protective clothing and full-face shields are to be worn whenever the possibility of splashing cryogens exists.

B.2.3. Other Hazards

When appropriate, tools or other items used with the potential to damage the SMD or Probe shall be tethered.

B.3. Mishap Notification

B.3.1. Injury

In case of any injury obtain medical treatment by immediately calling 117

B.3.2. Hardware Mishap

In case of an accident, incident, or mishap, notification is to proceed per the procedures outlined SU P0879 and as referenced therein to Lockheed Martin Engineering Memorandum EM SYS229.

B.3.3. Contingency Response

Contingency responses to possible equipment troubles or irregularities (e.g., power failure) are listed in Appendix 3.

C. Quality Assurance

C.1. QA Notification

The NASA representative and SU QA shall be notified 24 hours prior to the start of this procedure. Upon completion of this procedure, QA will certify his/her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the designated place(s) in this document.

C.2. Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the Test Director or his designate and shall be approved by the QA Representative. Additionally, approval by the Payload Technical Manager shall be required, if in the judgment of the test director or QA Representative, experiment functionality may be affected.

C.3. Discrepancies

A Quality Assurance Representative designated by D. Ross shall review any discrepancy noted during this procedure, and approve its disposition. Discrepancies will be recorded in a D-log or a DR per Quality Plan P0108. Any time a procedure calls for verification of a specific configuration and that configuration is not the current configuration; it represents a discrepancy of one of three types. These types are to be dealt with as described below.

C.3.1. If the discrepancy has minimal effect on procedure functionality (such as the state of a valve that is irrelevant to performance of the procedure) it shall be documented in the procedure, together with the resolution. Redlines to procedures are included in this category.

C.3.2. If the discrepancy is minor and affects procedure functionality but not flight hardware fit or function, it shall be recorded in the D-log. Resolution shall be in consultation with the Test Director and approved by the QA representative.

C.3.3. All critical and major discrepancies, those that effect flight hardware fit

or functions, shall be documented in a D-log and also in a Discrepancy Report, per P0108.

D. Test Personnel

D.1. Personnel Responsibilities

The performance of this procedure requires a minimum complement of personnel as determined by the Test Director. However, during the startup of the transfer (Sec. G.14), there are to be a minimum of two qualified persons (Sec. D.3) in attendance. The person performing the operations (Test Director or Test Engineer) is to sign the "Completed by" sign-off. Any other qualified person or QA person who can attest to the successful performance of this procedure may sign the "Witnessed by" sign-off. The Test Director will perform pre-test and Post-Test briefings in accordance with P0875 "GP-B Maintenance and Testing at all Facilities". Checklists will be used as directed by P0875.

D.2. Personnel Qualifications

The Test Director must have a detailed understanding of all procedures and facility operations and experience in all of the SMD operations. Test Engineers must have SMD Cryogenic operations experience and an understanding of the operations and procedures used for the cryogenic servicing/maintenance of the Dewar.

D.3. Qualified Personnel

The names of those actually performing this procedure are to be initialed and the name of the person acting as Test Director should be circled.

Test Director	Test Engineer
Mike Taber Dave Murray	Tom Welsh Ned Calder

E. Requirements

E.1. Electrostatic Discharge Requirements

All work on the SV requires the use of grounding wrist straps attached to grounding points on the SV per LM requirement.

E.2. Lifting Operation Requirements

There are no lifting operations in this procedure

E.3. Hardware/Software Requirements

E.3.1. Commercial Test Equipment

Leak Detector

E.3.2. Ground Support Equipment

The Ground Support Equipment includes the Gas Module, the Pump Module, the Electrical Module, and the Vacuum Module. The Gas Module provides the capability to configure vent paths, read pressures and flow rates, and pump and backfill vent lines. The Pump Module provides greater pumping capacity than the Gas Module, together with additional flow metering capabilities. The vent output of the Gas Module flows through the Pump Module. The Electrical Module contains the instruments listed in Table 1(see the Electrical Module Manual for details), and provides remote control of valves in the Gas Module, Pump Module, and SMD. The Vacuum Module contains a turbo pump, backed by a vane pump, and provides the capability to pump out the SMD vacuum shell.

This procedure uses hardware located in the Gas Module (Figure 1), the Pump Module and the Electrical Module (Table 1). However, the Pump Module may be omitted if a stand-alone gas meter (a substitute for PFM-1) is connected at the Gas Module Vent Output. The primary helium vent and all vane pump exhausts must be connected to an outside vent.

E.3.3. Computers and Software:

The Data Acquisition System (DAS) and data acquisition software are required for this procedure. The DAS reads and displays pressures, temperatures, and flow rates and monitors critical parameters. No additional computers or software are required.

E.3.4. Additional Test Equipment

Description	Manufacturer	Model
AMI Level Sensor Readout for LHSD	AMI	110

E.3.5. Additional Hardware

Description	Manufacturer	Model
SMD Vent Bayonet O-rings	Parker	2-027
SMD Bayonet fit check tool	SU	N/A
Apiezon	MI Products Ltd	Model N
No. 5 rubber stopper with .5 psid relief valve	N/A	N/A

E.3.6. Tools

Description	Serial No.	Cal Due
Strap wrench 2-in.	N/A	N/A

E.3.7. Expendables

Description	Quantity	Mfr./Part No.
Ethyl alcohol	AR	N/A
99.99% pure gaseous helium	AR	N/A
Tie wraps – large size	AR	N/A

E.4. Instrument Pretest Requirements

The GSE instruments required to perform this procedure are listed in Table 1, together with their serial numbers, where available. Instruments that are required to have current calibrations are indicated in the Cal-Required column. Instruments that do not require calibration are those not used to verify performance requirements and are not connected to flight instrumentation. The status column is to be filled in with the due date of the instrument calibration sticker and verified to be in calibration by QE or QE designee. Serial numbers are to be updated as appropriate.

Table 1. Required Instrumentation and Calibration Status

No.	Location	Description	User Name	Serial No.	Cal Required	Status Cal due date
1	DAS	Power Supply, H-P 6627A	A1, A2, A3, A4	3452A01975	Yes	
2	DAS	Power Supply, H-P 6627A	B1, B2, B3, B4	3452A01956	Yes	
3	DAS	Data Acquisition/Control Unit H-P 3497A	-	2936A245539	No	-
4	DAS	Digital Multimeter H-P 3458A	-	2823A15047	Yes	
5	EM	Vacuum Gauge Controller Granville-Phillips Model 316	EG-1a, -1b	2827	No	-
6	EM	Vacuum Gauge Controller Granville-Phillips Model 316	AG-2a, -2b	2826	No	-
7	EM	Vacuum Gauge Controller Granville-Phillips Model 316	EG-3	2828	No	-
8	EM	MKS PDR-C-2C	EG-2, FCG	92022108A	No	-
9	EM	Flow meter – Matheson 8170	EFM-1	96186	No	-
10	EM	Flow meter totalizer Matheson 8124	EFM-1	96174	No	-
11	EM	Liquid Helium Level Controller American Magnetics, Inc. 136	LLS Main Tank	96-409-11	No	-
12	EM	Liquid Helium Level Controller American Magnetics, Inc. 136	LLS Guard Tank	96-409-10	No	-
13	EM	Liquid Helium Level Controller American Magnetics, Inc. 136	LLS Well	96-409-9	No	-
14	EM	Liquid Helium Level Controller American Magnetics, Inc. 136	LLS Axial Lock	96-409-12	No	-
15	EM	Pressure Controller – MKS 152F-92	EV-7a, -7b	96203410A	No	-
16	EM	Power Supply HP 6038A	H08D Tank Heater	96023407A	Yes	

No.	Location	Description	User Name	Serial No.	Cal Required	Status Cal due date
17	EM	Power Supply HP 6038A	H09D Tank Heater	3511A-13332	Yes	
18	EM	Power Supply HP 6038A	RAV Power Supply	3329A-12486	Yes	
19	EM	Vac Ion Pump power supply Varian 929-0910, Minivac	SIP	5004N	No	-
20	EM	Flow meter totalizer Veeder-Root	PFM-1	576013-716	No	-
21	GM	Pressure Gauge, Heise	AG-1	CC-122077	No	-
22	GM	Pressure Gauge, Marshall Town	AG-3	N/A	No	-
23	GM	Main Tank Heat Exchanger: a) Thermocouple, b) Current meter, c) Temperature set point controller	EH-1	C-19950	No	-
24	GM	Guard Tank Heat Exchanger: a) Thermocouple, b) Current meter, c) Temperature set point controller	EH-2	C-09920	No	-
25	VM	Vacuum Gauge readout, Granville-Phillips 316	VG-3 VG-4	2878	No	-
26	VM	Vacuum Gauge readout, Granville-Phillips 360	VG-1, VG-2 VG-5	96021521	No	-
27	Leak Detector	Standard leak internal to leak detector	N/A	-	N/A	Yes

E.5. Configuration Requirements

E.5.1. Main Tank

Liquid in the Main Tank must be at its normal boiling point (NBP), 4.2 K. The SMD is vertical with the +Z axis up. The actuator control valve for EV-9 controls the state to which EV-9 defaults should a power failure occur. For this procedure it must be in the “NBP.” Position, ensuring that EV-9 remains open in the event of power failure.

E.5.2. Guard Tank

The Guard Tank is filled with liquid helium to a level greater than 20%.

E.5.3. Well

The Well is evacuated and the Well pump-out at VTH may be in one of the following configurations:

1) closed with the VTH operator removed;
2) have the Well manifold connected to a closed VTH; or
3) have an open VTH with a pumpout valve, VW-3, and convectron, PW-2, making up the Well manifold.

E.5.4. SMD Vacuum Shell

The Vacuum Shell pressure must be less than 1×10^{-4} torr.

E.5.5. Alarm System

1. The DAS alarm system must be enabled and contain the following alarm set-points:
   a. Top of lead bag temperature set (CN 28) at $T \leq 6.5$ K.
   b. Top of lead bag temperature set (CN 29) at $T \leq 6.5$ K.
   c. Relative Guard Tank Pressure (CN 46) set at $\Delta P \geq 0.3$ torr.
2. The watchdog alarm must be armed.

E.5.6. GSE and Non-flight Hardware

1. A relief valve or flight-like burst disk may be installed in place of the SMD fill-line burst disk.
2. The ion-pump magnet must be installed.
3. GSE cabling must be connected between the SMD and the Electrical Module (P/N 5833812) and between the SMD and the Data Acquisition System (P/N 5833811).
4. The Main Tank is venting to the room via the Main Tank vent cap assembly.
5. The Guard Tank is pressurized at the GTVA via the GTV-Va valve and then to the GM helium source at APR-2V.
6. The thruster vent port must be plumbed to an Endevco pressure transducer, STG.
7. The Fill Cap Assembly must be installed at SV-13 (Figure 3)
8. Top Plate heaters must be installed on SMD and be operational.

E.6. Optional Non-flight Configurations

The following non-flight modifications of the basic SMD and optional GSE configurations are incidental to the performance of this procedure. Any combination represents an acceptable configuration.

1. The SV is installed in: the SMD transportation and test fixture or in the space vehicle assembly fixture; or the space vehicle tilt dolly.
2. A foreign object and debris shield may cover the upper cone of the SMD. If it is not present, any object that could cause damage to the payload, if dropped, must be tethered.
3. The Vacuum shell pump out port at SV-14 may be connected to the Vacuum Module (P/N 5833816) via a 2-in valve and valve operator and pumping line, with the valve in either the closed position or in the open position. The Vacuum Module pump may be off, actively pumping the pumping line up to a closed SV-14, or actively pumping the vacuum shell
4. If the Vacuum shell operator is not installed, then the vacuum shell valve is closed and capped off.

E.7. Verification/ Success Criteria

N/A

E.8. Payload Constraints and Restrictions

N/A

F. **Reference Documents**

F.1. Drawings

Drawing No.	Title
LMMS-5833394	Instrumentation Installation

F.2. Supporting documentation

Document No.	Title
LMMC-5835031	GP-B Magnetic Control Plan
GPB-100153C	SMD Safety Compliance Assessment
EM SYS229	Accident/Mishap/Incident Notification Process
LMSC-P088357	Science Mission Dewar Critical Design Review
SU/GP-B P0108	Quality Plan
LMMS GPB-100333	Science Mission Dewar Failure Effects and Causes Analysis
SU/GP-B P059	GP-B Contamination Control Plan
SU/GP-B P0879	GP-B Accident/Incident/Mishap Notification Process

F.3. Additional Procedures

Document No.	Title
SU/GP-B P0213	Connect Vacuum Module/ Pump on SMD Vacuum Shell
SU/GP-B P0676	Connect Guard Tank Vent Line to Gas Module
SU/GP-B P0875	GP-B Maintenance and Testing at all Facilities
SU/GP-B P0879	Accident/Incident/Mishap Notification Process

Operation Number:_____

Date Initiated:_____

Time Initiated:_____

G. Operations

G.1. Perform Preparatory Operations

G.1.1. Verify SU QA notified.

Record: Individual notified _____,

Date/time _____/_____.

G.1.2. Verify NASA representative notified.

Record: Individual notified _____,

G.1.3. Verify LM SV Operations representative (Frank Mendoza, Norm Bennett) notified of approximate time for RAV-2 operations.

Record: Individual notified _____,

Date/time _____/_____.

G.1.4. Record calibration due dates in Table 1 (Sec. E.4).

G.1.5. Verify that persons actually performing this procedure have initialed their names in Sec. D.3 and the name of the Test Director is circled.

G.1.6. Verify Pre-ops meeting with operations group has been conducted.

G.1.7. Verify Purity of All Sources of Helium Gas

Record serial number on helium bottle/s.

1. _____ 2._____ 3. _____
4. _____ 5 _____ 6. _____

G.1.8. Verify helium bottle/s have been tested for purity and record Op. Number. Op. Number:_____

Date/time _____/_____.

Quality _____

G.2. **Connect GTV to GM**

G.2.1. Connect GTVA to GM using procedure "Connect Guard Tank Vent to Gas Module, P0676, Record Op number _____. **Note:** Stop the procedure at the completion of para. G.6.11, **the point at which the UTS is pumping up to a closed GTV-V and with the Guard Tank pressurized at GTV-Va from the helium 6-pack.**

G.2.2. Record: Date/Time _____

G.3. **Verify Configuration Requirements**

G.3.1. Ensure DAS Watch Dog Alarm enabled.

G.3.2. Ensure that Top Plate heaters on SMD are operational.

G.3.3. Verify GSE cabling, excluding P801 and P802 flight cables, are connected between SMD, Electrical Module, Gas Module and Data Acquisition System.

G.3.4. Record MT pressure (STG) ____ torr.

G.3.5. Verify DAS and liquid level alarms enabled and record set points.

1. Main Tank level ("A" or "B"): Record set point _____%
2. Top of lead bag temperature/a – verify [CN 28] on DAS alarm list and set to alarm at $T \leq 6.5$ K. Record set point _____K
3. Top of lead bag temperature/b – verify [CN 29] on DAS alarm list and set to alarm at $T \leq 6.5$ K. Record set point _____K
4. Relative Guard Tank Pressure – verify [CN46] on DAS alarm list and set to alarm at $\Delta P \geq 0.3$ torr. Record set point _____torr
5. Relative Main Tank Pressure – verify [CN49] on DAS alarm list and set to alarm at $\Delta P \geq 4.0$ torr. Record set point _____to

G.3.6. Verify orientation of SMD/SV: is vertical with +Z up.

G.3.7. Verify Main Tank is venting to the room via the Main Tank Vent Cap Assembly (MTVCA) relief valve.

G.3.8. Verify Guard Tank is venting via the GTV-RV of GTVA.

G.3.9. Verify connected/connect the DAS Endevco read out to GTV-G (2 psid) on the GTVA and verify read out and DAS receive appropriate indicated values.

G.3.10. Ensure ion-pump magnet and signal cable installed.

G.3.11. Record Vacuum Shell Pressure.

1. Turn on Vac-ion pump and record time of day _____
2. Use DAS [Monitor Data] for CN 99.
3. When value is steady, record pressure (IP) _____ torr. If pressure is above $1x10^{-4}$ torr, perform procedure P0213, *Connect of Vacuum Module / Pump on SMD Vacuum Shell*, to connect Vacuum Module and pump out SMD vacuum shell.
   - Pressure is $<5x10^{-5}$ torr, continue at step 4.
   - Pressure is $>5x10^{-5}$ torr, turn of vac-ion pump and perform P0213, record date/time _____.

4. Exit [Monitor Data] and collect data with [Set Data Interval] to 10 min.
5. When data cycle is complete, turn off Vac-ion pump.

G.3.12. Verify Actuator Control for EV-9 set to “NBP” position.

G.3.13. Record: Date/Time _____

Quality _____

G.4. **Verify Gas-Module Configuration and Record Initial Conditions**

G.4.1. Verify valve states as indicated in following Table.

Verify Initial Valve States		
	Verify Open/Active	Verify Closed
Main Tank vent Not Connected to GM, venting to room	SV-9, MTVC-RV	MTVC-Va
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the UTS up to GTV-V Venting	TV-1, TV-2, EV-5, EV-14, EV-4, EV-7A/B, **EV-16** **GTV-RV**	GTV-V, GTV-Va
Remaining EV valves		All other EVs
AV valves	APR2, APR2-V	All other AVs

G.4.2. Record initial temperatures

1. Top of Lead Bag CN [28] _____ K.
2. Top of Lead Bag CN [29] _____ K.
3. Temperature at bottom of Main Tank CN 09] _____K.

G.4.3. Record pressures.

1. Guard Tank (GTV-G) CN[46]:_____ torr (relative to atm.)
2. Main Tank (STG) CN[49]:_____ torr. (Endevco on Thruster Vent Manifold)

G.4.4. Record liquid level in Main Tank _____ %.

G.4.5. Record liquid level in Guard Tank _____ %.

G.4.6. Verify Main Tank liquid level is above 35%.

G.4.7. Verify Guard Tank liquid level is above 20%.

G.4.8. Record status of Well pump-out:

- VTH closed and Well manifold not installed.
- Well manifold installed, record valve positions and pressure:

  VTH ____ , VW-3 _____ , PW-1 _____ torr.

Quality_____

G.5. **Set Up Data Acquisition System**

Note: Refer to DAS operating instructions for information on configurations and mechanics of keyboard/mouse operation.

G.5.1. Verify DAS set to configuration 4Y.

G.5.2. Set DAS to fast scan mode using [other menus], [data config], [fast scan] and [Remove MultScan]

G.5.3. Record directory and data file name _____.

G.5.4. Start "Special Data Cycle" by using [Other Menus] + [Special Data Col].

G.5.5. Enter CNs: 28, 24, 64, 46 (GTV-G) and 49 (ST-G, Thruster Vent) and 114 (EG-1a).

G.5.6. [Init. Collectn]

G.5.7. [Enter] use default file name.

G.5.8. Record directory and special data file name _____.

G.5.9. Ensure printer is displaying special Data Cycle data.

G.5.10. Connect/verify connected power supply A1 and A2 to Guard Tank heaters H03D and H-04D.

G.5.11. Turn on power supply A and set outputs A1 and A2 to 0.08 amp current limit.

G.5.12. Verify heater power to H03D and H04D are recorded and plotted at DAS.

G.5.13. Record heater settings in Table G.5

Table G.5 Guard Tank Heater

Date/Time	H03D CN64	H04D CN66	GT Temp CN24	Lead Bag CN28	
	Watt	Watt	K	K	

Quality_____

G.6. **Prepare FEE Guard Tank Vent Line (FGTVL)**

G.6.1. Record the bayonet female fit check gap measurements made in LM operations order No. INT-251 for the inboard FEE Guard Tank Vent Line.

1. Maximum gap _____
2. Minimum gap _____

G.6.2. Record the bayonet male fit check gap measurements made in LM operations order No. INT-251 for the outboard end of the FEE Guard Tank Vent Line.

1. Maximum gap _____
2. Minimum gap _____

G.6.3. At a convenient time enter the above values in the Bayonet Usage Book.

G.6.4. Prepare a new bayonet O-ring (Parker Viton 2-027) with a thin layer of Apiezon N vacuum grease.
Record: Lot No. _____ , Expiration date _____ .

G.6.5. Install the O-ring into the outlet bayonet O-ring groove of the FGTVL.

G.6.6. Valve configuration: Same as G4.1

Quality_____

G.7. **Remove GT Short Vent Line**

G.7.1. Prepare a No. 5 rubber stopper with a 1 psid relief valve (1/8-in NPT size)

CAUTION

In the following steps the Guard Tank pressure must be prevented from going subatmospheric which could result in air contamination and plugging of the internal Guard Tank vent. Corrective action is to increase the flow rate by raising the Guard Tank heater voltages.

G.7.2. Remove GTSVL from SMD GT vent port (B2) and **Immediately** install No. 5 stopper/relief valve.

G.7.3. Verify Guard Tank is venting via stopper/RV combination.

G.7.4. Remove O-ring from SMD bayonet and clean O-ring groove with clean room wipes and ethyl/isopropyl alcohol.

G.7.5. Remove stopper assembly and:

Immediately insert the male bayonet gauge fit check and using feeler gauges measure gap and record:

Maximum gap _____ Minimum gap _____

G.7.6. Remove tool and reinstall stopper.

G.7.7. Prepare a new bayonet O-ring (Viton 2-027) with a thin layer of Apiezon N vacuum grease.
Record: Lot No. _____ , Expiration date _____ .

G.7.8. Install the O-ring into the SMD Guard Tank vent bayonet O-ring.

G.7.9. Remove the Guard Tank Vent Assembly (with GTLVL attached) from the GTSVL and install onto the bayonet outlet for FGTVL. Keep helium purge hose on closed GTV-Va and signal cable on GTV-G.

G.7.10. Valve configuration:

Verify Initial Valve States		
	Verify Open/Active	Verify Closed
Main Tank vent Not Connected to GM, venting to room	SV-9, MTVC-RV	MTVC-Va
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the UTS up to GTV-V	TV-1, TV-2, EV-5, EV-14, EV-4, EV-7A/B, EV-16	
Venting	**B2-RV**	GTV-V, GTV-Va
Remaining EV valves		All other EVs
AV valves	APR2, APR2-V	All other AVs

G.7.11. Record: Date/Time _____

Quality_____

G.8. **Install FGTVL**

CAUTION

In the following steps the Guard Tank pressure must be prevented from going subatmospheric which could result in air contamination and plugging of the internal Guard Tank venting. Corrective action is to increase the flow rate by raising the Guard Tank heater voltages.

CAUTION

Watch the special data collection output to warn of excessive lead bag temperatures. Corrective action is to increase Guard Tank flow by increasing Guard Tank heater voltages.

G.8.1. Perform LM operations order No. INT 251 "Install Guard Tank Vent Line …" up to the point of removing B2 rubber stopper.

G.8.2. Verify helium flow from stopper/relief valve.

NOTE

In the following step ensure helium gas flow out of Guard Tank B2 and out of GTVA (open GTV-Va for purging) as FGTVL is assembled to dewar B2.

G.8.3. Continue with the LM operation.

G.8.4. When the operation is completed verify FGTVL has been purged by Guard Tank outflow and the valve GTV-V and GTV-Va are closed with vent path supplied by GTV-RV.

G.8.5. Record: Date/Time _____

Quality_____

G.9. **Preparing Equipment for Leak Detection**

G.9.1. Verify SV is vertical, Main Tank is venting to room via SV-9 and Main Tank Vent Cap Assembly relief valve, MTVC-RV

G.9.2. Ensure 'pump exhaust' of Gas Module is vented to outside of facility.

G.9.3. Close verify/closed RGA-V.

G.9.4. Install Neon Standard Leak at GTV-Va opening GTV-Va to allow purging of NSL flex hose before making plumbing connection.

G.9.5. Record Neon Standard Leak and calculate leak value:

1. Record original leak value _____ sccs Ne.
2. Record original leak calibration date _____ .
3. Record rate of change in leak value _____ %/year.
4. Calculate present leak value _____ sccs Ne.

G.9.6. Leave GTV-Va open.

G.9.7. Verify the configuration of the Vacuum Module, Gas Module, UTS, RGA, Neon Standard Leak and SMD is as shown in Figures 1b with valve configuration as given below.

G.9.8. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the UTS up to GTV-V	TV-1, TV-2, EV-5, EV-14, EV-4, EV-7A/B, EV-16	
Venting	GTV-RV	GTV-V, GTV-Va
Remaining EV valves		All other EV valves
Neon leak valves	GTV-Va	RGA-SOV, RGA-LV, NSL-V
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

Quality_____

G.10. **Remove Liquid Helium from Guard Tank**

G.10.1. Begin recording data in Table G.10.

G.10.2. Input comment to DAS "Begin Guard Tank boil-off".

G.10.3. Verify heater power to H03D and H04D are recorded and plotted by DAS.

G.10.4. When Guard Tank temperature [CN24] reaches 35 +/-5 K, power off heaters.

Table G.10 Guard Tank boil-off Data

Date/Time	H03D	H04D	GT Temp CN24	Lead Bag CN28	GT LLS	
	Watt	watt	K	K	%	

G.10.5. Record: Date/Time _____

Quality_____

G.11. **Pump Guard Tank with AP-1**

G.11.1. Put Gas Module control panel into INTLK DEFEAT.

G.11.2. Turn on/verify on AP-1.

G.11.3. Close EV-5.

G.11.4. Verify RGA-LV closed.

G.11.5. Open RGA-SOV slowly.

G.11.6. Open RGA-V slowly.

G.11.7. Open AV-6: AP-1 now pumping up to closed GTV-V.

G.11.8. Open GTV-V gradually, keeping pressure at EG-1a to less than 20 torr.

G.11.9. Enter comment to DAS: "Begin pumping Guard Tank".

G.11.10. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the AP-1	AV-6, EV-14, EV-4, EV-7A/B, EV-16, GTV-V	
Remaining EV valves		All other EV valves
RGA & Neon leak valves	TV-1, TV-2, RGA-SOV, RGA-V, GTV-Va	RGA-LV, NSL-V
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

NOTE:

The UTS turbo is now pumping up to RGA-LV, EV-21, -22, EV-4, EV-8 and AV-5.

AP-1 is pumping Guard Tank through a partially open GTV-V

G.11.11. Record: Date/Time _____

Quality_____

G.12. **Configure for Neon Leak Detection**

G.12.1. Enter comment to DAS " Start neon leak at 50 torr".

G.12.2. Power-on RGA.

G.12.3. Verify RGA-SOV is open.

G.12.4. Adjust RGA-LV to maintain TG-1 between 1E-5 to 8E-5 torr.

G.12.5. Set up RGA in leak detect mode for mass 20.

G.12.6. Start data recording in Table 1.

G.12.7. Bag/verify bagged, connections at GTVA/GTLVL, FGTVL/GTVA and FGTVL/B2 bayonet.

G.12.8. Install/verify installed regulator on Neon supply Bottle.

G.12.9. When GTV-G is approximately 50 torr proceed with the following steps

G.12.10. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the UTS	AV-6, EV-14, EV-4, EV-7A/B, EV-16, GTV-V	
Remaining EV valves		All other EV valves
RGA & Neon leak valves	TV-1, TV-2, RGA-V, RGA-SOV, RGA-LV, GTV-Va,	NSL-V
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

Quality_____

G.13. **Leak Check at 50 Torr**

G.13.1. Leak Check GTVA/GTLVL Bayonet at 50 Torr: Date/Time _____

1. Record data in Table 1.
2. Open/verify open RGA-SOV.
3. Adjust RGA-LV to maintain TG-1 to 5 +/- $1x10^{-5}$ torr.
4. Verify RGA is in leak check mode for mass 20.
5. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
6. Introduce neon gas into bagged GTV bayonet for 2 mins.
7. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
8. Comments: _____

G.13.2. Leak Check FGTVL/GTVA bayonet at 50 Torr
Date/Time
.

1. Open/verify open RGA-SOV.
2. Adjust RGA-LV to maintain TG-1 to 5 +/- $1x10^{-5}$ torr.
3. Verify RGA is in leak check mode for mass 20.
4. Record steady state data in Table 2 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
5. Introduce neon gas into bagged FGTVL/GTVA bayonet for 2 mins.
6. Record reading _____ amps.
7. Comments: _____

G.13.3. Leak Check FGTVL/B2 bayonet at 50 Torr
Date/Time _____.

1. Adjust RGA-LV to maintain TG-1 to 5 +/- $1x10^{-5}$ torr.
2. Introduce neon gas into bagged FGTVL/B2 bayonet for 2 mins.
3. Record steady state data in Table 2 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
4. Comments: _____
5. Enter comment to DAS “End 50 Torr Leak Test”.

Quality_____

G.14. Pumping Guard Tank to Vacuum and Leak Check

G.14.1. When EG-1a is between 1 and 10 torr, and GTV-V is fully open:

1. Power off RGA and TG-1.
2. Close RGA-LV and RGA-SOV.
3. Close AV-6.

G.14.2. Open EV-5: now pumping Guard Tank with UTS turbo.

G.14.3. When TG-3 < 1 torr power on TG-1.

G.14.4. Power on TG-1.

G.14.5. Record: TG-1 _____ torr, VG-4 _____ torr Date/Time _____

G.14.6. When TG-1 is less than 8E-5 proceed.

G.14.7. Record TG-1 _____ torr. Date/Time _____

G.14.8. Power on RGA and place in leak check mode for mass 20.

Calibrate RGA at Low Pressure

Note: The neon standard leak has a value of _____ sccs Ne, ref. G5.9.

G.14.9. Open NSL-V.

G.14.10. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, I_{RGA} _____ amp.

G.14.11. Close NSL-V

G.14.12. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, I_{RGA} _____ amp.

G.14.13. Open NSL-V.

G.14.14. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, I_{RGA} _____ amp.

G.14.15. Close NSL-V

G.14.16. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, I_{RGA} _____ amp.

G.14.17. When time allows calculate RGA sensitivity, $1.5X10^{-6}$ sccs/change in amps, _____sccs/amp.

Quality_____

G.15. **Leak Check at low pressure**

NOTE:

Maximum Leak rate shall be less than $1X10^{-6}$ sccs Neon

G.15.1. Leak Check GTVA/GTLVL Bayonet Date/Time _____

1. Open/verify open RGA-SOV.
2. Adjust RGA-LV to maintain TG-1 on same value as used for low pressure calibration above.
3. Verify RGA is in leak check mode for mass 20.
4. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
5. Introduce neon gas into bagged GTV bayonet for 2 mins.
6. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
7. Calculate leak rate using RGA sensitivity determined above _____sccs Ne.
8. Calculate leak rate: _____ sccs Ne
9. Verify leak rate is less than $1x10^{-6}$ sccs Ne.
10. Comments: _____

G.15.2. Leak Check FGTVL/GTVA bayonet Date/Time _____.

1. Verify RGA is in leak check mode for mass 20.
2. Record steady state data in Table 2 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
3. Introduce neon gas into bagged FGTVL/GTVA bayonet for 2 mins.
4. Record reading _____ amps.
5. Calculate leak rate: _____ sccs Ne
6. Verify leak rate is less than $1x10^{-6}$ sccs Ne.
7. Comments: _____

G.15.3. Leak Check FGTVL/B2 bayonet

Date/Time _____.

1. Adjust RGA-LV to maintain TG-1 on same value as used for low pressure calibration above.
2. Introduce neon gas into bagged FGTVL/B2 bayonet for 2 mins.
3. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, I_{RGA} _____ amp.
4. Calculate leak rate: _____ sccs Ne
5. Verify leak rate is less than $1x10^{-6}$ sccs Ne.
6. Comments: _____

G.15.4. Enter comment to DAS "End low pressure Ne Leak Test".

G.15.5. Spray Ne around the GTLVL/HEX bayonet and adjacent GM joints up to EV-13 and EV-16.

G.15.6. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, I_{RGA} _____ amp.

G.15.7. Turn off RGA.

G.15.8. Close/verify closed RGA-LV.

G.15.9. Close/verify closed RGA-SOV, RGA-V.

G.15.10. Close GTV-Va.

G.15.11. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Connected to GM at "Guard Tank Vent" and pumped by the UTS	TV-1, TV-2, EV-5, EV-14, EV-4, EV-7A/B, EV-16, GTV-V	
Remaining EV valves		All other EV valves
RGA & Neon leak valves		GTV-Va, NSL-V, RGA-SOV, RGA-LV, RGA-V
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

Quality_____

G.16. **Helium Leak Check**

G.16.1. Put RGA in spectrum mode to monitor He, H_2O, O_2, N_2 and CO_2

G.16.2. Continue pumping with UTS until the leak detector shows a background of less than $1X10^{-5}$ sccs He.

G.16.3. Maintain data entries in Table 1.

G.16.4. Remove leak detector from UTS, cap the pumping port, put leak detector in test mode and record:
Std leak size _____sccs
Std leak signal _____sccs
Std leak S/N _____.
Std leak call due date _____.

G.16.5. Verify agreement to within 5% of full scale.

G.16.6. Connect leak detector to TV-3.

G.16.7. Leak check all plumbing up to closed TV-3.

G.16.8. Perform periodic leak detector hookups to determine the leak detector background using:

1. Activate leak detector using leak detector instructions
2. Close TV-2 open TV-3.
3. Record background in Table 1.

G.16.9. When background is less than $2X10^{-5}$ proceed.

G.16.10. Record leak detector background _____sccs He

G.16.11. Leak Check GTVA/GTLVL Bayonet

Date/Time _____

1. Verify leak detector backing UTS turbo pump.
2. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, He background _____ sccs He
3. Introduce helium gas into bagged GTVA bayonet for 2 mins.
4. Record steady state data in Table 1 and below:
Record TG-1 _____ torr, He leak rate _____ sccs He
5. Verify helium leak rate is less than $1x10^{-6}$ sccs.
Comments: _____

G.16.12. Leak Check FGTVL/GTVA bayonet Date/Time _____.

1. Verify leak detector backing UTS turbo pump.
2. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, He background _____ sccs He
3. Introduce helium gas into bagged FGTVL/GTVA bayonet for 2 mins.
4. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, He leak rate _____ sccs He
5. Verify helium leak rate is less than $2x10^{-6}$ sccs.
   Comments: _____

G.16.13. Leak Check FGTVL/B2 bayonet Date/Time _____.

1. Verify leak detector backing UTS turbo pump.
2. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, He background _____ sccs He
3. Introduce helium gas into bagged FGTVL/B2 bayonet for 2 mins.
4. Record steady state data in Table 1 and below:
   Record TG-1 _____ torr, He leak rate _____ sccs He
5. Verify helium leak rate is less than $2x10^{-6}$ sccs
   Comments: _____

G.16.14. Enter comment to DAS “End helium leak test”.

G.16.15. Spray He around the GTLVL/HEX bayonet and adjacent GM joints up to EV-13 and EV-16.

G.16.16. Verify helium leak rate is less than $2x10^{-6}$ sccs.

G.16.17. Remove leak detector from UTS, cap the pumping port, put leak detector in test mode and record:
Std leak size _____sccs
Std leak signal _____sccs

G.16.18. Verify agreement to within 5% of full scale.

G.16.19. Shut down leak detector

G.16.20. Power down RGA and close RGA-V, Date/Time _____.

Quality_____

G.17. **Re-pressurize Guard Tank with Helium Gas from Main Tank**

Date/Time_____

G.17.1. Record: EG1b _____ torr.

G.17.2. Close EV-5, EV-14, and EV-4.

G.17.3. Close TV-1 and shut down UTS.

G.17.4. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Locked up to GM manifold	EV-16, GTV-V	
Remaining EV valves	EV-7A/B	All other EV valves
RGA & Neon leak valves		GTV-Va, NSL-V, RGA-SOV, RGA-LV, RGA-V
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

Quality_____

G.18. **Prepare Fill Line**

G.18.1. Verify installed/install 1-in. pumping line from Access-1 of Gas Module to FCV of FCA.

G.18.2. Turn on pump AP-1.

G.18.3. Open AV-8 and AV-3.

G.18.4. Open valve FCV and evacuate to 20 mtorr as measured at AG-2.

G.18.5. Close AV-8.

G.18.6. Open AV-1 and adjust AV-9 to give 1 psig at AG-1.

G.18.7. Close AV-1

G.18.8. Open AV-8 and evacuate to 20 mtorr. as measured at AG-2.

G.18.9. Close AV-8 and FCV.

G.18.10. Once the pressure in the Fill Cap Assembly has stabilized, record Fill Cap Assembly pressure (FCG): _____ torr.

G.18.11. Open valve SV-13 to bring Fill Cap Assembly up to SMD Fill line pressure and record
Fill line pressure (FCG): _____ torr.

Quality_____

G.19. **Open RAV-1**

G.19.1. Enter comment to DAS "Start repress of GT". Date/Time _____.

G.19.2. Verify all selector switches are off.

G.19.3. Power up RAV power supply to 28 volt at 1.9 a.

G.19.4. Power up RAV controller No. 1.

G.19.5. Position selection switch to RAV-1.

G.19.6. Record initial switch status: Open: θ θ Closed: θ θ

G.19.7. Activate controller No. 1 and record:

1. run time: _____ seconds
2. current draw: _____ amp
3. time of day: _____ hrs

G.19.8. Record final switch status: Open: θ θ Closed: θ θ

G.19.9. Record operation in RAV log book.

G.19.10. Record FCG _____torr

G.19.11. Record EG-1a _____torr

Quality_____

G.20. **Open RAV-2**

G.20.1. Verify closed FCV.

G.20.2. Request LM personnel install arming plug for RAV-2

G.20.3. Request LM SV Operations open RAV-2.

G.20.4. Record FCG _____torr

G.20.5. Record EG-1a _____torr

G.20.6. Verify RAV-2 is open by near coincident with SV open command of rise of Guard Tank pressure to the Main Tank pressure (FCG).

G.20.7. Record FCG _____torr

G.20.8. Record EG-1a _____torr

Quality_____

G.21. **Close RAV-2**

G.21.1. Request LM SV Operations close RAV-2.

G.21.2. Request LM personnel remove arming plug for RAV-2

G.21.3. Verify by pressure rise in FCG that RAV-2 is closed.

G.21.4. Record:

1. FCG ____torr
2. EG-1a _____torr

G.21.5. Verify APR-2 is adjusted to ~.5 psig .

G.21.6. Open EV-23 to regulate pressure to Guard Tank.

G.21.7. Adjust APR-2 gradually to ~2 psig, watching CN28 for temperature excedance.

G.21.8. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Pressurized by APR-2	EV-16, EV-23, APR-2, GTV-V, GTV-RV	GTV-Va
Remaining EV valves	EV-7A/B	All other EV valves
Fill line		FCG, SV-13, AV-1, AV-9
GSE RAVs	RAV-1, RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

Quality_____

G.22. **Close RAV-1 and Pump Fill Line**

G.22.1. Verify FCV and all AVs closed.

G.22.2. Open AV-3 and AV-8.

G.22.3. Open FCV.

G.22.4. When FCG < 20 mtorr, close FCV.

G.22.5. Open SV-13, record FCG _____ .

G.22.6. Close RAV-1.

1. Record initial switch status: Open: θ θ Closed: θ θ
2. Activate controller No. 1 and record:
   a. run time: _____ seconds
   b. current draw: _____ amp
   c. time of day: _____

   Immediately:
3. Verify SV-13 open
4. Record FCG _____ torr
5. Open FCV: now pumping fill line with AP-1.
6. Record final switch status: Open: θ θ Closed: θ θ
7. Record operation in RAV log book.
8. Position selection switch to off.
9. Power down RAV controller No. 1.
10. Power off RAV power supply.

G.22.7. Record FCG _____ torr, EG-1a _____ torr.

G.22.8. Record: Date/Time _____

Quality_____

G.23. Pump Fill Line

1. When AG-2b < 20 mtorr,
2. Record AG-2b _____ torr.
3. Close SV-13, torquing to 60 in-lb.
4. Close AV-8.

G.23.2. Backfill with helium gas via AV-1 and AV-9 to 1.5 psig as indicated by AG-1

G.23.3. Close FCV.

G.23.4. Close AV-1.

G.23.5. Open AV-8: pump line to vacuum.

G.23.6. When AG-2b < 20 mtorr

1. Close AV-8
2. Close AV-3.

G.23.7. Record FCG pressure for 30 minutes:

G.23.8. Date:___

G.23.9. Time _____ _____ _____ _____

G.23.10. FCG (torr) _____ _____ _____ _____

G.23.11. Verify no leakage at SV-13 into fill line.

Quality_____

G.24. **Final Configuration**

G.24.1. Valve configuration:

	Open/Active	Closed
Main Tank vent Not Connected to GM	SV-9, MTVC-RV	
Guard Tank vent Pressurized by APR-2	EV-16, EV-23, APR-2, GTV-V	GTV-Va
Remaining EV valves	EV-7A/B	All other EV valves
Fill line		FCV, SV-13, AV-1, AV-9
GSE RAVs	RAV-3	All other RAVs
SV RAVs	RAV-6B	RAV-2

G.24.2. Input comment to DAS “GT leak check completed”.

G.24.3. Stop DAS Special Data Cycle.

G.24.4. Remove pumping line between Access 1 and FCV.

Section G.25 complete. Quality_____

G.25. **Configuration of Dewar and GSE**

G.25.1. Record the Main Tank liquid level (LL-1D or LL-2D): _____ %

G.25.2. Record the following pressures:

1. Main Tank pressure (EG-3): _____ torr
2. Guard Tank pressure (EG-1a/GTVG): _____ torr

Quality_____

G.26. **Setting up Data Acquisition**

Note: Refer to Operating Instructions for mechanics of DAS keyboard/mouse operations.

G.26.1. Set DAS to configuration choice 4Y.

G.26.2. Stop Special Data Cycle by using [Other Menus] + [Special Data Col] + [Stop Data Col].

G.26.3. Record Vacuum Shell Pressure.

1. Turn on Vac-ion pump and record time of day _____ .
2. Use DAS [Monitor Data] for CN 99.
3. When value is steady, record pressure (IP) _____ torr.
4. Exit [Monitor Data] and collect data with [Set Data Interval] to 15 min.
5. When data cycle is complete, turn off Vac-ion pump.

G.26.4. Set DAS data cycle interval to 15 minutes.

G.26.5. Set Main Tank Liquid Level sampling interval to 10 minutes.

G.26.6. Confirm that the liquid level sensors are set at a sampling rate of 10 minutes or turned off.

G.26.7. Confirm that Vac-ion pump is off.

G.26.8. Enable/verify enabled the alarms on the Main Tank and Well Liquid Level Sensors.

G.26.9. Verify enabled the DAS alarm and record the set points:

a) CN ____, Level _____

b) CN ____, Level _____

c) CN ____, Level _____

d) Main Tank Level: _____ %

e) Guard Tank Level:_____ %

G.26.10. Ensure DAS watchdog timer and alarm enabled.

Quality _____.

H. **Procedure Completion**

Completed by: _____

Witnessed by: _____

Date: _____

Time: _____

Quality Manager:_____ **Date** _____

Payload Test Director:_____ **Date** _____

Table 1 Neon leak Data

Date/Time	Neon Amp	EG-1a Torr	TG-1 torr	EG-1a torr	FCG Torr-diff		Comments

Figure 1a. Schematic of Gas Module Plumbing at Start of FEE Guard Tank Vent Line Install

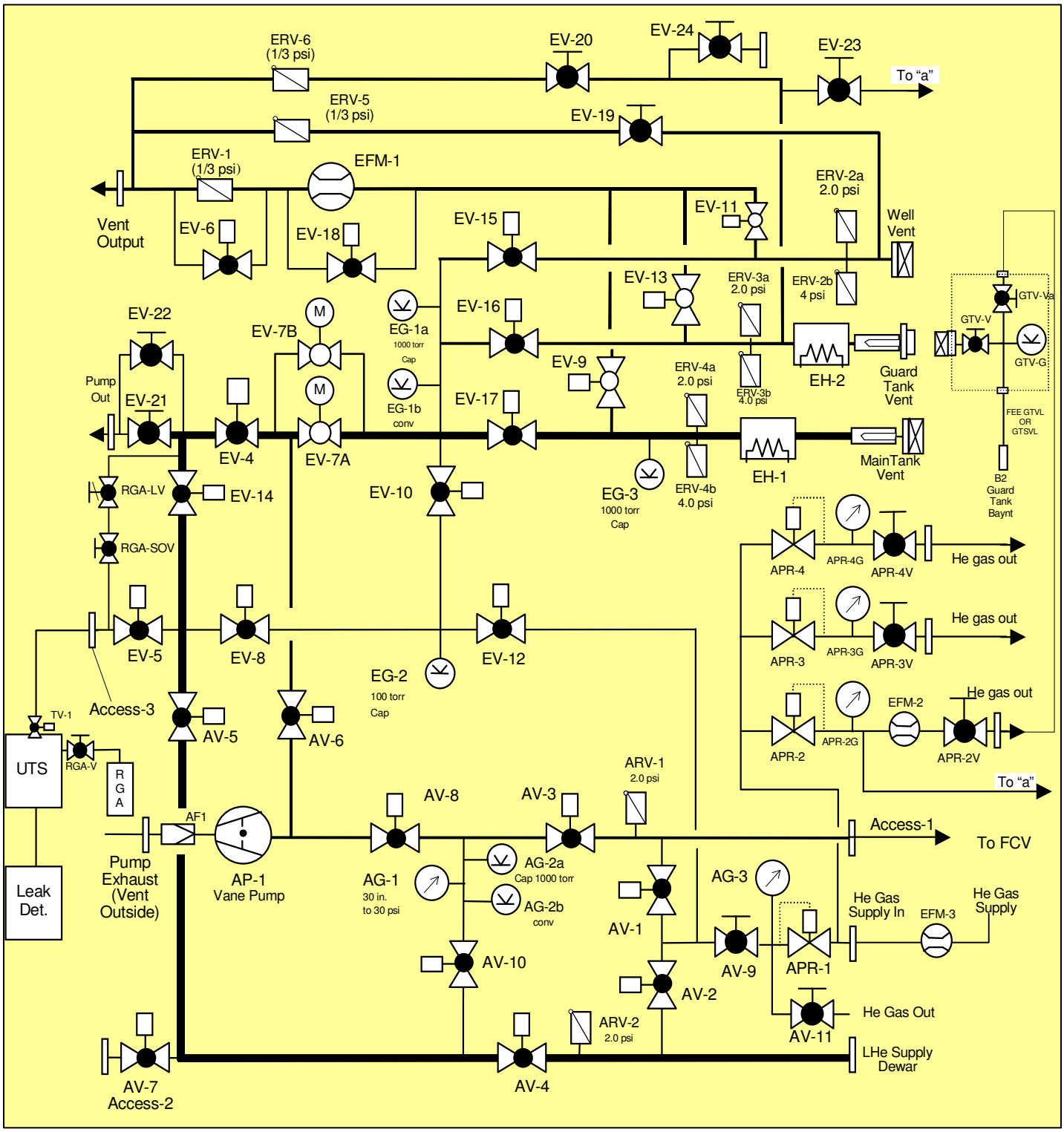


Figure 1b. Schematic of Gas Module Plumbing for Neon Leak Detection of Guard Tank Vent

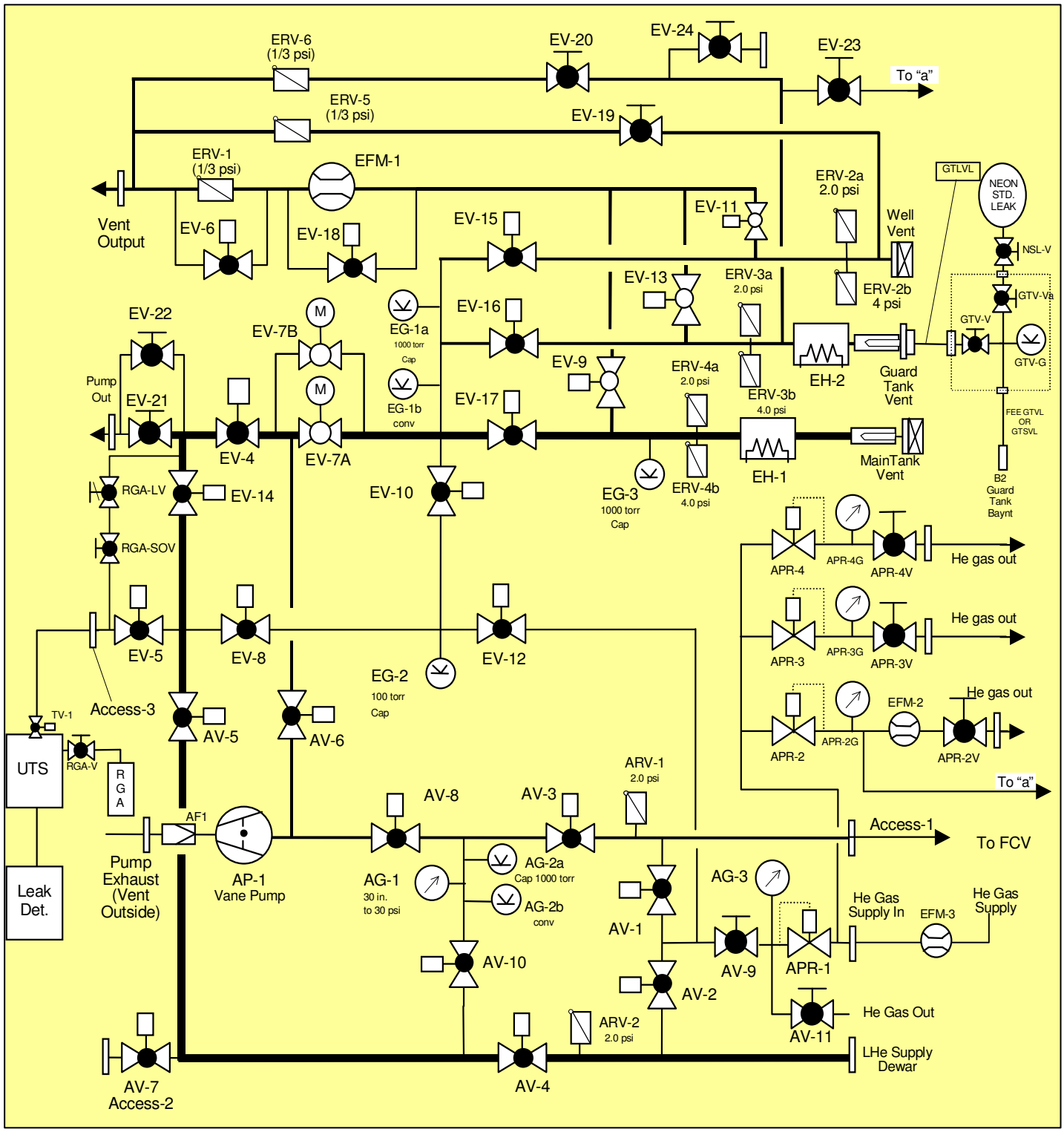


Figure 2 Gas Module and Vent lines connected to SMD

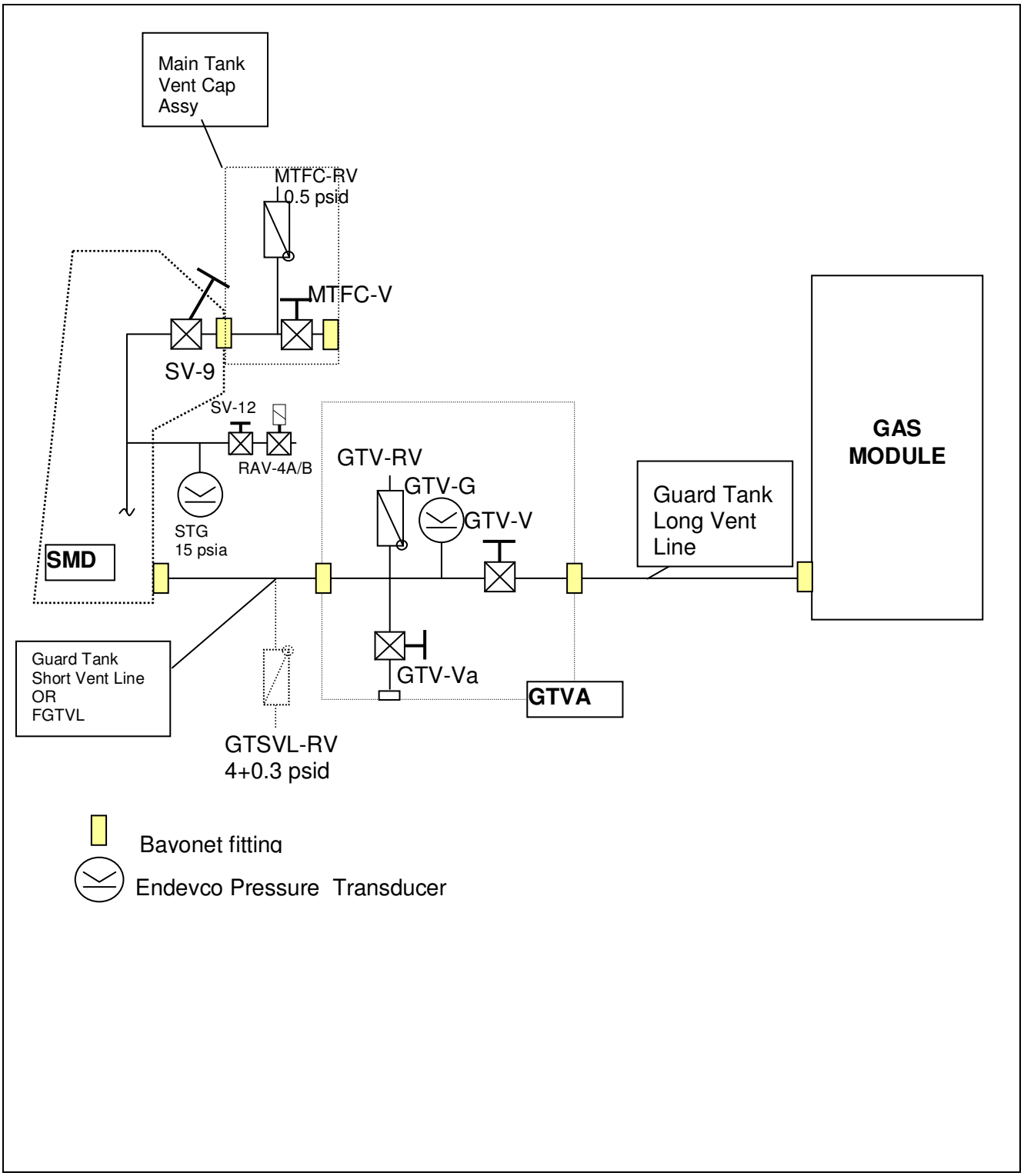


Figure 2 Utility Pump System with RGA for Neon leak detection

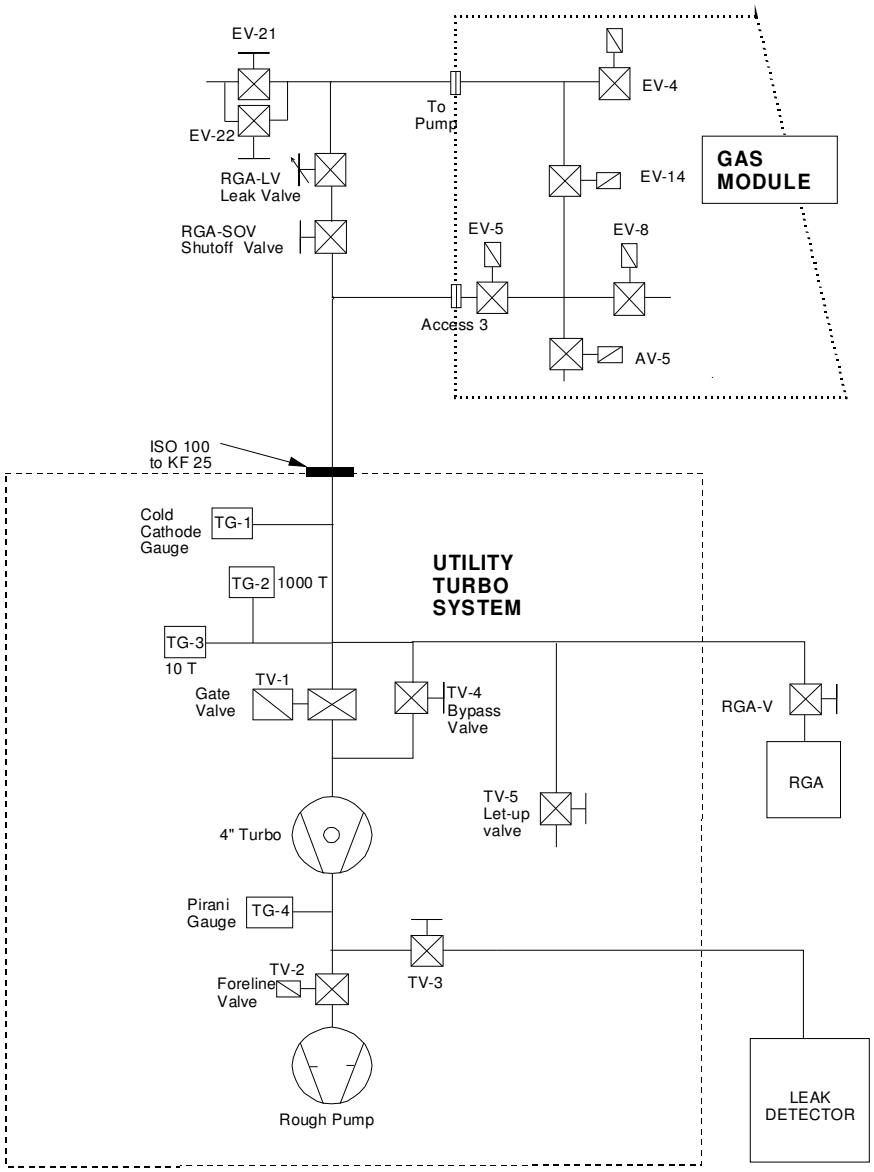
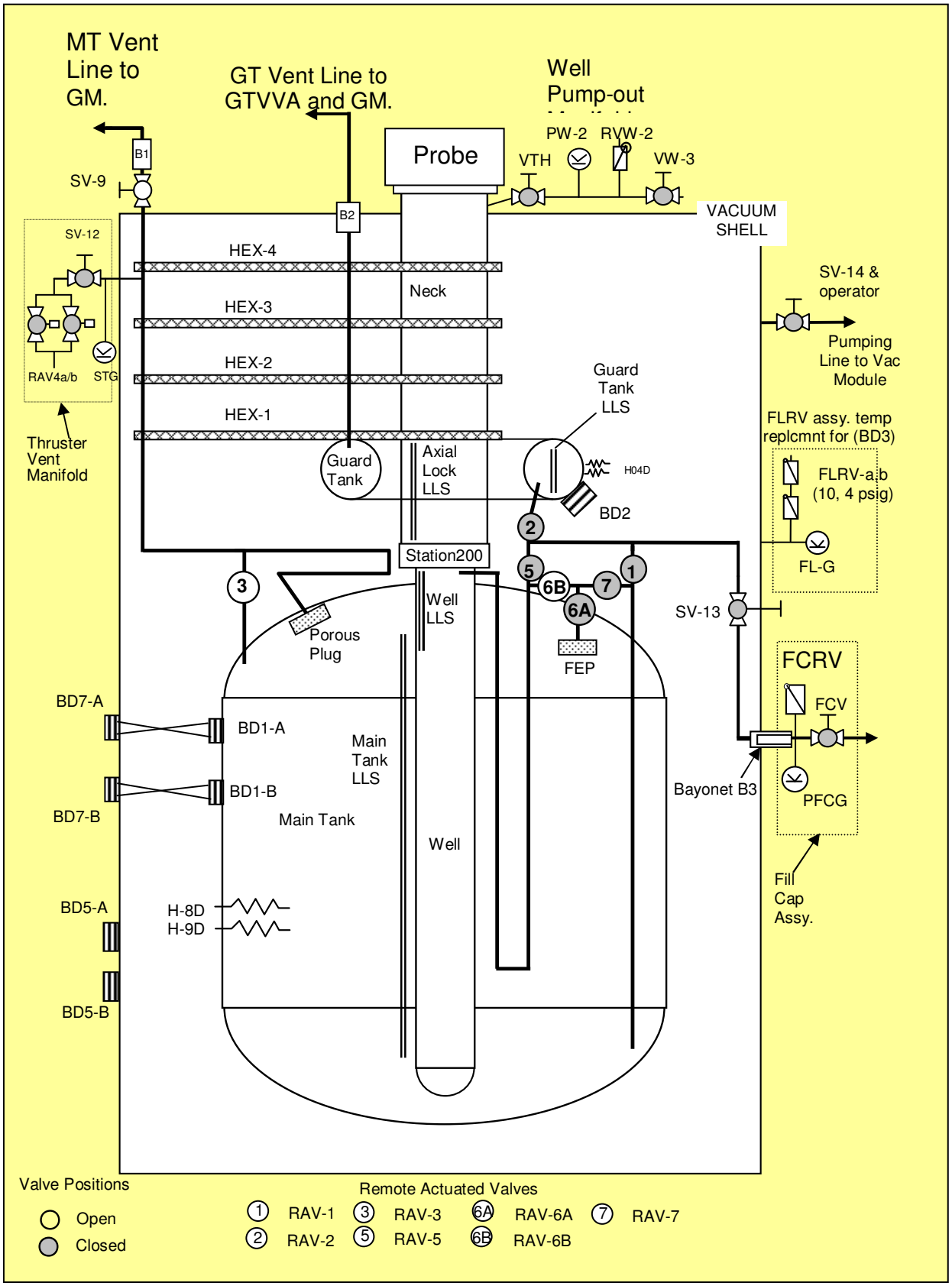


Figure 3. Schematic of Science Mission Dewar plumbing



I. Appendices

I.1. Appendix 1 Pre-Test Check List

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify the test procedure being used is the latest revision.		
	2. Verify all critical items in the test are identified and discussed with the test team.		
	3. Verify all required materials and tools are available in the test area.		
	4. Verify all hazardous materials involved in the test are identified to the test team.		
	5. Verify all hazardous steps to be performed are identified to the test team.		
	6. Verify each team member knows their individual responsibilities.		
	7. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF AN ITEM IN THE PROCEDURE IS NOT CLEAR.		
	8. Confirm that each test team member clearly understands that he/she must stop the test if there is any anomaly or suspected anomaly.		
	9. NOTIFY MANAGEMENT OF ALL DISCREPANCY REPORTS OR D-LOG ITEMS IDENTIFIED DURING PROCEDURE PERFORMANCE. IN THE EVENT AN INCIDENT OR MAJOR DISCREPANCY OCCURS DURING PROCEDURE PERFORMANCE MANAGEMENT WILL BE NOTIFIED IMMEDIATELY.		
	10. Confirm that each test team member understands that there will be a post-test team meeting.		
	Team Lead Signature: _____		

I.2. Appendix 2 Post-Test Check List

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify all steps in the procedure were successfully completed.		
	2. Verify all anomalies discovered during testing are properly documented.		
	3. Ensure management has been notified of all major or minor discrepancies.		
	4. Ensure that all steps that were not required to be performed are properly identified.		
	5. If applicable sign-off test completion.		
	6. Verify all RAV valve operations have been entered in log book		
	7. Verify the as-run copy of procedure has been filed in the appropriate binder		
	Team Lead Signature: _____		

I.3. **Appendix 3– Contingency Responses**

	Condition	Circumstance	Response
1	Power Failure		
		Any time	Wait for power restoration Note: the DAS computer will continue to function for several hours, however no data will be collected DAS computer still operating: Reset GM valving per the last configuration in procedure and resume procedure DAS computer not operating: Reboot computer and launch DRP_SMD and select auto startup option Reset GM valving per the last configuration in procedure and resume procedure
2	Temperature limits (CN 28 or 29) exceeded	ANY TIME	Lower inflow of helium gas to Guard Tank OR, INCREASE MAIN TANK VENTING Open MTVC-V momentarily or if problem persists see 3 below
3		ANY TIME	PROMOTE INCREASE IN MAIN TANK VENTING Power up heater at H08D or H0-9D and starting at 15 vdc input increase power until increased flow has cooled the problem area
4	Burst disk rupture (MT/GT)	ANY TIME	Evacuate room