GRAVITY PROBE B
PROCEDURE FOR
SCIENCE MISSION DEWAR

Pressurize Well to One Atmosphere with Probe Installed

P0650A

ECO 1089

September 25, 2000

Revised by

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REVISION RECORD

REVISION	***ECO***	***PAGES***	***DATE***
A	1089	Changed title to *Pressurize Well to One Atmosphere with Probe Installed*. Changed Sections A, B, C, D, E, and F to comply with other cryogenic procedures, as well as, accurately reflect changes in scope and changes in personnel. Incorporated list of configuration requirements Changed Section G (Operations). Added sections to verify QA notification and initial configuration. Deleted sections on leak back testing of VTH, replaced with leak test of newly installed vent line.	

Table of Contents

List of Abbreviations and Acronyms

AG-x	Gauge x of Gas Module auxiliary section
AMI	American Magnetics Inc.
ATC	Advanced Technology Center
Aux	Auxiliary
AV-x	Valve x of Gas Module auxiliary section
Bot	Bottom
CN [xx]	Data acquisition channel number
DAS	Data Acquisition System
EFM	Exhaust gas Flow Meter
EG-x	Gauge x of Gas Module exhaust section
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
FIST	Full Integrated System Test
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
HX-x	Vent line heat exchanger in Gas Module
KFxx	Quick connect o-ring vacuum flange (xx mm diameter)
LHe	Liquid Helium
LHSD	Liquid Helium Supply Dewar
Liq	Liquid
LL	Liquid level
LLS	Liquid level sensor
LMMS	Lockheed Martin Missiles and Space
LMSC	Lockheed Missiles and Space 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
PFCG	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
PTD	Payload Test Director
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 necessary to raise the pressure in the Well to one atmosphere while the Probe is installed. These steps include:

Pump and backfill vent line

Open Well to vent line

Open RAV-7

The procedure requires that the Well be immediately filled with liquid per procedure P0210.

B. SAFETY

B.1. Potential Hazards

Personal injury and hardware damage can result during normal positioning, assembly and disassembly of hardware. Examples include: positioning Dewar in tilt stand; integrating probe with airlock; positioning airlock on Dewar; removing airlock from Dewar; removing probe from Dewar; and positioning support equipment such as pressurized gas cylinders and supply dewars.

A number of undesired events may be associated with these operations. For example, personnel or equipment can be struck when hardware is being moved (e.g. by forklift or crane load). Personnel are subject to entrapment while positioning hardware, such as hands or feet caught between objects as hardware is moved into place. Suspended hardware may be dropped. Personnel can be caught between objects such as forklifts and walls or loads and building support columns.

In addition, 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

The FIST OPS laboratory has an oxygen deficiency monitor that alarms when the oxygen level is reduced to 19.5%. Additional 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, and oxygen collection pans are on the floor beneath them.

The following requirements apply to personnel involved 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.

The FIST Emergency Procedures document, SU/GP-B P0141, discusses emergency procedures. These documents should be reviewed for applicability at any facility where the hardware is operated.

B.3. Injuries

In case of any injury obtain medical treatment as follows
LMMS **Call 117;** Stanford University **Call 9-911**

C. QUALITY ASSURANCE

C.1. QA Notification

The ONR representative and SU QA shall be notified 24 hours prior to the start of this procedure. Upon completion of this procedure, the QE Manager will certify 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 PTD or his designate and shall be approved by the QA Representative. Additionally, approval by the Hardware Manager shall be required, if in the judgement of the PTD 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.

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.
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 PTD and approved by the QA representative.

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. The Test Director is the designated signer for the "witnessed by" sign-off located at the end of each procedure. The person in charge of the operation (Test Director or Test Engineer) is to sign the "completed by" sign-off.

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

Test Director	***Test Engineer***
Mike Taber	Tom Welsh
Dave Murray	Chris Gray
Jim Maddocks	Bruce Clarke
Dave Frank	

E. REQUIREMENTS

E.1. Electrostatic Discharge Requirements

This procedure does not include any equipment sensitive to electrostatic discharge.

E.2. Lifting Operation Requirements

There are no lifting operations in this procedure

E.3. Hardware/Software Requirements

E.3.1. Commercial Test Equipment

No commercial test equipment is required for this operation.

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, 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 calls for use of hardware located in the Gas Module (Figure 1), and Electrical Module (Table 1).

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

No additional test equipment is required

E.3.5. Additional Hardware

Description
1-inch diameter Well vent line
3-ft. Stainless steel flex line (optional)

E.3.6. Tools

No special tools are required

E.3.7. Expendables

No expendables are required

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	-	3452A01975	Yes	
2	DAS	Power Supply, H-P 6627A	-	3452A01956	Yes	
3	DAS	Data Acquisition/Control Unit H-P 3497A	-	2936A245539	No	-
4	DAS	Digital Multimeter H-P 3458A	-	2823A15047	Yes	

No.	*Location*	*Description*	*User Name*	*Serial No.*	*Cal Required*	*Status Cal due date*
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	
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	-	C-19950	No	-
24	GM	Guard Tank Heat Exchanger: a) Thermocouple, b) Current meter, c) Temperature set point controller	-	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	-

E.5. Configuration Requirements

E.5.1. Main Tank

Liquid in the Main Tank must be at its normal boiling point (NBP).

E.5.2. Guard Tank

The Guard Tank may contain liquid or be depleted and pressure regulated.

E.5.3. Well

The Well is evacuated, and the Probe is installed.

E.5.4. SMD Vacuum Shell

The Vacuum Shell pressure is not read in this procedure.

1. The DAS alarm system must be enabled and contain the following alarm set-points:
   a. Station 200 temperature (CN 01) set at $T \leq 6.5$ K.
   b. Top of lead bag temperature set (CN 28) at $T \leq 6.0$ K.
   c. Relative Guard Tank Pressure (CN 46) set at $\Delta P \geq 0.3$ torr.
2. The Facility Main Alarm System must be armed.

E.5.5. GSE and Non-flight Hardware

1. 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).
2. The Well vent manifold pictured in Figure 2 must be installed at the Well vent.
3. The Guard Tank Vent Valve Assembly is installed in the GT vent line.

E.6. **Optional Non-flight Configurations**

The following modifications or non-flight arrangement of the basic SMD configuration may also be in place. They are incidental to the performance of this procedure and not required.

1. The SMD is installed in its transportation/test fixture.
2. A relief valve is installed in place of the fill line burst disk.
3. A foreign object and debris shield covering the upper cone of the SMD is installed.
4. The ion pump magnet is installed.
5. The Main Tank vent may be connected to the Gas Module with a vacuum insulated line (P/N 5833806) or may be disconnected and venting through the appropriate vent line cap.
6. The Guard Tank vent may be connected to the Gas Module (P/N 5833813) with a vacuum insulated line or may be disconnected from the Gas Module and depleted of liquid, with its pressure independently regulated.
7. The Vacuum shell pump out port at SV-14 may be connected to the Vacuum Module (P/N 5833816) via a 2-in 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.

8. The thruster vent port must be flanged to a shut-off valve.
9. The Fill Cap Assembly may be installed at SV-13.

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*
SU/GP-B P0141	*FIST Emergency Procedures*
LMSC-P088357	*Science Mission Dewar Critical Design Review*
P0108	*Quality Plan*

F.3. Additional Procedures

Document No.	*Title*
SU/GP-P0210	*Internal Main Tank to Well Transfer*

Operation Number:_____

Date Initiated:_____

Time Initiated:_____

G. OPERATIONS

G.1. Verify Appropriate QA Notification

o Verify SU QA notified.

Record: Individual notified _____,

Date/time _____/_____.

o Verify ONR representative notified.

Record: Individual notified _____,

Date/time _____/_____.

G.2. Verify Configuration Requirements and Record Initial Conditions

G.2.1. Verify enabled/enable Facility Main Alarm System.

G.2.2. Verify Probe installed.

G.2.3. Verify liquid in Main Tank at NBP (4.2<T<4.3) and record temperature at bottom of tank CN [9] _____K.

G.2.4. Verify GSE cabling connected between SMD and Electrical Module and between SMD and Data Acquisition System.

G.2.5. Verify DAS alarm system enabled and record set points.

1. ***Station 200 temperature*** – verify [CN 1] on DAS alarm list and set to alarm at T ≤ 6.5 K. Record set point. _____K
2. ***Top of lead bag temperature*** – verify [CN 28] on DAS alarm list and set to alarm at T ≤ 6.0 K. Record set point. _____K
3. ***Relative Guard Tank Pressure*** – verify [CN46] on DAS alarm list and set to alarm at ΔP ≥ 0.3 torr. Record set point. _____torr

G.2.6. Verify enabled and record the liquid-level alarm set points.

1. ***Main Tank*** – ensure liquid-level alarm set ≥ 20%. Record set point. _____%
2. ***Guard Tank*** – ensure liquid-level alarm set ≥ 10% (if liquid in GT). Record set point. _____%

G.2.7. Verify VTH closed.

G.2.8. Verify Well vent manifold installed per Figure 2.

- o Manifold installed with optional flex-line.
- o Manifold installed without optional flex-line.

G.3. **Verify Gas-Module in Standard Configuration**

G.3.1. Establish Intital configuration.

Configuration	***Initial Valve States***	
	Open	***Closed***
Main Tank at NBP		
o Connected to GM	EV-9	EV-17
o Disconnected from GM	MTVC-Va	EV-9, EV-17
Guard Tank connected to GM		
o Venting in bypass mode:	EV-20, EV-16, GTV-V	EV-13, EV-23
o Venting in common manifold mode	EV-16, EV-13, GTV-V	EV-20, EV-23
o Depleted and pressure regulated: verify He gas connected through APR-2 to EV-23.	EV-16, EV-23, GTV-V	EV-13, EV-20
Guard Tank disconnected from GM		
o Venting in bypass mode:	GTV-V	EV-13, EV-16, EV-20, EV-23, GTV-Va, GTVC-V, MTVC-V
o Venting in common manifold mode:	GTVC-V, MTVC-V GTV-V	EV-13. EV-16, EV-20, EV-23, GTV-Va
o Depleted and pressure regulated: verify He gas connected through APR-2 to GTV-Va.	GTV-Va	EV-13. EV-16, EV-20, EV-23, GTVC-V, MTVC-V, GTV-V
Well		VTH, VW-3, EV-19, EV-11,
o Evacuated with Probe installed:		EV-15
Other EV valves	EV-7a/b	EV-4, EV-5, EV-6, EV-8, EV-10, EV-12, EV-14 EV-18, EV-21/22, EV-24
AV valves		All

G.3.2. Record pressures.

1. Well Vent Manifold (PW-3) _____ mtorr.
2. If Main Tank connected to GM (EG-3):_____ torr.
3. If Main Tank disconnected from GM (MTVC-G) _____ torr (relative to atm)
4. If Guard Tank Connected to GM (EG-1a):_____ torr.
5. If Guard Tank disconnected from GM (GTV-G) _____ torr (relative to atm.).

G.4. **Verify SMD in Standard Configuration**

G.4.1. Using the RAV log book verify that the dewar's internal valves are in the following positions. If not, investigate to verify previous RAV operations properly recorded. If necessary, note resolution in D-log.

1. ***Open***: RAV-3, and RAV-6B.
2. ***Closed***: RAV-1, RAV-2, RAV-5, RAV-6A, and RAV-7.

G.5. **Connect Well Vent to Gas Module, Pump and Backfill Vent Line**

G.5.1. Attach 1-inch diameter Well vent line from EV-19 on Gas Module to KF fitting at VW-3 on Well vent manifold, per Figure 2.

G.5.2. Pump out and backfill Well vent line as follows:

1. Turn on pump AP-1.
2. Close/verify closed EV-16.
3. Open AV-6 and EV15: now pumping up to closed VW-3.
4. When EG-1b < 50 mtorr close AV-6.
5. Open EV-10 and EV-12.
6. Open AV-9 and adjust vent line pressure to one atmosphere, as indicated by EG-1a, then close AV-9.
7. Close EV-10 and EV-12
8. Open AV-6, now pumping up to VW-3.

G.6. **Perform Leak Test on Well Vent Line:**

G.6.1. When EG-1b < 20 mtorr close AV-6 and record time of day _____.

G.6.2. Record pressure EG-1b every 5 minutes for 25 minutes

Time	0	5	10	15	20	25
EG-1b (mtorr)	_____	_____	_____	_____	_____	_____
Pressure Rise (mtorr)		_____	_____	_____	_____	_____

G.6.3. Verify pressure EG-1b doesn't rise by more than 5 mtorr during the last 10 minutes. Pass ____ Fail____.

G.6.4. If leak test fails, check vent line connections at EV-19 and VW-3 and repeat leak test

Time	0	5	10	15	20	25
EG-1b (mtorr)	_____	_____	_____	_____	_____	_____
Pressure Rise (mtorr)		_____	_____	_____	_____	_____

G.6.5. Verify pressure EG-1b doesn't rise by more than 5 mtorr during the last 10 minutes. Pass ____ Fail____.

G.7. **Verify Well Evacuated**

G.7.1. Open AV-6

G.7.2. Open VW-3, now pumping up to VTH

G.7.3. When PW-3 < 20 mtorr, close VW-3 .

G.7.4. Open VTH to verify Well evacuated.

G.7.5. Record Well pressure PW-3 _____ torr.

G.8. **Open Well to Gas Module**

G.8.1. Close AV-6

G.8.2. Open VW-3, Well now open to gas module

G.9. **Bring Well Up to One Atmosphere by Opening RAV-7:**

G.9.1. Verify all RAV selection switches in the OFF position.

G.9.2. Turn on RAV power supply – adjust current limit to 1.8 amps.

G.9.3. Adjust power supply to 28 VDC.

G.9.4. Power up controller #4.

G.9.5. Position controller #4 selection switch to RAV-7.

G.9.6. Record initial switch status: Open: θ θ Closed: θ θ

G.9.7. Activate controller #4 to open RAV-7 and record:

1. Run time: _____ seconds
2. Current draw: _____ amp
3. Time of day: _____

G.9.8. Record final switch status: Open: θ θ Closed: θ θ

G.9.9. When convenient, record operation in RAV Log Book.

G.10. **Close RAV-7**

Note: As soon as the Well pressure reaches 1 atm., as indicated by EG-1a, Close Rav-7.

G.10.1. Record initial switch status: Open: θ θ Closed: θ θ

G.10.2. Activate controller #4 to close RAV-7 and record:

1. Run time: _____ seconds
2. Current draw: _____ amp
3. Time of day: _____

G.10.3. Record final switch status: Open: θ θ Closed: θ θ

G.10.4. Turn controller selection switch #4 to OFF position.

G.10.5. Power off controller #4.

G.10.6. Turn off RAV power supply.

G.10.7. When convenient, record operation in RAV Log Book.

G.10.8. Enter comment in DAS "Pressurized Well to 1 atmosphere."

G.11. **Fill Well**

G.11.1. Turn on power to Well liquid level sensors.

G.11.2. Open EV-19: Well venting in bypass mode.

G.11.3. Fill Well to cover Well liquid level sensors and continue 15 minutes past that point using Procedure P0210. Record Operation No. _____

Note: filling the Well may be difficult in that it is likely to be warm, resulting in a rapid boiloff rate. Two or three repetitions of P0210, over a period of 48 hours, may be necessary before the Well level remains at Station 200 (i.e., maintains a non-zero reading on the Well level sensor).

G.12. **(Option) Add Flex Line Section Between VTH and Well Manifold:**

Comment: This may be required to allow clearance for various test or fit-check activities (See Figure 2.).

G.12.1. Verify strong flow of helium from Well vent.

G.12.2. Prepare 3-ft length flex line with one end capped off with a 0.5 psid relief valve.

G.12.3. Close VW-3 and remove the Well vent manifold at VTH and immediately install the flex line.

G.12.4. If necessary replace PW-3 with compound gauge.

G.12.5. Arrange Well manifold so as not to interfere with activity.

G.12.6. Remove relief valve from flex line and attach to Well vent manifold.

Verify Final Configuration

G.12.7. Verify valve states are as indicated in following Table. Record configuration in left-hand column, then verify corresponding valve states.

Configuration	***Initial Valve States***	
	Open	***Closed***
Main Tank at NBP		
o Connected to GM	EV-9	EV-17
o Disconnected from GM	MTVC-Va	EV-9, EV-17
Guard Tank connected to GM		
o Venting in bypass mode:	EV-20, EV-16, GTV-V	EV-13, EV-23
o Venting in common manifold mode	EV-16, EV-13, GTV-V	EV-20, EV-23
o Depleted and pressure regulated: verify He gas connected through APR-2 to EV-23.	EV-16, EV-23, GTV-V	EV-13, EV-20
Guard Tank disconnected from GM		
o Venting in bypass mode:	GTV-V	EV-13, EV-16, EV-20, EV-23, GTV-Va, GTVC-V, MTVC-V
o Venting in common manifold mode:	GTVC-V, MTVC-V GTV-V	EV-13. EV-16, EV-20, EV-23, GTV-Va
o Depleted and pressure regulated: verify He gas connected through APR-2 to GTV-Va.	GTV-Va	EV-13. EV-16, EV-20, EV-23, GTVC-V, MTVC-V, GTV-V
Well	VTH, VW-3	EV-11, EV-15
o Filled with Probe installed:	EV-19	
Other EV valves	EV-7a/b	EV-4, EV-5, EV-6, EV-8, EV-10, EV-12, EV-14 EV-18, EV-21/22, EV-24
AV valves		All

G.12.8. Verify DAS alarm enabled and record set points if changed

- Thermal conditions substantially unchanged, alarm set points for Station 200 and lead bag are unchanged and set to alarm.
- Thermal conditions substantially changed, temperature alarm points reset as follows:

  a. Station 200 set point [CN 1] _____ K (≤ 6.5 K)

  b. Top of Lead Bag set point [CN 28] _____ K (≤ 6.0 K)

G.12.9. Ensure liquid level sensor alarms enabled and record set points if changed.

1. ***Main Tank Level*** – ensure liquid-level alarm set ≥ 20%.
   Record set point. _____ %
2. ***Well Level*** – ensure liquid-level alarm set ≥ 20% if able to maintain liquid. Record set point. _____ %
3. ***Guard Tank Level*** – ensure liquid-level alarm set ≥ 10% (if liquid in GT). Record set point. _____ %

G.12.10. Verify Main Facility Alarm enabled.

Completed by:_____

Witnessed by:_____

Date: _____

Time:_____

Quality Manager_____**Date**_____

Payload Test Director_____**Date**_____

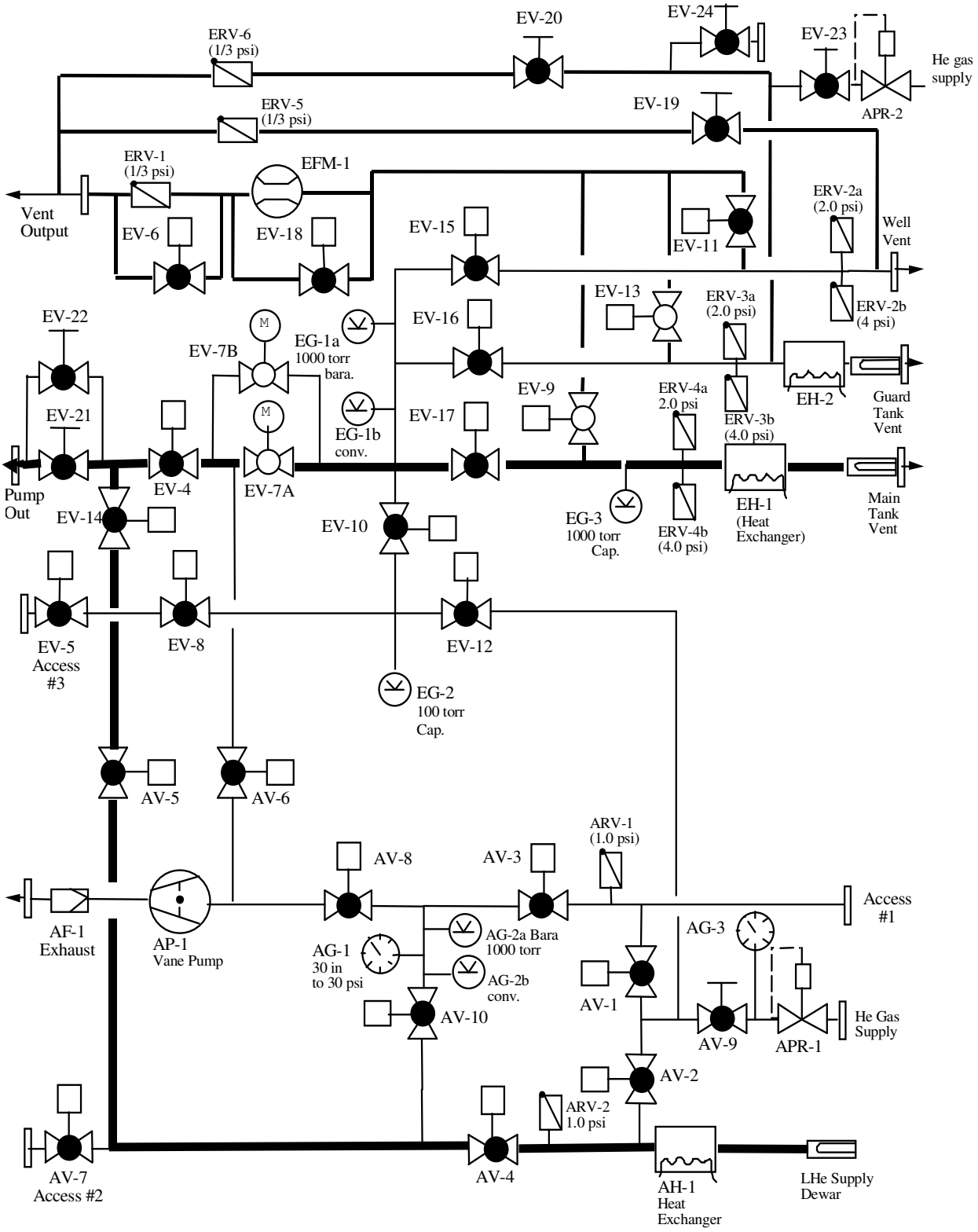

Figure 1. Schematic of Gas Module Plumbing.

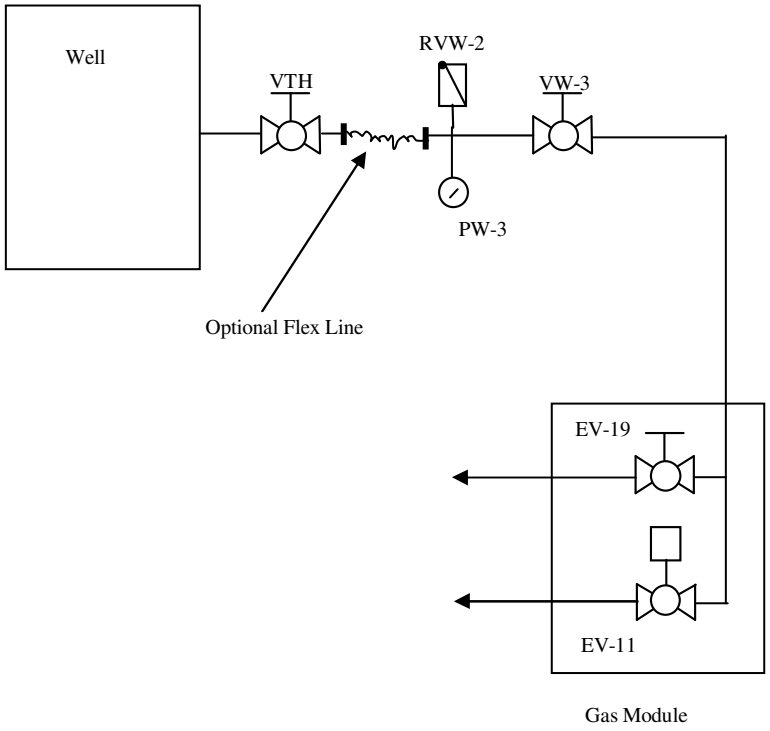

Figure 2. Schematic of Well vent manifold and its connection to the Gas Module.

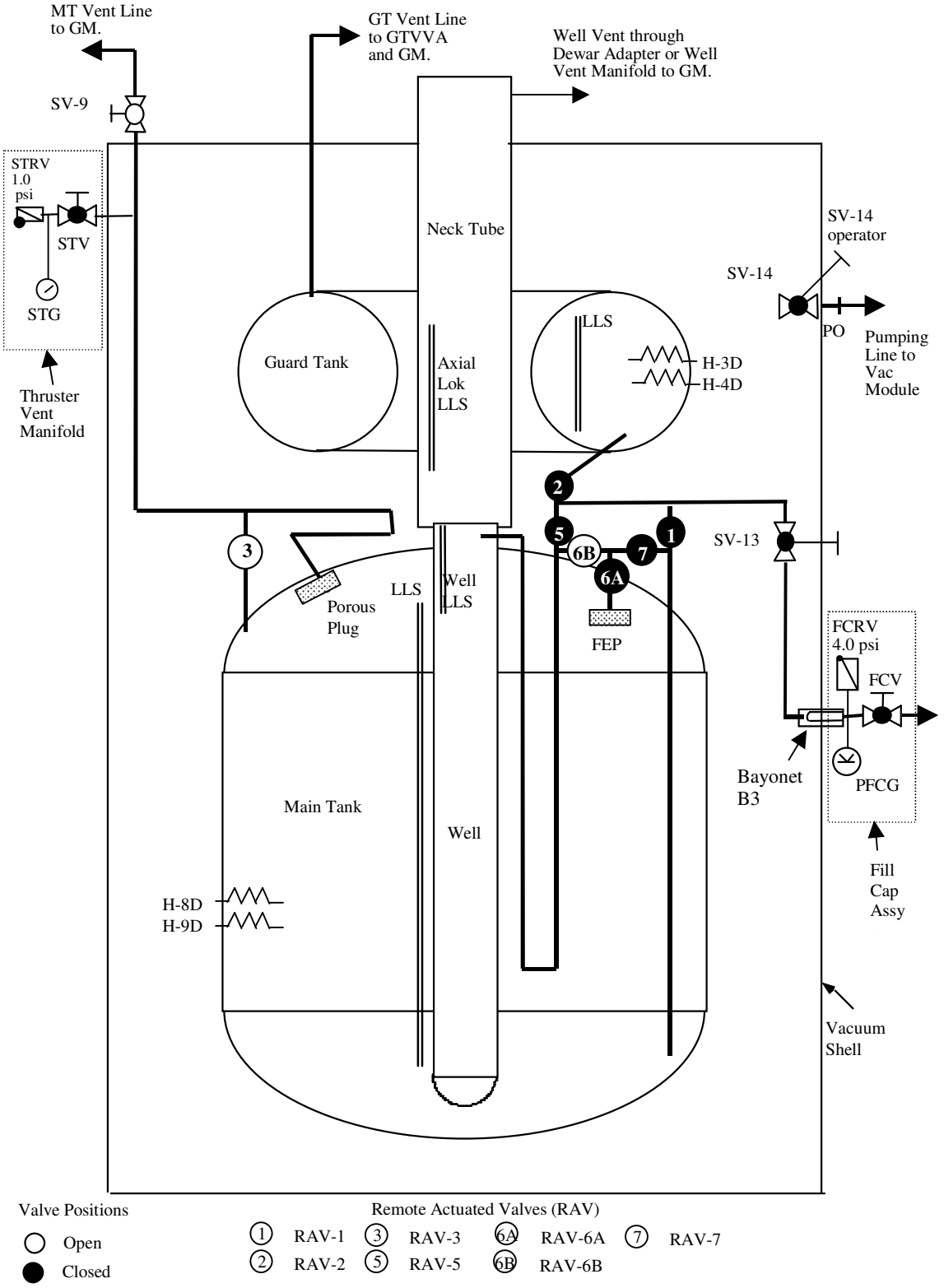

Figure 3. Schematic of Science Mission Dewar plumbing.

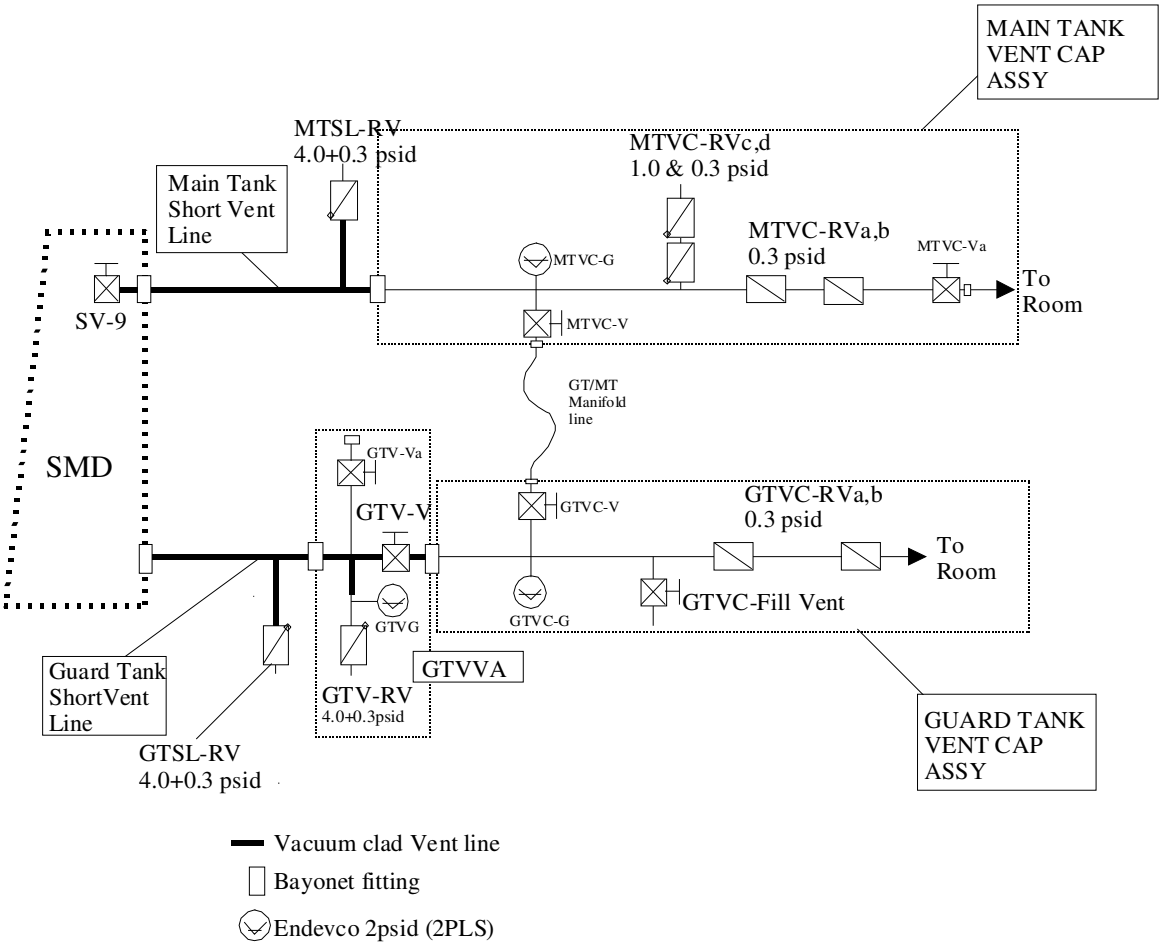

Figure 4. Schematic representation of Guard Tank Vent Valve Assembly (GTVVA) and Main Tank and Guard Tank vent cap assemblies. Common manifold capability is provided by the GT/MT manifold line.