GRAVITY PROBE B

PROCEDURE FOR

PAYLOAD VERIFICATION

POROUS PLUG CHARACTERIZATION TEST

PROCEDURE NO. P0537 REV. -
05/28/99

Prepared by: Rose LaLanne

Approvals

Program Responsibility	Signature	Date
J. Vanden Beukel Test Leader		
R. LaLanne He Thruster REE		
M. Taber Payload Test Director		
J. Janicki Safety Engineering		
D. Ross GP-B Quality Assurance		
S. Buchman GP-B Hardware Manager		

NOTES:
Level of QA required during performance of this procedure:
___Stanford QA Representative
___Government QA Representative

All redlines must be approved by QA

Revision Record:

Rev	Rev Date	ECO #	Summary Description
-	05/28/99		Initial Release

Acronyms and Abbreviations:

Acronym / Abbreviation	**Meaning**
N/A	

Table of Contents

A Scope

This Operations Order characterizes Dewar temperature control while using a GP-B Helium Thruster to control the rate of boiloff through the Porous Plug. This test is performed to collect engineering data only, and is not performed as part of an acceptance test sequence or verification of requirements.

B Requirements Verification

B.1 Requirements Cross Reference

N/A

B.2 Expected Data for verification per requirement

N/A

C Configuration Requirements

Refer to Figure 1 of this Procedure for Configuration Requirements. LMMS has supplied all test equipment and plumbing which interfaces with the Payload Plumbing Pallet (ref. Figure 1). Wet Test Meter connected to Pump Module at PV-5 and PV-6. SMD operating at 1.8 K and tilted in -X direction such that Porous Plug is immersed in LHe by 3-4 cm. RAV-3 should be in the closed position.

D Hardware Required

D.1 Flight hardware required

Description	No. Req'd
Refer to Figure 1 of this Procedure.	

D.2 Commercial test equipment

Manufacturer	Model	Serial Number	Calibr. Exp. Date
HP Data Logger	HP 34970A	LMMS Supplied	N/A
HP 20-Channel Multiplex	HP34901A	LMMS Supplied	N/A
HP Omnibook 2100	2100	LMMS Supplied	N/A
MKS Type 146 Cluster Gauge	Type 146C	LMMS Supplied	N/A
Pirani Gauge (Qty. 2)	103150014	LMMS Supplied	N/A
MKS Baratron Sensors (Qty. 2)	Baratron	LMMS Supplied	N/A
HP Digital Signal Analyzer	HP 35665A	LMMS Supplied	N/A
MKS Type 250C Readout	Type 250C	LMMS Supplied	N/A
Power Designs Power Supply	TW 6050A	LMMS Supplied	N/A

D.3 Mechanical/Electrical Special test equipment

Description	Part No.	Rev. no.	Serial No.	Certification Date
Thruster Controller Electronics	8A00399GSE	-	-	LMMS ETP-013
Thruster Actuator Drive Electronics	8A00400GSE	-	-	LMMS ETP-013
±10V Adjustable Bi-Level Voltage Reference	8A02018GSE	-	-	LMMS ETP-083A

D.4 Tools

Description	No. Req'd
N/A	

D.5 Expendables

Description	Quantity
Gaseous Helium, Bottle (for post-test purging of LMMS test system)	1

E **Software Required**

None Required

F **Procedures Required**

Procedure Name	Procedure No.
N/A	N/A

G **Equipment Pretest Requirements**

Equipment	Serial No.	Test Required	Proc. No.	Test Performed	
				Date	By
N/A					

H **Personnel Requirements**

This test to be conducted only by certified personnel.
Payload Test Leads: Mike Taber, Dave Murray
Propulsion/ Mechanical Test Leads: Jeff Vanden Beukel, Rose LaLanne
ATC Test Leads: Mark Anderson, Jon Kirschenbaum, Phil Rittmuller

I **Safety Requirements**

All Payload Dewar hardware operations shall be performed by certified and authorized Stanford GP-B personnel only. Safety Requirements for Dewar operations will be observed by Stanford GP-B personnel.

J **General Instructions**

J.1 Redlines can be initiated by Jeff Vanden Beukel or Rose LaLanne and must be approved by QA.

J.2 Any nonconformance or test anomaly should be reported by a Discrepancy Report. Refer to the Quality Plan, P0108, for guidance. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

J.3 Only the following persons have the authority to exit/terminate this test or perform a retest:

Payload Test Leads: Mike Taber, Dave Murray
Propulsion/ Mechanical Test Leads: Jeff Vanden Beukel, Rose LaLanne
ATC Test Leads: Mark Anderson, Jon Kirschenbaum, Phil Rittmuller

K **References and Applicable Documents**

N/A

L **Operations**

Op Order No.:_____
Date Initiated:_____
Time Initiated:_____

NOTE:

Refer to Figure 1 of this Test Procedure for identification of numbered valve and sensor locations.

NOTE:

Prior to starting this procedure, record Main Tank liquid level, measured before and after tilting operations.

Main Tank liquid level prior to tilting operations:_____

Main Tank liquid level after tilting operations:_____

Date/time:_____
Operator's initials:_____

L.1 **Startup Procedure:** Verify the following initial conditions: RAV's 4A and 4B closed. Dewar vented through bayonet B1. JV2, JV3, JV4 and JV9 closed. JV1, JV5, JV6, JV7 and JV8 open. [For JV5 open, either command from cluster gauge or unplug power supply.] Pump module isolated from system by closed valve. PID box and Current Drive Amplifier Box connected to thruster. **VERIFY TEST CONFIGURATION IS PER FIGURE 1 BEFORE PROCEEDING WITH TEST OPERATIONS.**

L.1.1 Begin pumping using Utility Turbopump System (UTS). When pressure is less than 1 x 10-2 torr, as indicated by JP3, slowly open valve JV3. Then open JV4, followed by JV2. **ENSURE JV2 IS FULLY OPEN**.

L.1.2 When pressure, as indicated by JP3, is less than 1 x 10-2 torr, record initial restrictor pressure readout on data logger. Close valve JV6. Turn on pump module. Begin pumping using pump module by opening pump module valve.

Initial Restrictor Pressure (Data Logger): _____torr

Date/time:_____
Operator's initials:_____

L.1.3 Close JV2. Close JV4.

L.1.4 On laptop, change Data Logger Configuration from “Trending” to “Fast”.

L.1.4 1 Record Wet Test Meter flow rate (SMD DAS Channel #124).

Wet Test Meter flow rate: _____mg/sec

Date/time:_____
Operator's initials:_____

L.1.5 Stop pumping through the bayonet by closing SV9.

L.1.6 Open RAVs 4A and 4B:

L.1.6.1 Verify all RAV selection switches are in the OFF position.

L.1.6.2 Turn on RAV power supply and adjust current limit to 3.9 amps.

L.1.6.3 Adjust power supply to 28 VDC.

L.1.6.4 Power up RAV controller No. 4A.

L.1.6.5 Position selection switch to RAV-4A.

L.1.6.6 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.1.6.7 Power up RAV controller No. 4B.

L.1.6.8 Position selection switch to RAV-4B.

L.1.6.9 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.1.6.10 Activate controller for Nos. 4A and 4B and record:

a) 4A run time: _____ seconds
4B run time: _____ seconds
b) current draw: _____ amp
c) time of day: _____

L.1.6.11 Record final 4A switch status: Open: θ θ Closed: θ θ

L.1.6.12 Record final 4B switch status: Open: θ θ Closed: θ θ

L.1.6.13 Record operation in RAV log book.

L.1.7 Slowly close JV3 so that total mass flow from dewar, as indicated by the wet test meter, is equal to the equilibrium mass flow rate. Record the value of JP3 at this condition. Verify that breakthrough has cleared using the liquid point sensor.

Pressure at JP3: _____torr

Date/time:_____
Operator's initials:_____

L.2 **Flow Characterization Test**:

L.2.1 Open JV2. **ENSURE JV2 IS FULLY OPEN.**

L.2.2 Command thruster until restrictor pressure as indicated by Data Logger readout indicates approximately 2.4 ± 0.1 torr, corresponding to approximately 2 mg/s mass flow. Record actual restrictor pressure in torr.

Restrictor Pressure (@ 2 mg/s): _____torr

Date/time:_____
Operator's initials:_____

L.2.3 Re-Adjust JV3 so that the pressure indicated by JP3 is equal to the value recorded in Step L.1.7.

L.2.4 Command thruster to minimum mass flow by commanding actuator drive box to -0.4 Amps. Then command thruster to thruster saturation, flow by commanding actuator drive box to +0.4 Amps in16 steps: -0.35, -0.3, -0.25, -0.2, -0.15, -0.1, -0.05, 0.0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4 Amps.

L.2.5 Command thruster until restrictor pressure as indicated by Data Logger readout indicates approximately 2.4 ± 0.1 torr, corresponding to approximately 2 mg/s mass flow. Record actual restrictor pressure in torr.

Restrictor Pressure (@ 2 mg/s): _____torr

Date/time:_____
Operator's initials:_____

L.2.6 Re-Adjust JV3 so that total mass flow from the dewar is equal to 13.5 mg/s, as indicated by the wet test meter. Record the pressure value indicated by JP3.

Pressure at JP3: _____torr

Date/time:_____
Operator's initials:_____

L.2.7. Command thruster to minimum mass flow by commanding actuator drive box to -0.4 Amps. Then command thruster to thruster saturation, flow by commanding actuator drive box to +0.4 Amps in16 steps: -0.35, -0.3, -0.25, -0.2, -0.15, -0.1, -0.05, 0.0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4 Amps.

L.2.8 With thruster commanded to zero current, adjust JV3 so that the pressure indicated by JP3 is equal to the value recorded in Step L.1.7.

L.3 **Frequency Sweep**: Initial Setup - use LMMS Op Order THR-001A Steps 20-70 (exception to Step 70: set minimum frequency to 0.4 Hz instead of 4.0 Hz). Then perform Steps 160-180.

L.3.1 Command thruster to –0.1 amp, perform closed loop frequency sweep from .4 to 200 Hz (Perform Steps 190-240 of LMMS Op Order THR-001A).

Frequency at which dB Magnitude equals 0 dB:_____Hz

DSA Output Filename:_____

Date/time:_____
Operator's initials:_____

L.3.2 Command to 0 amps, repeat sweep.

Frequency at which dB Magnitude equals 0 dB:_____Hz

DSA Output Filename:_____

Date/time:_____
Operator's initials:_____

L.3.3 Command to .1 amp, repeat sweep.

Frequency at which dB Magnitude equals 0 dB:_____Hz

DSA Output Filename:_____

Date/time:_____
Operator's initials:_____

L.3.4 Command thruster to 0 amps, and adjust JV3 so that the pressure indicated by JP3 is equal to the value recorded in Step L.2.6.

L.3.5 Command thruster to –0.1 amp, perform closed loop frequency sweep from .4 to 200 Hz.

Frequency at which dB Magnitude equals 0 dB:_____Hz
DSA Output Filename:_____
Date/time:_____
Operator's initials:_____

L.3.6 Command to 0 amps, repeat sweep.

Frequency at which dB Magnitude equals 0 dB:_____Hz
DSA Output Filename:_____
Date/time:_____
Operator's initials:_____

L.3.7 Command to .1 amp, repeat sweep.

Frequency at which dB Magnitude equals 0 dB:_____Hz
DSA Output Filename:_____
Date/time:_____
Operator's initials:_____

L.3.8 With thruster commanded to zero current, adjust JV3 so that the pressure indicated by JP3 is equal to the value recorded in Step L.1.7.

L.4 **Trend Dewar**:

L.4.1 Close JV2.

L.4.2 Open JV4 and adjust until JP3 is equal to the value recorded in Step L.2.6.

L.4.3 Close JV8.

L.4.4 Re-adjust JV4 and until JP3 is equal to the value recorded in Step L.1.7.

L.4.5 Command thruster current to +0.4 Amps.

L.4.6 Open JV2. **ENSURE JV2 IS FULLY OPEN.**

L.4.7 Activate JV5 by plugging-in power supply. Ensure JV5 closes.

L.4.8 Slowly adjust thruster command so that the pressure indicated by JP3 is equal to the value recorded in Step L.1.7

L.4.9 Change Data Logger Configuration from “Fast” to “Trending”. Monitor until dewar temperature or dewar temperature rate of change is stable, as judged by engineering.

L.5 **Step Mass Flow**:

L.5.1 Open JV8.

L.5.2 Close JV4. Then power-off JV5 unplugging its power supply. Ensure JV5 opens.

L.5.3 Command the thruster to a current of -.2 amps. Adjust JV3 until the pressure indicated by JP3 is equal to the value recorded in Step L.1.7.

L.5.4 Turn on ±10V Adjustable Bi-Level Voltage Reference box. Set voltage select to V1. Adjust the R1 potentiometer until the flow rate as indicated by the wet test meter is equal to the equilibrium flow rate plus 7 mg/s. Verify that the thruster current is .350 amps or less. Switch the command voltage box from V1 to V2. Record actual thruster current:

Current:_____Amps

Date/time:_____
Operator's initials:_____

L.5.5 Monitor until dewar temperature or dewar temperature rate of change is stable, as judged by engineering Change Data Logger Configuration from “Trending” to “Fast”.

L.5.6 Switch the command voltage box from V2 to V1.

L.5.7 Record data until the dewar temperature rate of change is constant, as judged by engineering.

L.5.8 Switch the command voltage box from V1 to V2.

L.5.9 Using Data Logger, record data until the dewar temperature rate of change is constant, as judged by engineering.

L.5.10 Turn off ±10V Adjustable Bi-Level Voltage Reference box.

L.6 **Step Dewar Heater**:

L.6.1 Command thruster to a pressure equivalent to the equilibrium flow rate. Close JV8.

L.6.2 Turn on dewar heater (H-10D or H-11D), using a constant voltage, for 2 hours, then turn off. Monitor dewar response for 2 hours after heater turn off, or longer if deemed necessary by engineering.

L.7 **Choking**:

L.7.1 Open JV8.

L.7.2 Command thruster to minimum current of -0.40 Amps.

L.7.3 Adjust JV3 so that the total mass flow from the dewar is approximately 25 mg/s, as indicated by the wet test meter. Record the value of JP3.

Pressure at JP3: _____torr

Date/time:_____
Operator's initials:_____

L.7.4 Using thruster, induce choking by increasing total mass flow rate to 27.5 mg/s as indicated by the wet test meter. If ΔT is less than 25mK, further increase mass flow. Then reduce mass flow rate by commanding the thruster to minimum flow (-0.42 Amps), and then adjusting JV3 until ΔT across plug is less than 4 mK. To verify recovery, adjust JV3 until a mass flow of 16 mg/s is achieved. Then adjust JV3 until the pressure indicated by JP3 is equal to the value recorded in Step L.1.7.

L.7.5 Repeat the above process to two total flow rates other than 27.5 mg/s, within the range of 20 to 35 mg/s.

First Repeat:

Total mass flow:_____ mg/s as indicated by wet test meter

Pressure at JP3: _____torr

Date/time:_____

Operator's initials:_____

Second Repeat:

Total mass flow:_____ mg/s as indicated by wet test meter

Pressure at JP3: _____torr

Date/time:_____

Operator's initials:_____

L.8 **Breakthrough**:

L.8.1 Command thruster to a restrictor pressure of 6.7 torr (mass flow equivalent to 6.5 mg/s).

L.8.2 Close JV8.

L.8.3 Using thruster, induce breakthrough by reducing mass flow to 2 mg/s or lower (restrictor pressure <2.3 torr as indicated by Data Logger readout). Breakthrough is identified by indication of liquid on the downstream side of the plug by the liquid point sensor. Then increase thruster pressure command in steps to induce recovery. Recovery is defined as no indication of liquid by the liquid point sensor. Record thruster restrictor pressure as indicated by Data Logger readout at recovery:

Verify that liquid was observed: _____

Date/time:_____

Operator's initials:_____

Restrictor Pressure at recovery: _____torr

Date/time:_____

Operator's initials:_____

L.8.4 Command thruster to a pressure equivalent to a flow rate of 4 mg/s (restrictor pressure of 4.4 torr as indicated by Data Logger readout). Induce breakthrough by closing RAVs 4A and 4B. Verify breakthough has occurred using the liquid point sensor. Re-open RAVs 4A and 4B. Record data with Data Logger until recovery is achieved. Record time required to achieve recovery.

L.8.4.1 **Close RAVs 4A and 4B** : Verify that controller Nos. 4A and 4B already powered up and that RAV selection switch is already set to RAVs 4A and 4B.

L.8.4.2 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.4.3 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.4.4 Activate controller for Nos.4A and 4B and record:

a) 4A run time: _____ seconds

4B run time: _____ seconds

b) current draw: _____ amp

c) time of day: _____

L.8.4.5 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.4.6 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.4.7 Record operation in RAV log book.

Verify that liquid was observed: _____

Date/time:_____

Operator's initials:_____

Time required to achieve recovery: _____ seconds

Date/time:_____

Operator's initials:_____

L.8.4.8 **Re-Open RAVs 4A and 4B** : Verify all RAV selection switches are in the OFF position.

L.8.4.9 Turn on RAV power supply and adjust current limit to 3.9 amps.

L.8.4.10 Adjust power supply to 28 VDC.

L.8.4.11 Power up RAV controller No. 4A.

L.8.4.12 Position selection switch to RAV-4A.

L.8.4.13 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.4.14 Power up RAV controller No. 4B.

L.8.4.15 Position selection switch to RAV-4B.

L.8.4.16 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.4.17 Activate controller for Nos. 4A and 4B and record:

a) 4A run time: _____ seconds

4B run time: _____ seconds

b) current draw: _____ amp

c) time of day: _____

L.8.4.18 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.4.19 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.4.20 Record operation in RAV log book.

L.8.5 Command thruster to a pressure equivalent to a flow rate of 6 mg/s s (restrictor pressure of 6.25 torr as indicated by Data Logger readout). Induce breakthrough by closing RAVs 4A and 4B. Verify breakthough has occurred using the liquid point sensor. Re-open RAVs 4A and 4B. Record data with Data Logger until recovery is achieved. Record time required to achieve recovery.

L.8.5.1 **Close RAVs 4A and 4B** : Verify that controller Nos. 4A and 4B already powered up and that RAV selection switch is already set to RAVs 4A and 4B.

L.8.5.2 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.5.3 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.5.4 Activate controller for Nos.4A and 4B and record:

a) 4A run time: _____ seconds

4B run time: _____ seconds

b) current draw: _____ amp

c) time of day: _____

L.8.5.5 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.5.6 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.5.7 Record operation in RAV log book.

Verify that liquid was observed: _____

Date/time:_____

Operator's initials:_____

Time required to achieve recovery: _____ seconds

Date/time:_____

Operator's initials:_____

L.8.5.8 **Re-Open RAVs 4A and 4B** : Verify all RAV selection switches are in the OFF position.

L.8.5.9 Turn on RAV power supply and adjust current limit to 3.9 amps.

L.8.5.10 Adjust power supply to 28 VDC.

L.8.5.11 Power up RAV controller No. 4A.

L.8.5.12 Position selection switch to RAV-4A.

L.8.5.13 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.5.14 Power up RAV controller No. 4B.

L.8.5.15 Position selection switch to RAV-4B.

L.8.5.16 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.5.17 Activate controller for Nos. 4A and 4B and record:

a) 4A run time: _____ seconds
4B run time: _____ seconds
b) current draw: _____ amp
c) time of day: _____

L.8.5.18 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.5.19 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.5.20 Record operation in RAV log book.

L.8.6. Command thruster to a pressure equivalent to a flow rate of 8 mg/s s (restrictor pressure of 8 torr as indicated by Data Logger readout). Induce breakthrough by closing RAVs 4A and 4B. Command thruster to a pressure equivalent to a flow rate of 8 mg/s. Verify breakthough has occurred using the liquid point sensor. Re-open RAVs 4A and 4B. Record data using Data Logger until recovery is achieved. Record time required to achieve recovery.

L.8.6.1 **Close RAVs 4A and 4B** : Verify that controller Nos. 4A and 4B already

powered up and that RAV selection switch is already set to RAVs 4A and 4B.

L.8.6.2 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.6.3 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.6.4 Activate controller for Nos.4A and 4B and record:

a) 4A run time: _____ seconds
4B run time: _____ seconds
b) current draw: _____ amp
c) time of day: _____

L.8.6.5 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.6.6 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.6.7 Record operation in RAV log book.

Verify that liquid was observed: _____
Date/time:_____
Operator's initials:_____

Time required to achieve recovery: _____ seconds
Date/time:_____
Operator's initials:_____

L.8.6.8 **Re-Open RAVs 4A and 4B** : Verify all RAV selection switches are in the OFF position.

L.8.6.9 Turn on RAV power supply and adjust current limit to 3.9 amps.

L.8.6.10 Adjust power supply to 28 VDC.

L.8.6.11 Power up RAV controller No. 4A.

L.8.6.12 Position selection switch to RAV-4A.

L.8.6.13 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.8.6.14 Power up RAV controller No. 4B.

L.8.6.15 Position selection switch to RAV-4B.

L.8.6.16 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.8.6.17 Activate controller for Nos. 4A and 4B and record:

a) 4A run time: _____ seconds
4B run time: _____ seconds
b) current draw: _____ amp
c) time of day: _____

L.8.6.18 Record final 4A switch status: Open: θ θ Closed: θ θ

L.8.6.19 Record final 4B switch status: Open: θ θ Closed: θ θ

L.8.6.20 Record operation in RAV log book.

L.8.7. Repeat test at higher mass flows, if necessary (if the other mass flows don't achieve recovery, or if recovery takes longer than 1 minute.) N/A this step if not required, otherwise, record data below:

Commanded equivalent thruster flowrate:_____mg/s

Time required to achieve recovery: _____ seconds

Date/time:_____
Operator's initials:_____

L.9 **Interim Shutdown Procedure:**

L.9.1 Close RAVs 4A and 4B.

L.9.1.1 Verify that controller Nos. 4A and 4B already powered up and that RAV selection switch is already set to RAVs 4A and 4B.

L.9.1.2 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.9.1.3 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.9.1.4 Activate controller for Nos.4A and 4B and record:

a) 4A run time: _____ seconds

4B run time: _____ seconds

b) current draw: _____ amp

c) time of day: _____

L.9.1.5 Record final 4A switch status: Open: θ θ Closed: θ θ

L.9.1.6 Record final 4B switch status: Open: θ θ Closed: θ θ

L.9.1.7 Record operation in RAV log book.

L.9.2 Begin pumping on dewar through bayonet by opening SV9.

L.9.3 Shut off power supply to thruster drive electronics.

L.9.4 Open JV8.

L.9.5 When pressure (as indicated by JP3) drops below 1 x 10-2 torr, open JV6.

L.9.6 Close valve to pump module. Shut down pump module.

L.10 **Full Shutdown Procedure:**

L.10.1 Close RAVs 4A and 4B:

L.10.1.1 Verify that controller Nos. 4A and 4B already powered up and that RAV selection switch is already set to RAVs 4A and 4B.

L.10.1.2 Record initial 4A switch status: Open: θ θ Closed: θ θ

L.10.1.3 Record initial 4B switch status: Open: θ θ Closed: θ θ

L.10.1.4 Activate controller for Nos.4A and 4B and record:

a) 4A run time: _____ seconds
4B run time: _____ seconds
b) current draw: _____ amp
c) time of day: _____

L.10.1.5 Record final 4A switch status: Open: θ θ Closed: θ θ

L.10.1.6 Record final 4B switch status: Open: θ θ Closed: θ θ

L.10.1.7 Record operation in RAV log book.

L.10.2 Deactivate RAV system:

L.10.2.1 Turn all RAV selection switches to OFF.

L.10.2.2 Power off all controllers.

L.10.2.3 Turn off RAV power supply.

L.10.3 Begin pumping on dewar through bayonet by opening SV9.

L.10.4 Open JV8.

L.10.5 When pressure (as indicated by JP3) drops below 1 x 10-3 torr, open JV6.

L.10.6 Open JV2 and JV5. **ENSURE JV2 IS FULLY OPEN.**

L.10.7 Hookup helium supply to JV9 and begin flowing gas.

L.10.8 Close valve to pump module. Shut down pump module.

L.10.9 Shut down UTS.

L.10.10 Continue backfilling with helium until pressure reaches 2.4 x 10^0 torr as indicated by JP3 or JP4. Close JV9.

L.10.11 Wait until plumbing has reached room temperature, then open JV9.

Test completed.

Completed by: _____
Witnessed by: _____
Date: _____
Time: _____

Figure 1: Porous Plug Characterization Test Setup

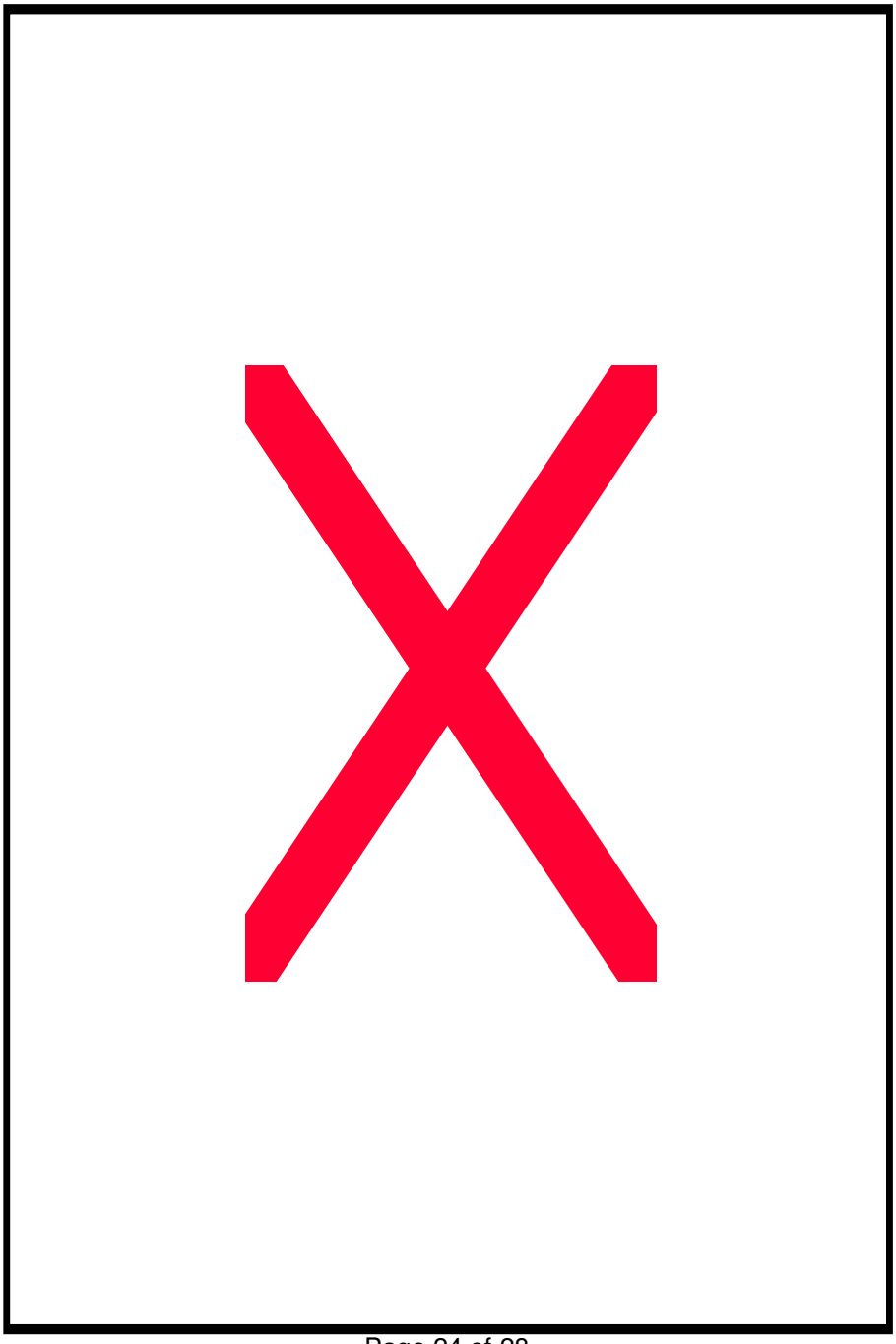

TABLE 1: Data Logger Scan Setup - FAST

Channel ID	Name	Function	Range	Resolution	Gain	Label
201	Restrictor Pressure	DC volts	± 10 V	4.5 Digits	-1.95437	Torr
202	Actuator Current	DC volts	± 1 V	4.5 Digits	1.0	VDC
203	Thruster Temp	2w ohms	10 K	4.5 Digits	1.0	OHM
204	Command Generator	DC volts	± 10 V	4.5 Digits	1.0	VDC
205	JP1-Plmg Upstream Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
206	JP2-Plmg Dwnst Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
207	JP3-Exhaust Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
208	JP4-Reference Press	DC volts	± 10 V	4.5 Digits	10.0	Torr
209	JT1-Plmg Upstrm Tmp	Temp (type T)			1.0	C
210	JT2-Plmg Dwnst Tmp	Temp (type T)			1.0	C
211	T10D-Main Tank Tmp	DC volts	± 10 V	5.5 Digits	1.0	VDC
212	T11D-Main Tank Tmp	DC volts	± 10 V	5.5 Digits	1.0	VDC
213	T12AD-Plug Dwmstrm	DC volts	± 10 V	5.5 Digits	1.0	VDC
214	T12BD-Plug Dwmstrm	DC volts	± 10 V	5.5 Digits	1.0	VDC

TABLE 2: Data Logger Scan Setup - TRENDING

Channel ID	Name	Function	Range	Resolution	Gain	Label
201	Restrictor Pressure	DC volts	± 10 V	4.5 Digits	-1.95437	Torr
202	Actuator Current	DC volts	± 1 V	4.5 Digits	1.0	VDC
203	Thruster Temp	2w ohms	10 K	4.5 Digits	1.0	OHM
204	Command Generator	DC volts	± 10 V	4.5 Digits	1.0	VDC
205	JP1-Plmg Upstream Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
206	JP2-Plmg Dwnst Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
207	JP3-Exhaust Pres	DC volts	± 10 V	4.5 Digits	10.0	Torr
208	JP4-Reference Press	DC volts	± 10 V	4.5 Digits	10.0	Torr
209	JT1-Plmg Upstrm Tmp	Temp (type T)			1.0	C
210	JT2-Plmg Dwnst Tmp	Temp (type T)			1.0	C
211	T10D-Main Tank Tmp	DC volts	± 10 V	5.5 Digits	1.0	VDC
212	T11D-Main Tank Tmp	DC volts	± 10 V	5.5 Digits	1.0	VDC
213	T12AD-Plug Dwmstrm	DC volts	± 10 V	5.5 Digits	1.0	VDC
214	T12BD-Plug Dwmstrm	DC volts	± 10 V	5.5 Digits	1.0	VDC
315	H-10D Voltage	DC volts	± 10 V	4.5 Digits	1.0	VDC
316	H-10D Current	DC volts	± 10 V	4.5 Digits	1.0	VDC
317	H-11D Voltage	DC volts	± 10 V	4.5 Digits	1.0	VDC
318	H-11D Current	DC volts	± 1 V	4.5 Digits	1.0	VDC
319	JV5 Open Indicator	2w ohms	10K	4.5 Digits	1.0	OHM
320	JV5 Closed Indicator	2w ohms	10K	4.5 Digits	1.0	OHM

FIGURE 2: Schematic of Dewar GSE Electrical Interface with LMMS Filter Box and Data Logger