GRAVITY PROBE-B

TEST PROCEDURE

PREPARE PROBE-C FOR TESTING

June 1, 1998

Originator
D. Murray

Approval:

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REVISION	PAGES	DATE/ APPROVALS
Original	All	June 1, 1998
A	Incorporate redlines from Probe C fit check operations	June 24, 1999

ABBREVIATIONS

xxP	Kit number xx of P type kits (ref. SU GP-B P0141)
ALSP	Airlock Support Plate
ALSPV	Airlock Support Plate Valve
ATC	Advanced Technology Center (at LMSS)
AVxx	Gas Module valve number xx
BPS	Bellville Pre-load System
CNT	Composit Neck Tube of Probe
ESD	ElectroStatic Discharge
EVxx	Gas Module Valve number xx
AWG	American Wire Gauge
Cryoperm	Trade name for cryogenic magnetic shielding
CT	Cooling Tube
CTE	Cryogenic Test Engineer
DAS	Data Acquisition System
DEV-xx	Dewar Exhaust Valve number xx
DVM	Digital Volt Meter
EEBA	Emergency Evauation Breathing Apparatus
EG-xx	Gas Module Exhaust Gauge number xx
ESD	ElectroStatic Discharge
EVRx	Gas Module Relief Valve number x
FIST	Final Integrated System Test
GHe	Gaseous Helium
GP-B	Gravity Probe-B program (also, Relativity Mission)
GRT	Germanium Resistance Thermometer
GSE	Ground Support Equipment
GTU-2	Ground Test Unit number 2
HEPA	High Efficiency Particulate Assembly
ISO	International Standards Organization
LD	Leak Detector
LDT	Linear Displacement Transducer
LGS	Leakage Gas System
LLS	Liquid Level Sensor
LMSS	Lockheed Martin Space Systems
LN_2	Liquid Nitrogen
mG	milli Gauss
MHz	Megahertz
NPB	Normal Boiling Point
Ozsi	Ounces per square inch
PPS	Programable Power Supply
PWx	Well Pressure gauge x
QD	Quick Disconnect - O-ring seal under screw down cap
RCM	Rotating Coil Magnetometer
RGA	Residual Gas Analyzer
RSE	Responsible Saftey Engineer
RQE	Responsible Quality Engineer
sccs	Standard cubic centimeters per second
SMD	Science Mission Dewar (of GP-B , Relativity Mission program)
SU	Stanford University
TAO	Thermal Acoustic Oscillation
TGxx	UTS Gauge xx
TM xx	Task Module number xx.
TVxx	UTS Valve xx
VMA	Valve of Mini-Airlock
UTS	Utility Turbo pumping Station
VFV	Vatterfly Valve
VSx	Valve number x on Shutter
VW-1	Valve on Dewar Adapter connecting Well to outside

Table of Contents

1 SCOPE

This procedure describes the steps necessary to effect the preparation of the Gravity Probe-B (GP-B) (Relativity Mission) Probe for testing after the initial insertion into the Science Mission Dewar (SMD).

Figure 1 is a Flow Diagram for the required procedures.

2 REFERENCE DOCUMENTS

2.1 Procedures:

The procedures listed are those required to insert a Probe into the SMD. S0317 presents an overview of the process and is for information only. The material of S0318 is used as a reference document with all the other procedures to identify the various attachment, lifting, etc. hardware that have been assembled into kits.

Procedure No.	Title
P0210	SMD Tank to Well Helium Transfer
P0207	SMD Main Tank Normal Boiling Point Fill
P0133	Preparation for Probe/Airlock Integration
P0134	Airlock/Dewar Integration
P0135	Probe Insertion into Dewar
P0141	FIST Emergency Procedures
S0317	Probe/SMD Insertion Overview
S0318	Prove/SMD Hardware Kit list

2.2 Drawings:

Lockheed Dwg No.	
5833519 Rev C	Helium Airlock Assembly
5823341 Rev D	Helium Airlock Installation
5813359	Axial-lock Assembly
5813395	SMD External plumbing

2.3 Figures

Fig. 1	Test Flow for Probe Insertion
Fig. 2	Gas Module Plumbing Configuration

2.4 Supporting documentation

2.4.1 netic Control Plan, LMMS-5835031

2.4.2 2.4.3 ty Compliance Assessment, LMMS GPB-100153C 100153C

2.4.4 FMECA, LMMS GPB-100333

2.4.5 rgency Procedures SU/GP-B P0141

2.4.6 var Hardware Kit List, SU/GP-B P0144

2.4.7 Assembly, LMMS 5833500

2.4.8 ntamination Control Plan SU/GP-B P059

TEST FLOW CHART

FOR

PREPARE PROBE-C FOR TESTING - P0140

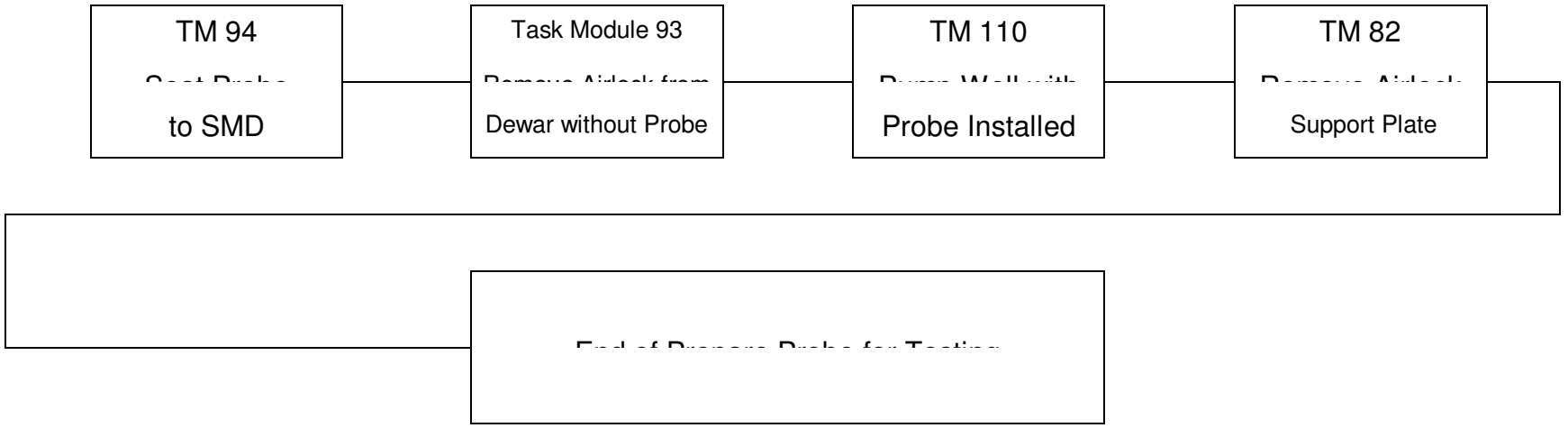

Figure 2 Gas Module Plumbing Schematic

3 SAFETY

3.1 General

Personal injury and hardware damage can result during normal positioning, assembly and disassembly of hardware (e.g. positioning of Dewar in tilt stand; integration of probe into airlock; integration of airlock/probe onto Dewar; removal of airlock from Dewar; removal of probe from Dewar); and during positioning of support equipment (e.g. pressurized gas cylinders; supply dewars).

Undesired events associated with these operations include: (1) Personnel or other objects are struck (e.g. by forklift or crane load) when hardware is being moved . (2) Personnel who are positioning hardware get their hands or feet caught between objects as hardware is moved into place. (3) Suspended hardware is dropped. (4) Personnel who are present during hardware movements (e.g. by forklift; crane) are caught between objects (e.g. forklifts and walls; loads and building support columns).

3.2 Lifting operations

The following Paras. apply to lifting operations.

3.2.1 Hard hats shall be available and used by personnel working around elevated working platforms.

3.2.2 Hoisting equipment operators shall be trained and qualified in the safe operation of all lifting equipment employed. They shall be competent in rigging lifting hardware. It is the responsibility of these individuals to ensure proper lifting configuration, based upon a review of procedures, drawings, training and experience.

3.2.3 Movements shall be verbally rehearsed before performing them.

3.2.4 All personnel in the area of hoisting operations shall wear hard hats.

3.2.5 Spotters shall be used as required. The crane operator and spotters shall agree upon and use a standard safety signal system prior to the start of any lifting operation.

3.2.6 Personnel who are positioning hardware shall use extreme caution so that they don't get their fingers pinched between the load and other objects.

3.2.7 Standard rigging fittings and lifting devices specially designed for the specific task shall be used at all times for hoisting material and equipment. The use of C-

clamps, mild steel bolts and non-shouldered eye bolts are prohibited for use as rigging fittings.

3.2.8 Safety hoist ring bolts shall be tightened to the torque value indicated on the safety hoist rings. Safety hoist rings shall not be modified in any manner. The use of substitute parts is expressly prohibited. Only those replacement or exchange parts recommended by the manufacturer are authorized.

3.2.9 The hoist operator shall visually inspect accessory hoisting equipment for damage or defects prior to each use. Particular attention shall be paid to the condition of slings (e.g. broken wires, fraying, excessive wear, abrasions, kinks, deformation, cracks, etc.). Equipment found to be defective shall be immediately removed from service and reported to the supervisor.

3.2.10 The hoist operator shall inspect cranes, hoists and all other primary lifting equipment each day before the initial use and before any critical lifting operation as specified by procedure. He shall perform a hoist checkout, or verify one has been performed within the previous seven days.

3.2.11 The hoist operator shall be responsible for the rigging of each lifting operation called out in each procedure. The lifting sling, attachment, etc., shall be selected from P0144, Probe-B/SMD Hardware Kit List.

3.2.12 The hoist operator shall be responsible for the safety of all lifting operations.

3.3 Injuries

In case of any injuries adhere to the following:

3.3.1 Obtain medical treatment. **Call 9-911**

3.3.2 Notify Test Director, Mike Taber, telephone **54136** or beeper **(9) 599-8033**

3.4 Liquid Helium Dump

Certain failure modes of the SMD can lead to a rapid dump of liquid/gaseous helium into the room. The following precautions will minimize possibly injury to personnel.

3.4.1 Non-flight diverters (90-deg elbows) are to be attached to the outboard flange of the two Main Tank and two Vacuum Enclosure burst disk assemblies. These diverters shall be positioned to direct the potential helium flow to the floor (or

other designated safe dump area).

3.4.2 When the diverters are directed to the floor, drip pans shall be placed under them to prevent liquid oxygen collection on the floor.

3.4.3 In the case of a fast helium dump the oxygen concentration may be lowered below a safe level (19.5%). In this case an oxygen concentration sensor mounted on the west wall will sound an alarm. All personnel shall immediately exit the FIST Operations room.

3.5 Genie Operations

Work at the top of the Airlock after it has been integrated with the SMD requires the use of Genie personnel lifts. The following steps shall be used whenever the Genie lifts are employed.

3.5.1 Before raising the Genie ensure the four outriggers (or floor anchors) have been installed and locked and the leveling jacks have been adjusted to firmly touch the floor and the base is level.

3.5.2 Do not adjust outriggers or reposition the machine while the platform is raised.

3.5.3 No work should be performed by leaning out over the rails.

3.5.4 Those working at the top of the Airlock shall each have easy access to an EEBA (Emergency Exit Breathing Apparatus) to be used for evacuating the room in case of a sudden dump of the helium cryogen and resultant depletion in oxygen concentration in the room.

3.6 Safety

The SMD Safety Compliance Assessment, LMMS GP-B 1000153C, discusses the safety design, operating and maintenance requirements of the SMD. This document should be reviewed for applicability at any facility where the hardware is operated.

3.7 Hazards Analysis

The GP-B SM Dewar FMECA, LMMS GP-B 100333, discusses hazards inherent in ATC-developed SMD hardware in detail.

3.8 Emergency Procedures

The FIST Emergency Procedures, SU/GP-B P0141, sets forth the procedures to be taken in case of facility power loss, arming and disarming the FIST alarm system and safeing of equipment in case of a sudden loss of liquid helium from the Dewar.

4 CONTAMINATION CONTROL

4.1 Particulate Contamination:

The control of particulate contamination of the probe is described in GP-B Contamination Control Plan SU/GP-B P059. Specific cases that require special methods are treated individual in this procedure. In general the when the Probe is in the FIST Lab it should be covered in clean room plastic and handled with gloves.

4.2 Magnetic Contamination:

The control of magnetic cleanliness of the probe and/or dewar is described in GP-B Magnetic Control Plan, LMMS-5835031. Specific cases that require special tools and handling are treated individually in this procedure.

5 TEST PERSONNEL

5.1 Personnel Qualifications:

The performance of this procedure requires a Test Director and crew of from 1 to 3 Cryogenic Test Engineer (CTE) and one Responsible Safety Engineer (RSE). The RSE attendance for Test Modules 92 and 93 is required; his attendance at other portions of the procedures is at his discretion.

The test director is the designated signer for the Awitnessed by≅ signoffs located at the end of each procedure/task module.

5.2 Qualification of Personnel:

The Test Director must have a detailed understanding of all procedures and facility operations and experience in all of the Probe insertion operations.

The Cryogenic Test Engineers must have Probe/FIST operations experience and an understanding of the operations and procedures used for the cryogenic servicing/maintenance of the Dewar.

At present (May, 1998) the personnel who qualify for the above categories are:

Test Director:	Mike Taber	Stanford University
	Dave Murray	Lockheed
Cryogenic Test Engineer:	Tom Welsh	Lockheed
	Dave Frank	Lockheed
	Dean Read	Lockheed
	Dave Donegan	Lockheed
	Chuck Warren	Stanford University
	Mike Taber	Stanford University
	Dave Murray	Lockheed
Quality Engineer	Ben Taller	Stanford University
	Phil Unterreiner	Lockheed
Safety Engineer	John Janicki	Lockheed
	A. Rodriguez	Lockheed

5.3 Redline Authority

The persons authorized to create and sign-off on redline modifications of the procedure as it is performed are the test directors, M. Taber and D. Murray. The redlines will be reviewed and approved by the RQE during or after the performance of the redline.

5.4 Critical Operations

All operations which are deemed critical by the test director(s), e.g., any moving or lifting of the Probe, shall have at least one Test Director and a RSE in attendance.

5.5 Quality Assurance

Quality Assurance engineering shall be notified at least 48 hours prior to the start of this procedure. In the event of a failure during the execution of testing, Quality Assurance shall be contacted. Any redlines made to this procedure shall be initialed by a program RQE prior to his/her final sign off.

6 OPERATIONS

6.1 Verify that the Critical Operations Review meeting of Para. 4.3 has been completed and that all applicable personnel have attended or been briefed of the results.

6.2 Test Director for this Procedure is: _____ .
Starting Date & Time: _____ .

6.3 Verify responsible safety and quality engineers have been notified at:

Time/Date

6.4 Verify Completion of procedure P0135 Probe Insertion.

6.5 Perform, in sequence, the following Task Modules:

Task Modules for Probe Insertion						
Para. No.	Task Module	Op. No.	Started		Completed	
			Date	Time	Date	Time
5.3.1	Task Module 94: Seat Probe to Dewar					
5.3.2	Task Module 93: Remove Airlock from Dewar without Prob					
5.3.3	Task Module 110: Pump Well with Probe Installed					
5.3.4	Task Module 82: Remove Airlock Support Plate					

6.6 Prepare Probe for Testing completed.

Approved By:

Witnessed By:

RQE signoff:

Date:

Time:

APPENDIX A

TASK MODULES

FOR

PROCEDURE
P0140

Task Module 94: Seat Probe to Dewar

Task Module 94: Seat Probe to Dewar

Operations Number
Date Initiated
Time Initiated

A Scope

This module effects the removal of the Probe Spacer Flange and seating the Probe onto the Dewar O-ring flange. In addition, this procedure results in the mating of Probe and Dewar Station 200S and the mating of the Probe thermal shoes to the Dewar thermal stop rings.

B General Requirements

B.1 Magnetic screened tools, obtained from non-magnetic tool box are used for all open well operations. Magnetic Zone SP, black marking (shrink tubing), is to be assumed.

B.2 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry, unless otherwise noted.

C Configuration Requirements

C.1 Probe is installed in the Dewar with the Probe Spacer Flange interfaced with the Probe and Dewar with Piston Plate and Airlock in place and the bottom door of the Airlock removed.

D Hardware Required

D.1 Hardware installed/removed/used:

a) Probe Spacer Flange (removed)
b) Titanium (6AL-4V) bolts, 0.250-28 UNJF, Part No. NAS6404V6H, 0.750 long for fastening Top Hat flange to SMD (30).
c) Belleville washer Part No. 1C34360-105 (install nearest SMD).
d) Flat washer, Part No. 1C34361-112.
e) Kit 33G, 3/4-in long bolts for interim fastening Top Hat flange to SMD (6)

D.2 Tools required:

a) Linear Displacement Transducers (LDT) (3)
b) Miscellaneous hand tools
c) 7/16 combination open/box end wrench (3)
d) Torque wrench (snap over type) with 7/16 socket (2)
e) 7/64 allen speed wrench (magnetic) for Split Spacer handles
f) Set of Brass feeler gauges

Task Module 94: Seat Probe to Dewar

F Operations

1 Verifying Liquid Helium Levels:

1.1 Perform internal tank to Well transfer per Procedure SU P210 as required to meet requirements of para 1.2. Ops Order No.

1.2 Fill the Well until it is just over 0%

1.3 Record liquid helium levels; verify above (req=d %): Tank (∃3

Guard Tank (NA) _____ %

Well (100%) _____ %

Axial Lock (<0%) _____ %

Time

Date

CAUTION

The helium level in the Well must not be allowed below the top of the 10-in Lead Bag which is at a Well liquid level sensor reading of 10 %.

NOTE

The well liquid level will tend to change rapidly with a Probe installed due to the low liquid volume per unit of height.

1.4 Record the time the Axial Lock level passed 0%: Date/Time

Record time: Time

2 Arrange Equipment in Airlock:

2.1 Install the three LDTs (Linear Displacement Transducers) to bear on the Top Hat valve support structure in the following locations:

a) At ~ 10-deg CW from valve P1A

b) Between valves CG3 and CG4, 60-deg CW from BPS #1

c) Between Valves S1 and S2, 15-deg CCW from BPS #3

2.2 Bring LDT lead wires into the auxiliary hole of the Airlock Support Plate and seal with vacuum putty.

2.3 Verify functionality of LDTs, 9 volt excitation used on channel #4 of the Vishay signal conditioner (One volt ~ 1-in).

2.4 Verify all tools and equipment of Section D are installed inside the Airlock:

Record additions /deletions:_____

2.5 Verify Probe and Dewar areas are free of moisture.

2.6 If Top Hat heater is operating record:

Voltage _____ Current _____

Task Module 94: Seat Probe to Dewar

2.7 Position three of the 5/8-in bolts and washers from Kit 33G at each of the three BPS locations.

2.8 Place the remaining three 5/8-in bolts and washers in a plastic storage bin.

2.9 Place seven each 5/8-in bolts and washers in three plastic storage bins.

2.10 Tilt the bins so that Air will spill out during purge.

3 Purge Airlock:

3.1 Inspect for and remove any tools or other unnecessary objects that may have been placed inside the Helium Airlock.

3.2 Verify Well vent via 3-ft length of 1-in flexible vacuum line to the GM is connected and operational.

3.3 Install Gloves onto the Airlock. Locations, as numerically inscribed in the Airlock's ports, are as follows:

3.3.1 Port No. 16: Right hand glove.

3.3.2 Port No. 18: Right hand glove.

3.3.3 Port No. 20: Right hand glove.

3.3.4 Port No. 22: Right hand glove.

4 Sealing the Helium Airlock.

4.1 Verify Probe vacuum pumping operations, if any, have been closed out.

4.2 Install Airlock Windows over all open access holes in the Airlock. Use O-ring No. 7 and 8 screws, washers, and lock washers from Kit No. 15G per Access Cover.

4.3 Install Airlock Bottom Door.

4.4 Inflate the Piston inflatable seal to 5 +/-1 psig.

4.5 Prepare to introduce helium gas to purge the Airlock via the quick disconnect fitting located on the support plate.

4.6 Verify the 0-10-in H_2O pressure gauge has been installed in the Support Plate

Task Module 94: Seat Probe to Dewar

5 Setting up Well Purge:

5.1 Initiate helium gas purge of Airlock via facility helium supply.

5.2 Maintain pressure at regulator to produce a flow of ~ **200 cuft/hr** (6 pack in 6 hrs.); use 6 pack supply pressure to track flow rate using 2 psig (6 pack)~1 cuft.

Date/ Time	6 pack Press	Flow Rate	Date/ Time	6 pack Press	Flow Rate	Date/ Time	6 pack Press	Flow Rate
---	psig	cuft/hr	---	psig	cuft/hr	---	psig	cuft/hr

a 5.3 Turn on power to O_2 Sensor and verify collection by FDAS. Note: at the above rate the purge should take approximately 2 hours.

5.4 Purge the Helium Airlock until the O_2 level is < 0.2 %.

CAUTION

When shutting down purge flow, take care that Airlock pressure does not go to zero, maintain sufficient flow to maintain > 0.2 in H_2O.

Remove hands form gloves slowly to avoid negative pressure.

6 Prepare Probe for Seating Operations:

6.1 Verify Crane maximum load cutoff has been set and tested with the last seven days.

Crane has been checked, skip this subsection

Crane has not been checked

Task Module 94: Seat Probe to Dewar

6.1.1 De-mate the Crane from the Piston Assembly/Compliance Device (Lockheed P/N 5829166-106) and move it to the lower floor area.

6.1.2 Install/verify installed the crane radio control Lockout Device which prevents AEast≅, AWest≅ and AP2" (fast) button operations.

6.1.3 Set the crane load limit to 1400 lbs. (This is the required setting for the case the Probe insertion is aborted and the Probe needs to be removed.)

6.1.4 Verify that the crane can lift the 1400 lb Test Load but shuts off by 1500 lbs: use the Load Cell Assembly to verify the weight limits.

6.2 Hook up Crane with Crane load cell to Probe via the Compliance Device.

6.3 Verify Crane is centered over the Probe .

6.4 Verify Crane load cell readout is connected to a strip chart recorder and Facility DAS and BPS DAS.

7 Set Up DAS Equipment:

7.1 Verify SMD DAS is running and record software: File: _____

7.2 Verify Facility DAS is running and record software: File: _____

7.3 BPS Equipment:

7.3.1 Verify proper setup of BPS DAS and Vishay signal conditioner has been done: refer to Addendum A for details.

7.3.2 Verify BPS DAS is running and record software: File: _____

7.3.3 Verify BPS DAS is plotting load versus displacement.

7.4 Begin data recording in Table 1.

Task Module 94: Seat Probe to Dewar

Task Module 94: Seat Probe to Dewar

8 Seating the Probe to Dewar with Airlock in Place:

8.1 Removing the Spacer Flange.

8.1.1 Verify all Top Hat Flange bolts have been removed.

8.1.2 Remove slack from the Crane/Probe connection one bump at a time until Top Hat flange is just separated from Spacer Flange (~ 1/8-in should be enough clearance).

NOTE

The BPS output probably will not register the above Crane motion as the motion is in a reverse direction (unloading): the BPS hysteresis will therefor mask the load change.

NOTE:

Two persons are required for the removal of each spacer half section.

8.1.3 Remove the bolts holding the spacer half sections together, two places.

8.1.4 Holding both handles of the -X spacer half, tilt the handles down slightly and remove the spacer by pulling back in the -X direction. Note: this Spacer half is has mating cutouts which clock to the Dewar top.

8.1.5 Holding both handles of the +X spacer half, tilt the handles down slightly and rotate the spacer CW until the +Y tang has cleared the Dewar vent valve handle.

8.1.6 Remove spacer by pulling back in the + X direction.

CAUTION

In the following Do not exceed a BPS total force of 2800 lbs.

8.2 Record data in Table 1 with appropriate comment.

8.3 Slacken Crane a small step at a time

8.4 When Top Hat flange is low enough, Insert three Titanium (6AL-4V) bolts, 0.250-28 UNJF, Part No. NAS6404V6H, 0.750 long using one Belleville washe, Part No. 1C34360-105 (install nearest SMD) and one flat washer, Part No. 1C34361-112, in the bolt holes located at the markings for each BPS and adjust these finger tight and then backed off one turn.

8.5 Stop when Crane is slack: verified by observation of the crane load cell strip chart recorder.

8.6 Verify Crane load is zero.

8.7 Tightening down Probe to Dewar:

NOTE:

In the following the torque limit of 50 in-lb must be measured with snap over-torque wrench. The bolts used are 50 ksi commercially pure Ti.

8.7.1 Adjust each screw to bring the Probe in contact with the Dewar progressing 1/6 turn at a time: record data in Table 1.

8.7.2 When torque exceeds estimated 50 in-lb, insert more bolts in a symmetric pattern: record in Table 1.

8.7.3 Continue bolting down Probe until Top Hat flange is mated (metal-to-metal) with the Dewar or the load cell total force reaches the limit of 2800 lbs.

8.7.4 Verify Top Hat Flange is metal-to-metal with Dewar: use brass feeler gauges.

8.8 Final Bolt-down:

8.8.1 Stop helium purge.

8.8.2 Open Bottom Door of Airlock and windows as required..

8.8.3 Insert remaining bolts and washers (see para. 8.3) and torque all bolts to a measured 50 in-lb.

NOTE: Final torquing may have to be done after Airlock removal.

8.8.4 Verify Top Hat Flange is metal-to-metal with Dewar: use brass feeler gauges.

8.9 The seating of the Station 200S is affirmed by the BPS load versus LDT displacement slope change (increase). (This slope change is calculated to be quite small). Record/calculate the separation of the Probe Top Hat and Dewar flange at this condition: _____ -in.

Task Module 94: Seat Probe to Dewar

9 Finalizing Probe/Dewar Configuration:

9.1 Verify open DEV-19.

10 Module 94 completed.

Completed by:

Witnessed by:

RSE:

Date:

Time:

RQE:

Task Module 94: Seat Probe to Dewar

Table 1 BPS/LDT data

Date/ Time	T_{S200D} CN 1	T_{S200P} CN118	T_{HEX1D} CN5	T_{HEX1P} CN141	BPS-1 CN81	BPS-2 CN82	BPS-3 CN83	T_{BPS} a/b	LDT-1 CN84	LDT-3 CN85	LDT-3 CN86	Comments
	(K)	(K)	(K)	(K)	(lb)	(lb)	(lb)	(K)	inxE-3	inxE-3	inxE-3	

Task Module 94: Seat Probe to Dewar

Table 2 BPS Bolt Down Data*

Date/ Time	Bolt @ BPS1 turns	BPS1 running Torque (in-lb)	Bolt @ BPS2 turns	BPS3 running Torque (in-lb)	Bolt @ BPS3 turns	BPS3 running Torque (in-lb)	Comments
	Gap LDT/Feeler		Gap LDT/Feeler		Gap LDT/Feeler		

Task Module 94: Seat Probe to Dewar

* BPS bolt down counts - plus is CW and minus is CCW

Task Module 94: Seat Probe to Dewar

Addendum A for Task Module 94

Setup of BPS Signal Conditioning and Data Acquisition Equipment

1 Prepare Equipment

1.1 Connect the equipment per Figure 94-1.

1.2 Verify Vishay excitation switches are off.

1.3 Power up MAC PC and start program ...

1.4 Power up Vishay and allow 30 minutes warmup.

2 Setup:

2.1 Set/verify set the values in the Table below.

2.2 Make adjustments to BPS DAS parameters as indicated in 5 below.

Unit	Note	BPS-1	BPS-2	BPS-3
Serial No.		BPS001	BPS003	BPS004
Channel No.		1	2	3
Excitation Voltage	1	3.000	3.000	3.000
Multiplier Setting(200)	2	200	200	200
Potentiometer Setting (5.00)	3	5.00	5.00	5.00
BPS DAS reading at Bridge Balance (lb)	4	333	333	333
Cal A voltage: Measured:	5			
Reference Value:		0.999	0.998	0.999
Cal B voltage: Measured:	5			
Reference Value:		-1.003	-0.993	-0.991

1. Set this voltage using external voltmeter at Exc Meter +/-.

Task Module 94: Seat Probe to Dewar

2. Setting is via screw drive adjustment.

3 Setting on 10 turn pot with 100 counts=1.00. The Gain is the product of this and the previous value. The overall sensitivity is given by GainxSensitivity(.001mv/v)xExcitaiton Voltage or nominally 3mv/unit= 3mv/lb.

4 The expected load for the condition of the Probe installed in the Assembly stand and the BPS adjusted to give a probe length (distance between mating surface of the Top Hat Flange and the mating surface of the Probe Station 200) of 34.827 is estimated to be between 894lb and 1028 lb: 1000 lb is used here.

5. These measurements allow for accurate compensation for lead wire resistance. The average shortfall between measured and reference value proportioned to the reference value is used to proportionally adjust the Vexc used in The BPS DAS (3.0 volt for no correction): the Vishay Vexc is kept at 3.0 volts.

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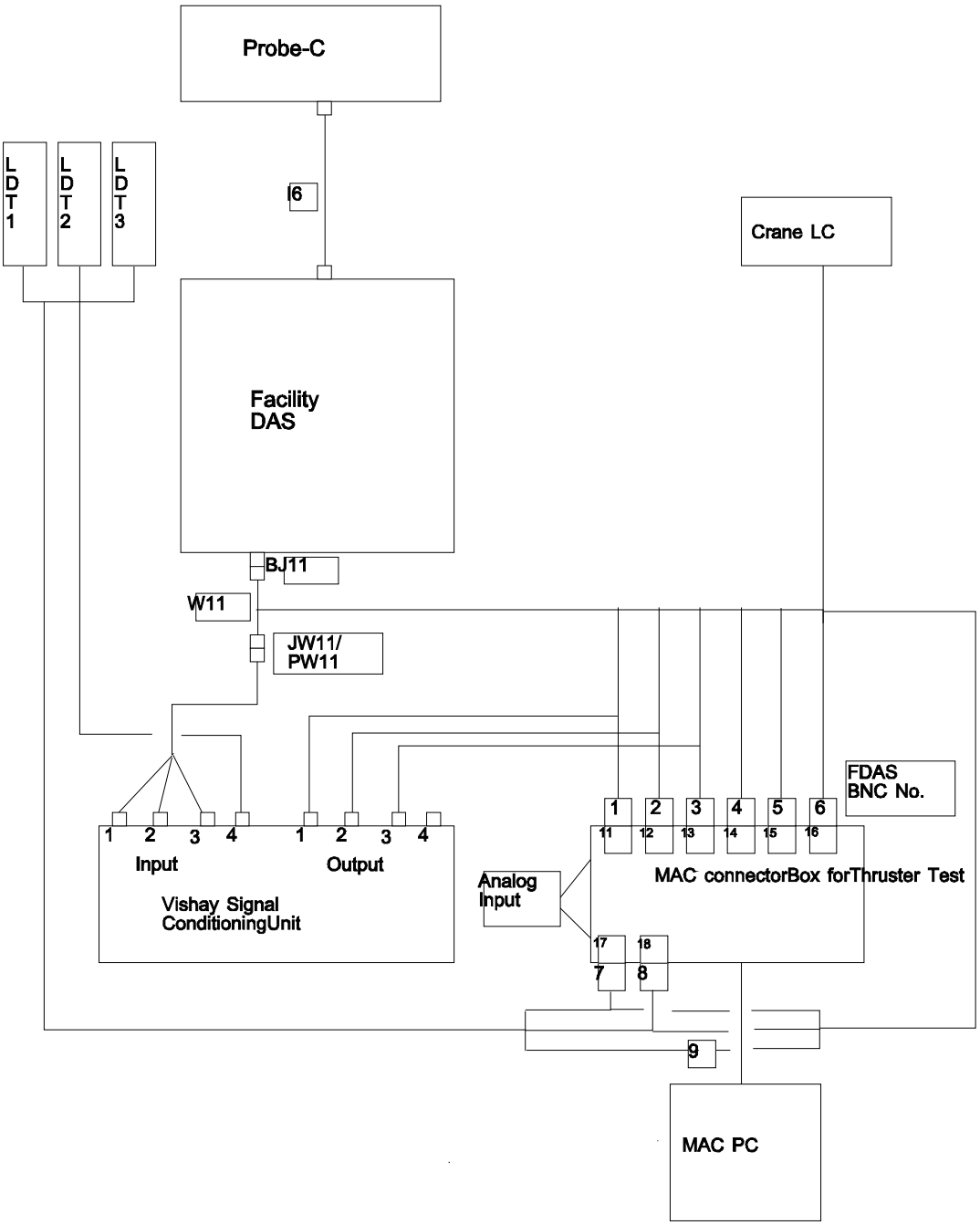
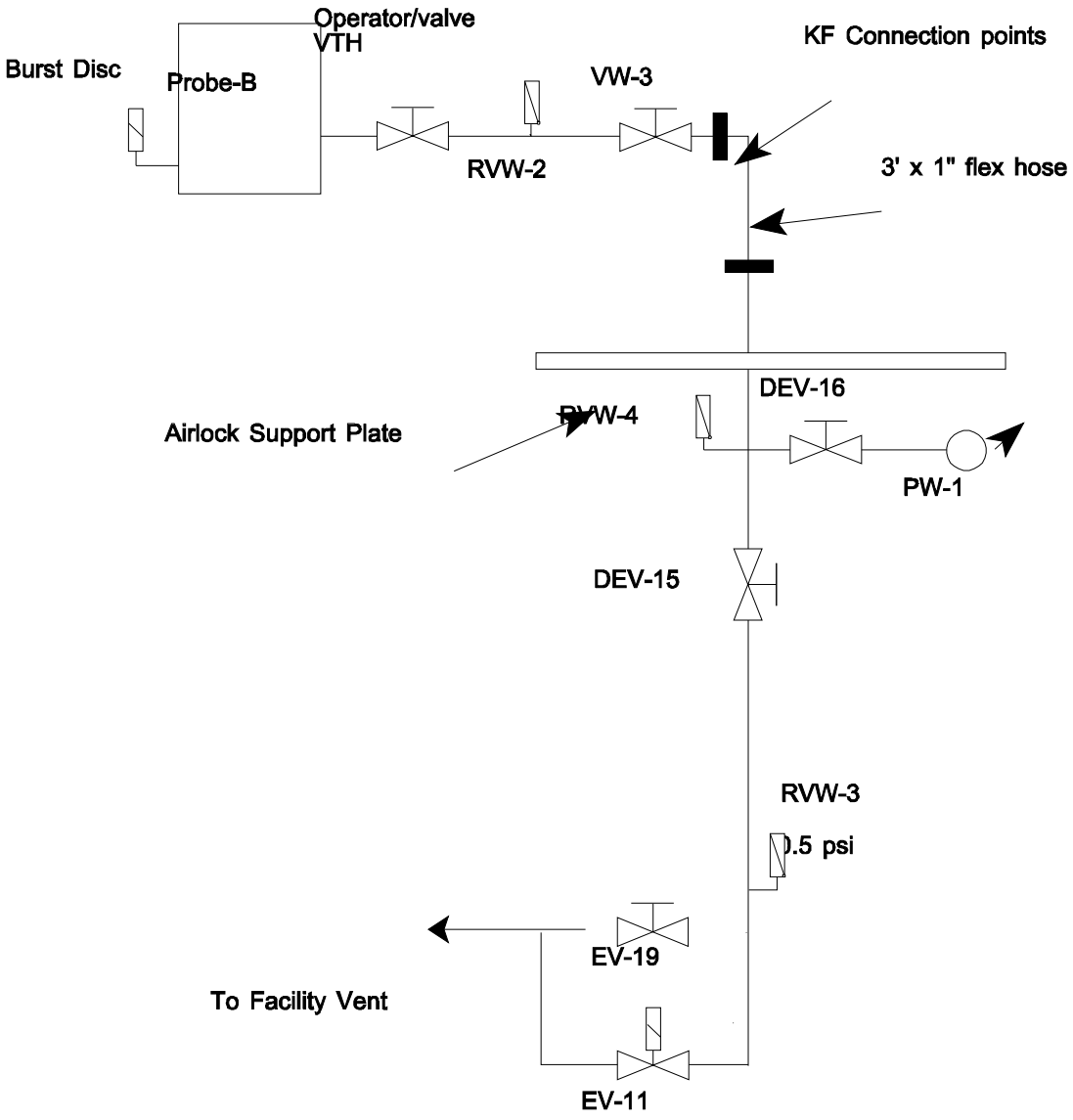


Figure 94-1 BPS Setup

Task Module 94: Seat Probe to Dewar

Figure 94-2 Post-Insertion Well Vent Plumbing Configuration



Task Module 93: Remove Airlock from Dewar without Probe

Operations Number
Date Initiated
Time Initiated

A SCOPE

This module effects the removal of the Airlock Assembly (Airlock, Piston, Bridge and Guide Rods) without a Probe from the Dewar .

B GENERAL REQUIREMENTS

B.1 Magnetic screened tools, obtained from non-magnetic tool box are used for all open-well operations. Magnetic Zone SP, black marking (shrink tubing), is to be assumed unless Zone 2, yellow marking, is specifically called out.

B.2 All O-rings installed shall be visually inspected, cleaned with isopropyl /ethyl alcohol as required and installed dry unless otherwise specified.

C CONFIGURATION REQUIREMENTS

C.1 The successful completion of Task Module 92: Lower Probe into Dewar.

D Hardware Required

D.1 Hardware installed/used:

a) Kits: 23P, 19G
b) Overhead Crane
c) Load Cell Assembly (Lockheed P/N 5833512)
d) Compliance Device (Lockheed P/N 5829166-106)
e) Guide Rod Lifter (Lockheed P/N 5833518-101)
f) Guide Rod Spacer Blocks

D.2 Hardware removed:

a) Kits: 5G, Clocking Assembly fasteners

10G, Probe to Piston fasteners

13Ga, Airlock Cylinder to A/L Support Plate fasteners

17Ga, Bridge to Piston fasteners

13Pa, Guide Rod supports to Support Plate fasteners

b) O-Rings: Nos. 4 and 6

D.3 Tools required

a) Miscellaneous hand tools.

E OPERATIONS

1 Verifying Liquid Helium levels:

1.1 Verify RSE has been notified of moving of flight hardware. Date/Time: _____ .

1.2 Verify that the liquid helium level in the Dewar Axial-Lock is greater than 5%. If not then perform Internal Well Fill, P0210. Note: VW-3 must be opened for Well fill for low back pressure venting.

1.3 Record liquid helium levels.

Tank (>30%) _____ %

Well (>100%) _____ %

Guard (N/A) _____ %

Axial Lock (>5%) _____ %

Time

Date

CAUTION

The helium level in the Well must be kept above the top of the 10-in Lead Bag which is at a Well level of 10 %. With the Probe installed the Dewar liquid level will drop quickly once the Well level sensors indicate <100%.

1.4 Maintain the Well level sensors > 90% for the duration of this Task Module.

WARNING

All personnel in or around crane handling operations or close to the Airlock must be wearing hardhats at all times.

2 Preparing to raise the Piston:

2.1 Remove Airlock Bottom Door, Windows and Gloves as necessary to gain access to the top of the Piston.

2.2 Verify relief valve RVW-2/-4 is relieving, Ref. Fig 93-1.

2.3 Remove 4 sets of Spherical Nuts and Spherical Washers. Stow into Kit No. 10G.

2.4 Using access through Airlock door remove Well Cover, Dial Indicator Gauge and all tools and any other loose items.

2.5 Pause the DAS and disconnect internal cables W101, W104 and W106.

2.6 Connect through the door cables I-3, I-5 and I-6.

2.7 Recommence DAS operation.

2.8 Deflate the Piston Inflatable Seal.

2.9 Remove the two wing nuts and washers securing the Plate on the Clocking Assembly and stow in Kit 5G.

2.10 Remove the balancing weight(s) (not ballast weights) from the Piston.

3 Raising Piston:

3.1 **Verify Piston is unbolted from Probe.**

3.2 Use the Overhead Crane to raise the Piston to near the top of the Airlock cylinder.

3.3 Remove the ballast weights and threaded rods.

3.4 Continue raising Piston until within 0.5-in of Bridge.

3.5 Secure the Piston to the Bridge with four 3/8-16 x 2-7/16 screws (Kit 17Ga), adjust the bolts so each has the same gap between bolt head and Bridge.

4 Preparing the Guide Rods:

4.1 Slacken Crane and de-mate from Compliance Device: remove Load Cell from Crane.

4.2 Fasten Guide Rod Lifter U-side up, to Guide Rods with two 0.5-13 X 1-3/16 -in bolts (Kit No. 20 G).

4.3 Loosen the two Guide Rod Clamps on the Airlock Support Plate.

4.4 Mate Crane to Guide Rod Lifter and lift Guide Rods to height sufficient to install Guide Rod Spacer Blocks.

4.5 Install Spacer Blocks, securing with locking T-pins at top and bottom of spacer.

4.6 Using Crane, lower Guide Rods until resting on Guide Rod Spacer Blocks.

4.7 De-mate Crane from Guide Rod Lifter.

4.8 Remove Guide Rod Lifter and stow in Genie lift.

4.9 Mate Crane with Load Cell to Compliance Device.

4.10 Disconnect the helium supply line from the inflatable seal.

4.11 Remove the upper scaffolding per engineers instructions.

5 Preparing to raise the Helium Airlock off the Dewar:

5.1 Remove, bag, and tag (Kit No. 13G), the 36 screws, lock washers, nuts, and 72 washers that hold the Airlock to the Airlock Short Cylinder.

5.2 Verify removal of all loose hardware from the Airlock Bridge and Piston area.

6 Removing Airlock without Probe:

6.1 Using Crane, raise Airlock to maximum height allowed by ceiling clearance and Guide Rods.

NOTE

Approximate clearances are: GR to support plate = 4.75-in, Air Lock to Support Plate= 9.1-in.

CAUTION

In the following, due to the small clearances, care must be taken that the moving parts of the Airlock hardware do not damage the Probe Top Hat hardware.

6.2 Move Airlock away from Probe/Dewar using CW rotation and small westward Crane translations to allow the Guide Rods to avoid the Probe Top Hat hardware.

6.3 Using Crane, move the Airlock over the Airlock Dolly and lower to just above the Dolly.

6.4 Install Airlock Bottom Door.

NOTE

Align the two bottom flange pins with mating cutouts in dolly.

6.5 Using Crane, lower Airlock onto Dolly.

6.6 Disconnect Crane and Load Cell from Compliance Device and secure Crane.

7 Configuring Probe/Dewar:

7.1 Verify connected, Probe plumbing to the Well Exhaust Manifold per Fig. 1.

7.2 Verify installed instrumentation cables I-3, I-5, and I-6.

7.3 Fold the Support Plate O-ring, Kit No. 6, onto the lower part of the Top Hat. (This O-ring can be removed only by cutting or removal of the two SMD vent lines.)

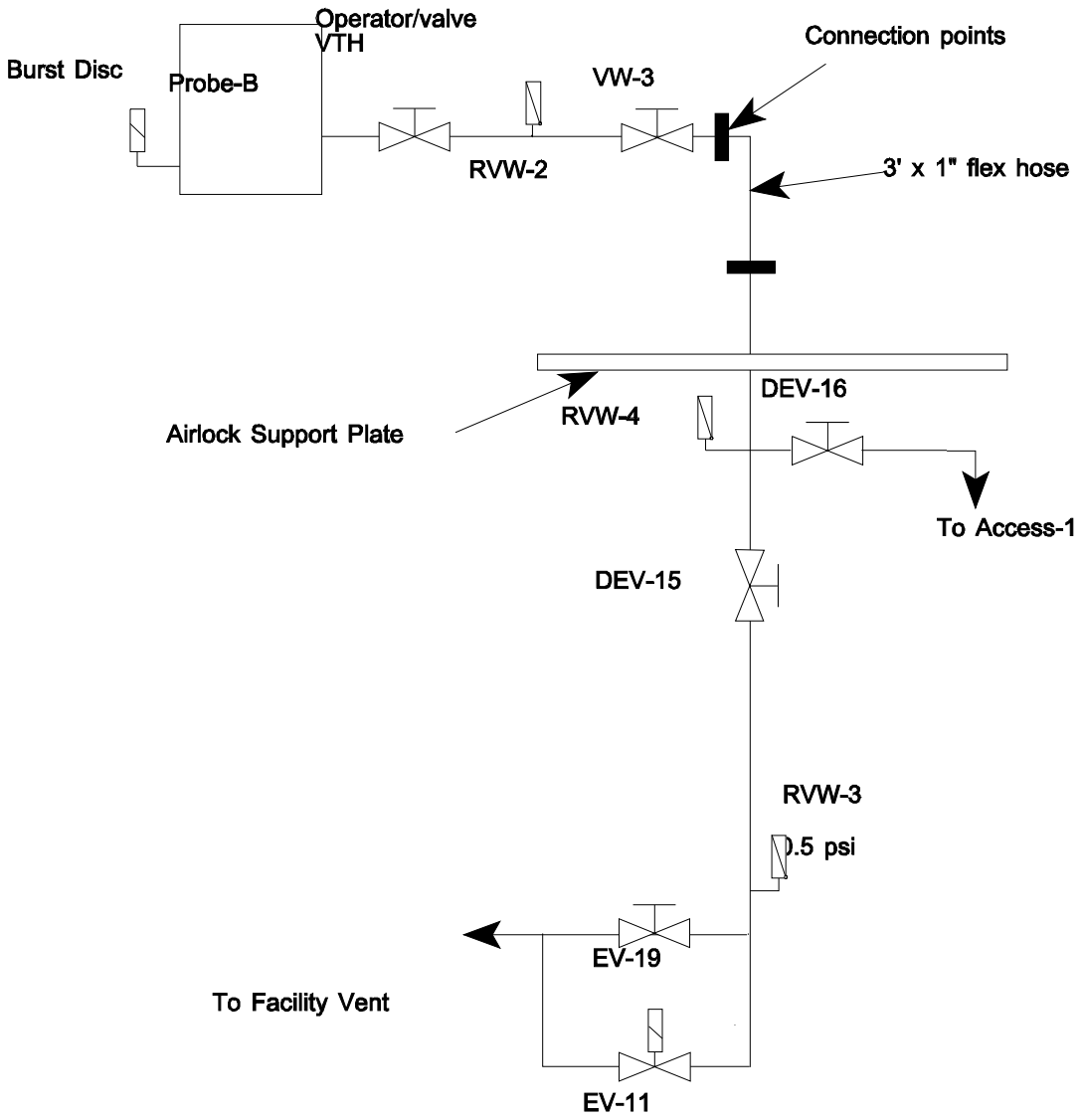
7.4 Remove the 2 Guide Rod Clamps from the Dewar. Stow the hardware into Kit 13P.

7.5 Input comment to DAS ≅Probe insertion complete≅.

8 Task Module 93 complete

Completed by:
Witnessed by:
RSE:
Date:
Time:
RQE:

Figure 1 Post-Insertion Well Vent Plumbing Configuration (Note that burst disk is installed in procedure P0136)



CONTENTS FOR TASK MODULE 110

Task Module 110: Evacuate Well with Probe Installed

Operation Number
Date Initiated
Time Initiated

A SCOPE

This Module effects the pumping out of the Well when a Probe is installed.

B GENERAL REQUIREMENTS

B.1 Magnetic screened tools, obtained from non-magnetic tool box are used for all open well operations. Magnetic Zone SP, black marking (shrink tubing), is to be assumed.

B.2 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry, unless otherwise noted.

C CONFIGURATION REQUIREMENTS

C.1 The Probe is integrated with the Dewar and the Well is venting via the Gas Module valves EV-11 or EV-19.

C.2 Well pump out pyro, PV3, is installed without ordnance.

D HARDWARE REQUIRED

D.1 Hardware installed/removed/used:

a) 1/2-in rubber stopper (size A1")
b) 1/2-in QD plug (2)
c) Axial Lock Covers (3), PN 5833413-101
d) Pre-cleaned Axial Lock seal-off plate Helicoflex (3), PN 5833392
e) Wrap-on heter

D.2 Tools required:

a) Allen wrench (non-magnetic)
b) Torque wrenche
c) Miscellaneous hand tools

F OPERATIONS

Verify the pyro valve, PV3, is installed (without ordnance),

1 Removing Axial Lock Liquid Level Sensors and Installing Radiation Baffles:

1.1 Enter comment to DAS AStart Evacuate Well/TM110".

1.2 Verify EV-19 is open.

1.3 Open/verify open EV-11 and EV-9. This will allow tank ullage to blow out of axial locks when they are opened to the atmosphere.

1.4 Power off Axial Lock Liquid level sensor signal conditioner and remove the cables from the No. 1 and No. 2 Axial Lock level sensors.

1.5 Remove Liquid Level Sensors and (Optionally) Install Flight Radiation Baffles:

Flight radiation baffles are to be installed: do the following steps:

1.5.1 Remove the QD plug from Axial Lock No. 3.
1.5.2 Immediately install a flight radiation baffle.
1.5.3 Reinstall the QD plug.
1.5.4 Loosen QD of Axial Lock No. 1 and pull liquid level sensor out slowly.
1.5.5 Install a flight radiation baffle.
1.5.6 Install a QD plug.
1.5.7 Loosen QD of Axial Lock No. 2 and pull liquid level sensor out slowly.
1.5.8 Install a flight radiation baffle.
1.5.9 Install a QD plug.

Flight radiation baffles are not to be installed: do the following steps:

1.5.10 Loosen QD of Axial Lock No. 1 and pull liquid level sensor out slowly.
1.5.11 Install a QD plug.
1.5.12 Loosen QD of Axial Lock No. 2 and pull liquid level sensor out slowly.
1.5.13 Install a QD plug.

1.6 Close EV-11.

2 Capping-off the Axial Lock Ports:

2.1 Ensure Axial Lock seal-off flanges, cleaned C-seals, and fastening hardware are at hand.

NOTE:

Helicoflex seals are to be cleaned with ethyl/isopropyl alcohol using a lintless swab and inspected for debris using a 20X binocular microscope.

2.2 Clean No. 1 rubber stopper with ethyl/isopropyl alcohol and lintless wipe.

2.2.1 Verify EV-11 and EV-9 are open. This will allow tank ullage to blow out of axial locks when the are opened to the atmosphere.

CAUTION

Take great care to not drop any screws or other paraphernalia into the open axial locks.

2.3 Installing Seal-off Flange on Axial Lock No. 1:

2.3.1 Clean the Axial Lock seal-off flange to be installed with ethyl/isopropyl alcohol and lintless wipe.

2.3.2 Have one person remove the Axial Lock Liquid Level Sensor (LLS) flange and a second person immediately stopper the Axial Lock opening.

2.3.3 Clean the Dewar Axial Lock Helicoflex mating surface with ethyl/isopropyl alcohol and lintless swab.

2.3.4 Remove the stopper and install the Axial Lock seal-off flange using the C-seal and six 10-32 nuts and lock washers.

2.3.5 Torque the nuts to 35 in-lb using a cross pattern.

2.3.6 Verify flange is seated metal-to-metal.

2.4 Install ing Seal-off Flange on Axial Lock No. 2:

2.4.1 Clean the Axial Lock seal-off flange to be installed with ethyl/isopropyl alcohol and lintless wipe.

2.4.2 Have one person remove the Axial Lock Liquid Level Sensor (LLS) flange and a second person immediately stopper the Axial Lock opening.

2.4.3 Clean the Dewar Axial Lock Helicoflex mating surface with ethyl/isopropyl alcohol and lintless wipe.

2.4.4 Remove the stopper and install the Axial Lock seal-off flange using the C-seal and six 10-32 nuts and lock washers.

2.4.5 Torque the nuts to 35 in-lb using a cross pattern.

2.4.6 Verify flange is seated metal-to-metal.

2.5 Installing Seal-off Flange on Axial Lock No. 3:

2.5.1 Clean the Axial Lock seal-off flange to be installed with ethyl/isopropyl alcohol and lintless wipe.

2.5.2 Have one person remove the Axial Lock Liquid Level Sensor (LLS) flange and a second person immediately stopper the Axial Lock opening.

2.5.3 Clean the Dewar Axial Lock Helicoflex mating surface with ethyl/isopropyl alcohol and lintless wipe.

2.5.4 Remove the stopper and install the Axial Lock seal-off flange using the C-seal and six 10-32 nuts and lock washers.

2.5.5 Torque the nuts to 35 in-lb using a cross pattern.

2.5.6 Verify flange is seated metal-to-metal.

3 Configure Plumbing

3.1 Configure the Probe and Well plumbing per Fig. 110-1.

3.2 Connect UTS, Neon Gas Assembly and Leak Detector to Gas Module per Fig 110-2 and 110-3.

4 Leak Check up to VW-3:

Yes perform this section

Skip this section as plumbing up to VW-3 has been previously leak checked in _____ .

4.1 Verify RVW-2, 0.3psid, is installed per Fig. 110-1.

4.2 Close VW-3 and verify RVW-2 is relieving.

4.3 Pump up to VW-3:

4.3.1 Close EV-16 and EV-19. Verify EV-11 and DEV-16 are closed.

4.3.2 Verify EV-9 and EV-13 open all other GM valves closed, including manual valves EV-19, EV-20 and EV-21.

4.3.3 Open EV-15, -7a, -7b, -4, -14, -8, and EV-10.

4.3.4 Start UTS and activate rough pumping up to EV-5: open TV-2 and -1.

4.3.5 Open AV-6: now rough pumping up to VW-3 with AP1.

4.4 When EG-1a and TG-2 are less than 5 torr close AV-6 and open EV-5: now pumping to VW-3 with UTS roughing pump.

4.5 Verify RGA-SOV is closed.

4.6 Start up UTS turbo:

4.6.1 Interlock in override mode.

4.6.2 Start Turbo

4.6.3 When Turbo reaches normal operating speed, put interlock on.

4.7 Start Leak Detector and calibrate:

Std leak value: _____ sccs He

Measured value: _____ sccs He

4.8 Leak check Leak Detector plumbing up to TV-3.

4.9 When possible, transfer UTS turbo form roughing pump to Leak Detector: close TV2, open TV-3.

4.10 Leak check all external plumbing up to VW-3 and record results.

Table 1 Helium Leak Check Data

Date/Time	Test Area	Background sccs He	With Helium Gas sccs He

4.11 When leak helium leak checking is complete transfer UTS turbo roughing back to UTS roughing pump: close TV-3 open TV-2.

5 Neon Leak Check Setup:

5.1 Close EV-5 and open RGA-V slowly.

5.2 Power up RGA and verify data recording is operating with data storage.

5.3 Ensure RGA is running (non-E-mult mode) and data display is set up for masses 2,4,20,28,32.

5.4 Install two plastic bags, one over the Top Hat flange (including the Axial Lock seals), and the other over the VTH/VW-3 plumbing.

5.5 Turn on Stokes pump and verify operation.

5.6 Open EV-21 to start pumping with the Stokes pump up to VW-3.

5.7 Open RGA-LV several turns to pump out region between RGA-LV and RGA-SOV and then completely re-close.

5.8 Open RGA-SOV.

5.9 Crack open VW-3 and adjust to obtain 2-5 torr pressure at EG-1A.

This initiates slow pumping on the Well with the Stokes pump via: VTH, VW-3, DEV-15 and EV-15, EV-7a,b , EV-4 and EV-21.

5.10 Adjust RGA-LV to give a total pressure of ~$5x10^{-5}$ torr at the RGA.

5.11 Record the partial pressures read by the RGA in Table 2.

6 Calibrate for Neon Leak Rate:

6.1 Open neon supply valve, NS-V1, and adjust regulator, NS-RV, to 1-5 psig.

6.2 Verify that NS-LV is completely closed and slowly open NS-V2.

6.3 Zero the neon flow meter.

6.4 Slowly open NS-LV until the Ne partial pressure read by the RGA approximately doubles.

6.5 Record the partial pressures and Ne flow rate in Table 2.

6.6 Completely close NS-LV.

7 Neon Leak Check of Probe Seals:

7.1 Insert a neon gas supply line and purge the Top Hat bag for at least 2 minutes and record partial pressures in Table 2.

7.2 Insert a neon gas supply line and purge the plumbing bag for at least 2 minutes and record partial pressures in Table 2.

7.3 Purge the two bags with He gas.

1 Evacuating the Well:

1.1 Verify Well vent plumbing temporary heater has been installed and operability is OK.

1.2 Slowly open VW-3 to maintain a reasonable rate of evacuation of liquid helium from the Well without excessive freezing of the O-ring seals in the plumbing. (Suggestion: maintain EG-1A in the 10 torr range.)

1.3 Periodically adjust RGA-LV to maintain a total pressure of ~ 5E-5 torr at the RGA and repeat the neon leak check of para. 7 above.

1.4 When the pressure at EG-1b reaches 500 mtorr perform the following section.

CAUTION

Do not go below 300 mtorr as pump oil backstreaming to Well may result.

2 Pump Well Dry with UTS Turbo:

2.1 Verify EV-5 is closed.

2.2 Close RGA-LV and RGA-SOV: UTS is now isolated from Gas Module.

2.3 Turn off the RGA.

2.4 Close TV-1.

2.5 Close EV-21.

2.6 Open EV-5.

The UTS inlet at TG-1 is now connected to the Well via: VTH, VW-3, DEV-15 and EV-15, EV7a,b, EV-4, EV-14 and EV-5.

2.7 Crack open TV-4 until the foreline pressure (TG-4) reads 100 mtorr: the UTS turbopump is now pumping on the Well.

2.8 Adjust TV-4 as necessary to maintain the foreline pressure at 100 mtorr.

2.9 When TV-4 is fully open, open TV-1 and close TV-4.

2.10 When the cold cathode gauge (TG-1) reads less than 10^{-4} torr, turn on the RGA.

2.11 Zero the neon flow meter.

2.12 Slowly open NS-LV until the Ne partial pressure read by the RGA approximately doubles.

2.13 Record the partial pressures and Ne flow rate in Table 2.

2.14 Completely close NS-LV and NS-V1.

2.15 Repeat the neon leak check of steps para. 7 above.

2.16 Continue pumping until an asymptotic pressure is reached.

Table 2 Neon Leak Check Data

Time/ Date	Neon PP torr	Helium PP torr	O_2 PP torr	H_2O PP torr	Total Press torr	VG-1a/b torr	TG-4/ TG-1 torr	Comments

3 Verify Leak Tightness of RAV2 and RAV5

3.1 Continue data recording on Table 3.

3.2 Verify all AV valves are closed.

3.3 Connect 1-in pumping line between Access-1 of GM to FCV.

3.4 Verify FCV and SV-13 are closed.

3.5 Record FCG _____ torr.

3.6 Open AV-8 and AV-3: pumping up to FCV with AP-1.

3.7 Open FCV and reduce pressure to < 20 mtorr as indicated by AG2b.

3.8 Record Well pressure, TG-1_____ torr and

3.9 Close FCV and Open SV-13: SMD fill manifold is now connected to the Fill Cap Assembly..

3.10 Record pressures, TG-1_____ torr, EG-1b ___ torr. FCG _____ torr.

Time:

3.11 If EV-1b<350 torr perform the steps below:

skip these steps, perform these steps

3.11.1 Close AV-8 and Open AV-1.

3.11.2 Adjust AV-9 until AG-1 reads .5 psia.

3.11.3 Close AV-1.

3.11.4 Record pressures, TG-1_____ torr, EG-1b ___ torr. FCG _____ torr.

Time:

3.12 Open FCV and evacuate fill line to <20 mtorr as indicated by EG-1b.

3.13 Record pressures, TG-1_____ torr, EG-1b ___ torr. FCG _____ torr.

Time:

3.14 Allow pressure equilibrium in Well and fill line to be reached.

3.15 Record pressures, TG-1_____ torr, EG-1b ___ torr. FCG _____ torr.

Time:

3.16 Evaluate the leakage through RAV-2 and/or RAV-5 by comparing before and after pressures of TG-1 and E-1b.

Results: _____

4 Evaluate Leakage via RAV7 and RAV6A:

4.1 Continue pumping the fill line.

4.2 Record : TG-1 torr, EG-1b _____ torr. FCG `_____ torr Time:

4.3 Close RAV6B

4.3.1 Verify all RAV selection swithces are off.
4.3.2 Power up RAV power supply to 1.85 a and 28 volts.
4.3.3 Power on RAV unit No. -------
4.3.4 Turn No. -- switch to RAV6.
4.3.5 Record position lights: On: Off:
4.3.6 Activate RAV and record:
a) Run time _____
b) Current draw _____
c) Time of day _____
4.3.7 Record position lights: On: Off:
4.3.8 Record operation in useage log book.

4.4 Record : TG-1, torr, EG-1b _____ torr. FCG `_____ torr Time:

4.5 Wait 5 minutes .

4.6 Record : TG-1, torr, EG-1b _____ torr. FCG `_____ torr Time:

4.7 Evaluate the leakage through RAV7 and/or RAV6A by comparing before and after pressures of TG-1 and E-1b.
Results: _____

4.8 If results show no leakage, open RAV6B

4.8.1 Verify all RAV selection swithces are off.
4.8.2 Power up RAV power supply to 1.85 a and 28 volts.
4.8.3 Power on RAV unit No. -------
4.8.4 Turn No. -- switch to RAV6.
4.8.5 Record position lights: On: Off:
4.8.6 Activate RAV and record:
a) Run time _____
b) Current draw _____
c) Time of day _____
4.8.7 Record position lights: On: Off:

4.8.8 Record operation in useage log book.

4.9 If results show leakage, leave RAV6B closed and open RAV7

4.9.1 Verify all RAV selection swithces are off.
4.9.2 Power up RAV power supply to 1.85 a and 28 volts.
4.9.3 Power on RAV unit No. -------
4.9.4 Turn No. -- switch to RAV7.
4.9.5 Record position lights: On: Off:
4.9.6 Activate RAV and record:
a) Run time _____
b) Current draw _____
c) Time of day _____
4.9.7 Record position lights: On: Off:
4.9.8 Record operation in useage log book.

5 Terminate fill line pumping:

5.1 Perform this section only if no leakage was discovered with fill line evacuated, para. 10.

5.2 Close SV-13 torquing to 60 in-lbs.

5.3 Open AV-1 and use AV-9 to raise pressure on AG-1 to 1.5 psig and then close AV-9.

5.4 Close FCV and record FCG pressure for 30 minutes.

Time	0				
FCV					

5.5 Verify no leakage through SV-13.

5.6 Close all AV valves.

6 Terminating Well Pumping:

6.1 Close VTH: isolating Well.
6.2 Close EV-5: isolating UTS from GM.
6.3 Close EV-8 and EV-4.
6.4 Adjust APR-1 to ~ 1psig.
6.5 Open AV-8 and AV-3 and AV-1.
6.6 When AG-2b < 20 mtorr close AV-8 and bring AG-2b up to ~ 1 torr by adjusting AV-9.
6.7 Close AV-9 completely.
6.8 Open EV-12: pressurizing GM manifold and Well vent line to VTH.
6.9 Close EV-12 and record leak down data in table below for period of > 20 minutes.

Time	0					
EG-1b						

6.10 Verify pressure did not drop by more than 1 %.(Excluding temperature equilibration effects.
6.11 Open EV-12 and adjust AV-9 to bring EV-1a to 760 torr.
6.12 Close EV-12 and record leak down data in table below for period of > 5 minutes.

Time	0					
EG-1b						

6.13 Verify pressure did not drop by more than 2 torr. (Excluding temperature equilibration effects.)
6.14 Close VW-3 and DEV-15.
6.15 Open EV-16, close EV-14, EV-10 and AV-8.

7 Configuring Fill Line:

Option 1

7.1 If active pumping of fill line is required close FCV and SV-13 .

7.2 Move the pumping line from Gas Module Access-1 to UTS pump inlet.
7.3 Roughj out pumping line up to FCV with roughing pump
7.4 Open FCV.
7.5 Open SV-13.
7.6 Start UTS Turbo>
7.7 Verify Turbo on >safe= mode.
7.8 Put TG-1, ion gauge on DAS for monitoring.

Option 2
7.9 If pumping is not required do the following:
7.10 Close SV-13.
7.11 Backfill line up to AV-13 with 0.5psia helium.
7.12 Close FCV and watch FCG for indication of leak into fill line.

Time(min)	0				
Press:(Torr)					

7.13 Close AV-1, AV3 and AV-8.

8 Reconfiguring Systems:

8.1 Final GM valve configuration:
Open EV-9, -13 and -16: all other EV and AV valves closed.

8.2 Shut down Leak Detector.
8.3 Shut down UTS.
8.4 Complete Task Module 110.

Completed by: _____
Witnessed by:
Date:
Time:
RQE Signoff:

Table 3 Well Pump Down Data

Date/Time	TG-1	EG-1a/1b	.T[5]	.T[1]	.T[28]	Comments

Table 4 Neon Leak Test of Well/Probe-C

Time	Partial Pressures of Mass No.						Pressures - Torr				Comment
	2	4	20	28	32	44	RGA	Tank	Well		

Figure 110-1 Post-Insertion Well Vent Plumbing Configuration

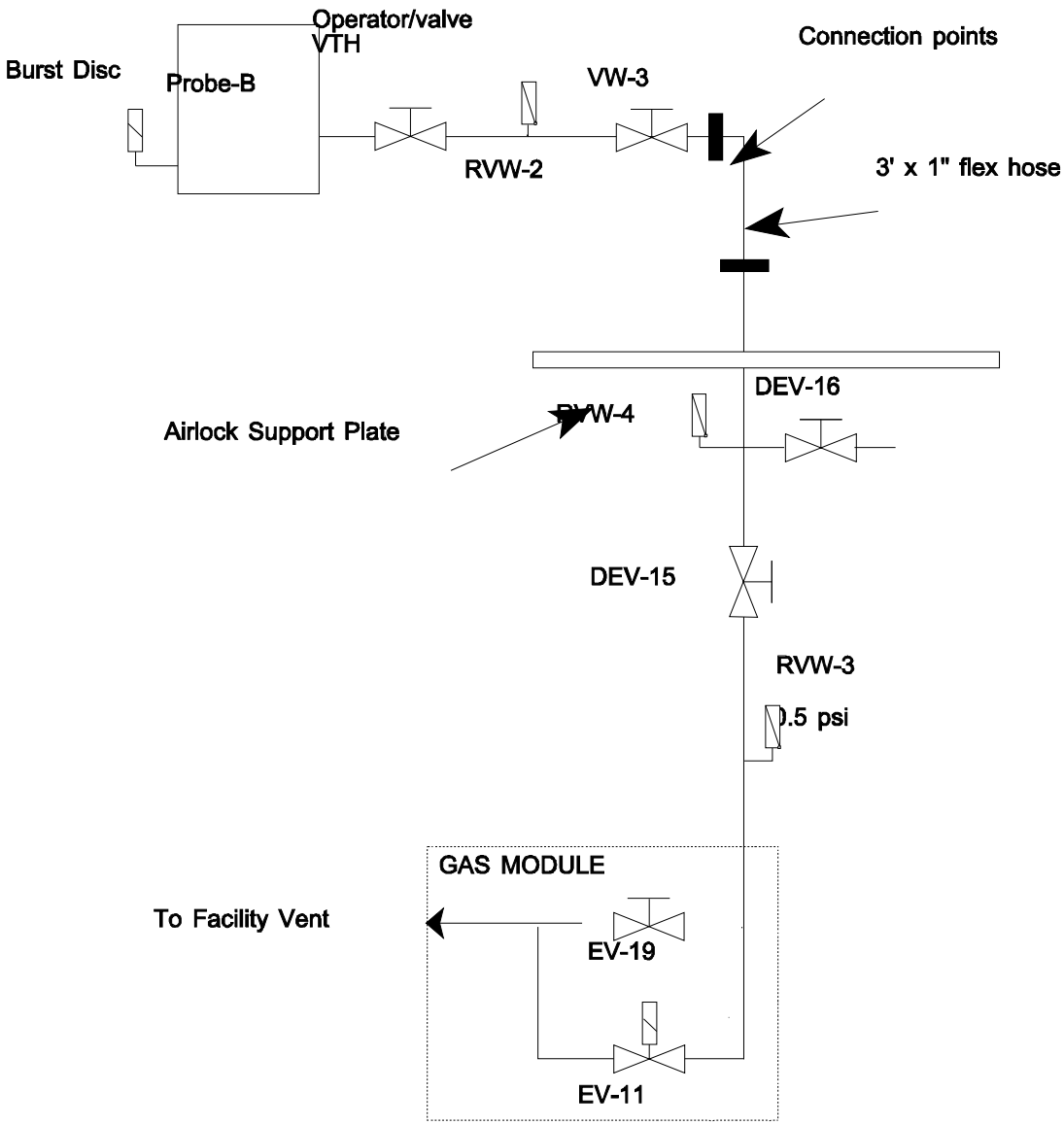


Figure 110-2 Utility Pump System with RGA for Neon leak detection

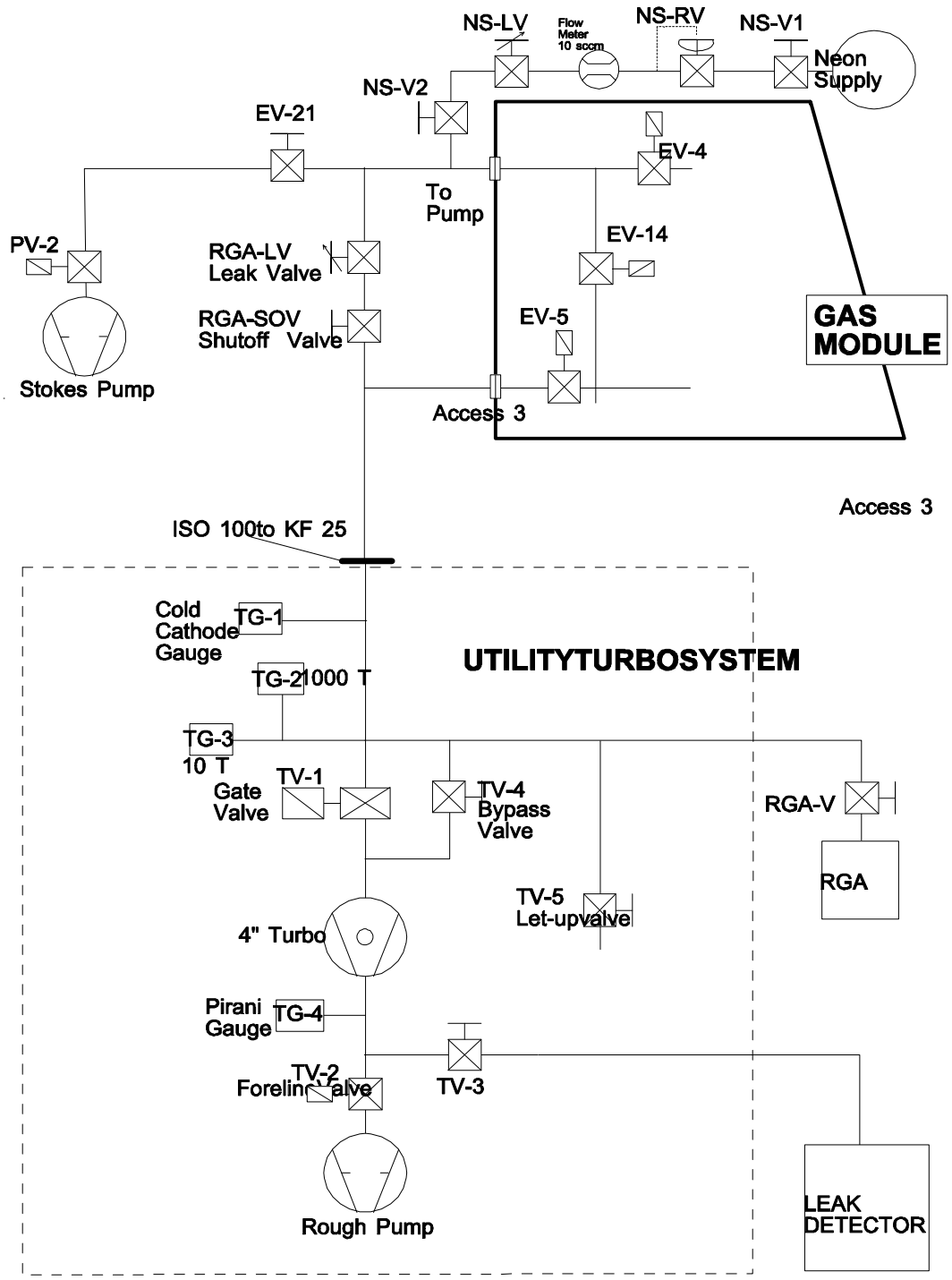


Figure 110-3 UTS and RGA Configuration for Neon Leak Detection

Task Module 82: Remove Airlock Support Plate

Operations Number
Date Initiated
Time Initiated

A SCOPE

This module effects the removal of the Airlock Support Plate (ALSP) and the Airlock Short Cylinder from the SMD.

B General Requirements

B.1 Magnetic screened tools, obtained from non-magnetic tool box are used for all open well operations. Magnetic Zone SP, black marking (shrink tubing), is to be assumed.

B.2 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry, unless otherwise noted.

C CONFIGURATION REQUIREMENTS:

a) Probe may/may not be installed in the Dewar.
b) SMD in test stand oriented in the vertical direction.
b) First level of Dewar scaffolding assembled and in position.

D HARDWARE REQUIRED:

a) Airlock Support Plate
b) Kits 28P, 29P, 30P and 13Gc

E OPERATIONS:

1 Preparing SMD:

1.1 Record the status/condition of SMD and any GSE in use _____

_____

_____

2 Removing the Airlock Short Cylinder:

2.1 Loosen and remove all 1/4-28 bolts holding Airlock Short Cylinder to Airlock Support Plate.

2.2 Stow bolts Kit 13Gc.

2.3 Remove any cables that are connected to the Dewar and Probe, record cables removed: _____ .

2.4 Record any removal of connectors from flight connectors below and in Use Log Book: _____

_____

2.5 Remove Support Plate short cylinder and stow to floor.

3 Removing Small Half of Support Plate:

NOTE: Three persons are require in the following steps.

CAUTION

Take extreme care to not bump the SMD with the Support Plate as permanent damage to vacuum shell may result.

3.1 Re-configuring the plumbing and cabling:

3.1.1 Remove the O_2 sensor line form the ALSP.

3.1.2 Remove purge line/pressure gauge assembly from ALSP and stow in cabinet.

3.1.3 Verify Well is venting via Well vent line and VW-3, DEV-15: check flow meters output on DAS screen/plotter.

3.1.4 If not venting:

a) Open EV-11, venting Guard and Main tanks via Well vent.

b) Record EG3 _____ .

c) Close DEV-15.

NOTE: In the line transfer below keep hand over Well vent line to prevent the loss of large amounts of helium gas.

3.1.5 Close well vent at VW-3, pressure relief is now at VWR-3, and remove well vent 1-in flex line from DEV-15 and re-plumb to VW-3.

3.1.6 **Immediately open VW-3 and verify flow by readout at DAS.**

3.1.7 Close/verify closed EV-11.

3.1.8 Remove DEV-15 plumbing and stow in cabinet for re-use.

3.1.9 Pause the DAS (GSE and Facility) and remove the cables from the Probe and record items disconnected:

3.1.10 If any flight connectors have been mated/demated, record in Usage Log Book.

3.1.11 Remove Airlock vent line.

3.1.12 Shut down SMD External Temp Control.

3.1.13 Re-plug SMD ETC outside of ALSP.

3.1.14 Turn on Temp Control unit and verify temperature control is working.

3.1.15 Shut down Axial Lock Liquid Level Senor (LLS) electronics.

3.1.16 Re-plug Axial Lock LLS cable outside of ALSP.

3.1.17 Turn on Axial Lock LLS electronics.

3.2 Remove the vent line cantilever support clamps (2) and stow in Kit 31P.

3.3 Install strain relief for the two vent lines.

3.4 Remove the 1/4-28 bolts to fasten the two support plate halves together and stow in Kit 29P.

3.5 Perform the next step while two persons support the small half of the Support Plate.

3.6 Remove the 20 (19?) 5/16-24 bolts which hold the small half of the Support Plate to the SMD top plate flange and stow in Kit 28P.

3.7 Lift the small half of the Support Plate away and stow.

4 Removing Large Half of Support Plate:

4.1 Pause GSE DAS.

4.2 Remove SMD cables and record: _____

_____

4.3 If any disconnects were made from flight connectors record in Usage Log Book.

4.4 Three persons are require in the following steps.

CAUTION

Take extreme care to not bump the SMD with the Support Plate as permanent damage to vacuum shell may result.

4.5 Perform the next step while two persons support the large half of the Support

Plate.

4.6 Remove all but 2 of the 29 5/16-24 bolts which hold the large half of the Support Plate to the SMD top plate flange and stow in Kit 28P.

4.7 While supporting the plate, remove the last 2 bolts.

4.8 Gently remove plate prying up to disengage the 2 1/4-in dowel pins.

4.9 Lift the large half of the Support Plate away and stow.

4.10 Remove the clam shell boots from the cable access holes and stow in Kit 16.

4.11 Tape the Airlock large diameter O-ring around the neck of the SMD.

5 Final Preparations:

5.1 Re-install all removed cables and record if flight connectors were disengaged: _____

and record in Use Log Book.

5.2 Verify cables are correctly connected by checking the matching color coding at the interface connectors or the permanent labels.

5.3 Strain relieve the Vent Lines.

5.4 Strain relieve the cables

6 Procedure completed.

Completed by: _____
Witnessed by:
Date:
Time:
RQE Signoff: _____