STANFORD UNIVERSITY **SU/GP-B P0133**

Rev A

GRAVITY PROBE-B

TEST PROCEDURE

PREPARATIONS FOR PROBE/AIRLOCK INTEGRATION

April 12, 1998

Approvals:

Mike Taber Date GP-B GTU Cryogenics Ops Mgr.	D.O. Murray Date Lockheed Test Engineer
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REVISION	ECO No.	PAGES	DATE
Original A	- 974	All All. Update incorporating redlines for Probe-C fitcheck redlines, include BPS setup, etc.	April 12, 1998 4/12/99

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	Composite 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 Evacuation 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
L.D.	Leak Detector
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	Programmable 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 Safety 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

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1 SCOPE

This procedure describes the steps required to prepare the instrument Probe and Airlock GSE for integration prior to insertion of the Probe into the SMD (Science Mission Dewar).

1 REFERENCE DOCUMENTS

Procedures:

Procedure No.	Title
P0133	Preparation for Probe/Airlock Integration
P0134	Airlock/SMD Integration
P0135	Probe Insertion into SMD
P0141	Facility Emergency Procedures
P0143	Probe-Dewar Insertion Overview

1.1 Drawings

LMMS Drawing No.	Title
5833519 Rev C	Helium Airlock Assembly
5823341 Rev D	Helium Airlock Installation
5813359	Axial-lock Assembly
5813395	SMD External plumbing

1.1 Figures

Fig. 1	Test Flow for Preparations for Probe/Airlock Integration
Fig. 2	Gas Module & SMD Plumbing Schematic

1.1	Supporting documentation
1.1.1	GP-B Magnetic Control Plan, LMMS-5835031
1.1.2	SMD Safety Compliance Assessment, LMMS GPB-100153C
1.1.3	SM Dewar FMECA, LMMS GPB-100333
1.1.4	FIST Emergency Procedures SU/GP-B P0141
1.1.5	Prove/Dewar Hardware Kit List, SU/GP-B P0144
1.1.6	SMD Final Assembly, LMMS 5833500
1.1.7	Internal Well to Tank Transfer SU/GP-B P0210

TEST FLOW CHART
FOR
PREPARATION FOR PROBE/AIRLOCK INTEGRATION GP-

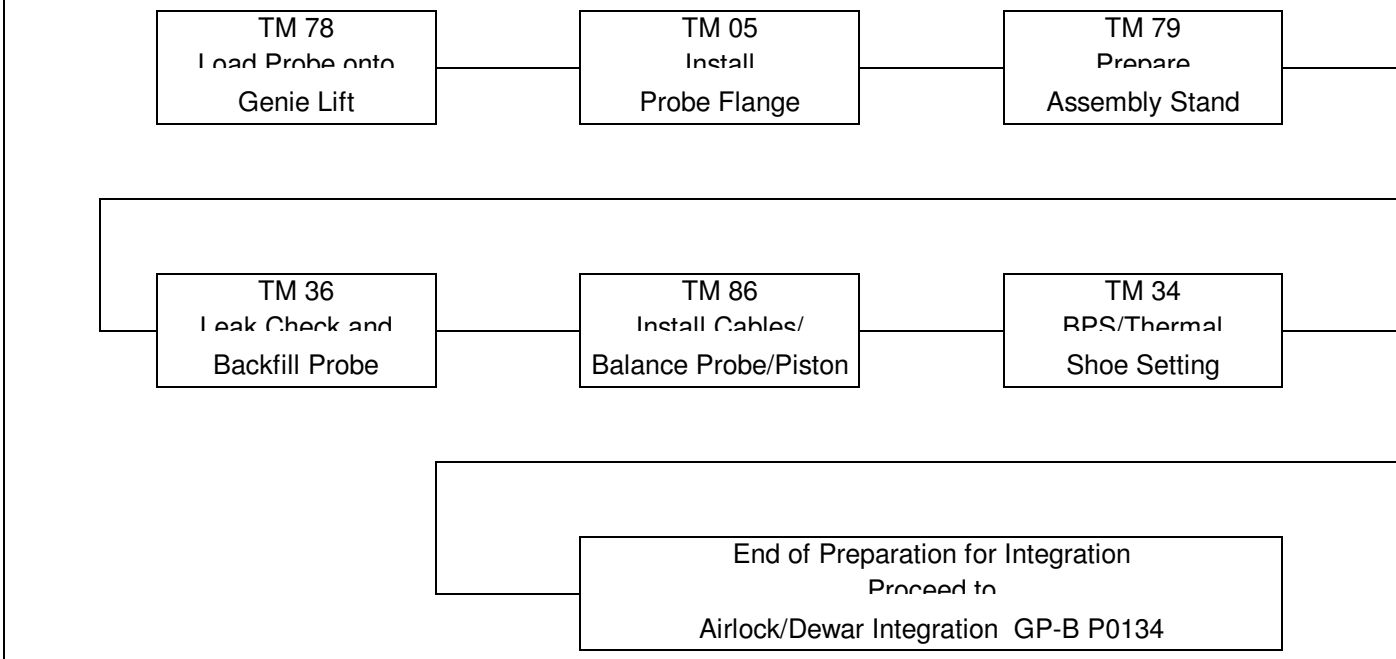
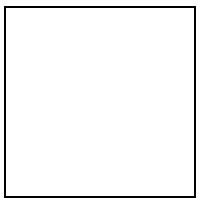


Figure 2 Gas Module & SMD Plumbing Schematic



2 SAFETY

2.1 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).

2.1 Lifting operations

The following Paras. apply to lifting operations.

2.1.1 The following equipment shall be available to and used by personnel working around elevated working platforms:

a) Hardhats.
b) Safety glasses.

2.1.1 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.

2.1.1 Movements shall be verbally rehearsed before performing them.

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

2.1.1 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.

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

2.1.1 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.

2.1.1 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.

2.1.1 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.

2.1.1 The hoist operator shall inspect cranes, hoists and all other primary lifting equipment each day before the initial use. Discrepant equipment shall not be used.

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

2.1 Injuries

In case of any injuries adhere to the following:

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

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

2.1 Safety

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

2.1 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.

2 TEST PERSONNEL

2.1 Personnel Qualifications:

The performance of the two Probe insertion procedures, P0134, Airlock/Dewar Integration and P0135, Probe Insertion into Dewar, require a Test Director and crew of from 1 to 3 Cryogenic Test Engineer (CTE) and one Safety Engineer (SE). The minimum number of personnel to accomplish most of the Task Modules of these procedures is: Test Director and one CTE. However, a crew of Test Director and two CTE would be more efficient for several of the Task Modules. The one exception to this manning scheme is the Task Module 92, Lower Probe into Dewar, for which the required manning is Test Director and three CTE and the RSE. The RSE attendance for Test Modules 78 and 80 is required; his attendance at other portions of the procedures is at his discretion.

The test director is the designated signee for the “witnessed by” signoffs located at the end of each procedure/task module. The CTE who performs the operation is to sign the “completed by” signoff.

2.1 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
	Chuck Warren	Stanford University
	Mike Taber	Stanford University
	Dave Murray	Lockheed
		Ken Bower
Quality Engineer	Dorrene	Lock
		Ben Taller
Safety Engineer	John Janicki	Lock
		M. Jeung-W

2.1 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 RSE during or after the performance of the redline.

2 OPERATIONS

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

2.1 Test Director for this Procedure is: _____ .

Date: _____Time:

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

Time/Date

2.1 Perform the following Task Modules in sequence except: Task Modules 86, 34, and 36 can be done in any sequence after Task Module 80 has been completed.

Preparation for Airlock/Dewar Integration						
Para No.	TASK MODULE Airlock/Dewar Integration	Op No.	START		FINISH	
			TIME	DATE	TIME	DATE
2.1.1	Task Module 78 Load Probe onto Genie Lift					
2.1.2	Task Module 05: Install Probe Flange					
2.1.3	Task Module 79: Prepare Assembly Stand					
2.1.4	Task Module 80: Mount Probe to Piston Plate					
2.1.5	Task Module 36: Leak Check and Backfill Probe					
2.1.6	Task Module 86: Install Cables/Balance Piston					
2.1.7	Task Module 34: BPS and Thermal Shoe Setting					
2.1.8	Task Module 230: Thermal Shoe Alignment					

2.1 Preparation for Airlock/Dewar Integration complete.

Approved By:

Witnessed By:

RQE sign off:
Date:

Time:

APPENDIX A

TASK MODULES

FOR

PROCEDURE P0133

Task Module 78: Loading Probe from the Gurney/Shipping Frame onto Genie Lift

Operations Number
Date Initiated
Time Initiated

A **SCOPE**

A.1 This module effects the loading the Probe from the Gurney fixture or Shipping Container shipping frame to the Genie Lift.

A **GENERAL REQUIREMENTS**

A.1 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A **CONFIGURATION REQUIREMENTS**

A.1 Probe has Yoke and worm gear assembly mounted. Probe is secured to Gurney or Shipping Frame and bagged.

A **HARDWARE REQUIRED**

A.1 Hardware installed/used:

a) Genie Lift with outriggers
b) Gurney or Shipping Frame
c) Worm Gear Assembly
d) Down flow clean booth

A.1 Hardware removed:

a) None

A **REFERENCES:**

Task Module78: Loading Probe from the Gurney/Shipping Frame onto Genie Lift

A.1 SMD Cryogen Handling SU/GP-B P0210

2. GP-B Magnetic Control Plan, LMMS 5835031

Task Module78: Loading Probe from the Gurney/Shipping Frame onto Genie Lift

1F **OPERATIONS:**

2F **Preparing Probe for Genie Lift:**

2.1 Wipe down the Genie lift using isopropyl alcohol.

2.2 Position Gurney/Shipping Frame to allow Genie Lift Mast Carrier to access Interface Block.

2.3 Tighten fully the Yoke Brakes.

2.4 Verify installed/install Worm Gear Assembly Interface block.

1 **Preparing the Genie Lift for the Probe:**

1.1 Remove two each 8.0-in bolts from the mast carrier.

1.2 Power up the Genie hydraulic motor-pump.

1.3 Move the Genie Lift Mast Carrier up to the Interface Block on the Yoke Assembly.

1.4 Verify installed/install the two 3-deg. shims in the Genie mast carrier trough.

1.5 Set the four Gurney/Shipping Frame Jack screws.

NOTE

The shims should be positioned to tilt the top of the Probe inboard, this compensates for the tilt of the Genie when loaded with the Probe.

1 **Mating Genie Lift to Gurney/Shipping Frame:**

CAUTION

To avoid full speed motion of the carrier mast and possible damage to the Probe, the hydraulic lift shut-off valve should be adjusted partially closed.

1.1 Position the Genie Lift Mast Carrier above the Interface Block .

1.2 Move Genie Lift in to line up the mast carrier to engage with the slots on the Interface Block.

1.3 Raise the Mast Carrier into the Interface Block until the bolt holes line up.

1.4 Install 3-deg shims in Genie Mast Carrier.

CAUTION

Take care to not loosen and loose the shims in the mast carrier frame.

1.1 Install the two 8-in. bolts thru the Mast Carrier into the Interface Block and tighten the nuts.

NOTE

If the bottom bolt will not fit into the Interface block the perform the following steps, else skip to step 3.5.

1.1.1 Install the top 8-in. bolt thru the Mast Carrier into the Interface Block and secure with nut and hand tighten.

1.1.2 On the Gurney/Shipping Frame, loosen the Spool Support Clamp and Vacuum Shell Clamp to allow the Probe a small amount of rotational freedom.

CAUTION

The Yoke is still pinned to the Gurney/Shipping Frame at this time. Only raise the Genie Mast Carrier by a very small amount or damage to the Probe and Lifting equipment may occur.

1.1.1 Raise the Genie Lift Mast Carrier just enough to insert the second 8-in. bolt. Secure with nut and hand tighten.

1.2 Remove the Support Clamp from spool piece on the Gurney/Shipping Frame.

1.3 Remove the Pin that secures the Yoke/Probe to the Gurney/Shipping Frame.

1.4 Slowly raise the Probe off the Gurney/Shipping Frame high enough to remove the Gurney/Shipping Frame.

1.5 Reinstall all hardware removed from the Gurney/Shipping Frame.

1.6 Bag and remove the Gurney/Shipping Frame to suitable storage location.

1 **Preparing Genie Lift for Portable Clean Room Booth:**

1.1 Lower the Probe to a height that will allow the Clean Booth to be moved around the Probe Top Hat.

1.2 Install the Genie Lift outriggers and set the jack screws.

1.3 Close the hydraulic valve on the Genie Lift to prevent any possible lowering of the Probe.

1 **Task Module 78 completed:** Completed by:

Witnessed by:

RSE Sign off:

Date:

Time:

RQE Sign off: _____

Task Module 5 Probe Flange Installation

Operations Number
Date Initiated
Time Initiated

A SCOPE

A.1 This module effects the installation of the Probe Flange onto Top Hat Cross Flange and the Installation of Pumpout Plate onto Vatterfly valve

A GENERAL REQUIREMENTS

A.1 All O-rings installed shall be visually inspected, cleaned with isopropyl/ethyl alcohol as required and installed dry unless otherwise noted.

A CONFIGURATION REQUIREMENTS

A.1 Probe on Genie stand and the clean room booth installed over Probe Top Hat area.

A HARDWARE REQUIRED

a) None

A.1 Hardware installed/used:

a) Kits Installed: 11P, 12Pa, 12Pb and 12Pc.
b) Probe Flange (cleaned to level 100)
c) Probe Flange Adapter (cleaned to level 100)
d) Vatterfly pump out flange with KF-50 blank-off (cleaned to level 100)
e) ISO 160 flange clamping bolts

A.1 Hardware removed:

a) None

A.1 Tools required

a) Portable Clean Room booth
b) Clean room particle counter (Atcor)
c) Leak detector and special plumbing
d) Miscellaneous hand tools
e) Ethyl/isopropyl alcohol
f) Braycote 600 vacuum grease
g) Gas Module

B **REFERENCES:**

Task Module 5 Probe Flange Installation

1. SMD Cryogen Handling SU/GP-B P0132
2. GP-B Magnetic Control Plan, LMMS 5835031
3. LMMS Drawing 5813395, SMD External plumbing
4. LMMS Drawing 5813396, SMD Plumbing Schematic
5. LMMS 5813353, Helium Airlock Assembly
6. LMMS 5823341, Helium Airlock Installation

1F **OPERATIONS**

1 Installing Probe Top Hat Area into Clean Booth:

1.1 Lower the Probe to a height that will allow the Clean Booth to be moved around the Probe Top Hat.

1.1 Set the Jack screws on the Genie Lift.

1.1 Close the hydraulic valve on the Genie Lift to prevent any possible lowering of the Probe.

1.1 Roll Clean Booth over the Probe Top Hat area and fold hanging slats to minimize suck-by from the outside.

1.1 Start up the Clean Booth fans.

1.1 Place the Atcor particle monitor inside the Clean Booth approximately 10-in from the floor.

1.1 Verify the particle monitor reading is better than Class 100.

1.1 Record the particle monitor reading:_____.

1.1 For all operations inside the Clean Booth a complete clean room suit with hair covers and gloves must be worn.

1.1 Install ground strap from facility ground point and Probe.

1 Installing the Pump-out Plate onto Top Hat Vatterfly Valve:

1.1 Locate the Pumpout Flange, verify it has been cleaned to level 100 and install/verify installed a blank-off flange has been installed on the KF-50 port.

1.1 Verify that the Vatterfly Valve is closed.

1.1 If the space between the hardware currently installed on the Vatterfly Valve and the Vatterfly Valve is known to be at one atmosphere pressure skip the steps of this Para.

complete the following skip the steps of this para., record source of knowledge for atmospheric pressure: _____ .

NOTE

Valve and other callouts are for Gas Module, see P0133, Fig. 2.

1.1.1 Connect a pumping line between the isolation valve on the current closeout hardware installed on the Vatterfly Valve and Access-1.

1.1.1 Close, verify closed, AV-1.

1.1.1 Verify that AV-9 is closed and the Helium pressure regulator, APR-1 is set to approximately 1 psig.

1.1.1 Open AV-8 and AV-3 to evacuate the pumping line to 20 mtorr.

1.1.1 Close AV-8.

1.1.1 Slowly crack open the isolation valve on the current closeout hardware and monitor the pressure on AG-2b. If the pressure does not rise above 1 torr, skip the next two steps.

1.1.1 Open AV-8, and continue to slowly open the isolation valve until AG-2b reads 20 mtorr.

1.1.1 Close AV-8.

1.1.1 Slowly crack open AV-9 to vent the system at a rate not to exceed 30 torr/min. Record data below.

Time	Press -Torr	Time	Press -Torr	Time	Press -Torr

1.1.1 When AG-2a reads one atmosphere, close AV-1 and the closeout isolation valve.

1.1 Using vacuum suction over the bolt heads remove the close out hardware from the Top Hat.

1.1 Remove, inspect, clean and lightly grease (Braycote 600) ISO 160 O-ring , install with centering ring and replace onto the Top Hat .

1.1 Using ISO clamping bolts, install the Pumpout Plate.

1.1 Verify installed, a KF-50 blank-off on the exit of the Pumpout Plate.

1.1 Installation of Pump-out Flange completed.

Completed by:

Witnessed by:

Date:

Time: _____

1 **Installing the Probe Flange onto Top Hat Cross Flange:**

1.1 Install/verify installed the Probe Guide onto the Probe Flange using 10 screws, washers, and lock washers from Kit No. 11P. Torque to 90-110 in-lbs (7.5 to 9 ft-lbs).

1.1 Verify Probe Flange Assembly has been cleaned: Interior Surfaces to Level 100; exterior surfaces to Level 200.

1.1 Verify Probe Adapter Flange interior surfaces have been cleaned to Level 100; exterior surfaces to Level 200. Staple cleaning data sheets at end of this module.

Task Module 5 Probe Flange Installation

1.1 Attach certifications for cleaning of parts in preceding two paras. at end of this procedure.

1.1 Solvent clean (Ethyl/isopropyl alcohol) the Probe Flange Valve and install.

1.1 Solvent clean (Ethyl/isopropyl alcohol) the relief valve (<3 psid cracking pressure) and install in the second Probe Flange port.

1.1 Inspect the two Probe Flange Dowel Pins.

1.1 Using vacuum suction over the bolt heads remove the bolts fastening the Holding Spool to the Top Cross Flange.

1.1 Remove the Holding Spool from the Top Hat Cross Flange and stow hardware into Kit No. 12Pc, with 3 washers.

1.1 If O-ring is in Holding Spool flange, remove, inspect, and clean (no grease) O-Ring No. 1b.

1.1 Clean (Ethyl/isopropyl alcohol), no grease, O-ring No. 1b into Probe Adapter Flange.

NOTE

Ensure clocking is correct for Probe Adapter Flange, +Y mark should be 90-deg CCW (viewed from the top of the Probe) from Top Hat Cross Flange +X mark.

1.1 Bolt Probe Adapter Flange to Top Hat Cross Flange Window-4 flange with 16 10-32x1.0 screws, with washers, from Kit 12Pb.

1.1 Torque bolts to 25 in-lb.

1.1 Install/verify installed the Dowel Pins to orient the Probe Flange.

1.1 Install purge line from facility helium supply to Probe Flange Valve, adjust blanked off pressure to 2 psig and maintain a helium gas purge throughout the next 2 steps.

NOTE

Ensure clocking is correct for Probe Flange, +Y notch should line up with Probe Adapter Flange +Y notch.

CAUTION

Verify bolts used in next step are correctly sized to not bottom out on Window-4 flange or damage to this flange may result.

1.1 Install the Probe Flange using the 12 3/8x1.0 bolts and washers from Kit No. 12Pa and O-ring 1b: use one 0.06-in thick washer on each bolt and O-ring No. P1b.

1.1 Torque the bolts to 240 in-lbs (20 ft-lb).

1.1 Close Probe Flange Valve and remove purge line.

1 **Task Module 5 completed.** Completed by:

Witnessed by:

Date:

Time:

RQE sign off : _____

Task Module 79 Preparing The Assembly Stand

Operations Number
Date Initiated
Time Initiated

A SCOPE

A.1 This module effects the preparation of the Assembly Stand by attaching Outriggers, Piston Plate and Guide Rods.

A GENERAL REQUIREMENTS

A.1 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A CONFIGURATION REQUIREMENTS

A.1 None.

A HARDWARE REQUIRED

A.1 Hardware installed/used:

a) Kits installed: 2G, 9G, 16G, 4G, 17G.

A.1 Hardware removed:

a) Kit 2G.

A REFERENCES:

Task Module 79 Preparing The Assembly Stand

Task Module 79 Preparing The Assembly Stand

1. GP-B Magnetic Control Plan, LMMS 5835031
2. LMMS Drawing 5813395, SMD External plumbing
3. LMMS Drawing 5813396, SMD Plumbing Schematic
4. LMMS 5813353, Helium Airlock Assembly
5. LMMS 5823341, Helium Airlock Installation
6. LMMS Drawing No. 5829167, Lifting Plate, Helium Airlock.
7. LMMS Drawing No. 582336, Clocking Assembly, Helium Airlock.
8. LMMS Drawing No. 5821484, Piston Assembly, Helium Airlock.
9. LMMS Drawing No. 5834808, Modification Assembly Stand, Helium Airlock (formerly Dwg. No. 5823338).
10. LMMS Drawing No. 5834815, Piston-Lift Plate Assembly.

Task Module 79 Preparing The Assembly Stand

Task Module 79 Preparing The Assembly Stand

4F **OPERATIONS:**

1 **Installing the two Guide Rods in the Assembly Stand:**

1.1 Guide Rods are to be installed, do 1.1.1 & 1.1.2; Guide Rods are in place, skip to para.2

NOTE

The end with the tapped hole is the top end of the Guide Rod.

1.1.1 Using three persons, lift Guide Rod by hand and install into the Assembly Stand using the retainer pins to hold the top and bottom of the Rods in place.

1.1.1 Repeat previous step for the second Guide Rod.

1 **Preparing the Piston Assembly:**

1.1 This section may be performed with the Piston on a workbench or already mounted on the Assembly Stand.

1.1 Install/verify installed the two windows onto Piston.

NOTE

One of the windows is spring mounted

1.1 Verify Clocking Device/Lifting Fixture is installed on Probe Flange.

1.1 Installing the Compliance Device onto the Piston (if not installed), see Fig. TM79-1:

Record: Compliance Device is to be installed, perform sub-steps ;
Compliance Device is in place, skip to para. 2.5.

CAUTION

Keep the Lifting Plate level while lowering onto studs. If level not maintained, binding will occur and may possibly damage the studs.

NOTE

Refer to Fig. TM79-1 for configuration of Compliance Device

1.1.1 Connect Crane and Load Cell to Lifting Plate compliance device and position it over the four attachment studs connected to Piston.

1.1.1 Carefully lower the Lifting Plate onto the four studs.

1.1.1 Install on each of the four Studs: one Spring, one Washer Plate, and two Jam Nuts from Kit 16G (See Fig. 79- 1).

1.1.1 Tighten the two Jam Nuts until the spring is compressed to the desired reference dimension of 4.24 - 4.27 inches.

1.1.2 Torque the two Jam Nuts to each other to 90 - 110 in-lbs.

1.1 Install/verify installed the inflatable Seal onto the Piston ensuring that the Seal Stem is inserted through the hole in the Piston Seal Groove.

1.1 Install/verify installed the four Vertical Jacking Screws.

1.1 Verify the Radial Jacking Screws are backed off fully.

1 **Mounting Piston to Assembly Stand (if not already mounted):**

1.1 Piston Assembly is to be installed; Piston Assembly is in place on the Assembly Stand, skip this section.

1.1 Move Piston Assembly under the crane.

WARNING

All personnel in or around crane lifting operations must be wearing hardhats at all times to guard against head injury

1.1 Verify Crane functional check-out has been performed for the current day:
Confirmed by Crane operator: _____ .

1.1 Attach Crane directly to Compliance Device

1.1 Using the crane, lift Piston to height above Assembly Stand.

1.1 Roll Assembly Stand under the Piston with the open side to the south..

1.1 Remove/verify removed the Guide Rod Spacers and Tee Pins from the Guide Rods.

1.1 Lower the Piston onto the Assembly Stand, keeping the +/- Y axes (Note axis labels on the hardware) of the Piston and Assembly Stand aligned and engaging the top ends of the Guide Rods in the cone linear bearings.

1.1 Lower the Piston until it rests in the Assembly Stand.

1 **Install/Verify Installed Bridge onto the Piston:**

Record: Bridge is to be installed, perform each step;
Bridge is installed, verify each step, marking with “V”.

NOTE

The Bridge should be in place, however, if not, then perform the following: in any case verify the following with a “V” notation rather than a check mark

1.1 Remove/verify removed from the Bridge the two Guide Rod/Bridge Flanges.

1.1 Attach the Bridge at its center to the Crane with a sling.

1.2 Attach Crane to the Bridge; rig this attachment using 1-in wide yellow nylon slings (1650 lbs capacity).

1.1 Remove/verify removed the two top-end Guide Rod T-pins.

1.1 Use Crane to lift Bridge above the Piston.

1.1 Lower the Bridge onto the Piston keeping the Bridge level while guiding the Guide Rods through the Bridge.

1.1 Remove sling from the Bridge.

1.1 Install and hand tighten the four 3/8-16 x 2 ½-in bolts with washers that fasten the Bridge to the Piston.

1.1 Using six 1/4-28 x 3/4-in screws with washers, install the two Guide Rod Flanges onto the Bridge and tighten with a wrench.

1.1 Install Guide Rod Spacers and top end locking T-pins.

1 **Preparing Assembly Stand for Topside work:**

1.1 Move Assembly Stand under the Crane positioned with open side to the south.

1.1 Install/verify installed two Outriggers with four ½-in bolts and 8 washers each.

1.1 Lock the four casters. Turn the locking wings to the **outside** of the stand.

1.1 Set the feet on the Assembly Stand Outriggers but do not raise casters off the ground.

1.1 Verify that the Assembly Stand casters are on the ground.

1 **Testing the Inflatable Seal:**

1.1 Install/verify installed coiled GHe line for the Inflatable Seal to Piston Plate bracket.

1.1 Install/verify installed the Inflatable Seal stem to the hose bracket on the Piston.

1.1 Attach gas line from facility helium gas supply to brass QD attached to the Bridge.

CAUTION

Do not inflate seal over 12 psig or damage may result.

1.1 Inflate Seal to 10 psig using facility helium regulator.

1.1 Examine the seal for any deforming or leaks.

Task Module 79 Preparing The Assembly Stand

1.1 Deflate Seal, disconnect the gas line from the QD on the Piston hose bracket.

1.1 ` **Task Module 79 completed.** Completed by:

Witnessed by:

Date:

Time: _____

RQE sign off :

Task Module 79 Preparing The Assembly Stand

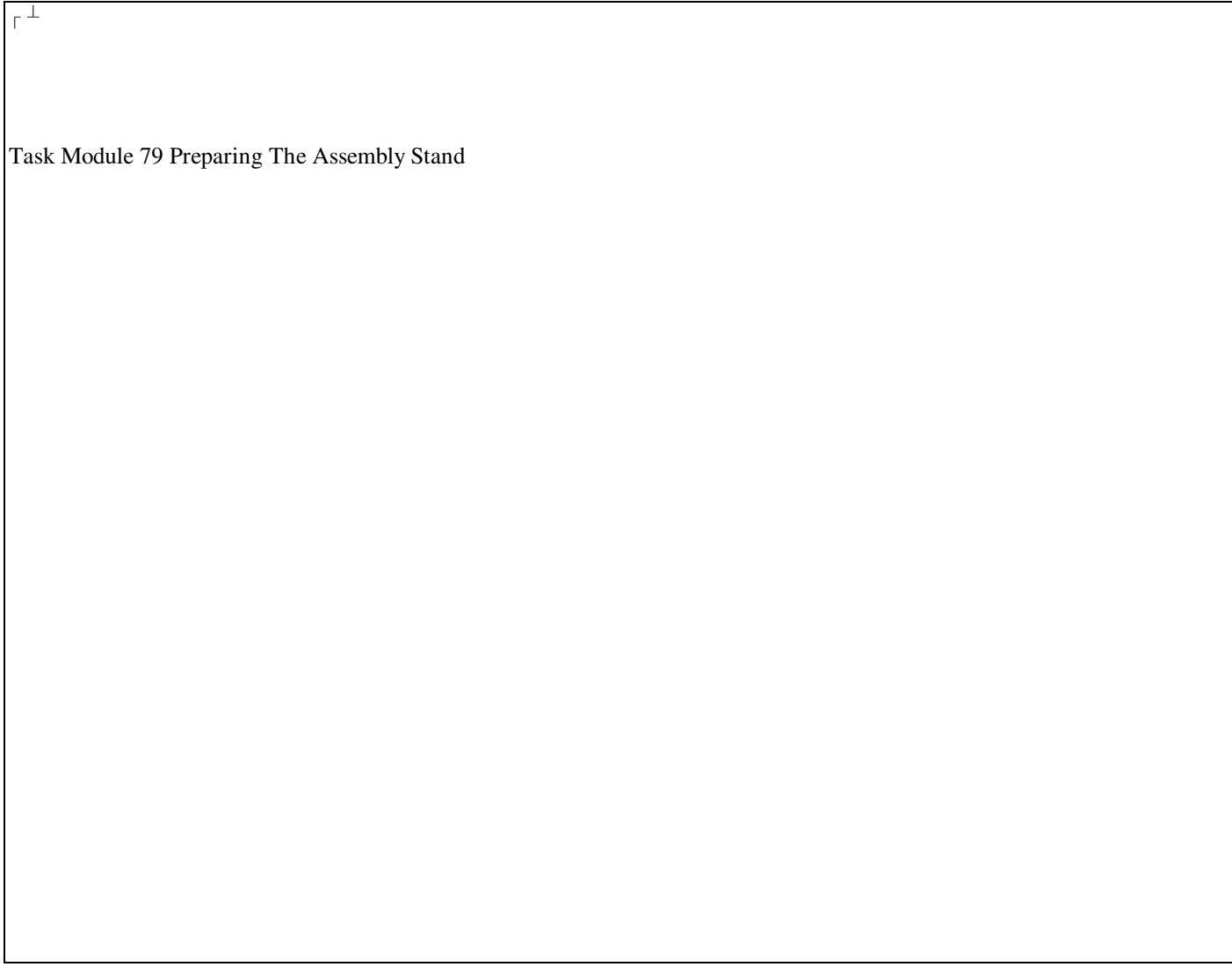


Figure TM79- 1. Compliance Device Configuration.

Task Module 80: Attach Probe to Piston Assembly

Operations Number
Date Initiated
Time Initiated

A SCOPE

A.1 This module effects the attaching of the Probe to the Piston on the Assembly Stand.

A GENERAL REQUIREMENTS

Task Module 80: Attach Probe to Piston Assembly

A.1 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A CONFIGURATION REQUIREMENTS

A.1 The successful completion of Task Module 78, Transfer Probe from Gurney/Shipping Frame to Genie Lift and Task Module 79, Prepare Assembly Stand.

A HARDWARE REQUIRED

A.1 Hardware installed/used:

a) Kits installed: 11P, 4G, 5G, 10G, and 16G

A.1 Hardware removed:

a) Probe neck tube Strongback and fasteners
b) Station 200 Yoke (from Genie Stand)
c) Kits removed: 5G, 17G, 20P, 23P.

A.1 Tools required
a) 0.125 diameter pin gauge
b) Miscellaneous hand tools

A REFERENCES:

Task Module 80: Attach Probe to Piston Assembly

1. SMD Cryogen Handling SU/GP-B P0132
2. GP-B Magnetic Control Plan, LMMS 5835031
3. LMMS Drawing 5813396, SMD Plumbing Schematic
4. LMMS 5813353, Helium Airlock Assembly
5. LMMS 5823341, Helium Airlock Installation

Task Module 80: Attach Probe to Piston Assembly
1F OPERATIONS

Task Module 80: Attach Probe to Piston Assembly

1 Preparing the Probe and Genie:

1.1 Record time of starting of this section: Time

1.1 Verify the Assembly Stand is positioned under the Crane, if other lab operations are in the way, position the Stand as close as possible to under the Crane). Ensure the open side is facing south and the +Y axis of the Piston to the west.

1.1 Verify radial jacking screws are fully retracted.

1.1 Adjust four vertical jack screws to protrude 1/8-in below Piston Plate bottom surface; use gauge to set this adjustment.

1.1 Verify installed, the Clocking/Lifting Tee on Probe Flange.

1.1 Turning Probe to the vertical:

1.1.1 Verify the two 3-deg. shims are installed in the Genie mast track (see TM78).

1.1.1 Verify Genie outriggers are set down.

1.1.1 Lock Yoke bearing such that the Probe can not rotate about its roll axis (Z).

1.1.1 Partially loosen worm gear brakes, but keep them tight enough to prevent backing up.

1.1.1 Plug in the Genie hydraulic motor.

1.1.1 Open partially the shut-off valve in the Genie hydraulic system (green-handled Nupro valve).

NOTE
Shut off valve can be adjusted to provide a slow and smooth motion of the Genie mast.

CAUTION
Do not leave the worm gear mechanism unlocked or unattended as Probe c.g. offset is sufficient to unwind mechanism and result in damage to Probe

CAUTION
Perform the Probe rotation slowly so as not to produce excessive whiplash/jerking accelerations. It is helpful in this respect to provide manual support to the Probe Top Hat thereby reducing the torque load on the gearing.

1.1.1 Turn worm gear crank until Probe vacuum shell is near the floor; then raise Probe with Genie lift high enough to allow further rotation towards the vertical. Repeat this until Probe is vertical.

1.1.1 Tighten worm gear brakes and close shut-off valve in the Genie hydraulic system.

1.1.1 Verify the Probe is approximately vertical.

Task Module 80: Attach Probe to Piston Assembly

1.1 Install/verify installed the Annular Seal onto the Probe Flange.

CAUTION
Adjust height of Probe to pass under the Piston Plate or collision damage may occur. Watch Probe valve clearances at all times.

1.1 Position Probe in Genie so that the +Y axis is to the west and aligned with Assembly Stand +Y axis. Rotate Probe with yoke crank as required.

1.1 Unlock/verify unlocked the crank for the Yoke gear drive.

1 Positioning Probe to Assembly Stand:

1.1 Remove/verify removed the bench from the open side of the Assembly Stand.

WARNING
Ensure the installation of the work bench performed below includes the track extender supports under the platform and that these are bolted to the Assembly Stand rail or the bench will fail when used.

1.1 Install/verify installed the work bench on the closed side of the Assembly Stand using the extender supports attached to the Assembly Stand rails.

1.1 Verify the clocking mechanism clamp has been removed and the clocking arm fully retracted.

1.1 Remove/verify removed the Genie Lift Outrigger.

CAUTION
Watch the top of the Probe Flange for interferences when close to mating with Piston or damage to Probe may occur: adjustment of clocking arm may be required.

1.1 Using Genie Lift, position the Probe beneath the center of the Piston Assembly.

1.1 Using Genie hydraulic, raise the Probe up to Piston Plate; stopping when the Probe Flange studs are just below the Piston Plate.

1 Raising and Fastening the Probe to the Piston Plate:

CAUTION
Moving of the Assembly Stand with Probe installed SHOULD BE AVOIDED as vibration shock may damage the Probe. Any moving must be performed extremely carefully.

CAUTION
Close down almost completely the Genie safety valve to produce small movements of the mast to prevent impact between Probe and Stand.

Task Module 80: Attach Probe to Piston Assembly

1.1 Proceed to raise the Probe up to Piston Plate; stopping when the Probe Flange studs are just through the Piston Plate.

1.1 Install four spherical washers over the four studs.

1.1 Continue raising Probe until Probe Flange compresses the Flange seal.

1.1 Install and tighten four spherical nuts (Kit No. 10G) finger tight.

1 Loosening Genie from Probe:

1.1 Perform the following steps to remove the Collar Retaining Plates:

NOTE
The next step releases Probe from the Genie.

NOTE
Do not confuse the Inner Retaining Plates, which retain the Collar, with the Outer Retaining Plates which retain the Bearing. The Inner Plates are holding down the Beryllium Copper Split Collar Ring. These bolts clamp onto the Strongback annular flange as contrasted to the Outer Retaining Plates which bolt through this flange but do not attach to it.

1.1.1 Remove four each Collar Retaining Plates (inner plates) by removing eight each bolts (2 per Plate) and washers.

1.1.1 Stow hardware in Kit 20G.

1 Fastening the Probe Flange to the Piston Assembly:

1.1 Record time of starting of this section: Time
Date

1.1 Turn vertical jack screws down by hand until they contact the Probe Flange.

1.1 Remove the bottom Guide Rod Retaining Pins.

1.1 Use Genie Lift to lower Yoke to lowest position.

1.1 Attach Crane with Load Cell to Compliance Device.

CAUTION
The Probe weight may not be in balance and should be held securely at the bottom of the vacuum shell to prevent it from tilting excessively and putting strain on the CNT.

1.1 Raise Piston Plate/Probe/Bridge sufficiently to obtain a weight without the Guide Rods.
Record weight without Guide Rods: lbs
NOTE
This weight includes: Probe, Probe Flange, Strong Back with attachments, Piston, Bridge, compliance device, Guide Rods, Guide Rod Spacers, and balance weights (if used).

Task Module 80: Attach Probe to Piston Assembly

1.1 Raise Piston Plate/Probe assembly sufficiently to allow Genie Lift to move away from Assembly Stand.

Record weight with Guide Rods: lbs

1.1 Roll back Genie Lift from Assembly Stand.

1.1 Remove BeCu Collar from Probe Station 200 and stow in Yoke.

NOTE

This weight includes: Probe, Probe Flange, Strong Back with attachments, Piston, Bridge, compliance device, Guide Rods, Guide Rod Spacers, and balance weights (if used).

1.1 Use Crane and lower Piston/Probe Assembly back onto the Assembly Stand.

1.1 Install the bottom Guide Rod Retaining Pins.

Task Module 80: Attach Probe to Piston Assembly

1 Installing the Clocking Sleeves:

1.1 Record time of starting of this section: Time
Date

1.1 Loosen Vertical Jack Screws.

1.1 Remove any one of the four spherical nuts and washers.

1.1 Adjust radial jacking screws to center Probe Flange studs in their mating holes.

1.1 Install clocking sleeve, Spherical Washer and Nut and hand tighten.

1.1 Back off radial jack screws ~1/4-in.

1.1 Repeat above steps for the Probe Flange Stud at 180-deg clocking.

1.1 Remove/verify removed the crane/load cell from the Compliance Device.

1.1 Install the U-shaped Clocking Arm to the Clocking Tee and Clocking Assembly Plate using the hardware from Kit No. 5G.

NOTE
The moving arm studs should face to -X and bottom of "U" of the Clocking Arm should be lowest.

1.1 Adjust the spherical nuts to give a Probe Flange to Piston gap of 0.125-in using a 0.125-in pin gauge.

1 Completing Probe Installation:

1.1 Install Probe Restraining Collar around the Probe Vacuum Shell.

1.1 Verify installed the two Guide Rod Spacer Blocks on the Guide Rods with top-end locking T-pins.

Task Module 80: Attach Probe to Piston Assembly

2 Move Assembly Stand/Probe:

NOTE

This section is to be done only if use of the floor area under the Crane is required for other lab operations.

1.1 Yes, move Assembly stand No, No move required

1.1 Unlock wheels of Assembly Stand and raise outrigger feet.

1.1 Using three persons, move Assembly Stand with Probe to the south and east area, leaving room for roll up door egress.

1.1 Lock wheels and set the outrigger feet down.

1 Module 80 completed. Completed by:

Witnessed by:

RSE sign off :

Date:

Time:

RQE sign off :

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

Operations Number
Date Initiated
Time Initiated

A SCOPE

A.1 This module effects a leak check of the Probe and a backfill with helium exchange gas in preparation for inserting the Probe into the dewar

A GENERAL REQUIREMENTS

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

A.1 All O-rings installed shall be visually inspected, cleaned with ethyl/isopropyl alcohol as required and installed dry.

A CONFIGURATION REQUIREMENTS

A.1 The Probe vacuum space is in a known condition.

A.1 The Probe is installed on the Genie Lift inside the HEPA flow booth.

A HARDWARE REQUIRED

A.1 Hardware installed/used:

a) Spool Pumpout Flange
b) Leak detector
c) Utility Turbo Station (UTS)
c) Misc. vacuum hoses and valves

A.1 Hardware removed:

a) None

A.1 Tools required

a) None

A REFERENCES:

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

1. GP-B Magnetic Control Plan, LMMS 5835031
2. LMMS Drawing 5813395, SMD External plumbing
3. LMMS Drawing 5813396, SMD Plumbing Schematic
4. LMMS 5813353, Helium Airlock Assembly
5. LMMS 5823341, Helium Airlock Installation
6. LMMS Drawing No. 5819926, Probe Flange

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

1 Determine if Leak Check and Gas Backfill Was Done Previously:
No : Continue with Procedure para. 2.
Yes : Record below and Procedure complete.

1.1 Record the backfill pressure internal to the Probe and the source of this information:

Press: Torr Source/Date:

Completed by
Date:
Time

1 Initiating Pumping on Probe:

1.1 Verify Probe Vatterfly valve (VFV) is closed as shown by it's mechanical indicator.

NOTE:
Refer to the plumbing diagram of Fig. TM36-1. for the following hookups.

1.1 ‼ tc " Verify Probe Vatterfly valve (VFV) is closed as shown by it's mechanical indicator.
NOTE:
Refer to the plumbing diagram of Fig. TM36-1. for the following hookups.

" \l 3⊥ Verify convectron gauge is installed on port P1a:
Yes, gauge is installed Not installed, install per engineering instructions

1.1 Connect UTS to flange of VFV valve with 2 in. diameter, 10 foot long flex pumping hose.

1.2 Verify Installed/install an RGA to the UTS with a KF-40 tee.‼ tc "Connect UTS to flange of VFV valve with 2 in. diameter, 10 foot long flex pumping hose.
Verify Installed/install an RGA to the UTS with a KF-40 tee." \l 3⊥

1.3 Connect leak detector to foreline in UTS at valve TV-3 and verify calibration of Leak Detector with valve TV-3 closed.
Record: Backgrnd: ; Leak value ; Measured value
. .

1.1 Start Up of UTS and Pump Up to VFV:

1.1.1 Verify the power to the UTS compressor is on.

1.1.2 Place valve Interlock switch in the "over ride" position.

1.1.3 Turn on Vane Pump and Converter.

1.1.4 Push the red "reset" button to reset the interlock circuit.

1.1.5 Open/verify open the foreline valve, valve switch (red illuminated switch on front panel) is "on".

1.1.6 Open gate valve, TV-1; now rough pumping up to VFV.

1.1.7 Push the Sensor button on the Vacuum gauge display so that the "Pir" annunciator shows.

1.1.8 When the vacuum gauge reads <1 torr, push the Start button on the Turbo Controller: now pumping with turbo up to VFV.

1.1.9 ‼ tc " " \l 4⊥ When the"Normal betrieb" light comes on ‼ tc "When the"Normal betrieb" light comes on " \l 4⊥ switch the Valve Interlock switch to the "protected" position.

1.1.10 ‼ tc "switch the Valve Interlock switch to the “protected” position.
" \l 4⊥ Push the Sensor button on the Vacuum Gauge readout so that the “Hi-Vac” annunciator shows, and push the “Emis” button to turn on the cold cathode gauge (TG-1).

1.1 Leak Check Up to Valve VFV on Probe:

1.1.1 Verify that Leak Detector is operational and pumping up to valve TV-3.
1.1.2 Place the leak detector “vent disable” switch in the “disable” position.
1.1.3 Open TV-3 and close the Foreline Valve (TV-2).
1.1.4 Leak check all plumbing up to VFV valve and record:
a) Initial background: sccs
b) Final reading: sccs
1.1.5 Close valve TV-3 and open Foreline Valve (TV-2).

1.1 ‼ tc "Close valve TV-3 and open Foreline Valve (TV-2).

" \l 4⊥ Verify TV-5 and VFV (TV-6) are closed.

1.1 When the pressure is < 10-5 torr as read by the cold cathode gauge (TG-1), record:
a) Date/Time
b) Cold Cathode:
c) 10 torr baratron:

1.1 Verify UTS interlock switch is in the “protected” position.

1.1 Now pumping with UTS turbo up to valve VFV.

1.1 Verify valve P1a/P9 is open:
Yes, valve is open Not open, open valve
1 Measuring the Static Probe Pressure:

1.1 Yes, omit this section; pressure is known to be
as documented by .
1.1.1 Proceed to Para. 4.0.

1.1 No, the pressure is not know, do this section.
1.1.1 When TG-1< 3E-6 proceed with the following steps.
1.1.2 Close/verify closed TV-5.
1.1.3 Record:
a) Cold Cathode(TG-1) :_____ torr.
b) 10 torr baratron (TG-2) :_____ torr.
1.1.4 Close TV-1.
1.1.5 Open valve VFV and record for >2 minutes:
Time:
Cold Cathode(TG-1) :
10 torr baratron (TG-2):
1000 torr baratron (TG-3):
1.1.1 When satisfied an equilibrium pressure has been reached proceed to the next section.

1 Analyzing Probe Gas:

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

1.1 Verify TV-5 open and TV-4 closed.

1.2 Open RGA-V slowly (it is assumed that the RGA has been left in an evacuated condition); otherwise proceed to shut down turbo and rough out the RGA.

1.3 The turbo should now be pumping full on the RGA and up to TV-1 and TV-4.

1.4 Actuate the RGA and wait for stable readings (Use RGA with E-mult off).

1.5 Once valid RGA operation is verified; proceed with following steps.

1.6 Record RGA storage file name: .

1.7 Open TV-4 slowly and record RGA output in Table 1.

1.8 When a satisfactory analysis of the Probe gas has been obtained proceed with next step.

1 Pump Probe:

1.1 Valve VFV is:

Open, skip to para. 4.2 Closed, perform the following steps

1.1.1 Vent pumping line to one atmosphere using N2.

1.1.2 Record TG2/3 torr.

1.1.3 Open VFV.

1.1.4 Record TG2/3 torr.

1.1 Verify off/turn off RGA.

1.2 Verify closed RGA-V.

1.3 Verify closed TV-5.

1.4 If TG-3>30 torr:

1.4.1 Close TV-1.

1.4.2 Power-off turbo and rough pump and let turbo bleed up.

1.4.3 Put UTS in “OVER RIDE”.

CAUTION

Do not exceed a pump down rate of 10 torr/min as damage to Probe may occur.

1.1.1 Start rough pump and open TV-5 slowly to rough down probe, record data in table below.

Rate-
Rate-
Rate-

1.1.1 When TG-2<1 torr, close TV-5, open TV-1 and start turbo.

1.1.2 When turbo is in normal operation switch to “protected” mode.

1.1 If TG-3<30 torr:

1.1.1 Power-off turbo

1.1.2 Switch UTS interlock to “OVERRIDE”.

1.1.3 Open TV-1.

1.1.4 When TG3<1 torr start turbo.

NOTE

Now pumping Probe with turbo.

1.1 When turbo is “Normal betrieb” switch UTS interlock to “PROTECTED”.

1 Leak Check Probe:

1.1 Record: Date/Time:

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

1.1 When Probe pressure as measured by TG-1 is <3E-5 then proceed with leak checking.

1.1 Transfer rough pumping to leak detector.

1.1.1 Put leak detector on line up to TV-3 and TV-7.

1.1.2 Verify the leak detector “vent valve disable” switch is in the “disable” position.

1.1.3 Close TV-2 and open TV-3; putting leak detector on high pressure side of turbo.

1.1 Perform helium spray leak detection starting from top of Probe and working down:

Record: background sccs He. Time

Record results in the table below.

TG-1
Leak Det

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas

1.1 Bag the Probe Top Hat/CNT area and the Vacuum Shell area separately.

1.1.1 Flood the Vacuum Shell with helium and record::

Background	sccs He	Time
Start helium into bag	sccs He	Time
End helium into bag	sccs He	Time
Open bag	sccs He	Time

1.1 Flood the Top Hat bag with helium and record::

Background	sccs He	Time
Start helium into bag	sccs He	Time
End helium into bag	sccs He	Time
Open bag	sccs He	Time

1.1 Conduct further detailed leak check as required

1 Terminate Pumping of Probe:

1.1 Verify the leak detector "vent valve disable" switch is in the "disable" position.

1.2 Close TV-3, open TV-2 and deactivate leak detector.

1.3 Purge and install GHe line to TV-4.

1.4 Record the following pressures:‼ tc "Record the following pressures:" \l 3⊥

a) Cold Cathode: _____ torr

b) 10 torr baratron: _____ torr

c) P9 gauge: _____ torr

d) Probe convectron: _____ torr

1.1 Close UTS gate valve (TV-1).

1.2 Verify closed RGA-V.

1.3 Turn Turbo pump off.

1.4 Verify closed foreline valve (TV-2).

1 Backfill Probe to 2 torr Helium.

1.1 Use TV-4 to slowly raise line and Probe up to 2 torr.

1.2 Record UTS: 10 torr baratron: torr, Convectron torr.

1.3 Close VFV.

1.4 Let line up to 1 atm Helium.

1.5 Verify no leakage through VFV by observing pressure in line for 30 minutes:

Time: 0

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas
1000 torr Baratron (TG-3):
Convectron:

1.1 If no decay in pressure remove pumping line, and install KF-50 blank-off on valve VFV.

1 Task Module 36 completed‼ tc "Task Module 36 completed" \l 2⊥ . Completed by:
Witnessed by:
Date:
Time:
RQE sign off :

Task Module 36: Leak Checking and Backfilling Probe With Exchange Gas
Fig. TM36-1. Utility Pump System for pumping on Probe-B and Performing Leak Detection

‼ EMBED WPDraw30.Drawing \s * mergeformat¶ ┌ ┴

Task Module 86: Connect Cables And Balance Probe/Piston

Operations Number
Date Initiated
Time Initiated

A SCOPE

This module effects the connecting of the Instrumentation cables from the Probe to the Piston Assembly and from the Piston Assembly to the DAS. Also, the balancing of the Probe/Piston Assembly is performed here.

A GENERAL REQUIREMENTS

Task Module 86: Connect Cables And Balance Probe/Piston

A.1 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A CONFIGURATION REQUIREMENTS:

A.1 The Successful completion of Task Module 80: Attach Probe to the Piston Assembly.

A HARDWARE REQUIRED

A.1 Hardware installed/removed:

a) Lead bricks

A.1 Tools required

a) 3/16-in Allen wrench
b) 1/4-in Allen wrench
c) Bubble level

B REFERENCES:

Task Module 86: Connect Cables And Balance Probe/Piston

1. GP-B Magnetic Control Plan, LMMS 5835031
2. LMMS Drawing 5813395, SMD External plumbing
3. LMMS Drawing 5813396, SMD Plumbing Schematic
4. LMMS 5813353, Helium Airlock Assembly
5. LMMS 5823341, Helium Airlock Installation

Task Module 86: Connect Cables And Balance Probe/Piston
1F OPERATIONS

Task Module 86: Connect Cables And Balance Probe/Piston

1 Installing Instrumentation Cables:

CAUTION
Use gloves and ESD grounding straps when connecting cables to Probe.

1.1 Install the following instrumentation cables between the Probe and the Piston (Ref. Fig. TM86-2).

1.1.1 Verify connector savers are installed on Probe instrumentation connectors

1.1.1 Cable W106 which connects to I6 on Probe and A8 on Piston.

1.1.1 Cable W105/B which connects I3 and I5 on Probe to A7 on Piston.

1.1.1 Cable W100/c connects to A12 to thermocouples and Sentran and Convectron pressure gauges.

1 Balancing the Piston Assembly:

1.1 Attach the crane with load cell to the Lifting Plate.

1.1 Place the lead brick weights on the Piston and Bridge in the spots marked with tape. (See Fig. 86-1)

CAUTION
Have someone hold and stabilize the Probe vacuum shell as the Piston Assembly is raised off of Assembly Stand for balancing to prevent excessive whiplash motion.

1.1 Remove Guide Rod T-pins and the Guide Rod spacer blocks .

1.1 Remove Vacuum Shell Brace.

1.1 Verify four bolts holding Piston Plate to Bridge are installed and equally extended.

1.1 Slowly raise the Piston Assembly until clear of the Guide Rods .

1.1 Check the level of the Piston in both directions. (It may be necessary to make changes with the Lead Brick placement).

1.1 Record lead brick weights and locations on Fig 1 and describe here .

1.1 Record weight of suspended assembly: _____ lbs.

1.1 Verify this weighing includes the Probe, Strongback, Probe Flange, Probe Adapter Flange, Piston Plate with compliance device, and any balance weights. Record any additions/subtractions from this list:

Task Module 86: Connect Cables And Balance Probe/Piston

NOTE
It is preferable to have two persons to help guide Piston Assembly back onto Guide Rods.

1.1 Carefully lower the Piston back onto Guide Rods and Assembly Stand.

1.1 Install Guide Rod spacers and T-Pins.

1.1 Install Vacuum Shell Brace and tighten clamp.

1 Installing the instrumentation cables between the Piston, and Data Acquisition System (DAS):

1.1 Install the following cables between the Piston and the DAS (ref. Fig. 2):

1.1.1 Cable W099/C which connects the Piston connector A12 for the thermocouple and pressure readouts.

1.1.1 Cables W101 and W103 which connect to A9 and A10 on the Piston to the Facility DAS.

1.1 Use the DAS, controllers, and read-outs to verify proper operation of the instrumentation.

1 Task Module 86 completed. Completed by:
. Witnessed by:
Date:
Time:
RQE sign off :

Task Module 86: Connect Cables And Balance Probe/Piston
Fig. TM86-1 Piston Plate and Bridge Layout

‼ EMBED WPDraw30.Drawing \s * mergeformat¶ ┌ ┴

Task Module 86: Connect Cables And Balance Probe/Piston

Task Module 86: Connect Cables And Balance Probe/Piston

Fig. TM86-2 Cable Connections Prior to Airlock Installation onto Dewar

‼ EMBED WPDraw30.Drawing \s * mergeformat¶ ┌ ┴

Task Module 34: BPS and Thermal Shoe Adjustment
Updated on 2/9/99 per 5/22/98 performance of TM34/P0133
Task Module 34: BPS and Thermal Shoe Adjustment

Operations Number
Date Initiated
Time Initiated

A SCOPE

A.1 This module effects the removal of the Probe Strongback and the setting and spacing verification of the three BPS (Bellville Pre-load System) mounted on the Probe Flange. It also effects the verification of the installation/alignment of the thermal shoes.

A GENERAL REQUIREMENTS

Task Module 34: BPS and Thermal Shoe Adjustment

A.1 Magnetic screened tools, obtained from non-magnetic tool box are used for all components which will be integrated into the SMD Well.

A.1 All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A CONFIGURATION REQUIREMENTS

A.1 The successful completion of the Task Module 86: Connect Cables and Balance Probe/Piston.

A HARDWARE REQUIRED

A.1 Hardware installed/used:

a) BeCu Hinged Collar
b) BPS Adjustment Tool (Dwg. SK022895)

A.1 Hardware removed:

a) Strongback
b) Strongback screws, Kits 22Ga, 22Gb, 22Gc and 22Gd

A.1 Tools required
a) General hand tools
b) 7/16 nonmagnetic allen wrench (nonmagnetic)
c) 3/16 allen wrench (nonmagnetic)
d) 3/8 end wrench (nonmagnetic)
e) 36-in vernier caliper
f) bubble level with magnetic base
g) 6-in dial caliper

h) Thermal Shoe gauging tool (Tool #526B, per SK-338)

A REFERENCES:

Task Module 34: BPS and Thermal Shoe Adjustment

1. GP-B Magnetic Control Plan, LMMS 5835031
2. LMMS Drawing 5813395, SMD External plumbing
3. LMMS Drawing 5813396, SMD Plumbing Schematic
4. LMMS 5813353, Helium Airlock Assembly
5. LMMS 5823341, Helium Airlock Installation
6. LMMS Dwg. SK-338
7. LMMS Dwg. SK-022895
8. LMMS Engineering Memo SMS258

Task Module 34: BPS and Thermal Shoe Adjustment

1 Aligning Probe Vertical:

1.1 Remove/verify removed the Vacuum Shell Brace.

1.1 Use electronic inclinometer or machinist level held on vacuum shell to check and record Probe vertical alignment:

x-axis deg; y-axis deg

1.1 If alignment is more than 1-deg from vertical then correct as follows:

1.1.1 Alignment is better than 1-deg; skip this section.

1.1.1 Back off vertical jack screws.

1.1.1 Adjust four Spherical nuts to make Probe vertical.

1.1.1 Snug vertical Jacking Screws on their seats.

1.1.1 Final alignment:

x-axis y-axis

1.1.1 Snug Vertical Jack Screws.

1 Removing the Strongback from the Probe:

1.1 Record the BPS load cell values: Date/Time

CAUTION
The Probe neck tube can not withstand appreciable side loading. Thus, when the Strongback is loosened or removed the Probe must not be subjected to side loading, and must be kept vertical at all times.NOTE
The strongback and support bolts will be in tension if the Probe vacuum shell is at atmospheric pressure; it will be slightly in compression if it is at partial vacuum.

1.1 Remove all but three equally spaced bolts of the 16 bolts which hold the barrel nuts to the Top Hat Flange (Ref. Fig. TM34-1).
NOTE
The 16 bolts are equally spaced on the 32 bolt holes of the Top Hat Flange.

NOTE
If the Probe vacuum shell has atmospheric pressure the next step will transfer the axial load to the BPS.

1.1 Carefully back off the remaining bolts 1/4-turn at a time; count the number of 1/4-turns:

-1 Number of 1/4 turns .
-2 Number of 1/4 turns .
-3 Number of 1/4 turns .

Task Module 34: BPS and Thermal Shoe Adjustment

1.1 Record the BPS load cell values:

1.1 Back off all but three equally spaced barrel nuts; resulting in 13 barrel nuts loosened.

NOTE
If the Probe vacuum shell was evacuated the next step will transfer the axial load to the BPS.

1.1 Carefully back off the remaining barrel nuts 1/4-turn at a time; count the number of 1/4-turns:

-1 Number of 1/4 turns .
-2 Number of 1/4 turns .
-3 Number of 1/4 turns .

1.1 Record the BPS load cell values:

1.1 Loosen radial bolts at bottom of Strongback, leaving them finger tight.

1.1 Remove all but the top-most and bottom-most bolts from each side of the Strongback clamshell.

NOTE
Four people are required for this step. Support each clamshell half as it is loosened. Do not let them touch the neck tube.

1.1 Have two persons stabilize the top of the clam shells, a third person control the bottom of the clam shells and a fourth person remove in sequence the two top-most bolts and then the two bottom-most bolts.

CAUTION
Care must be exercised in the following step to prevent damage to the Probe neck tube area.

1.1 Remove the two clam shell halves.

1.1 Reassemble strongback clamshells and bag for storage.

1 Establishing the lengths for the three BPSs (Ref Fig. TM34-4):

NOTE
The top Load Stop nut is nominally not engaged as the BPS will limit the compression of the CNT bellows.

The setting of the bottom Load Stop nut provides a hard stop for CNT downward travel. It is engaged if the Probe is at atmospheric pressure.
NOTE
All dimensions for these settings are toleranced to ± .010 inches.
CAUTION
Use Zone-2 (black color coded) nonmagnetic tools for all adjustments

Task Module 34: BPS and Thermal Shoe Adjustment

1.1 Set up to verify a distance of 34.833 inches between the Probe Top Flange Mounting Surface (nominally, top of Dewar is at Station 234.40) and Probe Station 200 (Ref. LMMS Drawing No. 5834116, Sheet 14).

Note: DOM calc;		with SIA	(no SIA -88lbs)
just touching S200 (GTU-2)	34.764		
desired BPS compression	0.111		
unloading of BPS due to hanging Probe wt 246lbs at 13 lbs./0.001	0.019		(0.0012)
RT setting		34.894	(34.887)
cf. KS s value of	[34.884]		
Expected gap at S200 touchdown when RT setting is 34.827 (.111+.019)		.130	(.123)
(34.894-34.827)	-.067	-.067	
Total		.063	(.056)
cf. KSs value of	[0.053]	([.046])	

NOTE

This setting, 34.833, is a compromise between the expected value of 34.884, determined by measurement with Probe-B in GTU-2, and a calculated value of 34.770, based on room temperature measurements of the as-built Dewar and Probe and the thermal expansion coeficients. This compromise setting is chosen to be as close as possible to the GTU-2 based value but remain below the yield limit of the load stop tab for the case in which the Probe vacuum space loses vacuum and pressurizes to atmospheric pressure. In this case the bottom load stop nut will engage the load stop tab with a force of approximately 750 lb.
(On Probe insertion the Station 200's will meet with an expected (GTU-2 based) Probe to Dewar Flange separation of 0.063 rather than the desired 0.130. This results in under compression of the BPS, force of 1338 lbs compared to desired 1955 lbs.)

1.1.1 . Install/verify installed the BeCu collar ring on probe Axial Lock dog slots as shown in Fig. TM34-2.

1.1.1 Remove/verify removed the Vacuum Shell Restrainer.

1.1.1 Install BPS Adjustment Tool (Dwg. SK032898) onto the indium coated probe Station 200 surface using three 3-in C-clamps between the Tool and the BeCu collar. See Fig. TM34-2. Locate the C-clamps at the axial lock dogging positions (to minimize the possibility of contacting the Probe with the C-clamps), and use only light clamping pressure so as to not distort the tool.

1.1 Record the measurements made at three locations as measurement No. 1 in the table below (the number of the BPS is the same as the closest axial lock location).

NOTE

This measurement is best accomplished with a 36-in vernier caliper:

a) Attach a magnetic bubble level to the side of the caliper.

Task Module 34: BPS and Thermal Shoe Adjustment

a) The upper inside caliper jaw is fully inserted below the top of the Top Hat Flange (at the azimuthal location of one of the BPSs) and the tip of the bottom inside jaw is engaged with the top surface of the BPS Adjustment Tool.

a) Ensure that the caliper is vertical and parallel to the probe axis when making a measurement.

a) The vernier movable jaw should be locked with the set screw before removing for a reading as the jaw will not stay correctly aligned when not locked.

Task Module 34: BPS and Thermal Shoe Adjustment

Description of Location
1. Ref 8; LMMS EMO SMS258. Dimension was increased by .006-in. relative to Probe-C fit check to compensate for added weight (~80 lb.) of the Quartz Block.

1 Adjusting BPS:

1.1 Indicate if BPSs are to be adjusted .

1.1.1 Record BPS load cell readings in Table TM34-1 as the adjustments proceed.

1.1.1 Adjust caliper to desired setting.

1.1.1 If the spacing is currently too short, adjust all BPS adjustment nuts uniformly (1/2-turn at a time) to give a too large spacing (i.e., to make the Probe slightly longer than the desired length).

1.1.1 While one person holds the caliper vertical (using a magnetic bubble level) and in the measurement position a second person adjusts the nut such that the flanges just touch the caliper jaws.

1.1.1 Repeat for other two BPS adjustment nuts.

1.1.1 Repeat measurements of Para. 3.2 and record the results in the Table TM34-1.

1.1.1 If necessary, make fine adjustments on the BPS adjusting nuts to bring spacing into tolerance and repeat the measurements of Para. 3.2. Record the final results in the table.

Table TM34-1 Load Cell Readings
Cal.
meas.
Cal.
meas
Cal.
meas.

1.1.1 Reinstall Vacuum Shell Restrainer.

1.1 Using a pin or feeler gauge of 0.050-in determine the correct spacing of the lower Load Stop nut (3 places), and adjust the nuts such that the pin gauge just fits the gap.

1.1 Using a pin or feeler gauge of 0.550-in repeat the preceeding step for the upper load stop nut.

1.1 Using a 6" dial caliper, measure the spacing of each of the lower Load Stop tabs and Top Hat flange and record:

1.1 Inspect the BPS and laod cell wiring for all BPS units to insure that the wires will not be pinched during probe insertion or by the Belleville washers.

1.1 Inspect wiring at the top of the VAcuum Shell to ensure that it is tucked away from the STA 200 surface and will not be pinched during probe insertion.

Task Module 34: BPS and Thermal Shoe Adjustment
Re 'Inspect wiring...' need tie points such as wiretie holes in VS bolts.

1 Remove the Load Stop adjustment tooling installed in Para. 3.1

CAUTION
Care must be exercised in the following step to avoid damaging the electrical leads to thermometers located on the bottom side of the Thermal Shoe Rings in the vicinity of the -X axis.

1.1 Remove/verify removed the Vacuum Shell Restrainer.

1.1 Loosen the three C-clamps holding the tool to Station 200.

1.1 Remove the C-clamps and carefully remove the tool down and off the vacuum shell.

1.1 Install the Vacuum Shell Brace.

1 Verifying the Thermal Shoe settings:

1.1 Inspect each thermal Shoe and verify the flexure pivot mechanism is free to move and not damaged. Record results in TM34-2.

1.1 The Thermal Shoe adjustment is done in TM 230.

1 Task Module 34 completed. Completed by:
Witnessed by:
Date:
Time:
RQE signoff :
Table TM34-2 Thermal Shoe Adjustment
Flex
Pivot

1. Thermal shoe 1 is closest to +X axis in CCW (+Z rotation) direction and 2 is next CCW shoe, etc.

Task Module 34: BPS and Thermal Shoe Adjustment
Figure TM34-1 Strongback Arrangement

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Figure TM34-2 Probe Length Adjustment Schematic
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Figure TM34-3 Thermal Shoe Adjustment Schematic

‼ EMBED WPDraw30.Drawing \s * mergeformat¶ ┌ ┴

Fig TM34-4 BPS/Probe/Load Stop Schematic‼ EMBED Word.Picture.8 \s * mergeformat¶ ┌ ┴

Task Module 230: Thermal Shoe Radial Alignment

Operations Number
Date Initiated
Time Initiated

A SCOPE

This procedure describes the steps necessary to check and adjust the thermal shoe radial position.

A REFERENCE DOCUMENTS

A.1 Drawings:

A.1 Procedures:

A.1 Supporting documentation

A SAFETY

A.1 In case of any injuries obtain medical treatment: at:
LMMS Call 117 Stanford University Call 9-911

A.1 Safety

The GP-B (FIST) Safety Plan, LMMS-F314447, discusses safety design, operating and maintenance requirements which the ATC program office has adhered to. These requirements should be reviewed for applicability at any facility outside of ATC (e.g. Stanford University) where FIST hardware is operated.

A.1 Hazards Analysis

The GP-B (FIST) Preliminary Hazards Analysis, LMMS-F314446, discusses hazards inherent in ATC-developed FIST hardware in greater detail.

Task Module 230: Thermal Shoe Radial Alignment

A CONFIGURATION REQUIREMENTS

A.1 Completion of "Thermal Shoe Adjustment" Task Module 35 of P0133.

A.1 Probe is in vertical orientation with Top Hat up and with Strongback removed.

A.1 General Requirements:

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

b) Clean room gloves shall be worn by all persons working on hardware to be inserted into the well. For any work performed at the level of the dewar opening clean room shoes shall be worn in addition.

c) All O-rings installed shall be visually inspected, cleaned with alcohol as required and installed dry.

A HARDWARE REQUIRED

A.1 Hardware installed: None.

A.1 Hardware removed: None.

A.1 Hardware Used

A.1 Tools required:

a) SK282-113

a) SK282-114

a) SK643-101

a) SK643-102

a) SK643-103

a) Plastic feeler gauges

a) Tie wraps

Task Module 230: Thermal Shoe Radial Alignment

B Assemble Tooling onto Probe:

2.1 Clean, alcohol wipe, tool prior to assembly.

2.2 Verify configuration is per para. D.1 and D.2.

2.3 Install the tools, SK 282-113 and -114 to the Probe per Fig. 1. Use the fasteners and tie wraps for the attachment.

3 Verify Shoe position:

3.1 Hold the SK 643-101 Bar firmly against the -113 and -114 rings and place the -102 gauge block against the bar.

3.2 Measure the shoe to gauge block gap using plastic feeler gauges and record results in Table 1.

NOTE: 0.010 shim corresponds to a radial location of 6.275-in. (Maximum allowable)

0.030 shim corresponds to a radial location of 6.255-in. (Minimum allowable)

1.1 Adjust the position of the shim as required to locate it within the Max/Min dimensions. This is accomplished by bending the Shoe Thermal Strap.

NOTE: The positioning of the Shoes at the correct radial location assures that the shoe will mate with the CNT thermal stops and have adequate clearance to pass by the CNT interior hardware.

1.1 Check BPS :

1.2 Verify the BPS bottom flange and BPS spring stack are within the maximum dimension, 0.010 shim will fit in the gap.

1.3 Record results:

1 Task Module 34 completed. Completed by:

Witnessed by:

Date:

Time:

RQE signoff :

Task Module 230: Thermal Shoe Radial Alignment
Table 1 Thermal Shoe Adjustment Data
Thermal
Shoe

1. Thermal shoe 1 is closest to +X axis in CCW (+Z rotation) direction and 2 is next CCW shoe, etc.

Figure 210-1 Thermal Shoe Alignment Tool in Position on Probe

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