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GRAVITY PROBE B, RELATIVITY GYROSCOPE EXPERIMENT
STANFORD, CALIFORNIA 94305-4085

REPLACEMENT OF GMA/OFF-PALLET FILL AND DRAIN VALVE SNAP RING

GP-B ENGINEERING PROCEDURE

To be performed at Vandenberg Air Force Base Building 1610

THIS DOCUMENT CONTAINS NON-HAZARDOUS OPERATIONS

P0983 Rev –

1 August, 2003

PREPARED	S. Buchholz, Prepared by	Date
APPROVED	K. Bower, GMA Engineer	Date
APPROVED	C. Gray, GMA REE	Date
APPROVED	Harv Moskowitz, LMSSC Safety Engineer	Date
APPROVED	D. Ross, Quality Assurance	Date

APPROVED	_____	_____
	R. Brumley, Hardware Manager	Date

REVISION HISTORY

Rev	Date	Comments
-	8/01/03	

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List of Abbreviations and Acronyms

D-Log	Discrepency Log
DR	Discrepency Report
ECU	Electronic Control Unit
ESD	Electro Static Discharge
FEE	Forward Equipment Enclosure
F&D	Fill and Drain
GMA	Gas Management Assembly
GP-B	Gravity Probe B
GSE	Ground Service Equipment
He	Helium
LM	Lockheed Martin
MRB	Materials Review Board
NASA	National Aeronautics and Space Administration
POD	Not an acronym, it's a cluster of computers
QA	Quality Assurance
cfm	Cubic Feet per Minute
SU	Stanford University
TD	Test Director
VAFB	Vandenberg Air Force Base

LIST OF SPECIFIC HEADING DEFINITIONS

Each type of alert message will precede the procedural step to which it applies

1.	NOTE: Used to indicate an operating procedure of such importance that it must be emphasized
2.	CAUTION: Used to identify hazards to equipment
3.	WARNING: Used to identify hazards to personnel

A SCOPE

This procedure defines how to replace a snap ring on a Moog Inc. Fill and Drain valve installed on the GMA. This procedure is based on Moog procedure AVO 50E963-GWM-003. This operation can be completed on any Fill and Drain Valve on which the snap ring has been displaced. When completed, all required parties shall sign the completed procedure.

B SAFETY

B.1 General

The GMA is a gas pressure system. Under normal operations, the GMA requires no safety measures or equipment beyond those required for the use of a supply gas cylinder.
The GMA and the Space Vehicle are high value space flight hardware and should be handled with great care. The GMA tanks (mounted underneath the GMA pallet) are fracture critical items.

Care should be exercised during all connections to flight hardware to prevent contamination of wetted surfaces by particulates. Smocks, bonnets, and gloves (consistent with Class 10,000 practices) shall be worn whenever handling flight hardware. The operator making any fluid connections shall do a visual inspection before making the connection.

B.2 Mishap Notification

B.2.1 Injury

In case of any injury or illness requiring medical treatment - Dial 911

B.2.2 Hardware Mishap

In case of an accident, incident, or mishap, notification is to proceed per the procedures outlined in Lockheed Martin Engineering Memorandum EM SYS229 and Stanford University GP-B P0879. Additionally, VAFB NASA Safety and 30th Space Wing Safety will be notified as required.

B.2.3 Contingency Response

Responses to contingencies/emergency (e.g., power failure) are listed in Section **G.7**.

C QUALITY ASSURANCE

C.1 QA Notification

This operation will be conducted on a formal basis to approved and released procedures. **The QA program office shall be notified 24 hours prior to the start of this procedure**. A Quality Assurance Representative, designated by D. Ross shall be present during the procedure and shall review any discrepancies noted and approve their disposition. Upon completion of this procedure, the QA Program Engineer, D. Ross or her designate, will certify her concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the designated place(s) in this document.

C.2 Red-line Authority

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

C.3 Discrepancies

Discrepancies will be recorded in a D-log or as a DR per Quality Plan P0108.

D TEST PERSONNEL

D.1 Personnel Responsibilities

The Director shall be Chris Gray or an alternate that he shall designate. The person performing the operations (Test Director or Test Engineer) has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it.

D.2 Personnel Qualifications

Test Director must have a detailed understanding of all procedures and experience in all of the GMA operations. The Test Director shall designate a Test Engineer as required.

D.3 Required Personnel

The following personnel are essential to the accomplishment of this procedure:

FUNCTIONAL TITLE	NUMBER	AFFILIATION
Test Director/Test Engineer	1	Stanford
GP-B Quality Assurance	1	Stanford

E REQUIREMENTS

E.1 Electrostatic Discharge Requirements

When working on the space vehicle, proper ESD protection is required. All wrist straps will be checked using a calibrated wrist strap checker prior to use.

E.2 Lifting Operation Requirements

N/A

E.3 Hardware/Software Requirements

- Fill & Drain valves on GMA or Space Vehicle
- Snap Retaining Ring part #M16624-4050, for flight
- Torque wrenches as required

  #1) Make/model _____ S/N _____ Certificate expiration _____

  #2) Make/model _____ S/N _____ Certificate expiration _____

  #3) Make/model _____ S/N _____ Certificate expiration _____

E.4 Instrument Pretest Requirements

N/A

E.5 Configuration Requirements

- Access to Fill and Drain Valves (No GSE attached)

E.6 Optional Non-flight Configurations

N/A

E.7 Verification/ Success Criteria

New Snap Ring installed on any Fill and Drain Valve

E.8 Constraints and Restrictions

None

F REFERENCE DOCUMENTS

F.1 Drawings

Drawing No.	Title
26273	GMA Schematic, GP-B Dwg

F.2 Supporting Documentation

Document No.	Title
SU/GP-B P0108	Quality Plan
SU/GP-B P059	GP-B Contamination Control Plan
LM/P479945	Missile System Prelaunch Safety Package
EM SYS229	Accident/Mishap/Incident Notification Process
EWR 127- 1	Eastern and Western Range Safety Requirements
KHB 1710.2 rev E	Kennedy Space Center Safety Practices Handbook

F.3 Additional Procedures

Document No.	Title
SU/GP-B P0879	Accident/Incident/Mishap Notification Process
SU/GP-B P0875	GP-B Maintenance and Testing at all Facilities
Moog AVO 50E963-GWM-003	50E963 Fill and Drain Valve Retaining Ring Replacement

G OPERATIONS

G.1 Verify Appropriate QA Notification

QA Notified:

_____
(Date & Time)

G.2 Removal of Retaining Ring

Started on: _____ Identify Fill & Drain Valve_____

Note: Mark off each step of procedure as it is completed.

G.2.1 Verify Fill and Drain Valve is closed by turning the nut clockwise until hand tight. This will position outer thrust washer with the most clearance from retaining ring.

G.2.2 Remove tube cap and conical seal from AN fitting of valve stem. Bag and secure the tube cap.

G.2.3 Remove retaining ring with retaining ring pliers by removing the ring off over the AN fitting of the valve stem. Bag and secure the ring.

G.2.4 Inspect retaining ring groove for deformation or damage. If damage to groove flats or radii are present it must be evaluated by the test director.

Section complete. **Quality** _____

G.3 Installation of New Retaining Ring

Started on: _____

Note: Mark off each step of procedure as it is completed.

G.3.1 With the valve still in the closed position (Section **G.2**) and the outer thrust washer against the actuation nut. Place retaining ring onto retaining ring pliers with sharp flat side facing the pliers.

G.3.2 Install the retaining ring on over the AN fitting of the valve stem and into the retaining ring grove per figure 1. Verify that ring spins /rotates in groove.

G.3.3 Recheck that the sharp flat edge of the retaining ring is facing the valve inlet AN fitting.

G.3.4 Re-install tube cap and new conical seal onto AN fitting of valve stem. (See **fig 1**)

G.3.5 Torque AN fitting to 120□10 in.lbs

Wrench used_____

F&D_____torque QA _____

Section complete. **Quality** _____

G.4 Drawings

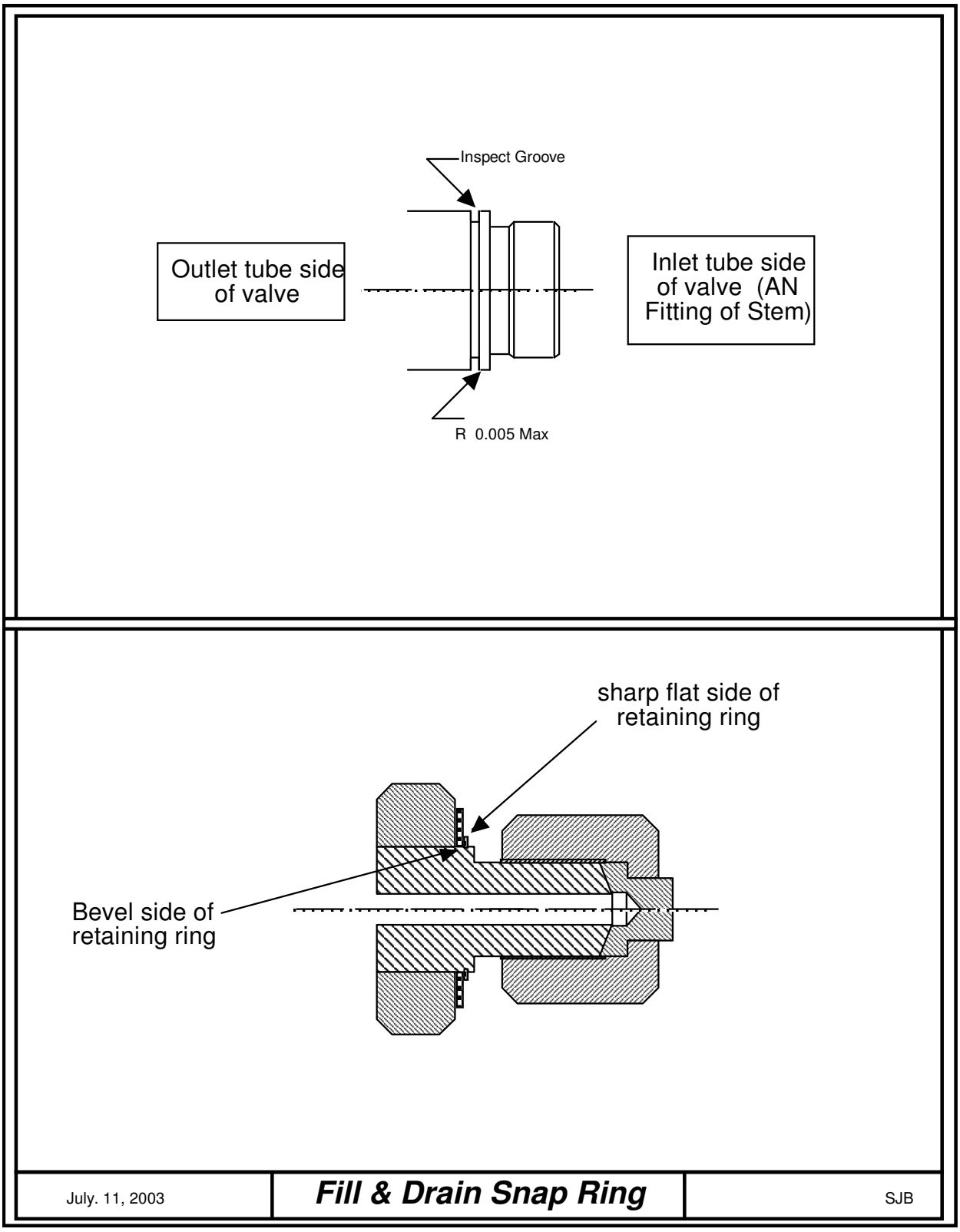

Figure 1

G.5 Pre-Test Checklist

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify the test procedure being used is the latest revision.		
	2. Verify all critical items in the test are identified and discussed with the test team.		
	3. Verify all required materials and tools are available in the test area.		
	4. Verify each team member is certified for the task being performed and know their individual responsibilities.		
	5. Confirm that each test team member clearly understands that he/she has the authority to stop the test if an item in the procedure is not clear.		
	6. Confirm that each test team member clearly understands that he/she must stop the test if there is any anomaly or suspected anomaly.		
	7. Notify management of all discrepancy reports or d-log items identified during procedure performance. In the event an incident or major discrepancy occurs during procedure performance management will be notified immediately.		
	8. Verify/Perform an Engineering and Safety high-bay walk down. Ensure all discrepancies are corrected prior to start of operations.		
	9. Confirm that each test team member understands that there will be a post-test team meeting.		
	Team Lead Signature: _____		

G.6 Post Test Checklist

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify all steps in the procedure were successfully completed.		
	2. Verify all anomalies discovered during testing are properly documented.		
	3. Ensure management has been notified of all major or minor discrepancies.		
	4. Ensure that all steps not required to be performed are properly identified.		
	5. If applicable sign-off test completion.		
	Team Lead Signature: _____		

G.7 Contingency/Emergency Responses

G.7.1 Emergency Shutdown/ Evacuation

In the event of an emergency requiring shutdown and/or evacuation which does allow time for steps to be taken without endangering personnel, the following general steps should be taken, in order of priority (operator to determine sequence):

- Isolate the flight hardware wetted surfaces (fluid flow paths) from the exterior environment by closing GSE valves (OM Valves, or similar, as applicable to the state of assembly.)
- Record state of all related flight volumes as known (valves open/closed, current pressures, ECU status, etc.).
- Shut down GSE as desired (leak detectors, vacuum sources, ECU control systems, etc.).

G.7.2 Power Failure

In the event of a power failure, the Test Director shall implement similar steps (see above emergency shutdown steps).

In the event that these steps have been taken (in part or whole), when it safe for personnel to return to the equipment:

- The Test Director shall perform an evaluation of the current state of the hardware.
- With concurrence of the GMA Responsible Engineer and QA, the Test Director shall issue a d-log detailing the steps required to return the flight equipment to its prior state and to establish which step the procedure shall continue from.
- If the Test Director, Responsible Engineer, or QA believe it necessary, a discrepancy report may be issued for MRB review.

H PROCEDURE SIGN OFF

The results obtained in the performance of this procedure are acceptable:

_____ date: _____
Test Director

Discrepancies if any:

Approved: _____ date: _____
C. Gray, GMA Responsible Engineer

Approved: _____ date: _____
QA Representative

Approved: _____ date: _____
D. Ross, QA