STANFORD UNIVERSITY
W.W. HANSEN EXPERIMENTAL PHYSICS LABORATORY
GRAVITY PROBE B, RELATIVITY GYROSCOPE EXPERIMENT
STANFORD, CALIFORNIA 94305-4085

BLEED DOWN OF THE HIGH GMA PRESSURE

GP-B ENGINEERING PROCEDURE

P0942 Rev B

1 October, 2002

PREPARED	R. Stephenson, GMA Engineer	Date
APPROVED	C. Gray, GMA REE	Date
APPROVED	D. Ross, Quality Assurance	Date
APPROVED	R. Brumley, Hardware Manager	Date

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REVISION RECORD

REVISION	ECO	PAGES	DATE
A	1382	Removal of pressure gauge from plumbing. Manual valve operations overlooked in Rev- Change of GMA safe state from launch configuration to all valves closed. Additional minor corrections	9/11/02
B	1389	Every section specifies starting configuration OMVent operations added	10/03/02

A SCOPE

This procedure is used to bleed excess pressure from the Gas Management Assembly (GMA). It starts by bleeding the pressure from the downstream portion of the system through the GMA Vent. Optionally, the supply tanks may be bled down as well. This procedure assumes that the areas of the GMA below the Gyroscope Valves (Zones 6 and 7 on Diagram 2) are at the correct pressure and therefore leaves them untouched.

B SAFETY

The GMA is a gas pressure vessel. Under normal operations, the GMA requires no safety measures or equipment beyond those required for the use of a supply gas cylinder. When any of the systems are pressurized and connected to a vacuum system, be cautious not to vent high pressure through the pumping portions of the system. Only allow high pressure to vent through approved ports and make sure that these are open at time of venting. Note that the GMA is an extremely high value piece of space flight equipment. The GMA tanks are also fracture critical items, so care must be taken not to damage them in any way.

C QUALITY ASSURANCE

C.1 QA Notification

This test will be conducted on a formal basis to approved and released procedures. **The QA program office and ONR representative 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.

C.3 Discrepancies

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

D TEST PERSONNEL

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

E REQUIREMENTS

E.1. Electrostatic Discharge Requirements

N/A

E.2. Lifting Operation Requirements

N/A

E.3. Hardware/Software Requirements

ECU Flight Equivalent Unit

Appropriate software for controlling GMA, this includes a null script which enables command-line control of the GMA.

Flight GMA

Vacuum system (Alcatel pump cart or equivalent)

Plumbing lines, cleaned consistently with Class 100 practices

Clean check valve

Clean manual valves (2)

CSTOL Scripts

VCR gender changers, elbows, etc. as required, cleaned consistently with Class 100 practices

Class 100 down flow hood, if required

Hand held particle counter, if required

E.4. Instrument Pretest Requirements

All test equipment used in taking data shall be "in calibration" at time of test.

E.5. Configuration Requirements

GMA work will be performed under Class 100 flow hood or in clean room.

E.6. Optional Non-flight Configurations

N/A

E.7. Verification/ Success Criteria

N/A

E.8. Constraints and Restrictions

Normal clean room practices apply under down flow hood and in clean room.

F REFERENCE DOCUMENTS

F.1. Drawings

GMA Schematic, Dwg. Number 26273

F.2. Supporting documentation

S0681 "CSTOL Scripts for GMA Testing"

F.3. Additional Procedures

P0930 "GMA Sleep Procedure"

G OPERATIONS

G.1. Verify Appropriate QA Notification

QA Notified_____ ONR Notified_____

G.2. Verify Configuration Requirements

Verify GMA is situated in a Class 1000 or better clean room or under a Class 100 or better flow hood. If GMA is under flow hood, verify the environment with a hand held particle counter. Counts under the hood must average better than 5 per 0.1 liter measured of size 0.5 micron or greater.

Quality _____

G.3 Setting up the GMA

Started on: _____

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

WARNING

HELIUM USED IN THE GRAVITY PROBE-B PROGRAM REPRESENTS A HAZARDOUS MATERIAL FOR THE PERSONNEL INVOLVED IN TESTING AND CRYOGENIC SYSTEM OPERATIONS. EXTREME CARE SHOULD BE USED WHEN WORKING AROUND OR WITH HELIUM.

3.1 Connect the ECU FEU to the GMA and start up the ECU and gma_null.prc.

3.2 Use the ECU to close all GMA solenoid valves.

3.3 Connect plumbing to the GMA vent per Diagram 1. If OMVent 2 is connected, verify that it is closed.

3.4 With BV1, and BV2 fully open, and OMVent closed start the vacuum system and evacuate the new plumbing.

3.5 Slowly open OMVent and evacuate up to the GMA solenoid valves.

3.6 Close BV2.

3.7 Read the GMA pressure transducers and fill in the table below.

Table 1, GMA pressures, PSIA:

	GP1	GP2	GP3	GP4	GP5	GP6
Expected	>299	>299	>299	railed	railed	railed
Actual						

Quality _____

G.4 Bleed down of GMA Downstream Pressure

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

4.1 Verify that GMA solenoid valves are all closed.

4.2 Verify that BV1 and OMVent are open and that BV2 is closed.

4.3 Open GMA solenoid valves V27 and V29.

4.4 Open OMvent a small amount to slowly bleed the pressure from the GMA.

4.5 When flow stops, close BV1 and open BV2 (Vacuum system is still operating).

4.6 Open GMA solenoid valve V4. Open V6 if necessary.

4.7 Monitor GP3.

4.8 When the pressure drops at GP3, close GMA solenoid valve V4 (and V6, if necessary) and record pressure at GP3 here _____.

4.9 Open GMA solenoid valve V3. Open V5 if necessary.

4.10 Monitor GP2.

4.11 When the pressure drops at GP2, close OMvent and record pressure at GP2 here _____.

4.12 Close GMA solenoid valves V29, V27, V3 and V5.

4.13 Determine if GMA tanks are to be vented as well. If not, skip to section G.6.

Quality _____

G.5 GMA Tank Bleed Down

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

5.1 Verify that sections G.3 and G.4 have been successfully completed.

5.2 Read the GMA pressure sensors and verify that GP2, GP3, GP4, GP5, and GP6 are all at about 20 psia.

5.3 Determine desired final GMA tank pressure and record it here _____ (300 psia if preparing for shipping).

5.4 Verify that GP1 reads above the pressure recorded in 5.3.

5.5 Verify that vacuum pump is running and open BV2.

5.6 Open OMVent.

5.7 Open GMA solenoid valves V1, V2, V3, V4, V5, V6, V27, and V29.

5.8 Monitor pressure at GP1.

5.9 When pressure reaches desired level (300 psia if preparing for shipping) close OMVent and record final pressure at GP1 here _____.

5.10 Close GMA solenoid valves V29, V27, V6, V5, V4, V3, V2, and V1.

Quality _____

G.6 GMA Final Configuration

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

6.1 Verify that sections G.4 and G.5 (if necessary) have been successfully performed.

6.2 Verify that OMVent is closed.

6.3 Run GMA sleep procedure, P0930, if required.

6.4 Disconnect the vacuum system and GSE from the GMA. (Note: leave OMVent connected to the GMA if desired.)

6.5 Cap the GMA vents, if necessary.

6.6 Shut down the ECU FEU.

Quality _____

G.7 Diagrams

Diagram 1: Bleed Manifold

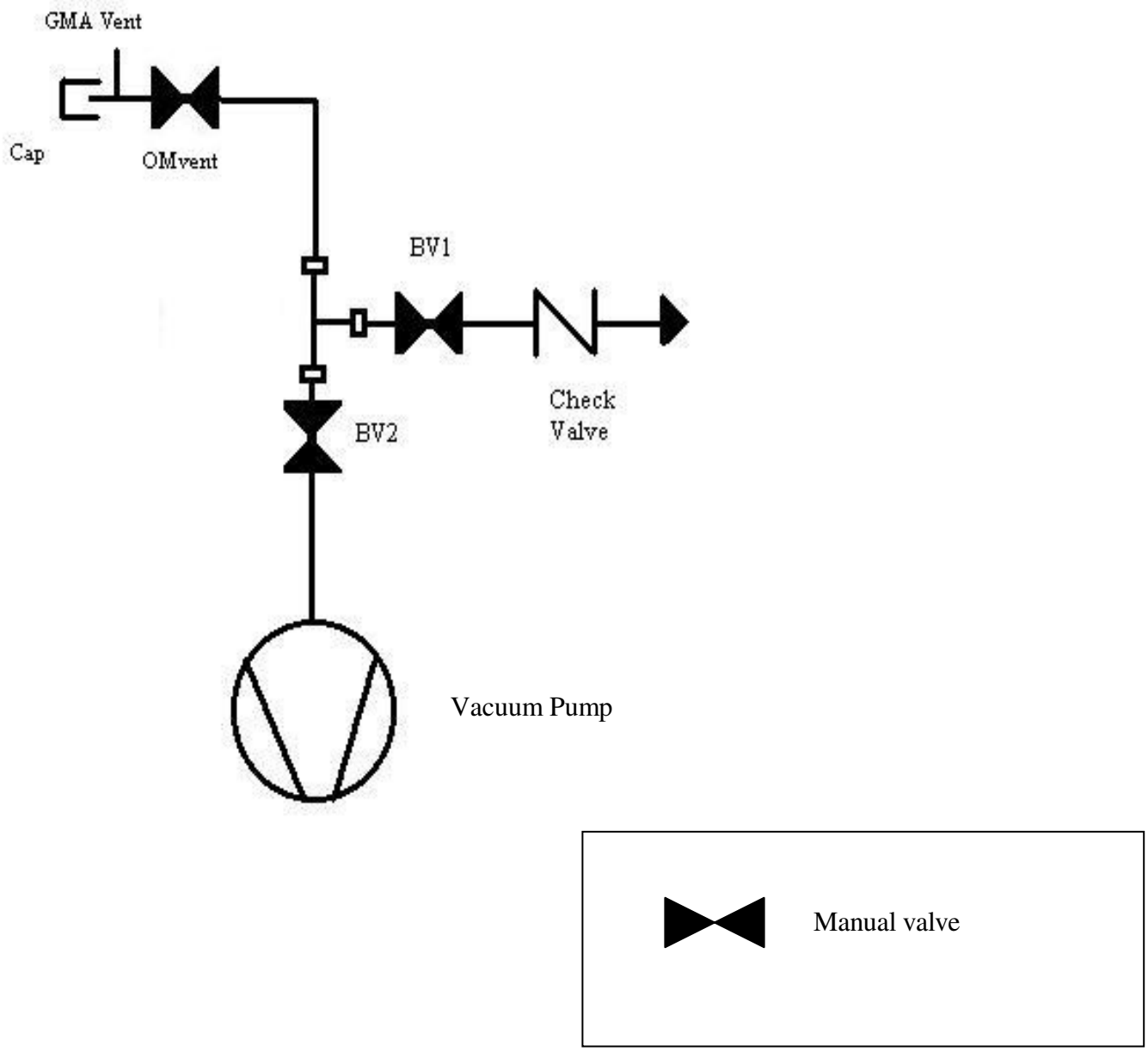
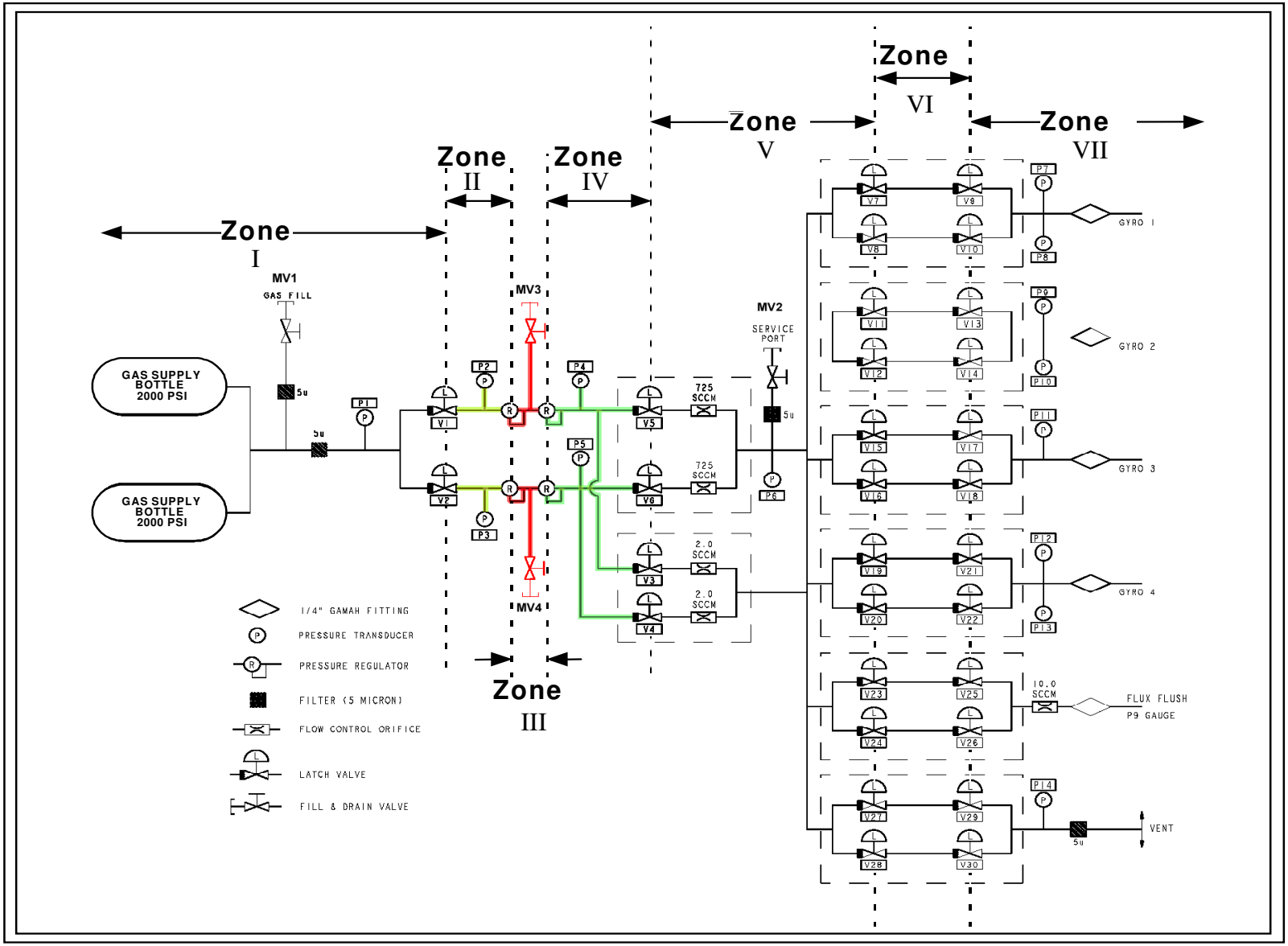


Diagram 2: GMA Schematic



G.9 PRE-TEST CHECKLIST

DATE	PROCEDURE #	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 PRE-STAGED AND AVAILABLE IN THE TEST AREA.		
		4. VERIFY ALL HAZARDOUS MATERIALS INVOLVED IN THE TEST ARE IDENTIFIED TO THE TEST TEAM.		
		5. IF HELIUM IS TO BE USED VERIFY THAT A BLUE "HELIUM" TAG IS AROUND THE NECK OF THE HELIUM CYLINDER.		
		6. VERIFY ALL HAZARDOUS STEPS TO BE PERFORMED ARE IDENTIFIED TO THE TEST TEAM.		
		7. VERIFY EACH TEAM MEMBER KNOWS THEIR INDIVIDUAL RESPONSIBILITIES.		
		8. 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. **NOTE: DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO**.		
		9. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF THERE IS ANY ANOMALY OR SUSPECTED ANOMALY **NOTE: DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO**		
		10. NOTIFY MANAGEMENT OF ALL DISCREPANCY REPORTS OR D-LOG ITEMS IDENTIFIED DURING THE PROCEDURE. IN THE EVENT AN INCIDENT OCCURS DURING PROCEDURE PERFORMANCE, MANAGEMENT WILL BE NOTIFIED IMMEDIATELY.		
		11. CONFIRM THAT EACH TEST TEAM MEMBER UNDERSTANDS THAT THERE WILL BE A POST-TEST TEAM MEETING.		
		TEAM LEAD SIGNATURE:		

G.10 POST-TEST CHECKLIST

DATE	PROCEDURE #	CHECKLIST ITEM	COMPLETED	REMARKS
		1- VERIFY ALL STEPS IN THE PROCEDURE WERE SUCCESSFULLY COMPLETED.		
		2- VERIFY ALL MINOR/MAJOR DISCREPANCIES DISCOVERED DURING TESTING ARE PROPERLY DOCUMENTED.		
		3- ENSURE MANAGEMENT HAS BEEN NOTIFIED OF ALL MINOR/MAJOR DISCREPANCIES.		
		4- ENSURE THAT ALL STEPS THAT WERE NOT REQUIRED TO BE PERFORMED ARE PROPERLY IDENTIFIED.		
		5- IF APPLICABLE SIGN-OFF TEST COMPLETION.		
		TEAM LEAD SIGNATURE		

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 REE

Approved: _____ date: _____
QA Representative

Approved: _____ date: _____
D. Ross, QA