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STANFORD, CALIFORNIA 94305-4085

ASSEMBLY OF GAS FLOW HARDWARE INTO SM GMA

GP-B SCIENCE MISSION PROCEDURE

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1 SCOPE

This procedure covers the build-up of the SM-GMA for the purpose of checkout and Acceptance Functional Testing necessary to permit its use on the Payload. Transfer to the flight base-plate, shake testing and thermal vac testing will be covered in other procedures.

This procedure describes the removal of non-flight shipping hardware from the Gas Management Assembly (GMA), and the method used to reassemble the solenoid valves and pressure regulators on the GMA in preparation for testing per drawing 25110. This procedure covers Stanford drawings 26211-101, -102, -103.

This procedure also describes the installation of the pressure sensors (ST550-15A-103, ST550-500A-103, ST550-5000A-103), metering valves (2 ea. 25499-101, 1 ea. 25107-102 and Gas Bottle Assembly (25106) on the GMA assembly as per drawing 25110.

1.1 Acronyms

The following acronyms are used in this document

ITD	Integration and Test Director
GMA	Gas Management Assembly for Science Mission
GMF	GMA Manipulator Fixture

2 REFERENCES

2.1 Plans and Procedures

P0059 GP-B Contamination Control Plan
 Braycote 601 Vacuum grease for O-rings

2.2 Drawings

25110	GMA Assembly
25709	GMA Shipping Plate
25106	Pressure Bottle Assembly
25121	Junctions
25107	Metering Valve Assembly
25499	Metering Valve Body
25500	Metering Valve Locking Bracket
26204	Guide, Poppet
26211	Solenoid/HP Regulator/LP Regulator Assy, GMA
26212	O-Ring Retainer
3269703-1	Allied Signal Solenoid Valve
3269705-1	Allied Signal Regulator, Absolute Pressure
3269697-1	Allied Signal Regulator, High Pressure

3 GENERAL REQUIREMENTS

3.1 Environmental Requirements

This procedure will be conducted in the Stanford Class 10 Cleanroom in the HEPL facility.

3.1.1. Cleanliness

The Class 10 clean room where this integration takes place shall be maintained at the cleanliness levels per GPB Contamination Control Plan P0059. Certified Class 10 cloth garments shall be worn in the Class 10 clean room.

3.1.2 Particulate Contamination

All parts and tools shall be cleaned at least to the cleanliness levels of the rooms where they are used for assembly or testing. In addition, all flight parts shall be maintained at level 100 cleanliness per GP-B Contamination Control Plan (P0059). Take all necessary precautions to keep tools and handling equipment free of particulate contamination.

To the maximum extent possible, personnel shall keep parts of their bodies downstream of the GMA relative to the HEPA wall.

When assembling parts that communicate with the gas flow to the probe, care shall be taken to ensure that production of particles is minimized.

3.1.3. Magnetic Contamination

When assembling parts that communicate with the gas flow to the probe, care shall be taken to ensure that production of particles is minimized.

3.1.4. Electrostatic Discharge Control

Not Applicable

3.2 Integration Personnel

3.2.1 Integration and Test Director

The Integration and Test Director (ITD) shall be Dr. Doron Bardas or his designate Gideon Asher. They have overall responsibility for the implementation of this procedure and shall sign off the completed procedure.

3.2.2 Personnel

All engineers and technicians participating in this procedure shall work under the direction of the ITD who shall determine whether the person is qualified to participate in this procedure. Personnel participating in this procedure are Doron Bardas, Gideon Asher and R. Stephenson and/or others whom the ITD shall deem appropriate.

3.3 Safety

The QA Representative shall be notified prior to any major movement of the GMA (i.e., any movement other than rotations or minor adjustments)

3.3.1 General.

Personnel working in the Class 10 Cleanroom must be cognizant of the base of the Precision Manipulator, and take special care to avoid tripping or bumping into it.

3.3.2 Hardware Safety

Care must be taken to avoid damaging the internal parts of the GMA weldments or the components to be installed. Exceptions to this are the necessary handling and installing of O-rings and their vacuum grease – Braycote 601.

3.3.3 Maximum Number of People in Cleanroom.

Under normal operating conditions, there shall be no more than 5 people in the Class 10 Cleanroom. This is to avoid violating legal make up air requirements, and to provide an efficient workspace. Exceptions must be for short periods only, and be approved by the ITD.

3.4 Quality Assurance

Integration shall be conducted on a formal basis to approved and released procedures. The QA program office shall be notified of the start of this procedure. A Quality Assurance Representative, designated by Dorrene 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, Dorrene Ross or her designate, shall certify his 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.

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

3.5 Red-line Authority

3.5.1 Authority to red-line

Authority to red-line (make minor changes during execution this procedure is given solely to the ITD or his designate and shall be approved by the QA Representative. Additionally, approval by the Hardware Manager shall be required, if in the judgment of the ITD or QA Representative, experiment functionality may be affected.

3.5.2 Procedure Computerization Special Requirements

Because of cleanliness requirements in the Class 10 room, and to conveniently record data directly into the procedure thus generating the “as-built” document, the procedure will be handled in a paperless fashion until completed. A Laptop computer containing an electronic version of this procedure will be operated by the ITD or QA Representative and data shall be recorded by typing directly into the electronic file.

3.5.3 As-Built Procedure

A hard copy of the “as-built” procedure shall be printed *and signed off by all the designated parties*. It shall then be filed, including an electronic copy into the data base.

3.5.4 The electronic editing of this document shall be as follows:

- Data will be inserted into the document using normal font, i.e. non-bold, non-italic
- “Signatures” shall be designated by **BLACK CAPITAL BOLD LETTERS**.
- “Redlines” shall be in **RED BOLD ITALICS** to make them distinguishable both on the Laptop screen and on the hard copy printout.
- If available, digital pictures shall be inserted into the document where appropriate.

4 REQUIRED EQUIPMENT

4.1 Flight Hardware

- Solenoid Valves, 3269702-1 Qty(32)
- Regulators, 3269704-1 Qty (2)
- Regulators, 3269696-1 Qty (2)
- Pressure Sensors, ST550-15A-103 Qty(6)
- Pressure Sensors, ST550-500A-103 Qty(7)
- Pressure Sensors, ST550-5000A-103 Qty(2)
- Metering Valves, 25107-101 Qty(2)
- Metering Valves, 25107-102 Qty(1)

4.2 Ground Support and Miscellaneous Equipment

4.2.1 Materials

- Braycote 601 Grease
- Epoxy Tra-Bond 2115
- Epoxy Tra-Bond 2143D
- Methyl Siloxone Dow Corning OS-30

4.2.2 Tools and Miscellaneous

- GMA Manipulator Fixture (GMF)
- Patch panel to activate the solenoids
- Ratchet, 1/4" drive
- Screwdriver bit, offset crucifix
- Hex head bit
- Torque wrench, calibration number: _____
- Close end wrench, 9/16"
- Allen wrench 1/16"
- Allen wrench 0.35"
- Pliers (Jawed wrench)
- Modified titanium tweezers

4.2.3 Replacement O-rings:

Original manufacturer's fluorosilicon O-rings or their butyl equivalent (see text):

- Butyl 1-010
- Butyl 1-011
- Butyl 1-031
- Butyl 3-904
- Butyl 3-910
- Butyl 5-105
- Butyl 2-024

5 ASSEMBLY

5.1 Initial Preparation

- 5.1.1 Rotate GMA Assembly on GMF in order to work on the top side of the GMA (valve side up).
- 5.1.2 Remove cap covers and O-rings, used during weldment manufacture, from junctions, metering valve bodies, regulator bodies, and solenoid bodies.
- 5.1.3 Locally clean the O-ring groove and all external surfaces with Freon followed by Ethyl Alcohol
- 5.1.4 Rotate GMA Assembly on GMF, in order to work on the bottom side of the GMA (bottle side up).
- 5.1.5 Remove all cap covers and O-rings used during weldment manufacture.
- 5.1.6 Locally clean the O-ring groove and all external surfaces with Freon followed by Ethyl Alcohol.
- 5.1.7 During assembly, tighten all fasteners until firm metal to metal contact is made. Then add 10 in-lbs. of torque. Final torque will be applied to all fasteners later after staking.

5.2 Assembly of Solenoids and Regulators, bottom

- 5.2.1 Make sure to match bottom assembly with appropriate body.
- 5.2.2 Insert poppet with the spring on it.
- 5.2.3 Grease cover O-ring.
- 5.2.4 Place smaller O-ring (2-011) on bottom.
- 5.2.5 Place O-Ring Retainer in body.
- 5.2.6 Install bottom cap using original screws.
- 5.2.7 Repeat for steps 5.2.2-5.2.7 for all solenoids and regulators.
- 5.2.8 Reinstall bottle assemblies on bottom of plate for testing

5.3 Assembly, Solenoid, top

- 5.3.1 Rotate GMA Assembly on GMF in order to work on the top side of the GMA (valve side up).
- 5.3.2 Make sure to match all components with appropriate valve body, i.e. match S/Ns of body and solenoid, including other attachment hardware such as wave springs etc.

- 5.3.3 Insert small washer into solenoid body so that it lies flat at the bottom of the spool housing
- 5.3.4 Remove small fluorosilicone O-rings from Poppett activator stem in spool by retracting the stem adequately for access to each O-ring. *Do not remove stem from spool or flip its orientation.*
- 5.3.5 Grease stem O-rings with a medium coat of Braycote 601; re-install on stem and push the latter until it protrudes approximately from both ends as it did before 5.2.3
- 3.3.6 Grease 1 ea. Butyl large (1-011) and small (1-010) spool O-rings with a medium coat of Braycote 601 and install on the spool at the top and bottom respectively
- 5.3.7 Insert spool assembly into solenoid body, ensuring that the hole in the side of the spool is aligned with the hole in the side of the spool housing.
- 5.3.8 Install spool retainer cap using original screws.
- 5.3.9 Ensure that the solenoid is in the closed position (i.e. stem retracted) by use of the control box and observation of the solenoid activator pin. Use connector savers [non-flight parts] to preserve the electronic connections.
- 5.3.10 Install wave spring and washers into bottom of solenoid.
- 5.3.11 Install solenoid onto base using original screws.
- 5.3.12 Repeat steps 5.3.2 through 5.3.11 for all solenoid valves.

5.4 Assembly, Regulator, Low pressure, top

- 5.4.1 Make sure to match all components with appropriate regulator body.
- 5.4.2 Insert stem.
- 5.4.3 Install inside top cover using original screws.
- 5.4.4 Insert bellows.
- 5.4.5 Grease large cover O-ring (1-031).
 - Install cover assembly using original screws and butyl O-ring (1-031).
 - Remove top cover and Fluorosilicon O-Ring.
 - Grease new Butyl O-Ring (2-024) and reinstall top cover with this O-Ring and original screws.
- 5.4.9 Repeat steps 5.4.1-5.4.7 for second regulator.

5.5 Assembly, Regulator, High pressure, top

- 5.5.1 Make sure to match all components with appropriate regulator body.
- 5.5.2 Grease original fluorosilicon O-rings (2-009) and install on stem.
- 5.5.3 Insert stem with O-rings into body.
- 5.5.4 Install inside cover using original screws.
- 5.5.5 Insert spring assembly.
- 5.5.6 Install cover assembly using original screws.
- 5.5.7 Repeat steps 5.5.1-5.5.6 for second regulator.

5.6 Disassembly of Metering Valve Stem

- 5.6.1 Turn Knob counter clockwise until it stop.
- 5.6.2 Using 1/16" Allen wrench, loosen Knob setscrew about one turn
- 5.6.3 Remove Knob
- 5.6.4 Using 9/16" box end wrench and Pliers, un-screw and remove Knurled Nut (see picture1)
- 5.6.5 Using Pliers, carefully rotate and remove Friction Collar, (see picture 2).
- 5.6.6 Remove the intern Stem assy. from the body.
- 5.6.7 Remove spring from the Stem.
- 5.6.8 Using modified titanium Tweezers, remove 1st Stem O-Ring, (see picture 3).
- 5.6.9 Using 0.35" Allen wrench, loosen Orifice setscrew one and a half turn and remove Orifice (see picture 4).
- 5.6.10 Remove 2nd Stem O-Ring.
- 5.6.11 Using modified titanium tweezers, remove 3ed Stem O-Ring, (see picture 5)
- 5.6.12 Using clean room Q-Tip dipped in Methyl Siloxone Dow Corning OS-30, wiped off the residue silicon grease from the O-Ring's grooves.
- 5.6.13 Repeat steps 5.6.1 to 5.6.12 to all valves taken apart and kit each valve in its own storage container.

5.7 Reassembly of Metering Valve Stem

- 5.7.1 Using Lubricant, Syntletic Braycote 601 lubricate six (6) O-Rings from each size (1-010, 1-011. 5-105). (Parker greasing procedure for O-Ring)
- 5.7.2 After lubrication of O-Rings remove old gloves and put on new gloves for the rest of the assembly procedure.

- 5.7.3 Install the three (3) replacement O-Rings (see picture 7).
- 5.7.4 Reassemble in the reverse order as mentioned in para. (6). During the Reassemble take care to assemble the Stem into the Valve Cartridge with proper Stem pin into the Valve cartridge body groove.
- 5.7.5 Open and close the Valve two (2) times to check ease of operation.
- 5.7.6 If it doesn't turn freely then return to step 6.4 and check for proper indexing of Stem into Valve Cartridge. Continue the remaining steps to complete the assembly and operate again

5.8 Installation of Pressure Sensors, Metering Valves, and Bottles

- 5.8.1 Install pressure sensors on junctions using Butyl O-ring 3-904 and drawing 25110 for placement. Tighten until O-Ring is firmly compressed.
- 5.8.2 Install metering valves on respective bodies using drawing 25110 for placement. Tighten until O-Ring is firmly compressed.
- 5.8.3 Rotate GMA Assembly on GMF in order to install the gas bottle assemblies 25106 on bottom of plate.
- 5.8.4 Install the gas bottle assemblies using new Butyl O-Rings (3-910). Tighten until O-rings are firmly compressed.

5.9 Verification of Solenoid Operation

- 5.9.1 Use patch panel.
- 5.9.2 Use connector savers to preserve the electronic connectors.
- 5.9.3 Activate all solenoids one at a time to verify proper operation.

6 PICTURES

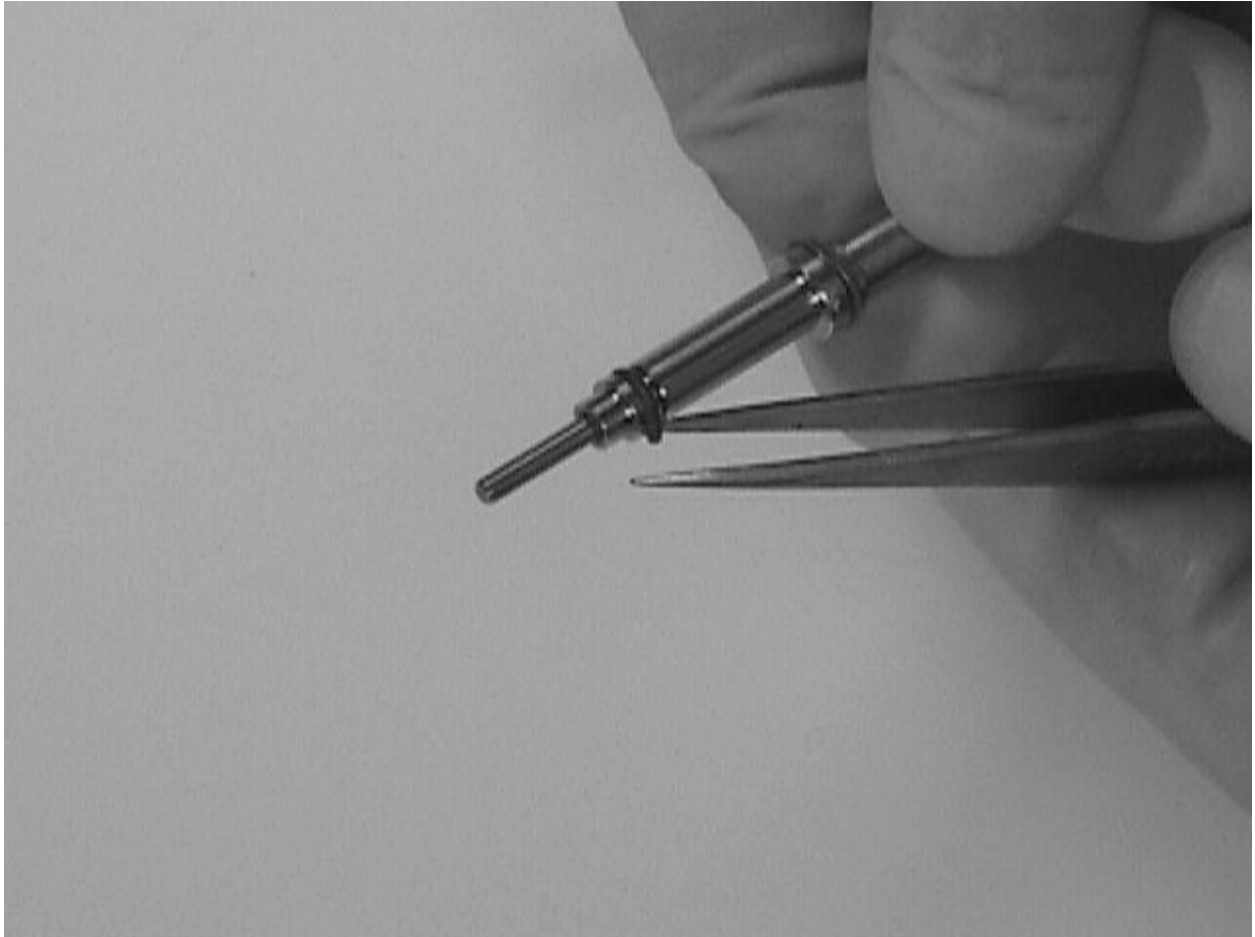
Picture 1



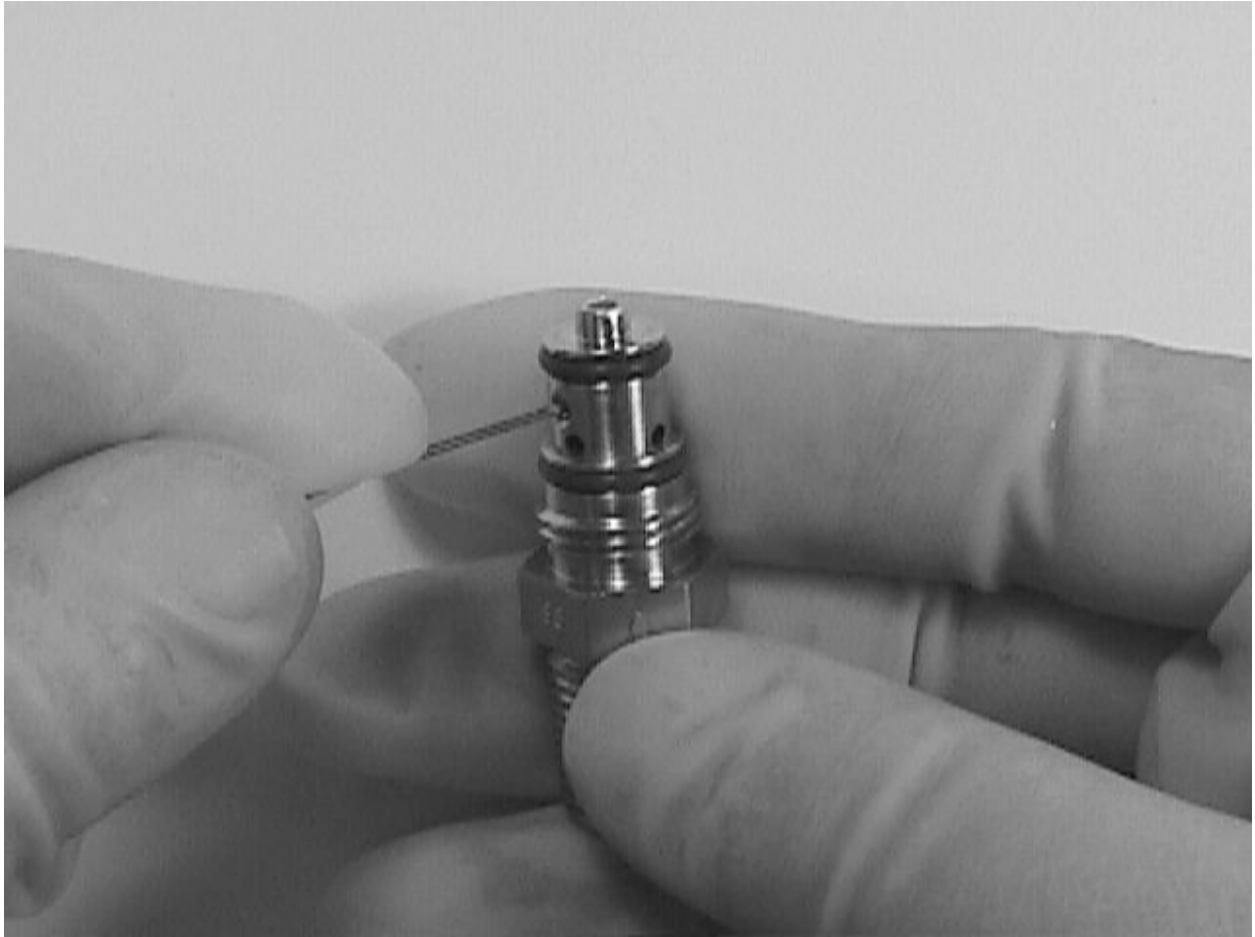
Picture 2



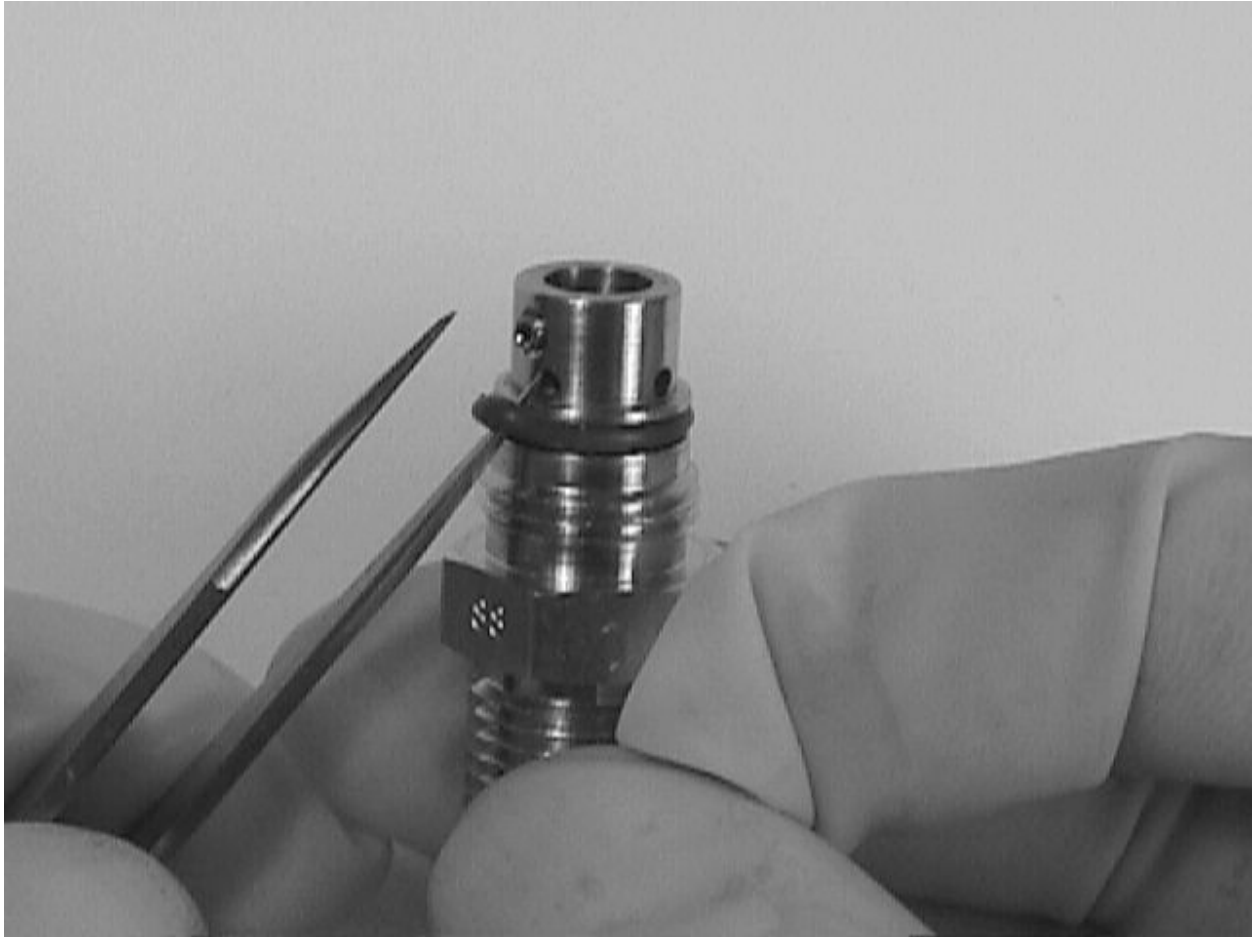
Picture 3



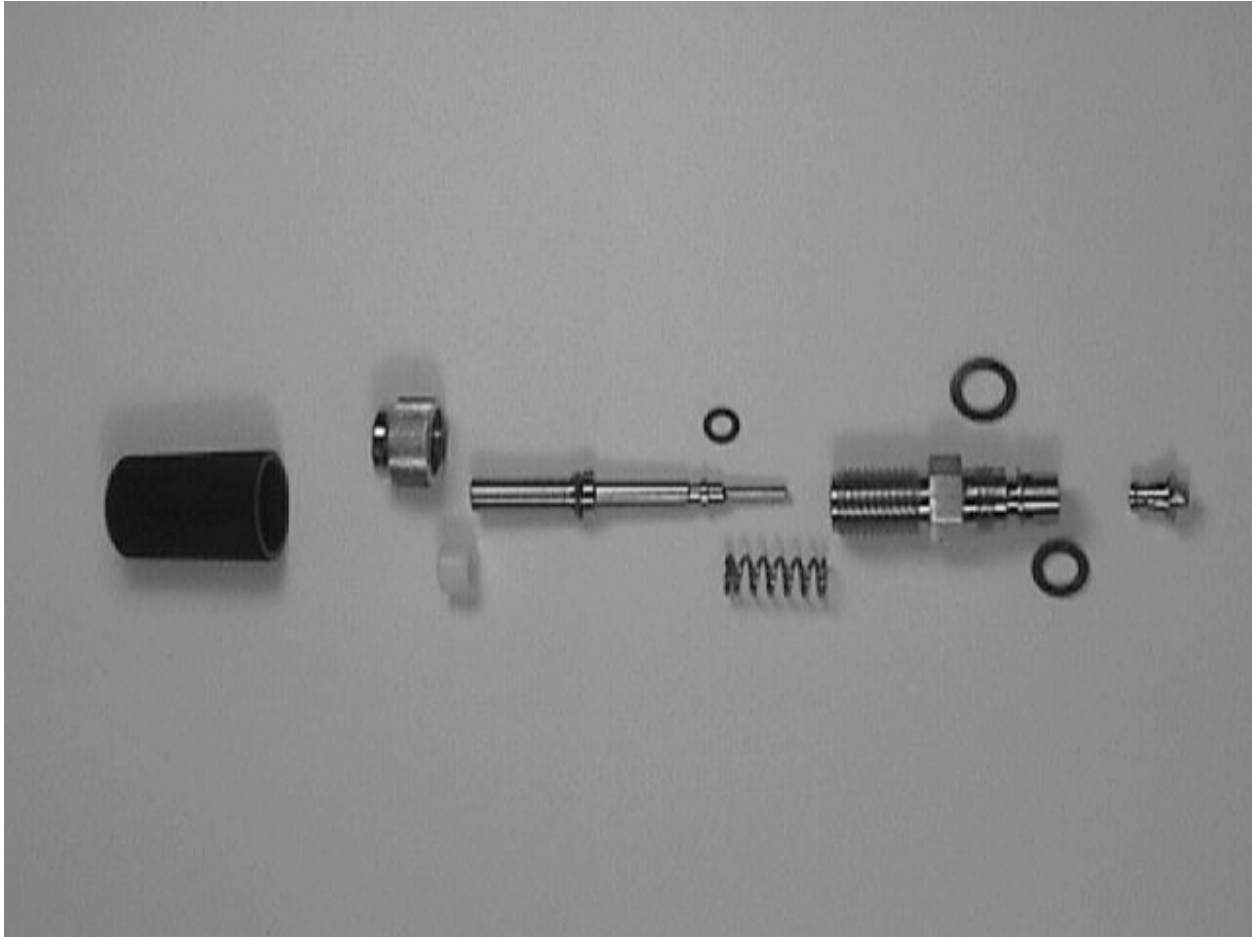
Picture 4



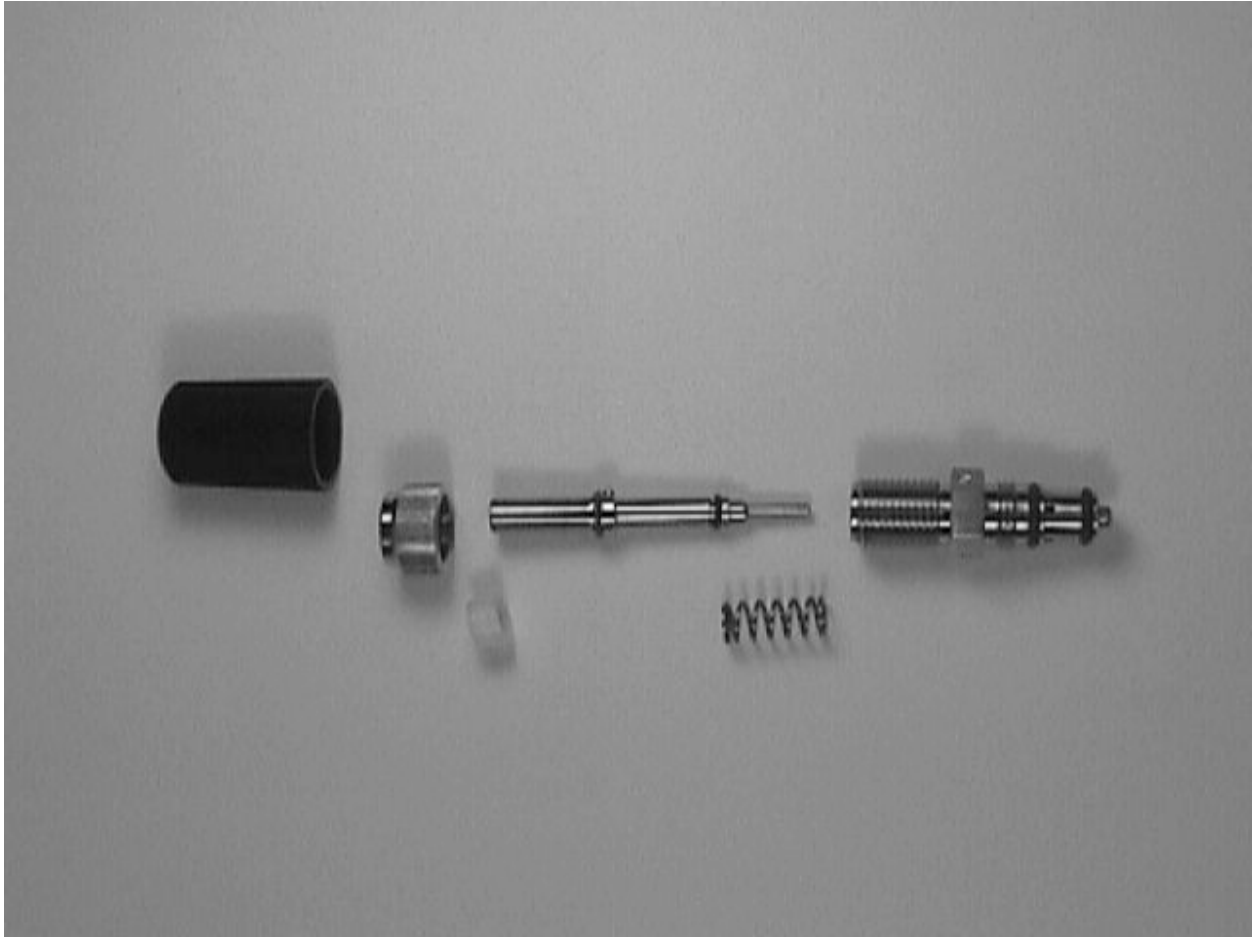
Picture 5



Picture 6



Picture 7



7 PROCEDURE COMPLETION

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

Integration Engineer _____ Date _____

Discrepancies if any:

ITD _____ Date _____

Test procedure is as represented and the documentation is complete and correct:

QA Representative _____ Date _____

QA Program Engineer _____ Date _____

Copy discrepancies to D-Log and open Discrepancy Reports when required.

Program Manager _____ Date _____

8 DATA BASE ENTRY

The following data shall be entered into the GP-B Data Base:

- a) Name, number and revision of this procedure
- b) An electronic copy of this document
- c) A copy of the “as-built” procedure with data and pictures, when completed.