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

SIA FASTENER STAKING AND SAFETY WIRING

GPB SCIENCE MISSION PROCEDURE

18 May 1999

PREPARED _____ _____
L. Sokolsky, Integration Engineer Date

APPROVED _____ _____
D. Bardas, Integration Manager Date

APPROVED _____ _____
J. Janicki, Safety Engineering Date

APPROVED _____ _____
B. Taller, Quality Assurance Date

APPROVED _____ _____
S. Buchman, Hardware Manager Date

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1 SCOPE

This document provides procedures for the staking and safety-wiring of SIA fastners.

1.1 Acronyms

The following acronyms may be used in this document

- QB — Quartz Block
- QBA — Quartz Block Assembly
- QBF — Quartz Block Flange
- QBS — Quartz Block Support (aluminum support on probe)
- QB/T — Integrated Quartz Block/Telescope
- SIA — Science Instrument Assembly
- ITD — Integration and Test Director
- Pr-C — Probe C, the Science Mission flight probe
- VM — SIA precision Vertical Manipulator
- QA — Quality Assurance
- TB — Terminal Block

2. REFERENCES

2.1 Plans and Procedures

- P0059 GPB Contamination Control Plan
- P0057 Stanford Magnetic Control Plan
- P0205(SM) Mounting Probe onto Precision Manipulator
- P0176 Removing Spider and Other Preps for Integration with SIA
- P0419 Operations Manual for the probe Precision Manipulator

2.2 Drawings

- 23170 Science Instrument Assembly Kit
- 23171 Science Instrument Assembly
- 1C34121 QBA Mounting Kit
- 1C34103 Probe / SIA Interface
- 1C34355 Pr-C to SU External Interfaces
- 1C34181 Shim, QBA Mounting

2.3 Specificationa

- NASM33540 General Practices For Safety Wiring and Cotter Pinning

3. GENERAL REQUIREMENTS

ONR representative, QA and Safety to be notified prior to beginning this procedure

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 their bodies and garments downstream of the SIA, relative to the HEPA wall.

3.1.3. Magnetic Contamination

All parts and tools shall be screened per Procedure P0057. All parts and tools shall be cleaned using methods consistent with achieving Mil Spec Level 100 cleanliness. In addition, all parts shall be maintained at level 100 cleanliness per GP-B Magnetic Control Plan, P0057. Take all

necessary precautions to keep tools and handling equipment free of particulate contamination. Tools to be cleaned with Ethyl Alcohol prior to use, or when contaminated.

3.1.4. Electrostatic Discharge Control

To prevent electrostatic charge buildup on the QB/T the particle ionizer shall always be upstream of the QB/T relative to the fan wall and the PM and the QB/PM shall be grounded.

3.2 Integration and Test Personnel

3.2.1 Integration and Test Director

The Integration and Test Director (ITD) shall be Dr. Doron Bardas or an alternate that he shall designate. The ITD has overall responsibility for the implementation of this procedure and shall sign off the completed procedure and relevant sections within it.

3.2.2 Integration Engineers and other personnel

All engineers and technicians participating in this procedure shall work under the direction of the ITD who shall determine personnel that are qualified to participate in this procedure. Participants in this procedure are expected to be D. Bardas, G. Asher, C. Gray, J. Stamets, with assistance from LMMS (particularly G. Reynolds) at certain times.

3.3 Safety

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

Extreme care must be taken to avoid accidentally bumping or scratching the QB/Telescope.

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 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 B. Taller 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, B. Taller or his designate, will 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 (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 Following completion of the 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.

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

The following equipment shall be in the Class 10 cleanroom.

Ground Support Equipment

- Probe Precision Manipulator

Tools and Miscellaneous

- Ethyl alcohol
- Methanol
- Trabond 2143D Tracon Epoxy
- Trabond 2115 Epoxy
- Wire for safety wiring
- Tools for safety wiring
- Ultrajet filtered compresses air
- BeCu Allen wrenches
- Wrench, for PM
- Socket wrenches for Probe yoke collar and PM tilt plate

5 STAKING OF SIA FASTENERS

5.1 Staking of fasteners when fasteners can be loosened

5.1.1 The preferred method of staking a bolt is to apply a drop of Trabond 2143D epoxy under the head of the bolt prior to final torque.

5.1.2 The preferred method of staking a nut is to apply a drop of Trabond 2143D epoxy under the head of the nut prior to final torque.

5.2 Staking of fasteners when fasteners cannot be loosened

5.2 1 When fasteners cannot be loosened, a drop of Trabond 2143D epoxy may be applied between the bolt or nut and the base material. However, for more effective staking, it is recommended that the procedure of 5.1 be followed whenever possible.

5.3 Alternate epoxy for staking

5.3.1 As an alternate for staking, Trabond 2115 may be used if it is allowed to sit for between 30 and 45 minutes of its pot life. However, the 2143D epoxy is the preferred material for staking.

6 SAFETY WIRING OF SIA NUTS AND BOLTS

6.1 Saftey wiring per NASM33540

6.1.1 SIA bolts requiring safety wiring shall be wired per NASM33540. Any of the approved methods shown in that specification are acceptable. The only exception from the specification is that the wire used shall be ????????

7 PROCEDURE COMPLETION

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

Integration Engineer(s) _____ Date _____

_____ Date _____

_____ Date _____

ITD _____ Date _____

The information obtained under this assembly and 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.

8 DATA BASE ENTRY

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

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