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

# GYRO RETAINER ASSEMBLY PROCEDURE

## GP-B SCIENCE MISSION PROCEDURE

7 August, 1998

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## 1 SCOPE

This document provides the procedure for assembling the Gyro Retainer Assembly, P/N 23279-201, consisting of the Gyro Retainer, P/N 23272-201, and three Socket Head Cap Screws, P/N 25100-111. See Figure 1 below. This procedure also includes the spreading of the Retainer fingers. It assumes the parts are cleaned, magnetically screened, released, and ready for integration. The following operations are contained in this procedure:

1. Spread Fingers
2. Insert Screws



Figure 1. Gyro Retainer Assembly

## **2. APPLICABLE DOCUMENTS**

### **2.1 Plans and Procedures**

P0059           GPB Contamination Control Plan  
 P0057           Stanford Magnetic Control Plan  
 P0355           Procedure for Epoxy Bonding Tra-Bond 2115

### **2.2 Drawings**

23279B          Retainer Assembly, Gyro  
 23273A          Retainer, Gyro

### **2.3 Other**

TRA-CON Technical Product Data Sheet for TRA-BOND 2115  
 TRA-CON Material Safety Data Sheet for TRA-BOND 2115 Resin  
 TRA-CON Material Safety Data Sheet for TRA-BOND 2115 Hardener

## **3. GENERAL REQUIREMENTS**

### **3.1 Environmental Requirements**

#### 3.1.1. Cleanliness

Assembly is conducted on a clean room flow bench with laminar flow in the HEPL Class 1000 Cleanroom . This bench shall be maintained at cleanliness level 100 per Federal Standard 209D. Minimum protective garments for personnel working in the clean rooms shall be the standard Tyvek clean room apparel for room classes from 10,000 to 1000.

#### 3.1.2. Particulate Contamination

All parts and tools shall be cleaned using methods consistent with achieving Mil Standard 1246B Level 100 cleanliness. In addition, all parts shall be maintained at level 100 cleanliness per Procedure P0059.

#### 3.1.3. Magnetic Contamination

Parts to be handled are in Zone 2. All parts shall have been pre-screened per Procedure P0057. Take all necessary precautions to keep tooling and handling free of magnetic contamination. Tools that come in contact with these components must be of beryllium copper, carbide, or other non-magnetic material. Post-magnetic screening shall be done per P0057.

### **3.2 Integration and Test Personnel**

#### 3.2.1 Integration and Test Director

The Integration and Test Director (ITD) shall be Dr. Doron Bardas. He has 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.

## 3.3 Safety

### 3.3.1 General

The responsible engineer shall ensure that all personnel are aware of the specific personnel and hardware safety concerns indicated in the safety requirements, cautions and warnings in this procedure.

### 3.3.2 Bonding Safety

Material Safety Data Sheets for TRA-BOND 2115 Resin and TRA-BOND 2115 Hardener shall be made available whenever this procedure is executed. All personnel performing any operation in this procedure shall familiarize themselves with these MSDSs. They shall be familiar with the emergency procedures outlined in the MSDS, in the event of overexposure.

<p><b>CAUTION: Epoxy material may cause sensitization, irritation, or other allergic responses. Avoid eye and skin contact and prolonged inhalation of vapors. When handling epoxy, protective gloves shall be worn. Use of epoxy shall be in a well ventilated area.</b></p>
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TRA-BOND 2115 is not considered a hazardous waste, and can be disposed of in the usual manner.

## 3.4 Quality Assurance

Assembly and bonding shall be conducted on a formal basis to approved and released procedures. A Quality Assurance representative designated by B. Taller shall review any discrepancy noted during this procedure, and approve its disposition. Redlines shall be stamped by the QA rep. The QA representative will nominally be A. Nakashima. Upon completion of this procedure, the QA program engineer, B. Taller or P. Unterreiner, will certify his concurrence that the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating his

## 3.5 Red-line Authority

Authority to red-line (make minor changes during execution ) this procedure is given solely to the ITD or his designate. Approval by the Hardware Director shall be required, if in the judgment of the ITD or QA program engineer, experiment functionality may be affected.

## 4. REQUIRED EQUIPMENT

### 4.1 Flight Hardware

PART NAME	PART NUMBER	QTY
Retainer Assembly	23279-301	4
Retainer, Gyro	23273-201	1
Screw, Socket Head Cap, #4-40	25100-111	12
adhesive	epoxy, Tra-Bond 2115	

NOTE: Serial Numbers and/or Lot Date Code of Flight Hardware are listed in Table 2 in Section 6.

### 4.2 Ground Support Equipment and Miscellaneous Equipment

#### Ground Support Equipment

Delrin Spreader Plug  
 Syringe or swab-tips for applying epoxy  
 Disposable plastic mixing cup  
 Small Vacuum Oven in Room Cleanroom132

#### Tools and Miscellaneous

Bottle of Freon TF Solvent , filtered to 0.2  $\mu$ m  
 Bottle of Ethyl alcohol  
 Bottle of Methanol  
 Isopropanol Spray  
 Allen wrenches, various

## 5 SPREAD RETAINER FINGERS

Record Start Date and Time \_\_\_\_\_

- 5.1 On the flow bench, with the Gyro Retainer (P/N 23273-201) resting on its bottom flat surface, use the special Delrin pre-load plug, to spread the three feet on the retainer. Push the plug down until the line marker on the plug reaches the top of the feet. Hold for 10 seconds.
- 5.2 Verify that the released position has diameter  $2.375 \pm 0.10$  inch, in accordance with Drawing 23273, Note 16. This is a go/no-go measurement. Record in Table 1.
- 5.3 Repeat for all Retainers.

Retainer Serial Number	Diameter meets $2.375 \pm 0.10$ in. length requirement. (Y/N)
01	
02	
03	
04	
05	
06	
07	
08	

Table 1. Verification of Retainer finger diameter



## 6 INSERT SOCKET HEAD SCREWS, P/N 25100-111

*NOTE: To ensure verification of dimension in 6.3 below, do a fit check of all screws into retainers prior to beginning this section.*

- 6.1 Prior to inserting each screw, hold the screw in an allen key on one end, and apply a minimal amount of TRA-BOND 2115 epoxy on the last 2 or 3 threads on the other end, in accordance with procedure P0354.

**CAUTION: Do not apply epoxy after insertion, due to risk of adhesive dropping on retainer.**

*NOTE: A minimum uniform bond coating has been demonstrated to have thickness between 0.001 - 0.002 inch.*

- 6.2 Insert three Socket Head Cap Screws (P/N 25100-111) (for holding the Caging Retainer) into each Gyro Retainer, by screwing them all the way in from the inside out (from feet side). There are 3 pairs of holes for these screws. The screws should be inserted in the rightmost clockwise hole of each pair, as one looks downward from the feet side. See Figure 2 for orientation.

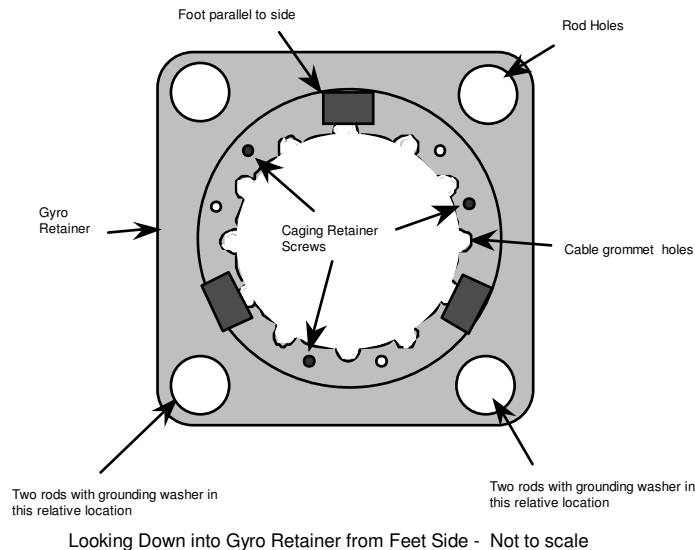


Figure 2. Screw Locations

- 6.3 Before allowing the bond to cure, verify the distance between the top surface of the screw and the top surface of the retainer. See Figure 3. This distance is required to be 0.42 +/- 0.01 inch.

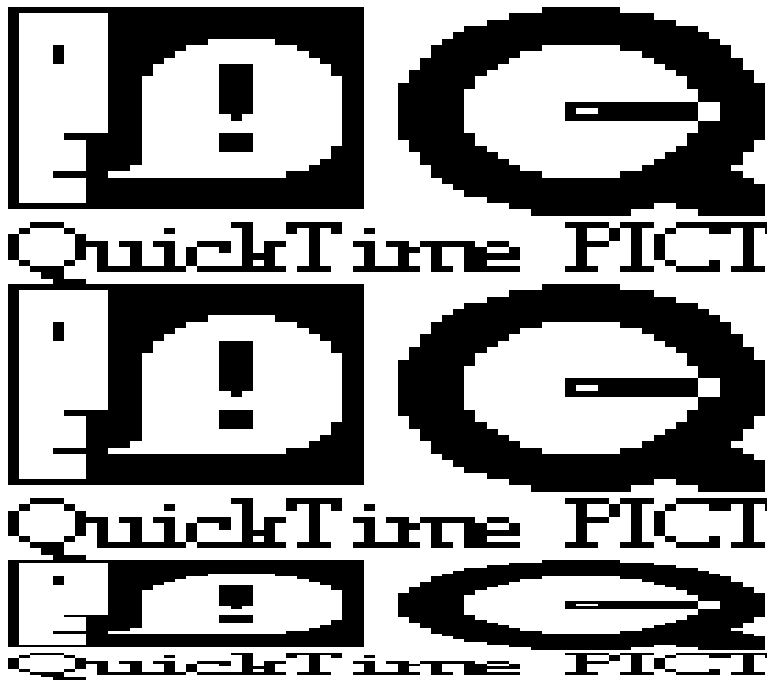


Figure 3. Protruding Screw Length

- 6.4 Let stand in a fixture for curing. Cure in accordance with P0354.
- 6.5 Record Serial Number and Lot Date Codes for each Assembly in Table 2 below.

Retainer (23272-201) Serial #	Screw#1 (25100-111) Lot Date Code	Screw#2 (25100-111) Lot Date Code	Screw#3 (25100-111) Lot Date Code	Tra-Bond 2115 Epoxy Lot # and Expiration Date
01				
02				
03				
04				
05				
06				
07				
07				
08				

Table 2. Serial Numbers and Lot Date Codes of Gyro Retainer Assemblies

6.6 Repeat 6.1 through 6.5 for all of the Gyro Retainer Assemblies.

Completed: \_\_\_\_\_ date: \_\_\_\_\_  
 Integration Engineer

Discrepancies if any:

Disposition and signoff: \_\_\_\_\_ date: \_\_\_\_\_  
 ITD

## 7 CLEAN AND MAG SCREEN

7.1 Clean the gyro retainer assemblies, with TF spray in accordance with P0059, bag, and store in cleanroom marked compartment.

7.2 Send to Stanford Magnetics Lab for magnetic testing, in accordance with P0057.

## 8 PROCEDURE COMPLETION

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

Integration Engineer \_\_\_\_\_ Date \_\_\_\_\_

ITD: \_\_\_\_\_ Date \_\_\_\_\_

The information obtained under this assembly and test procedure is as represented and the documentation is complete and correct.

Quality Assurance \_\_\_\_\_ Date \_\_\_\_\_

## 9 DATA BASE ENTRY

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

- 1) Name, number and revision of this procedure
- 2) Date of successful completion of procedure.

P0091 Rev \_\_\_\_  
7 August, 1998  
P0091 Gyro Retainer Assembly