

P0175(SM) Rev _____

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W.W. HANSEN EXPERIMENTAL PHYSICS LABORATORY
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STANFORD, CALIFORNIA 94305-4085

INTEGRATION OF GYRO ASSEMBLIES INTO THE QUARTZ BLOCK

GP-B SCIENCE MISSION PROCEDURE

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TABLE OF CONTENTS

1. SCOPE.....	1
1.1 Acronyms	1
2. APPLICABLE DOCUMENTS	2
2.1 Plans and Procedures	2
3. GENERAL REQUIREMENTS	2
3.1 Environmental Requirements	2
3.2 Integration and Test Personnel	3
3.3 Safety.....	3
3.4 Quality Assurance.....	3
3.5 Red-line Authority	3
4. REQUIRED EQUIPMENT	4
4.1 Flight Hardware.....	4
4.2 Ground Support Equipment and Miscellaneous Equipment	6
5 INITIAL PREPARATIONS.....	8
5.1 Room Setup	8
6. INSTALL LOCAL MAGNETIC SHIELDS	10
6.1 Shims for Magnetic Shields	10
6.2 Install Magnetic Shield into the QB bore for Gyro 1.....	11
6.3 Install Magnetic Shield into the QB bore for Gyro 2.....	13
6.4 Install Magnetic Shield into the QB bore for Gyro 3.....	13
6.5 Install Magnetic Shield into the QB bore for Gyro 4.....	13
6.6 Magnetic Shields Installation Completion:.....	15
7 INSERT GYRO RETAINER ASSEMBLY INTO QUARTZ BLOCK	16
7.1 Pre-assemble Short End of Retention Rods for a Single Gyro	16
7.2 Insert Gyro Retainer Assembly into the QB.....	17
8 PREPARE GYRO ASSEMBLY AND IP/S ASSEMBLY FOR INSERTION.....	20
8.1 Install Instrumentation on Gyro Assembly	20
8.2 Mate Gyro Assembly to Index Plate/Spacer	21
8.3 Install the Spinup Plumbing Retainer Assembly onto the IP/S/G Unit	22
9 INSTALL GYRO ASSEMBLY IN QUARTZ BLOCK.....	25
9.1 Insert IP/S/G Unit into the QB and Secure with Retention Hardware.....	25
9.2 Secure Gyro Cables, Install Caging Hole Blocker	30
9.3 Measurement of Gyro Alignment relative to QB.....	31
9.4 Record Completion of Gyro Installation	32
10 INSTALL TEMPERATURE SENSORS AND CLASP ASSEMBLIES	34
10.1 Install GRTS.....	34
10.2 Install Silicon Diodes.....	34
10.3 Install Clasp Assemblies	34
11 PROCEDURE COMPLETION.....	36

12 DATA BASE ENTRY36

1. SCOPE

This document provides procedures for integrating the four gyroscopes into the Quartz Block bores for Science Mission. This procedure assumes (1) the Telescope has been bonded to the Quartz Block, and the bond has set (P0200(SM)); (2) The Quartz Block/Telescope/Roller Mechanism Unit is on the Optical Table in the Class 10 Cleanroom (P0394, P0395); (3) the Index Plate and Spacer units have been bonded (P0084(SM), cleaned, and the dowels installed; (4) the Spinup Plumbing Assemblies have been assembled and tested (P0064); (5) the Gyro Retainer Assemblies have been assembled (P0091), and (6) the Gyro Assemblies are ready for integration. The following operations are contained in this procedure:

1. Install Local Magnetic Shields into the Quartz Block.
2. Pre-assemble the Short End of Gyro Retention Rods
3. Insert the Gyro Retainer Assembly into the Quartz Block
4. Install GRT and Heater into Gyro Assembly
5. Mate Gyro Assembly and Spacer
6. Install the Plumbing Retainer Assembly onto the IP/S/G Unit
7. Install the IP/S/G Unit into the Quartz Block and secure with the Gyro Retention Hardware
8. Perform the Measurement of Gyro Tilts
9. Secure the Gyro Cables
10. Install QB Temperature Sensors and Clasp Assemblies

1.1 Acronyms

The following acronyms are used in this document

QB	Quartz Block
QB/T	QB and Telescope Unit, bonded together
IP	Index Plate
IP/S	Index Plate and Spacer Unit, mated together
IP/S/G	IP/S Unit mated with Gyro Assembly
RM	Quartz Block Roller Mechanism
QB/T/RM	Quartz Block/Telescope Unit in Roller Mechanism
G1,..., G4 1,2,3,4	Gyro 1, ..., Gyro 4 refer to the rotor and housing in locations
R-side	Gyro Retainer side of the Gyro in the Quartz Block. This is the unpolished side of the QB
S-side	Spinup Plumbing side of the Gyro in the Quartz Block. This is the polished side of the QB, and the side of the IP
PM	Precision Manipulator
SIA	Science Instrument Assembly

2. APPLICABLE DOCUMENTS

2.1 Plans and Procedures

P0059	GPB Contamination Control Plan
P0057	Stanford Magnetic Control Plan
P0064	Spinup Plumbing Assembly Procedure
P0084(SM)	Bonding Index Plate to Spacer
P0200(SM)	Bonding Telescope to Quartz Block
P0394	Transfer QB/Telescope Assembly from X-Y Cart to Roller Mechanism Cart
P0395	Transfer QB/T/RM Unit from RM Cart to Optical Table
P0091	Gyro Retainer Assembly procedure

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 Room Cleanliness

The Class 10 clean room where this integration takes place shall be maintained at the cleanliness levels per Federal Standard 209D. All personnel in the clean room shall wear certified Class 10 cloth garments.

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 parts shall be maintained at level 100 cleanliness per GP-B Contamination Control Plan (P0059). A portable particle counter shall be set up on a table downstream of the local work area, and monitored to ensure that particulate counts are consistent with GPB 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 all parts of their bodies downstream of the QB/T, defined by the direction of HEPA airflow.

3.1.3 Magnetic Contamination

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, Science Mission (P0057). Take all necessary precautions to keep tools and handling equipment free of particulate contamination. Tools to be sprayed with Freon from Pressure can (filtered to < 0.2 micron) prior to use, or when contaminated.

3.1.4. Electrostatic Discharge Control

The ionizer bars should always be upstream of the SIA relative to the fan wall, to prevent electrostatic charge buildup on the SIA.

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. Personnel participating in this procedure are nominally D. Bardas, J. Efraín Alcorta, and C. Gray.

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 SIA, especially the telescope which protrudes over the side of the optical table. **Extreme care must be taken to avoid touching the polished surfaces of the QB and 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 be approved by the test director.

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 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 subsections of this procedure agreed to be of lesser importance, the QA Representative shall sign in the designated location. 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 countersigning and dating the subsections previously signed by the QA Representative (nominally Art Nakashima), and in addition QA Engineering shall sign the completed procedure for compliance.

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

NOTE: Those parts of multiple quantity with different serial numbers for each gyro position are to be inserted in Table 2, in Section 9. Those parts with a single Lot Date Code for the entire quantity are to be listed in Table 1 below.

PART NAME	QUAN TITY	PART NUMBER	SERIAL NO. OR LDC
SIA KIT	1	23170-101	
QUARTZ BLOCK ASSEMBLY	1	23171-101	
QB/Telescope Assembly	1	23521-101	
<i>Quartz Block, Science Mission</i>	1	22770-101	
<i>Telescope Assembly</i>	1	25091-101	
<i>Clip, QB/Telescope</i>	16	23535-101	
<i>Clip, Corrector</i>	5	25597-101	
Gyro Assembly	1	23185-101	
Gyro Assembly	1	23185-101	
Gyro Assembly	1	23185-101	
Gyro Assembly	1	23185-101	
Retainer Assembly	4	23279-301	
<i>Retainer, Gyro</i>	1	23273-201	
<i>Screw, Socket Head Cap, #4-40</i>	12	25100-111	
Dowel&Spacer/Index Plate Assembly	4	23553-p	
<i>Spacer/Index Plate Assembly</i>	4	23238-p	
Spacer/Index Plate Assembly, Machined	4	23238-211	
Spacer/Index Plate Assembly, Bonded	4	23238-212	
Index Plate, Gyro Housing	4	23237-201	
Spacer, Gyro Housing	4	23236-101	
<i>Pin, Dowel, QB/Index Plate</i>	16	23552-201	
<i>Pin, Dowel, Gyro Spacer</i>	16	23552-202	
Magnetic Shield Kit	4	23459-201	
<i>Magnetic Shield, Gyro</i>	4	23173-201	
<i>Shim Assembly, Local Shield</i>	4	25733-101	
Shim, Local Shield, Etched	4	25733-102	
Shim, Local Shield	4	25733-103	
<i>Shim, Local Shield, Etched</i>	8	25733-102	
Shim, Local Shield	8	25733-103	
Rod Retention, Gyro	16	23278-201	
Washer, Plumbing Retainer	8	23275-201	
Washer, Snouted	16	23274-201	
Washer, Retention Spring	12	23234-201	
Spring, Retention	32	23239-101	
Washer, Retention Spring Housing	16	23250-201	
Ring, Retaining	32	23174-201	
Washer, Belleville	48	22894-101	
Washer, Snouted	16	23274-302	
Washer, Grounding, Retention Spring	4	23523-301	
Housing, Retention Spring	16	23240-101	
Bar, Tie-Down, Plumbing	4	23466-201	
Cable Tie-Down Bar Kit	2	23514-201	NATP*
<i>Washer, Lower Insulation</i>	4	23511-201	NATP*
<i>Bar, Tie-Down, Cable</i>	2	23512-201	NATP*

<i>Washer, Upper Insulation</i>	4	23513-201	NATP*
<i>Washer, Flat</i>	4	23462-104	NATP*
<i>Screw, SHC, #4-40</i>	4	25100-105	NATP*
Plumbing Assembly, Spinup	4	23103-101	
<i>Retainer, Plumbing</i>	4	22883-201	
<i>Tube Assembly, Spinup Exhaust</i>	4	22879-101	
Tube, Exhaust	4	23184-101	
Fitting, Tube/Bellows	4	23242-201	
Fitting, Threaded	4	22884-201	
Bellows, Spinup	4	22888-101	
Fitting, Spherical	4	23244-101	
Fitting, Tube/Sphere	4	22885-201	
<i>Nut, Exhaust</i>	4	22889-201	
<i>Tube Assembly, Spinup Inlet</i>	4	22886-101	
Tube, Inlet	4	23241-201	
Fitting, Spherical, Inlet	4	23245-101	
Fitting, Threaded	4	22895-201	
Bellows, Spinup	4	22888-101	
<i>Nut, Inlet</i>	4	22890-201	
Temperature Sensor Assembly, GRT, Long	3	23179-202	
<i>Carrier, Instrumentation, Long</i>	3	22399-201	
<i>Temperature Sensor Subassembly, GRT</i>	3	23180-101	
Temperature Sensor, GRT	3	23531-101	
Plug, Connector, Stanford 4-pin	3	65113- 1C34317-116	
Modified Plug, Cable adapter	2	65113- 1C34321-101	
Temperature Sensor Assembly, SD, Long	2	23532-201	
<i>Carrier, Instrumentation, Long</i>	2	22399-201	
<i>Temperature Sensor Subassembly, SD</i>	2	25601-101	
Temperature Sensor, SD	2	23534-101	
Plug, Connector, Stanford 4-pin	2	65113- 1C34317-116	
Modified Plug, Cable adapter	2	65113- 1C34321-101	
Clasp Assembly, Wire	6	23175-203	
<i>Carrier, Instrumentation, Long</i>	8	22399-201	
<i>Clasp, Cable Routing, Short</i>	8	25476-202	
<i>Adapter, Clasp</i>	8	22760-101	
NUT, HEX	12	23193-101	NATP*
RETAINER, GROMMET	4	23461-101	NATP*
CONNECTOR, PLUMBING EXHAUST	4	23246-101	NATP*
CAGING ASSEMBLY, GYRO 1	1	23172-201	NATP*
CAGING ASSEMBLY, GYRO 2	1	23172-202	NATP*
CAGING ASSEMBLY, GYRO 3	1	23172-203	NATP*
CAGING ASSEMBLY, GYRO 4	1	23172-204	NATP*
CLASP KIT, TUBE, BIRDCAGE	7	23472-201	NATP*
Clasp, Tube	7	22765-101	NATP*
Screw, Flat Head, Socket #4-40	7	25147-107	NATP*
RAIL KIT	4	23518-201	NATP*
Rail, Tube Clasp, Caging	4	23515-201	NATP*
Clasp, Tube	8	22765-101	NATP*
Screw, Flat Head, Socket #4-40	8	25147-107	NATP*
Screw, SHC, 4-10 x .25	8	25100-107	NATP*
CLASP KIT, WIRE	6	23465-201	NATP*
Clasp, Cable Routing, Long	6	25476-201	NATP*

Nut, Hex	6	23193-101	NATP*
CLASP KIT, WIRE	10	23465-ni	NATP*
Clasp, Cable Routing, Long	10	25476-201	NATP*
Nut, Hex	10	23193-101	NATP*
Standoff, Clasp	10	25598-nk	NATP*
GROUNDING KIT, FINAL FILTER	1	23536-101	NATP*
Terminal, Solderable, Wire Gage30, Screw #4	1	23519-102	NATP*
Terminal, Solderable, Wire Gage30, Screw #10	1	23519-103	NATP*
SCREW, SHC, #4-40	1	25100-104	NATP*
GROUNDING KIT, GYRO NG	1	23524-nh	NATP*
Clamp, Grounding, Retention	1	23522-201	NATP*
Screw, SHC, #4-40	1	25100-104	NATP*
Screw, SHC, #4-40	1	25100-10?	NATP*
Washer Assembly, Retention Ground, Gyro #ng	1	23471-nh	NATP*
<i>Terminal, Solderable, Wire Gage 26, Screw #4</i>	<i>1</i>	<i>23519-101</i>	<i>NATP*</i>
<i>Terminal, Solderable, Wire Gage 26, Screw #10</i>	<i>1</i>	<i>23519-104</i>	<i>NATP*</i>
SQUID KIT, NEG X	1	25132-101	NATP*
SQUID KIT, POS X	1	25132-102	NATP*
ADAPTOR, GROUNDING	1	25714-101	NATP*

* Not Applicable to this Procedure

Table 1. SIA Kit Indentured Parts List

4.2 Ground Support Equipment and Miscellaneous Equipment

Ground Support Equipment

Oriel Optical Table (vibration isolated)
 Delrin Spreader Plug
 Retention Foot Tools (SU dwg 113511) (4)
 Index Plate Scissors Jack
 Cable Support Truss (4)
 QB Roller Mechanism
 MET 1, Portable Particle Counter
 Silver Plated Bolts for clamping halves of Roller Mechanism

Tools and Miscellaneous

Tie wraps - nylon
 Uncoated copper wire for wrapping and tying cable/wire bundles
 Several cans of Freon TF Solvent , filtered to 0.2 μ m
 Several spray bottles of Ethyl alcohol
 Several spray bottles of Methanol
 Several spray bottles of ultrajet alcohol drying solution
 Isopropanol Spray
 External clip pliers (2)
 Set of BeCu Allen wrenches
 Set of BeCu box/open end wrenches, standard sizes
 Set of BeCu 1/4 and 3/8" sockets, with ratchet drivers
 Set of BeCu screwdrivers, standard and Phillips
 Set of BeCu pliers, regular, needle nose and dikes
 a tube of Braycote 601 grease

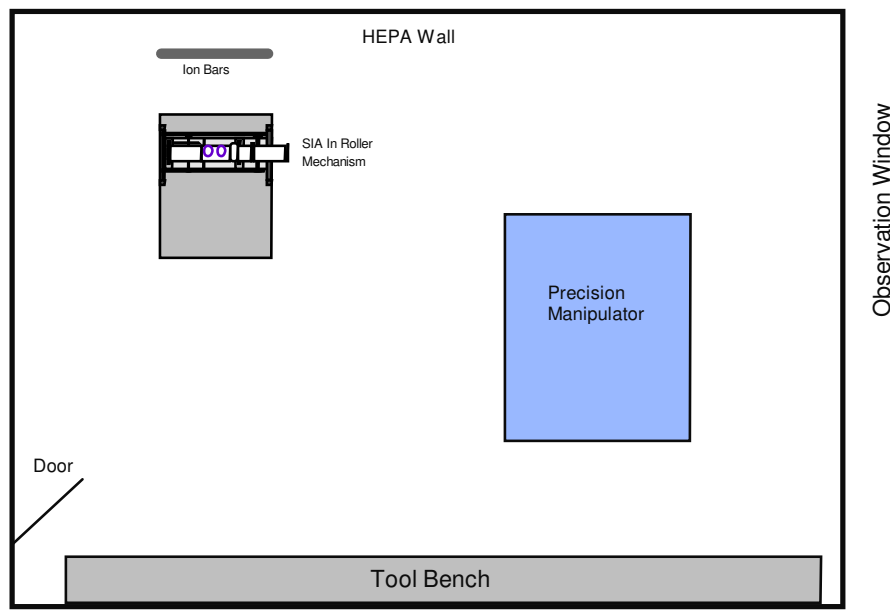
Allen wrenches, various
D- Clamps for clamping RM to Table
Foam Swabs

5 INITIAL PREPARATIONS

5.1 Room Setup

Record Start Date and Time _____

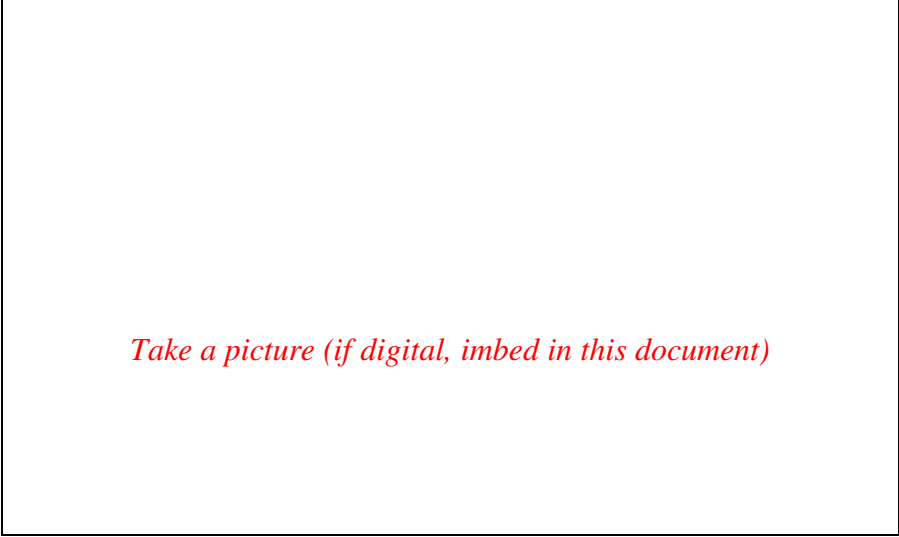
Setup the Class 10 room so that the short dimension of the optical table is facing the HEPA wall, and the telescope end of the QB/T assembly is facing the Observation window. See Figure 1 below. This arrangement allows a person on each side of the table to reach most areas of the QB. Clear off anything on the floor which are not used during integration, and put



Top View of Class 10 Cleanroom - not to scale

in Class 1000 Room.

Figure 1. Room Setup For Gyro Integration



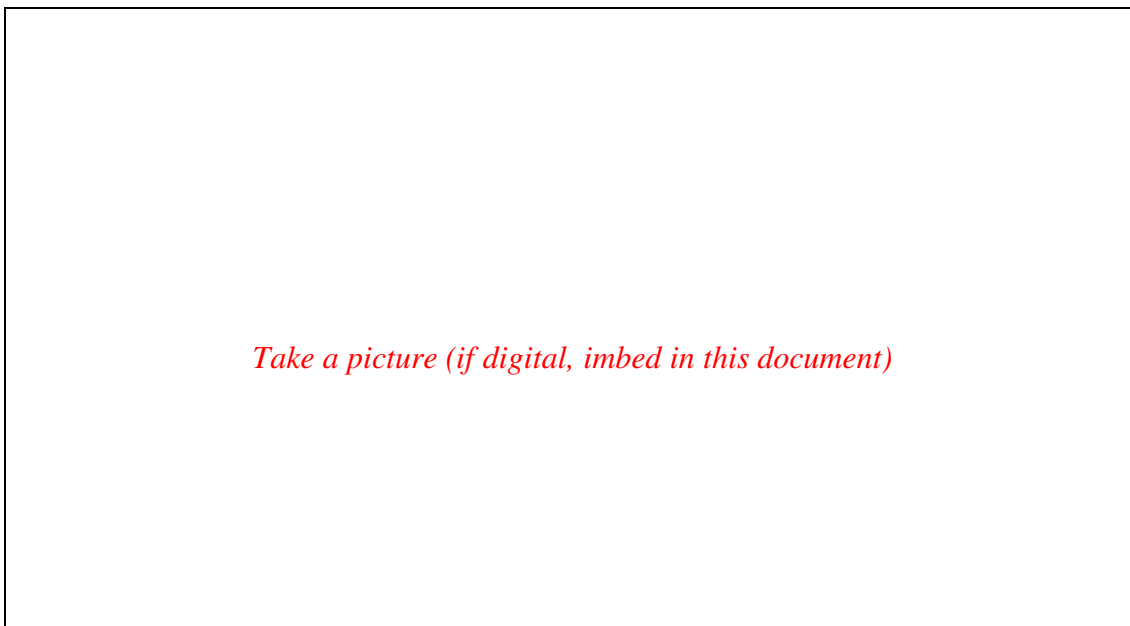
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6. INSTALL LOCAL MAGNETIC SHIELDS

Record Start Date and Time _____

6.1 Shims for Magnetic Shields

- 6.1.1 Each magnetic shield, P/N 23173-201, has 3 exterior longitudinal ribs, with centers 120 degrees apart. These ribs will be covered by shims, which are installed on the shield prior to installing the shield into the bore in the QB. One of the Shim Assemblies on each shield, P/N 25733-101, has two ground wires attached at one end. The other two shims without wires, are P/N 25733-102. Place the 3 shims to be matched with each shield together with the respective shield on the table.



- 6.1.2 Using a spare magnetic shield, center the rectangular part of each shim over a rib and carefully bend the tab at one end around the rib so that it lies flat against the shield. This should leave approximately equal gaps of external rib showing at each end. Clean each shim by spraying with Freon TF.
- 6.1.3 Record the Serial Numbers of the Magnetic Shield Assemblies in Table 2 in Section 9, and the Lot Date Code of the shims in Table 1 in Section 4.
- 6.1.4 Figure 2 shows the orientation of the Local Magnetic Shields schematically.

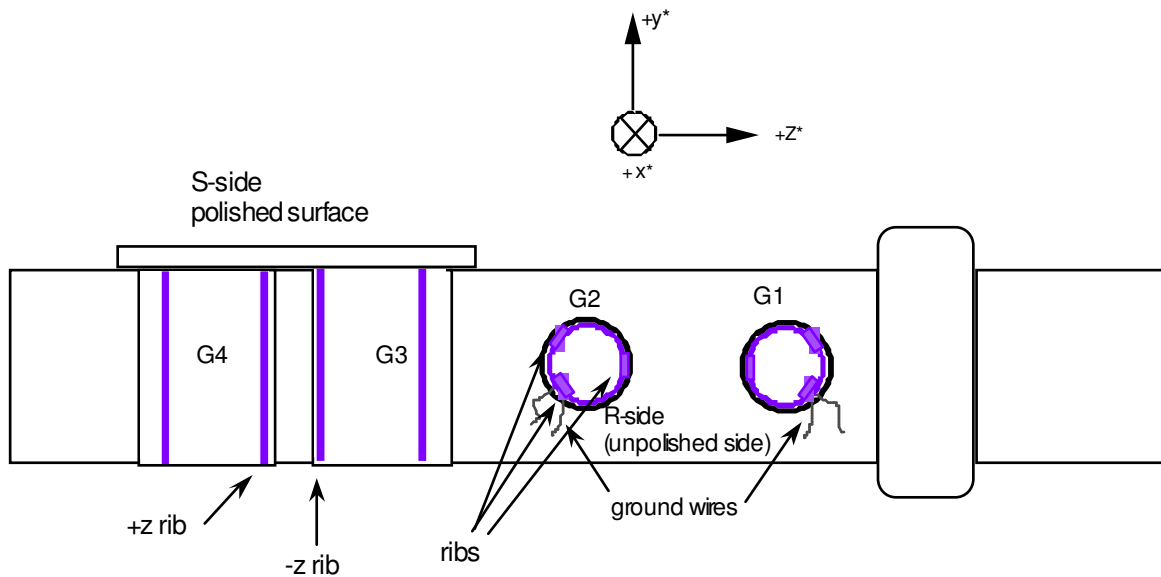


Figure 2. Local Magnetic Shields Orientation

NOTE: The requirement per T003, section 1.1 and PLSE-12, paragraph 3.7.1.4.4.2.4 is spin axis directions to be +z, -z, +z, -z for Gyros 1, 2, 3, and 4, respectively. The orientation of the shim along the z-axis always lies opposite the gyro spin direction.

6.2 Install Magnetic Shield into the QB bore for Gyro 1

- 6.2.1 Orient the QB/T/RM such that the unpolished surface of Gyros 1 and 2 (-X) is up, and angled approximately 45° toward you. For G1 & G2 shield enter from -X.
- 6.2.2 Locate a shim over each rib of a magnetic shield by "hooking" the bent ends of each shim over the same end of the shield (that which enters the bore). Hold by hand.

Take a picture (if digital, imbed in this document)

- 6.2.3 With a foam swab apply a minimal amount of Braycote 601 grease to create a thin film of lubricant on over about 0.5 inch of the shim's external surface near the tab end. This facilitates smooth insertion of the shield into the bore.
- 6.2.4 For the **G1** bore, orient the shield so that **one of the ribs without the ground wires is facing the -Z direction, and the rib/shim with the 2 short ground wires are facing toward -Y.**
- 6.2.5 When sure of the orientation, slide a magnetic shield/shim into the gyro bore so that both ends finish slightly below flush of the QB surfaces, being careful not to break the 2 grounding wires. Manipulate the assembly so that the shims enter the bore without chipping the quartz. Use steady even force. Do not allow the tab to protrude beyond the surface of the polished (+X) face. It should be below flush.

Take a picture (if digital, imbed in this document)

6.3 Install Magnetic Shield into the QB bore for Gyro 2

- 6.3.1 Repeat 6.2.2 through 6.2.4 for the shield for the **G2** bore, but orient the shield so that **one of the ribs without the ground wires is facing the +Z direction, and the rib/shim with the 2 short ground wires are facing toward -Y.**
- 6.3.2 When sure of the orientation, slide a magnetic shield/shim into the gyro bore so that both ends finish slightly below flush of the QB surfaces, being careful not to break the 2 grounding wires. Manipulate the assembly so that the shims enter the bore without chipping the quartz. Use steady even force. Do not allow the tab to protrude beyond the surface of the polished (+X) face. It should be below flush.

6.4 Install Magnetic Shield into the QB bore for Gyro 3

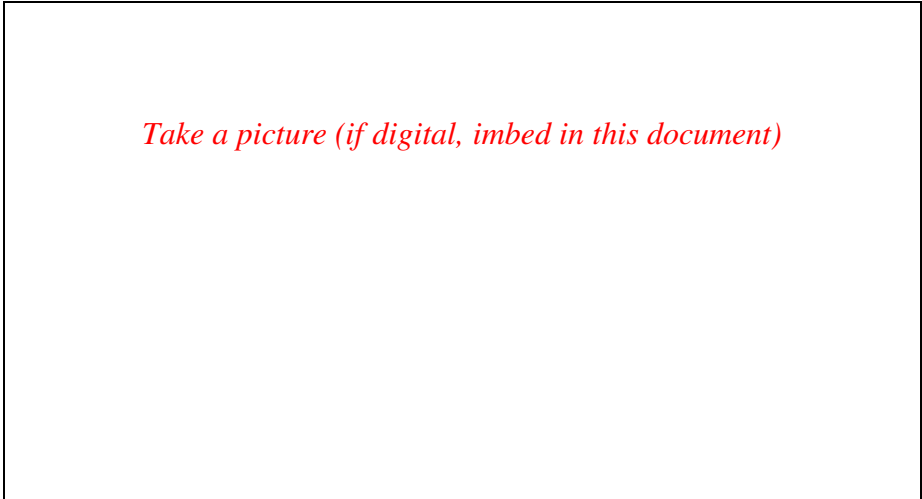
- 6.4.1 Rotate the QB in the Roller Mechanism so that the unpolished surface of gyros 3 and 4 (-Y) is rotated approx. 45° towards you. For G3 & G4 shield enter from -Y.
- 6.4.2 Repeat 6.2.2 through 6.2.4 for the shield for the **G3** bore, but orient the shield so that **one of the ribs without the ground wires is facing the -Z direction, and the rib/shim with the 2 short ground wires are facing toward -X.**
- 6.4.3 When sure of the orientation, slide a magnetic shield/shim into the gyro bore so that both ends finish slightly below flush of the QB surfaces, being careful not to break the 2 grounding wires. Manipulate the assembly so that the shims enter the bore without chipping the quartz. Use steady even force. Do not allow the tab to protrude beyond the surface of the polished (+Y) face. It should be below flush.

6.5 Install Magnetic Shield into the QB bore for Gyro 4

- 6.5.1 Repeat 6.2.2 through 6.2.4 for the shield for the **G4** bore, but orient the shield so that **one of the ribs without the ground wires is facing the +Z direction, and the rib/shim with the 2 short ground wires are facing toward -X.**

- 6.5.2 When sure of the orientation, slide a magnetic shield/shim into the gyro bore so that both ends finish slightly below flush of the QB surfaces, being careful not to break the 2 grounding wires. Manipulate the assembly so that the shims enter the bore without chipping the quartz. Use steady even force. Do not allow the tab to protrude beyond the surface of the polished (+Y) face. It should be below flush.

6.6 Magnetic Shields Installation Completion:



Completed: _____ Date: _____
Integration Engineer

Discrepancies if any:

Disposition./sign-off: _____ Date: _____
ITD

Concurrence: _____ Date: _____
QA Designated Representative

7 INSERT GYRO RETAINER ASSEMBLY INTO QUARTZ BLOCK

NOTE: SECTIONS 7 THROUGH 9 ARE GENERIC FOR ANY GYRO. These sections are completed for one gyro at a time, and repeated for each gyro.

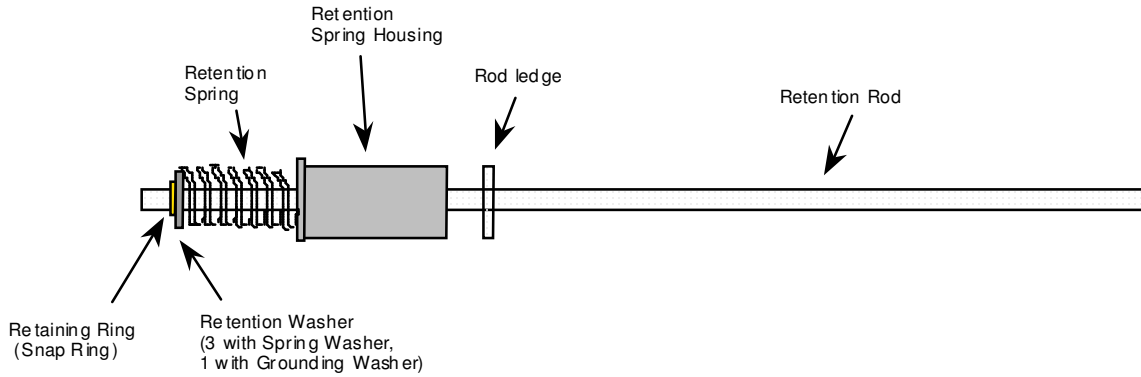
The order of Gyro integration into the QB is baselined to be 3, 2, 4, 1, unless changed by the ITD. This order minimizes disturbance or contamination to gyros already installed.

7.1 Pre-assemble Short End of Retention Rods for a Single Gyro

Record Start Date and Time _____

Note: There are 4 Retention Rod Assemblies per gyro, of which 3 are identical, and the fourth is identical except for the Retention Washer. During the assembly process, spray clean each new part with TF spray prior to adding to assembly.

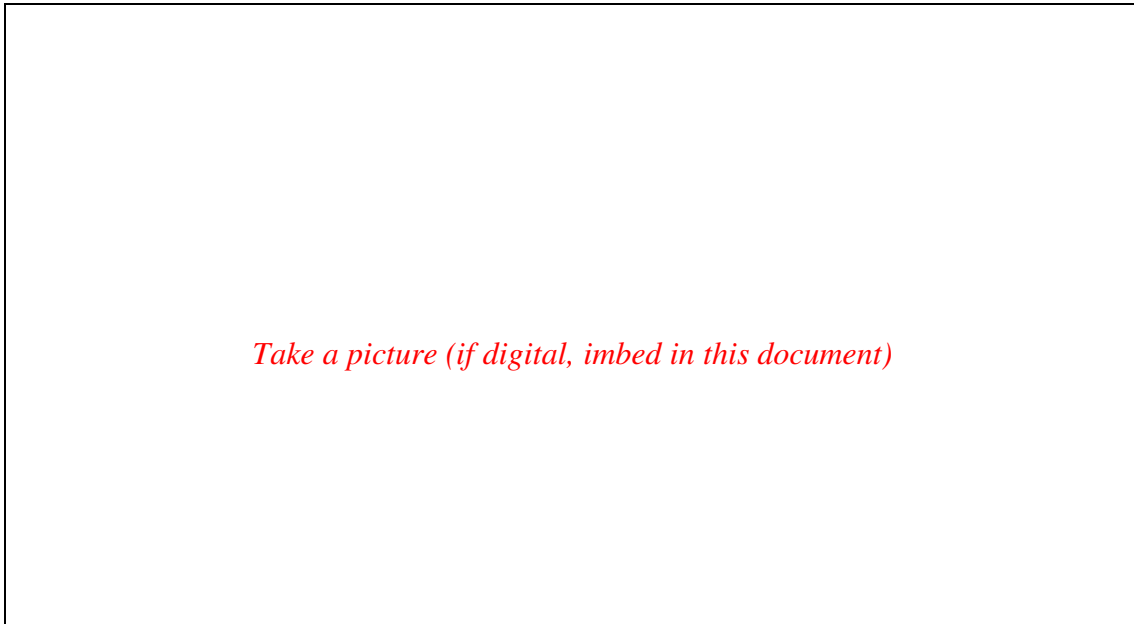
- 7.1.1 Insert a Retention Spring Housing Washer (P/N 23250-201) into a Retention Spring Housing (P/N 23240-101).
- 7.1.2 Insert the Retention Spring (P/N 23239-101) into the Retention Spring Housing (P/N 23240-101) by dropping it on top of the Retention Spring Housing Washer (P/N 23250-201).
- 7.1.3 Insert the Retention Spring Housing (P/N 23240-101) onto the Retention Rod (P/N 23278-201) by dropping it onto the ledge on the short side of the rod. See Figure 3 below.
- 7.1.4 Insert the Retention Spring Washer (P/N 23234-201) over the Retention Spring (P/N 23239-101). This washer is used on 3 of the 4 rods per gyro. Use the Retention Grounding Washer (P/N 23523-301) for the other rod.
- 7.1.5 Insert the Retention Ring (snap ring) (P/N 23174-201) over the Retention Washer in the groove on the rod on all 4 rods, using the Snap Ring Pliers.



Side View of Assembled Gyro Retainer Rod - Not to scale

Figure 3. Assembled Gyro Retainer Rod

7.1.6 Record the lot date code of the Rod Retention hardware in Table 1 of Section 4.



7.2 Insert Gyro Retainer Assembly into the QB

This section assumes the Gyro Retainer Assembly, P/N 23279-301, has the 3 Socket Head Cap Screws (P/N 25100-111), installed and bonded, and the retainer feet spread, in accordance with P0091.

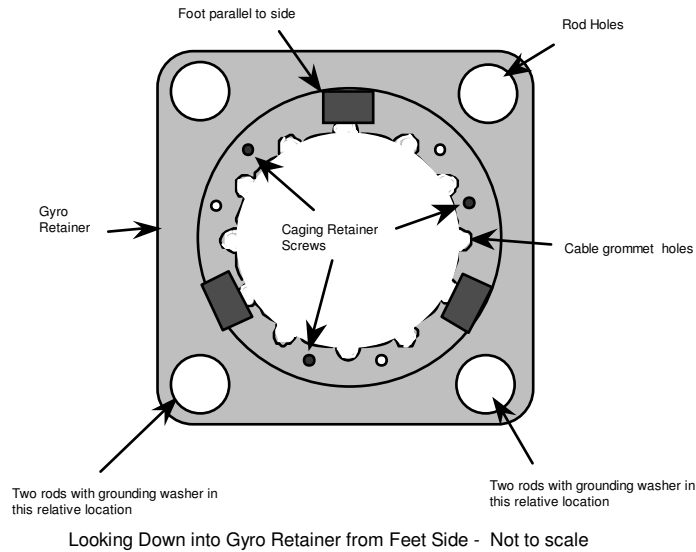
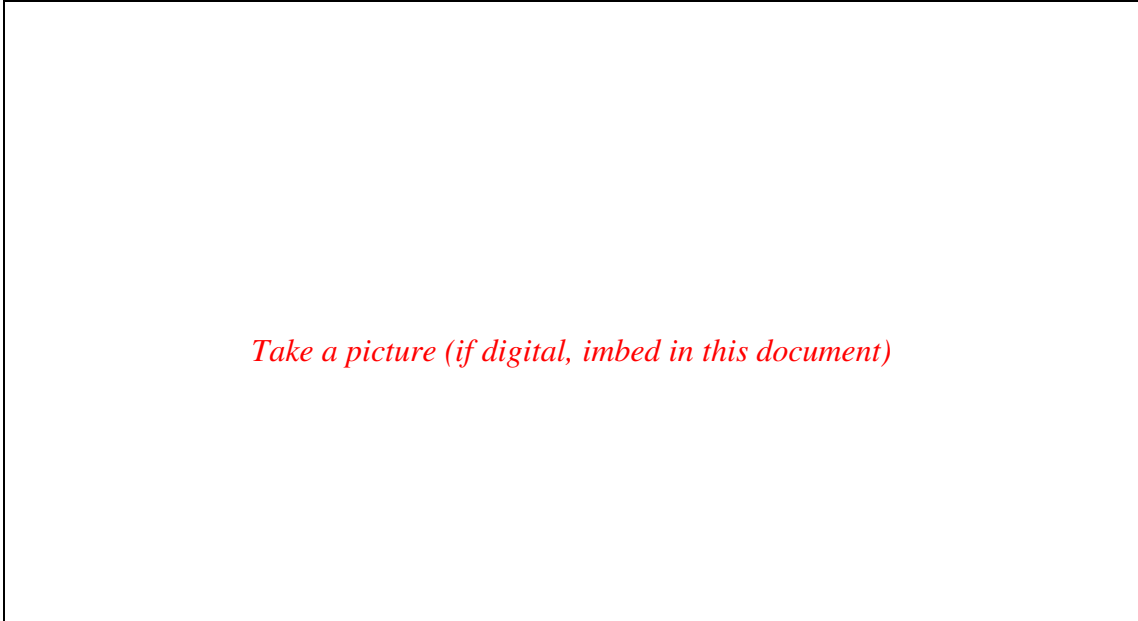


Figure 4. Gyro Retainer from Feet Side

- 7.2.1 Orient the QB/T such that the unpolished side (R-side) for the gyro being installed is facing upwards ($-X$ side for Gyros 1 and 2, $-Y$ side for Gyros 3 and 4).
- 7.2.2 Drop a Snouted Washer (P/N 23274-201) into each 0.5 inch dia. hole around a bore, making sure that the snout is seated properly in the smaller hole at the bottom.
- 7.2.3 Now drop a Retention Spring (P/N 23239-101) into the 0.5 inch hole.
- 7.2.4 Insert the Gyro Retainer into the bore from the R-side, as follows: There is one foot on each retainer which is midway on a side, (see Figure 4) That foot should line up with the Z-axis, on the same side as the Z-rib on the magnetic shield.
- 7.2.5 Insert the 4 pre-assembled Retainer Rods through the 4 corner holes of the Gyro Retainer into the QB such that the rod with the Grounding Washer is located near the two grounding wires from the magnetic shield.



Completed: _____ Date: _____
Integration Engineer

Discrepancies if any:

Disposition./sign-off: _____ Date: _____
ITD

Concurrence: _____ Date: _____
QA Designated Representative

8 PREPARE GYRO ASSEMBLY AND IP/S ASSEMBLY FOR INSERTION

8.1 Install Instrumentation on Gyro Assembly

- 8.1.1 Get the Gyro Assembly (P/N 23185-101 or 23185-102) being integrated. Record Serial Number in Table 1.
- 8.1.2 Use copper wire to wrap the cable bundles together, after cleaning the wire.
- 8.1.3 Insert the GRT Assembly, Short, P/N 23179-202, into the right side hole of the gyro housing, looking into the S-side of the housing. Insert the Heater Assembly, Gyro and Readout Cable, P/N 23550-101, into the hole on the other side of the housing. See Figure 5 below. Record Serial Numbers in Table 3 below. The GRT and Heater Designations are given in this table.

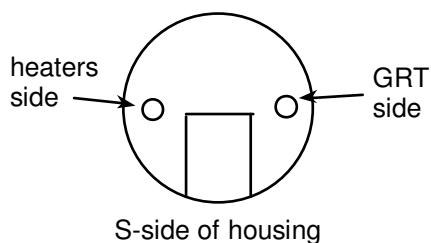


Figure 5. Location of GRT and Heater wires on Gyro Assembly

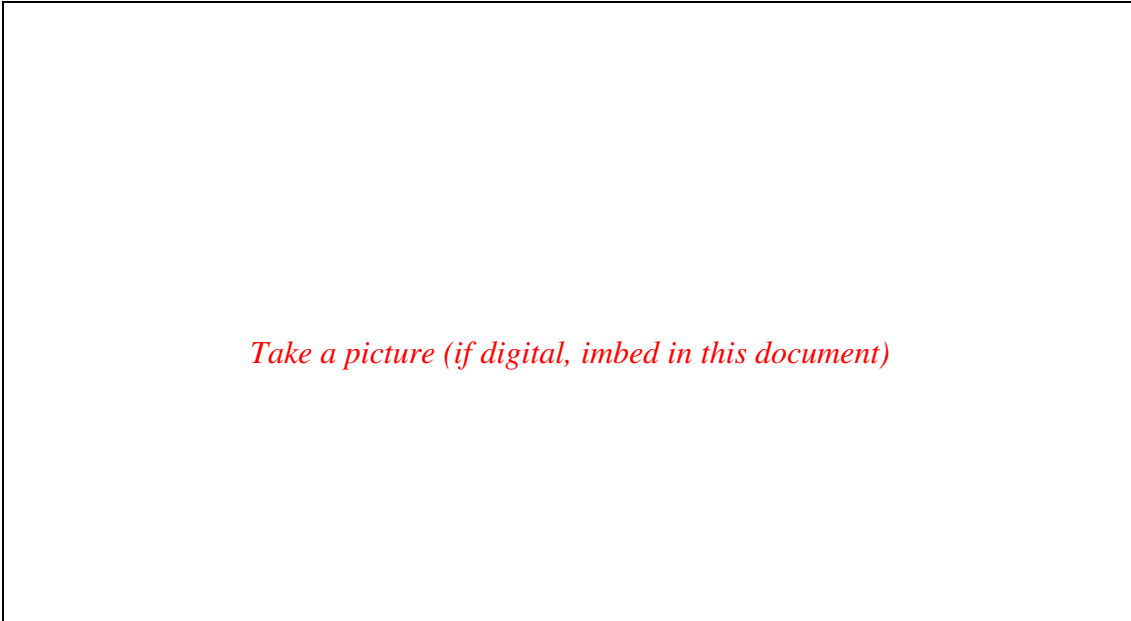
Gyro	GRT SubAssy, P/N 23179-202 Serial #	Heater Assy, P/N 23550-101, Serial #
1	T-1Q	H-1Q
2	T-2Q	H-3Q
3	T-3Q	H-5Q
4	T-4Q	H-7Q

Table 3. Gyro GRT and Heater Assemblies Serial Numbers

Take a picture (if digital, imbed in this document)

8.2 Mate Gyro Assembly to Index Plate/Spacer

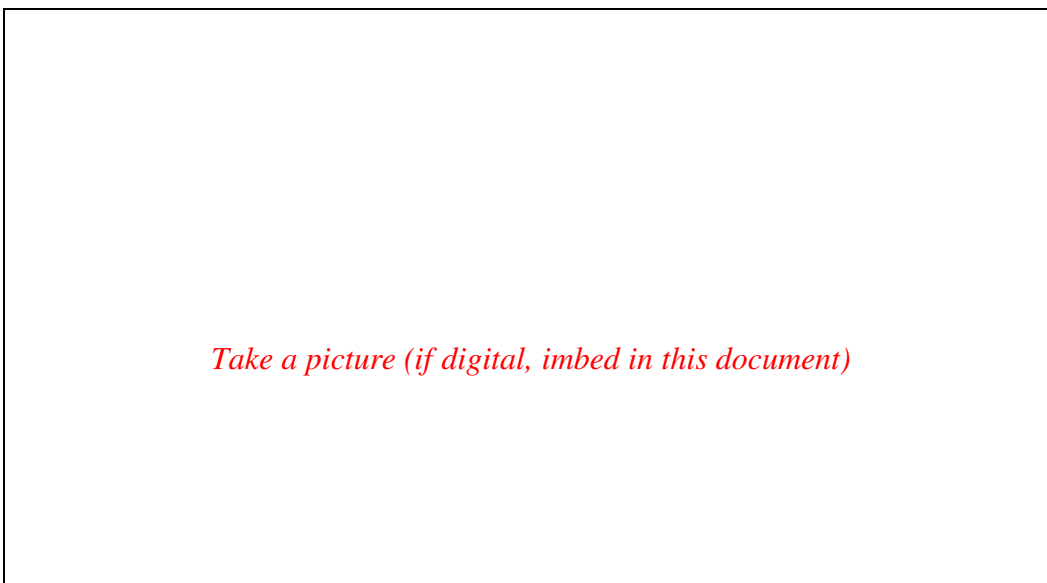
- 8.2.1 Get the Index Plate / Spacer Assembly (P/N 23238-p) which will mate to the gyro being integrated. Record in Table 1. Hold approximately 1 ft above the table to facilitate 8.2.5.
- 8.2.2 Spray the 4 Spacer to Gyro dowels (P/N 23552-202) with Freon TF solvent.
- 8.2.3 Use a foam swab to apply a minimal amount of Braycote 601 grease to create a thin lubricant film over each dowel. Insert the dowels into the Spacer, and push all the way down into the Spacer dowel hole.
- 8.2.4 If gloves become soiled with Braycote grease, change them before proceeding.
- 8.2.5 One person holds the GRT and Heater wires and guide them through the spacer hole from the gyro side while simultaneously supporting the main gyro cable bundle. The other person lowers the Gyro Assembly over the Spacer such that the dowel holes in the Housing go onto the dowels on the Spacer. Be sure when mating the Gyro Assembly to the Spacer that the notch of the Housing aligns with the notch in the Spacer. **It is very important not to allow the dowels to become wedged during this process. If the motion becomes hung up, or does not proceed smoothly, back off and start again.**



8.3 Install the Spinup Plumbing Retainer Assembly onto the IP/S/G Unit

This section assumes the completion of P0064, Spinup Plumbing Assembly Procedure, by which the inlet and exhaust tubing assemblies are assembled, cleaned, magnetically screened, and released as an assembly.

- 8.3.1 One person holds the Spacer in one hand and the gyro in the other and maintains sufficient force of one against the other that the interface does not come apart. This person uses one finger to hold the cover gyro cover securely in the caging recess. The IP/S/G is now inverted so that the gyro is underneath, while the other person take care to rest the cables on the table so that they are not strained., install 4 Winged Snouted Washers (P/N 23274-302) into the 1/4 inch holes of the index plate. Align the pre-assembled Plumbing Assembly, P/N 23103-101, relative to the IP/S/G Unit as seen from outside the Plumbing



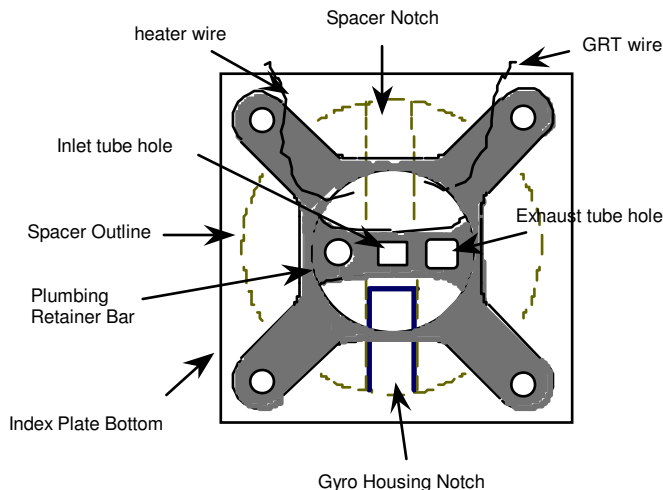
retainer. See Figure 6 below.

- 3.3.2 The second person now installs 4 Winged Snouted Washers (P/N 23274-302) into the 1/4 inch holes of the index plate and lowers the Plumbing Retainer to within 2 inches of the Index Plate, while carefully feeding the instrumentation wiring through the unobstructed hole in the Plumbing Retainer. The Plumbing retainer is now handed off to the person holding the gyro.

Take a picture (if digital, imbed in this document)

- 8.3.3 While holding the IP/S/G Assembly so that the gyro's exhaust hole is visible gently push the Plumbing Assembly (oriented so that the exhaust ball will line up with the gyro exhaust hole) into the IP/S/G meanwhile the other guides the GRT and heater wires. Wiggle the assembly slightly to facilitate the simultaneous insertion of the spinup and exhaust balls into their respective holes and ensure proper installation.
- 8.3.4 Now invert the entire assembly so that the gyro is on top again keeping force between the Plumbing Retainer and the gyro. The other person manages the cables to avoid strain.

Take a picture (if digital, imbed in this document)



Looking towards the gyro from outside Plumbing Retainer - Not to scale

Figure 6. Plumbing Retainer Orientation Relative to Index Plate/Spacer/Gyro Assembly

8.3.5 Record the serial numbers of the Plumbing Assembly corresponding to Gyro Position in Table 2 below.

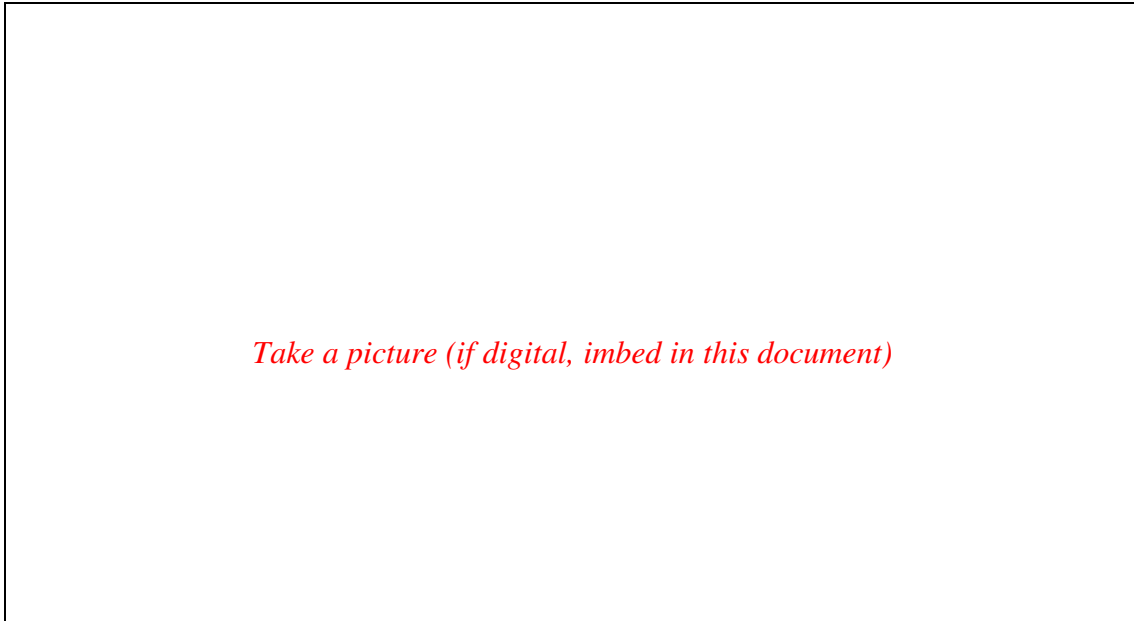
Table 2. Serial Number Log

Gyro Position	Gyro Housing / Rotor Serial Number	Index Plate / Spacer Serial #	Mag Shield Serial Number	Plumbing Retainer Assembly Serial Number	Gyro Retainer Assembly Serial Number
1					
2					
3					
4					

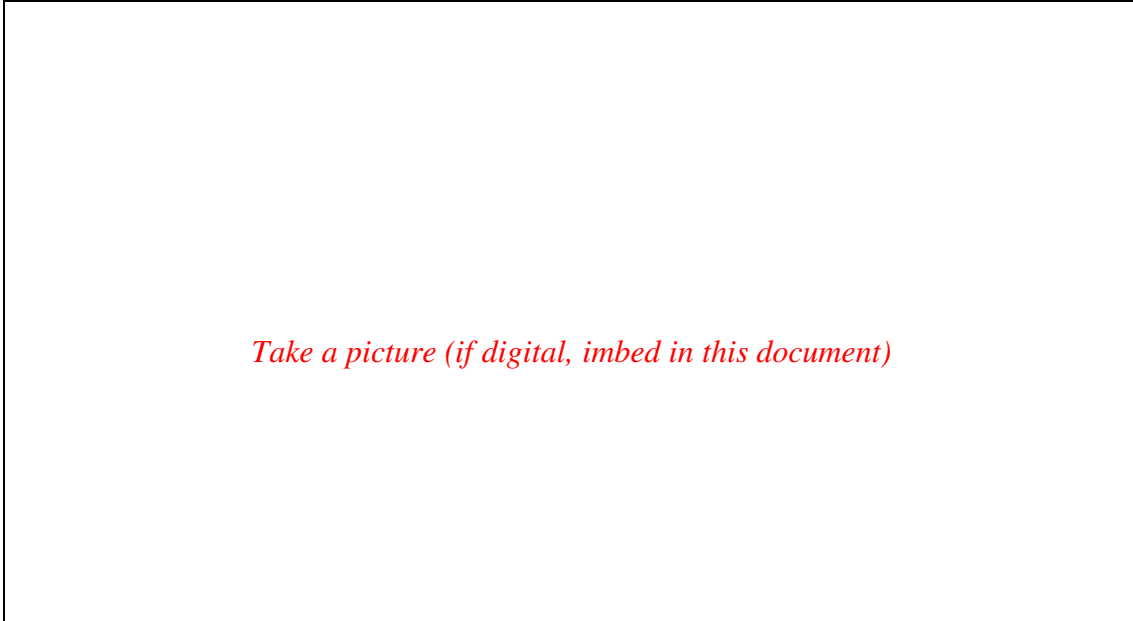
9 INSTALL GYRO ASSEMBLY IN QUARTZ BLOCK

9.1 Insert IP/S/G Unit into the QB and Secure with Retention Hardware

- 9.1.1 Spray 4 IP to QB dowels (P/N 23552-201) with TF solvent. Dry with the N₂ gas blower.
- 9.1.2 Use a foam swab to apply a minimal amount of Braycote 601 grease to create a thin film lubricant on over each dowel. Insert the dowels into the Index Plate, and push all the way down into the Index Plate dowel hole. Repeat for all 4 dowels.



- 9.1.3 If gloves become soiled with Braycote grease, change them before proceeding.
- 9.1.4 Orient the QB/T in the Roller Mechanism such that the polished surface of the gyro being installed (+X side for Gyros 1 and 2, +Y side for Gyros 3 and 4) faces down and angled toward you by approximately 45°.
- 9.1.5 Orient the IP/S/G unit relative to the bore so that the exhaust tube in the plumbing retainer is in the spin direction. For gyros 1 and 3, towards the telescope; for gyros 2 and 4, away from the telescope.
- 9.1.6 While guiding the cable bundle through the bore from the S-side, insert the IP/S/G Unit with Plumbing Assembly part way into the QB bore from the S-side. Grab the cables from the R-side of the bore and carefully guide them through the bore. Take care to avoid catching parts of the cable hardware on the retainer as they pass through the central hole.



- 9.1.7 While supporting the unit in position, rotate the QB/T/RM so the gyro bore is approximately vertical.
- 9.1.8 Insert the Index Plate dowels into the Quartz Block dowel holes until the Index Plate is flush against the QB, while applying gentle pressure to the Gyro Retainer from the top of the QB. A second person supports the cables on the R- side. **Do not allow the dowels to become wedged. If the motion becomes hung up, or does not proceed smoothly, back off and start again.** Secure the cables as appropriate on the QB, using cleanroom tape if necessary.



- 9.1.9 Assemble Retention foot tools (P/N/113511) with snap clip, 3 bellevilles, and washer (or plumbing tie down bar), as shown in Figure 7.

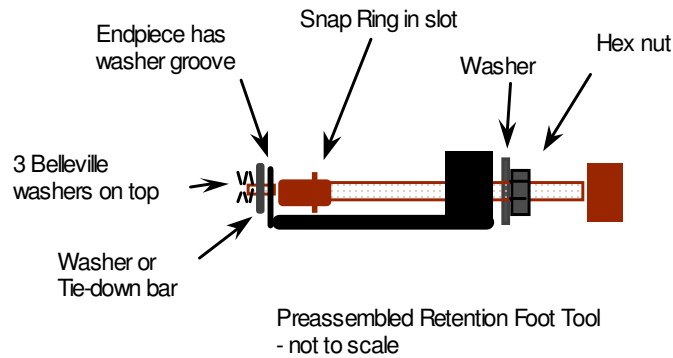
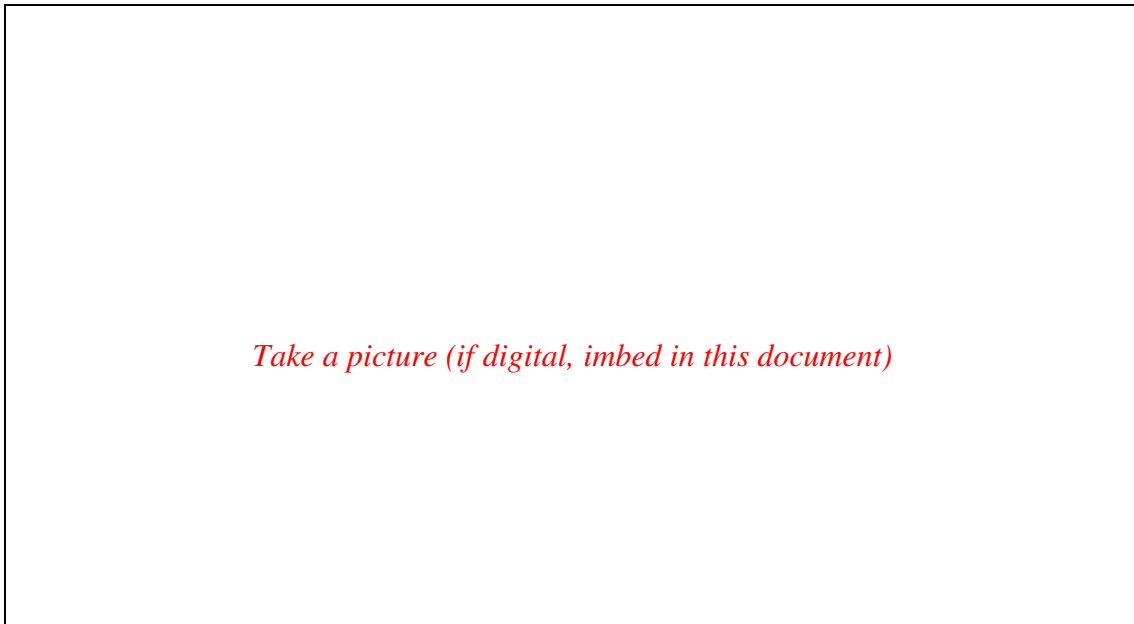


Figure 7. Assembled Retention Foot Tool



9.1.10 While one person holds the IP/S/G unit against the QB, a second person installs a Retention Foot Tool (P/N 113511) on two diagonally opposite Retention rods . See Figure 8. To accomplish this, the rod will need to be pushed through the IP hole, the snouted washer, and the Plumbing Retainer, since in equilibrium the end of the rod does not stick through these. The screw tip of the Foot Tool fits into the hole in the middle of the Retention Rod. Tighten to secure the Tool on the rod. Gently push the rod down from the R-side while taking up the slack on the Foot by tightening the nut. The IP/S/G/ Plumbing Retainer is now secure against the QB. Extend the rods so that the groove will protrude far enough so that it will protrude about .050 beyond the three bellevilles the plumbing retainer (or Retainer Washer)

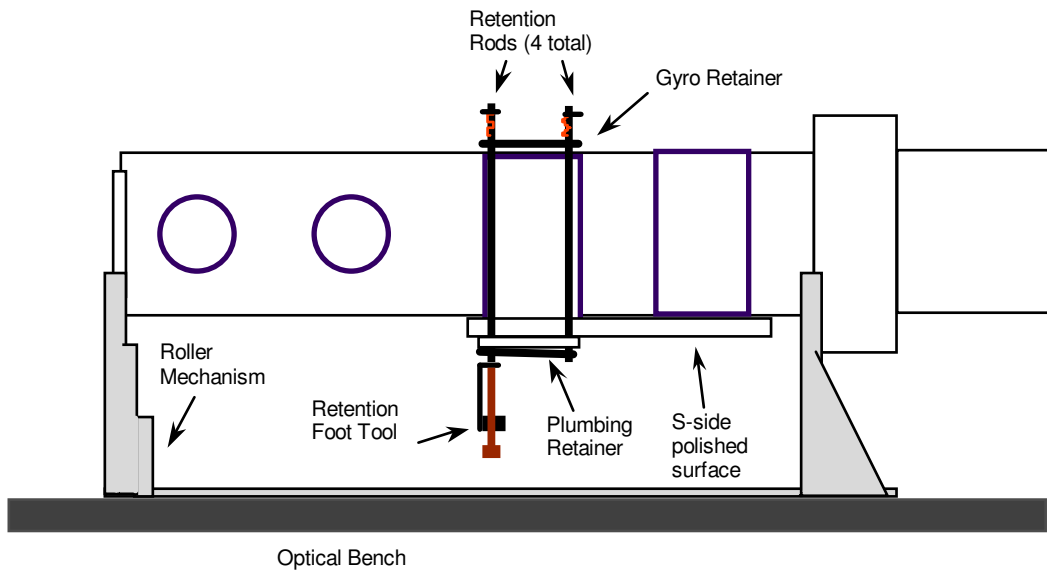


Figure 8. Installation of Foot Tool (pictured for Gyro 2)

- 9.1.11 Push the bellevilles and the washer towards the plumbing retainer and use the Snap Clip pliers to transfer the clip into the groove. Check that it is in securely.
- 9.1.12 Repeat for the other Retention foot tool.
- 9.1.13 Loosen the nuts on the two installed retention foot tools and remove the tools.
- 9.1.14 Repeat 9.1.9 through 9.1.12 for the other two diagonal rods.

Take a picture (if digital, imbed in this document)

9.2 Secure Gyro Cables, Install Caging Hole Blocker

- 9.2.1 Rotate the QB/T/RM so that the Gyro Retainer side for Gyros 1 or 2 (-X side) is facing within an angle less than or equal to 45° from vertical.

For Gyros 3 or 4 the above would apply to the - Y side.

- 9.2.2 For each cable, look down into the gyro cavity to select the grommet keyhole on the retainer which will keep the cable as straight as possible from the gyro to the retainer. Snap the grommet groove into the keyhole. Avoid applying forces to the retainer which may cause it to move during this process. Use the middle finger of one hand to squeeze the grommet into its keyhole while the thumb of the same hand provides the equal force on the edge of the retainer.

Note: The fiber optic cables are the most delicate, and should have first priority in bending as little as possible.

- 9.2.3 While holding the cables away from the QB, remove the caging hole cover and replace with the delrin fixture which attaches to the caging screws on the retainer.

Take a picture (if digital, imbed in this document)

9.3 Measurement of Gyro Alignment relative to QB

9.3.1 Initial Gyro Alignment Measurement

Before installing the next gyro perform an initial gyro alignment check using procedure P0206. Record results in the Initial Alignment column of Table 3 below. All tilts required to be $= \pm 4$ arc-s with respect to the QB reference surface, as measured about the designated axis in the Table. The “right-hand-rule” determines the sign of the tilts.

QA Designated Representative to sign-off the Table 3 entries for each gyroscope.

9.3.2 Repeat sections 7 through 9 for the other gyros

9.3.3 Final Gyro Alignment Measurement

After all gyroscopes are installed perform a final gyro alignment check using procedure P0206. Record results in the Final Alignment column of Table 3 below. All tilts required to be $= \pm 4$ arc-s with respect to the QB reference surface, as measured about the designated axis in the Table. The “right-hand-rule” determines the sign of the tilts.

QA Designated Representative to sign-off the Table 3 entries for each gyroscope.

NOTE: This measurement is a partial verification of Payload Spec Requirement 3.7.1.4.2.1.1, which states that the accuracy of perpendicularity between readout loops and telescope axis shall be $= \pm 55$ arc-s, of which ± 15 arc-s is allocated to r/o loop plane relative to telescope axis. The ± 4 arc-s between gyro housing and QB polished surface is a further sub-allocation of the 15 arc-s.

Take a picture (if digital, imbed in this document)

Table 3. Gyroscope Alignment Measurements

Gyro Position	Initial Alignment (arc-s)* after individual installation		Final Alignment (arc-s)* after all gyros installed	
1	around Y-axis	around Z-axis	around Y-axis	around Z-axis
Sign-off QA Rep				
2	around Y-axis	around Z-axis	around Y-axis	around Z-axis
Sign-off QA Rep				
3	around X-axis	around Z-axis	around X-axis	around Z-axis
Sign-off QA Rep				
4	around X-axis	around Z-axis	around X-axis	around Z-axis
Sign-off QA Rep				

* The measurements are + or – according to the “right hand rule” for the QB axis designated

9.4 Record Completion of Gyro Installation

Completed: _____ Date: _____
 Integration Engineer

Discrepancies if any:

Disposition./sign-off: _____ Date: _____
 ITD

Concurrence: _____ Date: _____
 QA Designated Representative

Concurrence: _____ Date: _____
QA Program Engineer

10 INSTALL TEMPERATURE SENSORS AND CLASP ASSEMBLIES

10.1 Install GRTS

10.1.1 Install the QB GRTs into their respective locations shown in drawing 23171. Secure to QB/T for integration with probe. Record Serial Numbers in Table 4 below.

10.2 Install Silicon Diodes

10.2.1 Install the QB Silicon Diodes into their respective locations shown in drawing 23171. Secure to QB/T for integration with probe. Record Serial Numbers in Table 4 below.

10.3 Install Clasp Assemblies

Install the Clasp Assemblies into their respective locations shown in drawing 23171. Secure to QB/T for integration with probe. Record Serial Numbers in Table 4 below.

Table 4. QB Temperature Sensor and Clasp Assemblies Serial Numbers

GRT Assembly, P/N 23179-201 Serial #	SD Assembly, P/N 23532-101, Serial #	Clasp Asy, Wire, P/N 23175-203, Serial #
T-5Q (+X, aft QB)	T-18Q (QB fwd)	
T-6Q (QB fwd)	T-7Q (-X, aft QB)	
T-17Q (QB flange)	T-16Q (tele, 135°)*	
T-12Q (tele, 235°)*		
T-13Q (tele, 180 °)*		
T-14Q (tele, 90°)*		
T-15Q (tele, 35°)*		
T-21Q (on DPA)		

* from +Y

Take pictures of QBA from several angles showing instrumentation (if digital, imbed in this document)

Take pictures of QBA from several angles showing instrumentation (if digital, imbed in this document)

Take pictures of QBA from several angles showing instrumentation (if digital, imbed in this document)

11 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:

QA Representative _____ Date _____

QA Program Engineer _____ Date _____

Copy discrepancies to D Log and open DRs when required.

Hardware Manager _____ Date _____

Systems Engineering _____ Date _____

12 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.
- 3) Part numbers and serial numbers of QB and Telescope.