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Gravity Probe B Relativity Mission

**GRAVITY PROBE-B
STANDARD OPERATING PROCEDURE**

**GP-B VATTERFLY VALVE INSPECTION
2.5 INCH AND 6 INCH**

P0890 REV-

December 16, 2001

Prepared By

Checked By

_____ Date _____
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Systems Effectiveness

_____ Date _____
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Deputy Program Manager

Approvals:

_____ Date _____
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Manager, Systems Effectiveness

_____ Date _____
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Payload Technical Manager

A. Scope:

This procedure provides the steps to be taken to accomplish an internal inspection of the 2.5 inch and 6 inch Vatterfly Valves. This inspection is necessary due to a failure of a 6 inch Vatterfly Valve discovered during testing at Pacific Design Technologies, in Goleta, California. A representative of Pacific Design Technologies will perform the required inspections with the assistance of a Lockheed Martin Technician. A Stanford Gravity Probe-B Test Director and Quality inspection representative will participate in the inspection.

B. Applicability:

This procedure applies to all personnel involved in the performance of the Vatterfly Valve Inspection to be conducted at the Lockheed Facility.

C. Responsibilities:

C.1. Safety

Personal injury and hardware damage can result during the assembly and disassembly of Vatterfly Valve hardware. All tools and loose hardware must be tethered at all times during this operation.

C.2. Mitigation of Hazards

Lifting hazards

There are no lifting operations in this procedure

Cryogenic Hazards

There are no cryogenic operations in this procedure.

Injuries

In case of any injury obtain medical treatment as follows
LMMS **Call 117**; Stanford University **Call 9-911**

D. Quality Notification

The MSFC QA representative and SU QA shall be notified 24 hours prior to the start of this procedure. Upon completion of this procedure, the QE Manager will certify his/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.

E. Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the Payload Test Director (PTD) or his designate and shall be approved by the QA Representative. Additionally, approval by the Payload Technical Manager shall be required, if in the judgement of the PTD or QA representative, inspection creditability may be affected. Redlines to this document shall also be coordinated with the representative of Pacific Design Technologies, Inc. who will be performing the actual Vatterfly Valve inspections.

F. Discrepancies

A Quality Assurance Representative designated by the Quality Manager shall review any discrepancy noted during this procedure, and approve its disposition. Discrepancies will be recorded in a D-log or a DR per Quality Plan P0108.

G. Equipment Pretest Requirements:

N/A

H. Special Tools:

Flexible Fiberscope 3.5 mm P/N AEI-FS35-100-2 (or equivalent)
C-Mount Video Adapter:
 Focusing Adapter
24W Fiberoptic Light Source
Color Camera
TV Monitor
Allen Wrench (straight) 7/64" (used for top cover)
Allen Wrench (straight) 3/32" (used for side covers)
Torque Wrench, 0 – 10 inch lbs
Cotton Swabs
Plastic bags
4X magnification with light
Lockwire 0.020

I. Personnel Requirements

This procedure is to be conducted only by certified personnel. Persons certified to perform this procedure are Ron Singley (Test Director) and Rich Densmore (Pacific Design Technologies, Inc. representative). The Test Director will perform Pre-Test and Post-Test briefings in accordance with P8075 "GP-B Maintenance and Testing at all Facilities". A Lockheed Martin technician may also be certified to assist in the performance of this procedure. Checklists will be used as directed by P8075 and are attachments #1 & #2 to this procedure.

J. Personnel Responsibilities

The performance of this procedure requires a minimum complement of personnel as determined by the Test Director. The Test Director is the designated signer for the "witnessed by" sign-off located at the end of each procedure.

K. Operations:

Verify Appropriate QA Notification

- o Verify SU QA program office notified.
Record: Individual notified _____,
Date/time ____/____.

- o Verify MSFC representative notified.
Record: Individual notified _____,
Date/time ____/____.

CAUTION

All tools and associated hardware used during performance of this inspection must be tethered.

CAUTION

All ESD requirements must be followed when performing this procedure.

Record Serial Number of Vatterfly Valve being inspected. _____

K.1 Removal of the Vatterfly Valve motor Cover. Proceed to step K.2 if Motor cover cannot be removed.

CAUTION

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING SAFETY WIRE TO ENSURE ALL SAFETY WIRE REMOVED IS ACCOUNTED FOR.

K.1.1 Cut and remove the 0.020 lockwire from the four (4) NAS1352C06H screws. Bag and tag safety wire for accountability.

QUALITY _____

K.1.2 Using th 7/64" allen wrench remove the four (4) NAS1352C06H4 #6-32 x 1/4" screws and cover. Bag and tag screws and cover.

QUALITY _____

K.1.3 Using 4 X magnification (with light) perform a visual inspection of the Vatterfly Valve to determine if there is any visible contamination. If contamination is visible record the location and perform the following steps:

K.1.3.1 Record location of contamination below: (if applicable)

K.1.3.2 Using a cotton swab remove contamination.

K.1.3.3 Bag and tag contamination.

QUALITY _____

K.1.4 If no contamination is visible perform the following steps:

CAUTION

EXTREME CARE MUST BE USED WHEN INSERTING THE FIBERSCOPE INTO THE VATTERFLY VALVE. DAMAGE TO THE STEPPER MOTOR WIRES OR THE OPTICAL SENSOR WIRES (2 SETS OF 4 EACH) COULD OCCUR.

K.1.4.1 Insert Fiberscope through the right and left side of the bearing Guides, inspect for damage to the outer bearing race, dislocated snap rings/grease shield or movement of the bearing shaft. (movement of the bearing shaft is indicated by a gap between the machined shoulder of the shaft and the ball nut housing. Record Results: Indicate "None" if no damage is evident.

K.1.4.2 Outer Bearings _____

K.1.4.3 Snap Rings _____

K.1.4.4 Shaft _____

K.1.4.5 Other findings _____

QUALITY _____

K.1.5 If no anomalies have been encountered reassemble the Motor cover to the Vatterfly Valve actuator. If it is determined that the Left sensor cover is to be removed proceed to step K.2 after the Vatterfly Valve left sensor cover is reinstalled.

K.1.5.1 Remove Vatterfly Valve motor cover from bag and place on top of Vatterfly assembly.

K.1.5.2 Remove four (4) NAS1352C06H4 from bag and install finger tight on assembly.

K.1.5.3 Torque each screw to 7 inch lbs.

Torque Wrench Serial # _____ Cal Due Date: _____

WITNESS/QUALITY _____

K.1.5.4 Using 0.020 lockwire, lockwire the screws as shown in attachment #3.

QUALITY _____

K.2 Removal of the Left Vatterfly Valve sensor Cover.

CAUTION

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING SAFETY WIRE TO ENSURE ALL SAFETY WIRE REMOVED IS ACCOUNTED FOR.

K.2.1 Cut and remove 0.020 lockwire from the four (4) NAS1352C04H4 screws. Bag and tag safety wire for accountability.

QUALITY _____

K.2.2 Using the 3/32 allen wrench remove the four (4) NAS1352C04H4. #4-40 x 1/4" screws and cover. Bag and tag screws and cover.

QUALITY _____

K.2.3 Using 4 X magnification (with light) perform a visual inspection of the Vatterfly Valve to determine if there is any visible contamination. If contamination is visible record the location and perform the following steps:

K.2.3.1 Record location of contamination below: (if applicable)

K.2.3.2 Using a cotton swab remove contamination.

K.2.3.3 Bag and tag contamination.

QUALITY _____

K.2.4 If no contamination is visible perform the following steps:

CAUTION

EXTREME CARE MUST BE USED WHEN INSERTING THE FIBERSCOPE INTO THE VATTERFLY VALVE. DAMAGE TO THE STEPPER MOTOR WIRES OR THE OPTICAL SENSOR WIRES (2 SETS OF 4 EACH) COULD OCCUR.

K.2.4.1 Insert Fiberscope through the left side of the bearing Guides, inspect for damage to the outer bearing race, dislocated snap rings/grease shield or movement of the bearing shaft. (movement of the bearing shaft is indicated by a gap between the machined shoulder of the shaft and the ball nut housing. Record Results: Indicate “None” if no damage is evident.

K.2.4.2 Outer Bearings _____

K.2.4.3 Snap Rings _____

K.2.4.4 Shaft _____

K.2.4.5 Other findings _____

QUALITY _____

K.2.5 If no anomalies have been encountered reassemble the Vatterfly Valve. If it is determined that the right sensor cover is to be removed proceed to step K.3 after the Vatterfly Valve left sensor cover is reinstalled.

K.2.5.1 Remove Vatterfly Valve left sensor cover from bag and place on Vatterfly Valve assembly

K.2.5.2 Remove four (4) NAS1352C04H4 from bag and install finger tight on assembly.

K.2.5.3 Torque each screw to 4 inch lbs.

Torque Wrench Serial # _____ Cal Due Date: _____

WITNESS/QUALITY _____

K.2.5.4 Using 0.020 lockwire, lockwire the screws as shown in attachment #1.

QUALITY _____

K.3 Removal of the right side Vatterfly Valve sensor Cover.

CAUTION

**EXTREME CARE SHOULD BE TAKEN WHEN
REMOVING SAFETY WIRE TO ENSURE ALL
SAFETY WIRE REMOVED IS ACCOUNTED FOR.**

K.3.1 Cut and remove safety wire from the four (4) NAS1352C04H4 screws. Bag and tag safety wire for accountability.

QUALITY _____

K.3.2 Using the 3/32 allen wrench remove the four (4) NAS1352C04H4. #4-40 x 1/4" screws and cover. Bag and tag screws and cover.

QUALITY _____

K.3.3 Using 4 X magnification (with light) perform a visual inspection of the Vatterfly Valve to determine if there is any visible contamination. If contamination is visible record the location and perform the following steps:

K.3.3.1 Record location of contamination below: (if applicable)

K.3.3.2 Using a cotton swab remove contamination.

K.3.3.3 Bag and tag contamination.

QUALITY _____

K.3.4 If no contamination is visible perform the following steps:

CAUTION

EXTREME CARE MUST BE USED WHEN INSERTING THE FIBERSCOPE INTO THE VATTERFLY VALVE. DAMAGE TO THE STEPPER MOTOR WIRES OR THE OPTICAL SENSOR WIRES (2 SETS OF 4 EACH) COULD OCCUR.

K.3.4.1 Insert Fiberscope through the right side of the bearing Guides, inspect for damage to the outer bearing race, dislocated snap rings/grease shield or movement of the bearing shaft. (movement of the bearing shaft is indicated by a gap between the machined shoulder of the shaft and the ball nut housing. Record Results: Indicate "None" if no damage is evident.

K.3.4.2 Outer Bearings _____

K.3.4.3 Snap Rings _____

K.3.4.4 Shaft _____

K.3.4.5 Other findings

QUALITY _____

K.3.5 If no anomalies have been encountered reassemble the Vatterfly Valve. If anomalies have been identified enter anomalies in D-Log.

K.3.5.1 Remove Vatterfly Valve right sensor cover from bag and place on Vatterfly Valve assembly.

K.3.5.2 Remove four (4) NAS1352C04H4 from bag and install finger tight on assembly.

K.3.5.3 Torque each screw to 4 inch lbs.

Torque Wrench Serial # _____ Cal Due Date: _____

WITNESS/QUALITY _____

K.3.5.4 Using 0.020 lockwire, lockwire the screws as shown in attachment #3.

QUALITY _____

Operation completed.

Completed by: _____

QA witness

Date: _____

Time: _____

ATTACHMENT #1 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: | | |

| ATTACHMENT #2 | | 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 | | |

FOR ATTACHMENT, SEE P0890 ATTACHMENT FILE