

**PROCESS SYSTEMS INTERNATIONAL
DOCUMENT REVIEW CHECKLIST**

MAR 05 1996

PROJECT NAME: LIGSO
PSI DOC. NO. V049-8-205

CHK	BY / DATE
<u>TS</u> PROJECT ENG	<u>THS 3-9-96</u>
<u>SM</u> MECHANICAL	<u>SM 7/2/96</u>
STRESS	
ELECTRICAL	
<u>RT</u> PROCESS	<u>RTM 3/7/96</u>
MFG. ENG.	
MANUF	
<u>AB</u> O.A.	<u>ABB 3-5-96</u>
DRAFTING	

**PROCESS SYSTEMS INTERNATIONAL
DOCUMENT APPROVAL CHECKLIST**

PROJECT NAME: _____
PSI DOC. NO. _____

NOTE: THIS REVIEW DOES NOT RELIEVE THE SELLER OR CONTRACTOR OF ANY OBLIGATIONS UNDER THE P.O. OR CONTRACT.

- FA = FINAL APPROVAL
- AS = APP'D AS NOTED - REVISE & RESUBMIT
- AF = APPROVED FOR FABRICATION
- NA = NOT APPROVED
- RP = RELEASED FOR PROCUREMENT OF MATERIALS ONLY
- RR = REVISE & RESUBMIT

BY _____ DATE _____

*Spec - Manufacturing
Process, Body Flange*

VENDOR NAME:	<u>GNB</u>
REVISION NO:	<u>-</u>
SUBMITTAL NO:	<u>1st</u>
STATUS:	<u>Review & Approval</u>

NUMBER: BF-001	PAGE: 1 OF 2	GNB CORPORATION	MANUFACTURING ROUTING
ISSUED:	REV:		

TITLE: MANUFACTURING PROCESS, BODY FLANGE, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

BODY FLANGE

- A. Record material control number.
- B. Face mill material to size per print.
- C. Inspect per print specifications.
- D. Stamp material control number on part edge.
- E. Approved outside supplier to grind material per print and clean.
- F. Inspect received material per print.

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TITLE: MANUFACTURING PROCESS, BODY FLANGE, LIGO

- G. Finish machine. Ref. step 5.
- H. Finish turn per print - Ref. step 5.
- I. Finish machine per print - Ref. step 5.
- J. Inspect finished machined part per print.
- K. Electropolish material per NTA Ultra Polish. (Outside vendor)
- L. Inspect surface finish of received material for surface roughness, handling marks such as nicks, dings and burrs.
- M. Clean per SP-001.
- N. Store cleaned part per UHV-001 Sec. 2.0

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TITLE: MANUFACTURING PROCESS, BONNET FRAME, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

BONNET FRAME

- A. Face mill material to size per print. (Dry)
- B. Inspect per print specification.
- C. Stamp material control number on part edge.
- D. #4 Grain material 2 sides, per Stainless Steel Polishing UHV process.
- E. Inspect surface finish for pits, uniform finish, handling marks such as nicks, dings, and burrs.

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TITLE: MANUFACTURING PROCESS, BONNET FRAME,LIGO

- F. Finish machine per print - Ref. step 5.
- G. Inspect per print specifications.
- H. Electropolish material per NTA Ultra Polish.
- I. Inspect, finish for surface roughness, handling marks such as nicks, dings and burrs.
- J. Clean material per SP-001.
- K. Store material per UHV-001 Sec. 2.0

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TITLE: MANUFACTURING PROCESS, BODY PLATES, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LOGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

BODY PLATES

- A. Face mill material to size per print (Dry)
- B. Inspect per print specifications.
- C. Stamp identifying part number on part edge.
- D. #4 Grain material 2 side per Stainless Steel Polishing UHV process.
- E. Inspect finish for surface roughness, handling marks such as nicks, dings and burrs.

*Process?
Control?*

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TITLE: MANUFACTURING PROCESS, BODY PLATES, LIGO

- F. Electropolish material per NTA Ultra Polish.
- G. Repeat step E.
- H. Clean material per SP-001.
- I. Store material per UHV-001 Sec. 2.0

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TITLE: MANUFACTURING PROCESS, BODY WELDMENT, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.

2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)

3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.

4. GNB specification UHV-001 shall apply to all process steps within this document.

5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

BODY WELDMENT

- A. Initiate individual inspection file of each weldment.
- B. Transfer all parts to welding cleanroom.
- C. Fit weldment per print specifications.
- D. Inspect weldment per print specifications.
- E. Vacuum and structural weld per print in accordance to Wp-001.

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TITLE: MANUFACTURING PROCESS, BODY WELDMENT, LIGO

- F. Repeat step C - stamp per WP-001 # 10
- G. Hand electropolish all weld zones to remove weld discoloration and oxidation.
- H. Clean per GNB-HS-001.
- I. Leak test body per GNB Standard Diffusion Pump Test Procedure. If weld repair is required WP-001 applies. Repeat steps D through H as required.
- J. Clean per SP-001
- K. Store per UHV-001 2.5

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TITLE: MANUFACTURING PROCESS, BONNET PLATES, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material, per print specification and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

BONNET PLATES

- A. Face mill material to size per print. (Dry)
- B. Inspect per print specifications.
- C. Stamp identifying part number on part edge.
- D. # 4 Grain material 2 sides per Stainless Steel Polishing UHV process.
- E. Inspect surface finish for pits, uniform finish, handling marks such as nicks, dings and burrs.

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TITLE: MANUFACTURING PROCESS, BONNET PLATES, LIGO

- F. Finish machine per print - Ref. step 5.
- G. Inspect per print specifications.
- H. Weld lifting eyes per print in accordance with WPS GT-5-P8.
- I. Electropolish material per NTA Ultra Polish.
- J. Inspect recieved material for surface roughness, handling marks such as nicks, dings and burrs.
- K. Clean material per UHV-001 Sec. 2.0

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TITLE: MANUFACTURING PROCESS, CARRIAGE, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-00, between operations.

CARRIAGE

NOTE: All surfaces machined and/or polished for reduced surface area and ease of cleaning.

- A. Saw cut material per B.O.M. Ref. preclean.
- B. Identify material per print note.
- C. Inspect material per print specification.
- D. Pre-machine all surfaces of material per print - Ref. step 5.

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TITLE: MANUFACTURING PROCESS, CARRIAGE, LIGO

- E. Stamp all material with identifying number stamp location as noted on drawing.
- F. Repeat step C.
- G. Fit and weld per print in accordance with WP-001. Insure venting of all joints or lapped surfaces.
- H. Repeat step C.
- I. Finish machine print - Ref. step 5.
- J. Inspect per print.
- K. Electropolish material per NTA Ultra Polish.
- L. Inspect finish for surface roughness, handling marks such as nicks, dings and burrs.
- M. Clean per SP-001.
- N. Store material per UHV-001 2.4

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TITLE: MANUFACTURING PROCESS, GATE FRAME, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

GATE FRAME

NOTE: All surfaces machined and/or polished. For reduced surface area and ease of cleaning

- A. Approved supplier to grind per print.
- B. Inspect per purchase order specifications.
- C. Stamp identifying part number on part edge. Machine to net shape. Ref. step 5
- D. Inspect per print specifications.

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TITLE: MANUFACTURING PROCESS, GATE FRAME, LIGO

- E. Fit and weld all sub-components per print in accordance with WP-001. Insure venting of all joints or lapped surfaces.
- F. Repeat step D.
- G. Finish machine per print - Ref. step 5.
- H. Inspect per print specifications.
- I. Electropolish material per NTA Ultra Polish.
- J. Inspect finish for surface roughness, handling marks such as nicks, dings, and burrs.
- K. Clean per SP-001.
- L. Store per UHV-001 2.4

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TITLE: MANUFACTURING PROCESS, GATE PLATE, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

GATE PLATES

- A. Turn per print - Ref. step 5.
- B. Inspect per print specifications.
- C. Finish machine all details per print.
- D. Repeat step B.
- E. Electropolish per NTA Ultra Polish.

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TITLE: MANUFACTURING PROCESS, GATE PLATES, LIGO

- F. Inspect finish for surface roughness, handling marks such as nicks, dings and burrs.
- G. Clean per SP-001.
- H. Store material per UHV-001 2.4.

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TITLE: MANUFACTURING PROCESS, LINK PLATE, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

LINK PLATE

- A. Saw cut material per B.O.M. Ref. preclean.
- B. Identify material per print note.
- C. Inspect material per print specification.
- D. Machine complete per print. (All surfaces) Polish for easy clean.
- E. Repeat step C.

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TITLE: MANUFACTURING PROCESS, LINK PLATE, LIGO

- F. Electropolish per NTA Ultra Polish.
- G. Inspect finish for surface roughness, handling marks such as nick, dings and burrs.
- H. Clean per SP-001.
- I. Store per UHV-001 2.4

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TITLE: MANUFACTURING PROCESS, PINS/AXLES, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (LIGO Rolling File Chart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material per print specifications and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

PINS/AXLES

- A. Saw cut material per B.O.M. - Ref preclean.
- B. Identify material per print note.
- C. Inspect material per print specification.
- D. Machine complete per print.
- E. Repeat step C.
- F. Heat treat per print note/specification.

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TITLE: MANUFACTURING PROCESS, PINS/AXLES, LIGO

- G. Hand polish to uniform surface finish.
- H. Clean per SP-001.
- I. Store per UHV-001 2.4.

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TITLE: MANUFACTURING PROCESS, DRIVE COMPONENTS, LIGO

1. **Order Certified Material.**
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. **Raw Material Receiving Inspection**
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (Ligo rolling file cart)
3. **Tag and Identify All Inspected Material**
 - 3.1 Identify all material, per print specification and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001 between operations.

MODIFICATION OF BALL SCREW AND COMPONENTS

- A. Modify each drive component per print.
- B. Inspect per print specifications.
- C. Clean components with 409 and alcohol to remove all contaminants, SP-001 does not apply to items outside the vacuum environment.
- D. Store per UHV-001 2.4.

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TITLE: ASSEMBLY PROCESS CARRIAGE/ GATE/ GATE FRAME ASSEMBLY

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Raw Material Receiving Inspection
 - 2.1 Raw material to be inspected to purchase order specifications.
 - 2.2 Record all inspection data and material certification in material records file located in receiving area. (Ligo rolling file cart)
3. Tag and Identify All Inspected Material
 - 3.1 Identify all material, per print specification and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 3.2 Store all identified material in a segregated area.
4. GNB specification UHV-001 shall apply to all process steps within this document.
5. Approved cutting fluids shall not be allowed to dry on part surface. Clean per GNB-HS-001, between operations.

CARRIAGE/ GATE/ GATE FRAME ASSEMBLY
(GNB ASSY-001 APPLIES SPECIFICALLY)

- A. Consolidate inspection files for components of each assembly.
- B. Assemble link, non-lubricated bearings and pin assembly per print.
- C. Assemble wheel, non-lubricated bearings and axle assembly per print.
- D. Inspect all sub-assemblies for bearing fit and freedom of rotation.
- E. Join all components per top level assembly.

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TITLE: ASSEMBLY PROCESS CARRIAGE/ GATE/ GATE FRAME, LIGO (CONT.)

- F. Inspect assembly for correct actuation and lock over position for wheel to wheel distances per print.
- G. Inspect all fasteners for proper fit and print specified torque.
- H. Wipe all accessible surface with chem wipes and alcohol to remove any contaminants.
- I. Transfer assembly to cleanroom, let set minimum of two (2) hours prior to final assembly.

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TITLE: ASSEMBLY PROCESS, VALVE, LIGO

1. Order Certified Material.
 - 1.1 Purchase approved material as described in section 6.0 PSI Specification V049-2-033 Rev 2.
 - 1.2 Material purchase shall be in accordance with UHV-001 1.0.
2. Tag and Identify All Inspected Material
 - 2.1 Identify all material, per print specification and in accordance with PSI Specifications V049-2-033 Rev. 2 Section 6.5.
 - 2.2 Store all identified material in a segregated area.
3. GNB specification UHV-001 shall apply to all process steps within this document.

VALVE ASSEMBLY

- A. Clean all surfaces with alcohol and chem wipes. Transfer to Class 100 Cleanroom assembly and handling carts.
- B. Attach drive assembly to carriage, gate and gate frame mechanism per top level as drawing.
- C. Install clean and baked O-rings to gate and bonnet plate O-ring grooves.
- D. Using handling cart insert drive and carriage, gate and gate frame assembly into valve body.
- E. Inspect/clean seal surface. Attach Bonnet plate to valve body with specified fasteners.
- F. Adjust gate seal per GNB Standard adjustment procedure, torque fasteners and set screws per print specifications.

*No grease
may need
reus
← How held in
piece*

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TITLE: ASSEMBLY PROCESS, VALVE, LIGO

- G. Cycle valve to inspect mechanism actuation.
- H. Inspect gate seal adjustment, repeat step F as required.
- I. Repeat step A.
- J. Valve to be fitted immediately with testing blanks.

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TITLE: TESTING, 1ST ARTICLE, LIGO

1. GNB specification UHV-001 shall apply to all process steps within this document.
2. Testing of all valves shall be typical with the exception of 1st article valve as follows

*Individual Test
of both gate seats
Test criteria*

VALVE TESTING 1ST ARTICLE

- A. Actuate valve in vertical position, actuator up 20 times in accordance with PSI Spe V049-2-005 Rev. 3 per attached procedure.
- B. Shock test.
- C. Actuate valve under vacuum and leak test per GNB Standard Diffusion Pump Procedure actuate 100 times.
- D. Disassemble and inspect all components. Engineering Manager and Manufacturing to review all components for adherence to original specifications.
- E. All components shall be cleaned per SP-001.
- F. All worn components shall be replaced as specified by engineering.
- G. Assemble valve per valve assembly procedure. Assy-001.

← Bakeout

← No

*← Inform customer of which parts were worn
← VAP-001?*

NOTE: Ligo project manager shall determine hold and witness points during the above testing.

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VALVTS STI

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TITLE: VALVE SHOCK TESTING PROCEDURES (LIGO ELECTRIC VALVE)			

1. Mounting

- A. The valve must be mounted in the vertical position resting on a pad which deflects at least 0.1 inches when the valve is placed on it in accordance with PSI Specification V049-2-005 Rev. 3 6.3.

2. Conditions

The valve will be tested in two conditions.

- A. Under normal atmospheric pressure.
- B. Under vacuum.

3. Test Specification

- A. Test will be performed on all the valve housings (or near the edge of one of the flange covers) near the connecting flanges (or weld stubs) in three axes (horizontal, vertical, and axial) to determine shock levels in each of the three axes. This test will be conducted under normal atmospheric pressure and under vacuum. The levels of shock will be measured in g's peak-to-peak. The final data will list values for each of the three axes.

Note:

- 1. Acceleration levels can be collected from additional points on the valve in all three axes at the request of the Buyer or end user.
- 2. Shock test to be performed and analyzed by Balance Engineering.
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Contact Person: Kevin Chin

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