

Title: SPECIFICATION FOR QUALITY ASSURANCE PLAN

SPECIFICATION FOR  
PROJECT QUALITY ASSURANCE PLAN  
FOR  
LIGO VACUUM EQUIPMENT

Hanford, Washington  
and  
Livingston, Louisiana

MANUFACTURING ENGINEER:

Philto Fyler

QUALITY ASSURANCE:

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TECHNICAL DIRECTOR:

D. A. McWilliam

PROJECT MANAGER:

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Information contained in this specification and its attachments is proprietary in nature and shall be kept confidential. It shall be used only as required to respond to the specification requirements, and shall not be disclosed to any other party.

REV LTR.	BY-DATE	APPD. DATE	DESCRIPTION OF CHANGE
1	D. McWilliam	REB 11/15/95	RELEASED PER DDG 351
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PROCESS SYSTEMS INTERNATIONAL, INC.			SPECIFICATION
INITIAL APPROVALS	PREPARED	DATE	APPROVED DATE
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		V049-2-029	1
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TABLE OF CONTENTS

- 1.0 Purpose
- 2.0 General
- 3.0 Responsibilities
- 4.0 Procedure

ATTACHMENTS

- 1. Final Document Summary Form

Number

Rev.

**SPECIFICATION**

Number

**A**

V049-2-029

Rev.

**1**

**1.0 PURPOSE**

The purpose of the QA Plan is to establish the quality requirements for the scope of work intended. This plan contains the PSI quality standards that will be imposed on the LIGO High Vacuum System.

**2.0 GENERAL**

The outlined plan will be imposed at PSI as well as all major component vendors.

**3.0 RESPONSIBILITIES**

The manager of Quality Assurance and the assigned Project Manager are responsible for the implementation of this plan.

**4.0 PROCEDURE****4.1 Quality Review And Planning**

4.1.1 Prior to fabrication the Quality Assurance Engineer will establish the hold/witness points from the Customers specification; the PSI inspection points and the applicable PSI procedures for the contract. From this information, the QAE will prepare a PSI Quality Plan, for each chamber or assembly built at PSI. The Quality Plan will define all of the inspection steps that require witness and/or verification during the course of manufacturing and assembly at PSI. Subcontractual work will be subject to the same planning, by the subcontractor, at his plant with witnessed HOLD points and inspections by PSI.

**4.2 Receiving Inspection**

4.2.1 All raw materials that are procured with Material Test Reports will be receipt inspected prior to use.

4.2.2 Procured components and items will be inspected at the vendor's plant. If inspection is not performed at the vendors plant, they will be receipt inspected upon arrival.

Number

Rev.

**SPECIFICATION**

Number

**A**

V049-2-029

Rev.

1

## 4.3 Material Certification

4.3.1 All vacuum chamber and flange materials will be procured with Material Test Reports. Other nozzle, small parts, small flange nozzles and bolting materials will be procured with a Certificate of Compliance. At receiving inspection, the materials will be verified against the Purchase Order for quantity, material markings and the Material Test Report will be verified to the applicable ASME and/or ASTM material specification for compliance.

4.3.2 If primary vacuum boundary materials are purchased from foreign (outside of USA), PSI will conduct independent lab analysis to verify material composition.

## 4.4 In-Process Inspection

4.4.1 QA/QC will verify material traceability throughout the manufacturing cycle. They will monitor the quality of welding and the qualifications of personnel, verify the final cleaning and verify/witness the testing required by the customers specification.

## 4.5 Cleaning

4.5.1 All materials will be cleaned free of grease, oil, rust and foreign matter prior to welding. After the welding and machinery operations, the assemblies will be cleaned to the required level, for the intended service.

4.5.2 Final cleaning will be performed in accordance with the LIGO cleaning procedure.

## 4.6 Welding

4.6.1 All welding exposed to the vacuum will be performed by the PAW or the GTAW (TIG) welding process, with a 100% Argon shield gas or plasma arc welding with 100% Argon shield gas. All open or closed root, butt welding will be purged with 100% Argon (backing gas). Slip-on-flanges and lap joint designs that allow for fillet welds will not require baking gas. All vacuum welding will performed utilizing ASME Section IX qualified welding procedures and qualified welders.

4.6.2 Welding operations will be monitored on a daily basis by the QA/QC department for compliance with the LIGO Project Procedures and the applicable codes.

## 4.7 Final Inspection

4.7.1 Final inspection will be accomplished on all components prior to shipment. This inspection will include but is not limited to the following: serialization of components, final cleaning, final acceptance testing and packaging for shipment.

## SPECIFICATION

Number	A	V049-2-029	Rev.	1
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## 4.8 Testing

- 4.8.1 Vacuum components shall meet pumpdown and helium leak rates per the LIGO Project Procedures.
- 4.8.2 Pumps and valves will be performance tested at the vendor plant. These tests will be witnessed by PSI.
- 4.8.3 All testing will be performed in accordance with LIGO Project procedures. All shop testing performed will be witnessed/verified by QA/QC.
- 4.8.4 Written test reports will be generated for all testing and will be included in the final documentation package.

## 4.9 Documentation

- 4.9.1 Final documentation on this project will consist of signed off Quality Plans, Material Test Reports for vacuum chamber and flange materials, certificates of conformance of all nozzle materials, small parts and bolting materials, final cleaning certificate, Helium leak test reports, pumpdown test report and a Certificate of Conformance to the codes and standards.

For PSI fabricated equipment, the final documentation summary sheet shall indicate the drawing revisions which fabricated the component.

For purchased components, the purchase order indicates the revision level of procurement documents.

## 4.10 Vendor Surveillance

- 4.10.1 Prior to fabrication, each vacuum vessel fabricator shall submit quality plans to PSI for approval. PSI QA and engineering will set mandatory hold points and perform periodic inspections at the vendor's plant. The vendor shall provide final documentation as detailed in the procurement specification for all PSI fabricated components. documentation shall be provided as shown in Attachment 1 "Final Documentation Summary".
- 4.10.2 For major purchased components, QA requirements are detailed in "QA Requirements Summary" form attached to each procurement specification.

Number

Rev.

## SPECIFICATION

Number	V049-2-029	Rev.
<b>A</b>		<b>1</b>

4.11 Engineering Plan Review

4.11.1 QA will be part of the design review team as the design develops.

4.12 Procurement Specification Review

4.12.1 QA will be part of the review team for all major component specifications.

Number

Rev.

**SPECIFICATION**

Number

**A**

V049-2-029

Rev.

**1**

Title

# SPECIFICATION FOR PROJECT QUALITY ASSURANCE PLAN

Attachment I  
V049-2-029

## LIGO VACUUM EQUIPMENT FINAL DOCUMENTATION SUMMARY

Component  
Model No.:  
Serial No.:

Date:  
Prepared By:

- |                                  |       |            |
|----------------------------------|-------|------------|
| 1. Quality Plan Doc. No.:        | _____ | Rev. _____ |
| 2. Material Test Reports:        | _____ | Date _____ |
|                                  | _____ | _____      |
|                                  | _____ | _____      |
|                                  | _____ | _____      |
| 3. Certification of Conformance: | _____ | _____      |
|                                  | _____ | _____      |
|                                  | _____ | _____      |
|                                  | _____ | _____      |
| 4. Heat Treat Charts:            | _____ | _____      |
|                                  | _____ | _____      |
| 5. Final Cleaning Certification: | _____ | _____      |
| 6. Bakeout Certification:        | _____ | _____      |
| 7. Final Vacuum Leak Reports:    | _____ | _____      |
| 8. Non-Conformance Reports:      | _____ | _____      |
| 9. Certificate of Conformance:   | _____ | _____      |

Notes:

<b>SPECIFICATION</b>		
Number	A	V049-2-029
		Rev.

Number  
Rev.